

ORTEC[®]

Micro-trans-SPEC[®]

Portable Integrated HPGe Spectrometer

User's Manual

Advanced Measurement Technology, Inc.
(“AMT”)

WARRANTY

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Quality Control

Before being approved for shipment, each AMT instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

Repair Service

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Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify AMT of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

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ADDITIONAL WARRANTY STATEMENT

Please note that the personal digital assistant (PDA) that controls the Micro-trans-SPEC is intended exclusively for the tasks detailed in this user's manual. Using this PDA for any other purpose *could void your warranty.*

In addition, the Micro-trans-SPEC contains *no user-serviceable parts.* Except for the battery hatch on the left side panel, which can be opened when the battery requires replacement, breaking the seal on the case *voids your warranty.* The Micro-trans-SPEC should be opened only by ORTEC-authorized service personnel.

If you have any questions about the use or maintenance of this instrument, please contact your ORTEC representative or our Global Service Center first.

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Safety Instructions and Symbols

This manual contains up to three levels of safety instructions that must be observed in order to avoid personal injury and/or damage to equipment or other property. These are:

DANGER Indicates a hazard that could result in death or serious bodily harm if the safety instruction is not observed.

WARNING Indicates a hazard that could result in bodily harm if the safety instruction is not observed.

CAUTION Indicates a hazard that could result in property damage if the safety instruction is not observed.

In addition, the following symbols may appear on the product:



DANGER – Hazardous voltage



ATTENTION – Consult the manual in all cases where this symbol is marked in order to determine the nature of the potential hazards and any actions that must be taken to avoid them



Protective earth (ground) terminal

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

Cleaning Instructions

To clean the instrument exterior:

- Disconnect the instrument from the power source.
- Remove loose dust on the outside of the instrument with a lint-free cloth.
- Remove remaining dirt with a lint-free cloth dampened in a general-purpose detergent and water solution. Do not use abrasive cleaners.

CAUTION To prevent moisture inside of the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

- Allow the instrument to dry completely before reconnecting it to the power source.



1. INTRODUCTION

The ORTEC[®] Micro-trans-SPEC[®] is an industry first: for the first time, an HPGe gamma-ray spectrometer with everything you need in a single easy-to-handle package. No need for liquid nitrogen. No long cables. One package, ready to go.

The Micro-trans-SPEC is full-featured:

- High-performance portable HPGe gamma spectrometer requires no liquid nitrogen.
- Rugged battery-powered, high-resolution HPGe gamma spectrometer with 16k resolution digital electronics in a single package!
- 50 mm diameter × 30 mm HPGe detector cooled by miniature, high-reliability mechanical cooler that runs from internal battery, supplemental external battery, line power, or automobile power outlet, all with automatic switchover.
- ORTEC Low Frequency Rejector¹ (LFR) digital noise filter minimizes microphonic noise.
- Detector element encapsulated in high-reliability, low-loss, all-metal sealed cryostat.
- Designed for continuous availability and operation.
- Digital stability gives consistent answers for long counts, changing count rates and temperatures.
- Operates in standalone mode or attached to a computer.
- Color LCD touchscreen provides all software controls and live display of acquiring data.
- Energy calibration using the touchscreen.
- Real-time nuclide ID and activity calculation for nine regions of interest (ROIs).
- Uses high-capacity SecureDigital memory cards for unlimited spectrum storage capacity.
- High-speed USB communications, connects directly to your laptop (MAESTRO[®] MCA Emulator Software included).

The Micro-trans-SPEC is a sister product of the ORTEC Detective-EX/DX[®] family of portable nuclide identifiers, which were developed to meet the specific needs of homeland security. The Micro-trans-SPEC brings the latest developments in technology to a more general range of portable gamma-ray applications, including:

- Nuclear materials hold-up
- Nuclear safeguards inspection
- In-situ waste assay measurements
- Emergency response
- Reactor maintenance, e.g., corrosion product monitoring
- Medical physics
- A host of other applications previously impossible with LN₂-cooled HPGe detectors

¹Patent pending.

Full hardware specifications are provided in Chapter 8.

1.1. HPGe Detector

The Micro-trans-SPEC HPGe detector is a P-type (“ORTEC GEM”) crystal, nominally 50 mm × 30 mm.² It is cooled by a small, high-reliability Stirling cooler that draws less than 25 W when operating — no liquid nitrogen is required. A potential problem of mechanical coolers is vibration, which causes microphonic noise on the detector output signal and degrades the peak resolution. However, by careful mechanical design and an active digital noise reduction filter — the ORTEC Low Frequency Rejector (LFR) filter — implemented in the digital spectrometer section of the Micro-trans-SPEC, excellent performance is achieved. (See also the hardware specifications in Chapter 8.)

1.2. Features

The Micro-trans-SPEC has a color touchscreen and an audible signal with adjustable volume. In standalone (portable) mode, the unit can be controlled entirely from the touchscreen. You can access the instrument's full capabilities without attaching it to a computer.

The Micro-trans-SPEC's spectrum display is patterned after our MAESTRO® MCA Emulator software, in use on thousands of systems worldwide. The 240 × 160 pixel LCD display makes it easy to set up and monitor data acquisition and instrument settings status. The spectrum display allows you to select logarithmic or linear vertical scaling, mark ROIs, move from one ROI to ROI, zoom in/out, and check ROI peak information.

The MAESTRO software included with Micro-trans-SPEC provides a convenient graphical user interface for all the controls needed to adjust the Micro-trans-SPEC acquisition parameters from a computer, if preferred. Data acquisition, calibration, and ROI settings selected in MAESTRO are retained when the Micro-trans-SPEC is returned to standalone mode, and are easily changed in the field.

MAESTRO is a member of the CONNECTIONS family of ORTEC products, all of which provide full networking with other ORTEC spectrometers and supporting computers. MAESTRO includes features for identifying peaks: editing libraries; and creating, printing and saving ROIs, performing energy calibrations, automating tasks using simple “job streams,” and more. For more information on these operations, see Chapter 9.

Spectral data can be saved and later reanalyzed in more detail using a more sophisticated analysis package such as GammaVision®, ISOTOPIC, or PC/FRAM.

²The trans-SPEC-DX-100 has a nominal 65 mm × 50 mm, P-type crystal.

To operate the Micro-trans-SPEC with your own software, we recommend using the CONNECTIONS Programmer's Toolkit with Microsoft® ActiveX® Controls (A11-BW). The instrument's firmware commands are given in Chapter 10.

1.2.1. GPS and Wireless Capabilities

The Micro-trans-SPEC has built-in global positioning (GPS) hardware. The GPS coordinates are captured at the end of each acquisition and saved in the spectrum file if you select the ORTEC Integer .SPC file format.

In addition, the Micro-trans-SPEC is equipped with IEEE 802.11 wireless connectivity. Third-party software can be used to implement wireless communications (see our technical note, P/N 932735).

1.2.2. Security

The Micro-trans-SPEC allows you to assign a user password that prevents unauthorized use of the instrument, and an administrator password that gives access to the unit but blocks access to advanced settings; see Section 4.1.7.1. In addition, the **Lock Display** command (Section 4.1.7.3) allows you to hide the spectrum display. A unit in this mode cannot communicate with a computer.

1.3. Micro-trans-SPEC Power Sources

The Micro-trans-SPEC can draw power from a variety of sources, and is designed for continuous operation. The miniature Stirling cooler has a very long operational life measured in years. Cool-down from ambient temperature takes approximately 12 hours. Once cold, the Micro-trans-SPEC requires only a few tens of watts to sustain it. The unit can operate for about 3 hours on the internal lithium-ion battery. The automobile accessory connector (included) allows you to charge and operate the instrument from a 12 V automobile battery. In addition, ORTEC offers optional battery belts to extend the remote operation time.

1.4. Spectrum Collection, Storage, Transfer, and Viewing

The live (currently displayed) spectrum and all the associated information are held in the spectrometer's memory. This information can then be saved, in ORTEC's Integer .SPC or Integer .CHN spectrum file format, in the PDA's *My Documents* folder or on user-supplied, removable SecureDigital (SD) memory cards.³ The stored spectra are retained when power is turned off and

³Note that the PDA also has a CF type II CompactFlash slot. However, the dust cover, which must be in place to prevent contaminating the card slots, blocks full insertion of CF cards.

when the battery is removed. However, the live spectrum is lost (see the note in the following section).

1.4.1. Live-Spectrum Memory

The live spectrum (i.e., the spectrum currently displayed on the Home screen) and its associated information, including presets, ROIs, calibration, and detector state-of-health (SOH) status, are held in the spectrometer's memory. This information can be saved on the PDA or memory card in ORTEC's *Integer .SPC* or *Integer .CHN* spectrum file format.

NOTE The live spectrum is retained when you exit the Micro-trans-SPEC software application and restart it, and when you display a stored spectrum.

The live spectrum is *lost* (erased) when you tap the **CLEAR** (clear spectrum) button, reboot the PDA, or put the PDA in energy-saving mode.

1.4.2. Stored Spectra

In standalone mode, after you acquire a spectrum, simply tap the **Save** button to copy the spectrum and all the information associated with this acquisition, including the presets, ROIs, calibration, and SOH bits from the live memory to the PDA's *My Documents* folder or removable memory card, in either the *.SPC* or *.CHN* format. The file can then be downloaded to a computer for further manipulation, archival, and so forth.

These *.SPC* files contains parameters in addition to the contents specified in the *ORTEC Software File Structure Manual for DOS and Windows Systems* (P/N 753800; hereinafter called the *File Structure Manual*):

- GPS coordinates
- The type of trans-SPEC used (e.g., Micro-trans-SPEC or trans-SPEC-DX-100)

Stored spectra are retained until you delete them, even when the Micro-trans-SPEC is powered off and has been disconnected from all external and battery power.

Available storage capacity depends on the PDA controlling the Micro-trans-SPEC and on the capacity of the memory card. You can collect and store spectra with any combination of conversion gain settings.

If you try to store a spectrum when the selected storage location is full, the Micro-trans-SPEC displays an *Error saving spectrum file* message.

The instrument's **Spectra** menu (Section 4.1.8) allows you to display and/or delete the stored spectra.

1.4.2.1. Spectrum Filenaming Conventions

The base filename is formatted as:

YYYY_MM_DD_hh_mm_sss

where YYYY_MM_DD is year/month/day, and hh_mm_sss is the acquisition start time, with seconds in decimal thousandths, according to the PDA's current time and time zone settings.

1.4.3. File Transfer

If you choose to store the spectrum files on SD cards, they can be transferred directly to your computer with an SD card reader and Windows Explorer. Alternatively, files stored on SD card or in the unit's **My Documents** folder can be downloaded via the USB port to any computer running under Microsoft Windows 8 or 7 (via the Windows Mobile Device Center), or Microsoft Windows XP® Professional SP3 (via Microsoft ActiveSync®). See Chapter 5 for detailed instructions.

IMPORTANT *Before connecting the Micro-trans-SPEC to a computer for the first time, install Windows Mobile Device Center or ActiveSync **first**. Otherwise, the Micro-trans-SPEC may not be able to communicate properly with the computer. Be sure to read Chapter 5.*

1.5. Before Using the Micro-trans-SPEC

The Micro-trans-SPEC must be set up, cooled, and calibrated as discussed in Chapters 2 and 3.

NOTES *The Micro-trans-SPEC is designed to function with the Regional Settings in Windows Mobile set to the English (United States) region and all of its default settings, as discussed in Section 6.10. **Using other than the factory default settings can cause operational problems.***

Although the Micro-trans-SPEC is ruggedly constructed, weather resistant, and easy to handle, it is a sensitive, precision instrument. *Always observe the cautions in Section 3.2.1 when using the Micro-trans-SPEC.*

1.6. The “Launcher” Interface for Multiple Identifier Applications

ORTEC supports our versatile Micro-Detective®/Micro-trans-SPEC platform with a wide range of nuclide identification applications. When only one identifier application is installed on your Detective-series instrument, each time the unit is powered on or rebooted, it automatically starts up that application. If subsequent ORTEC applications are added to your instrument, our easy-to-use application “Launcher” interface runs first, making it easy to switch between the ORTEC identifier programs, and exit to Windows Mobile. Simply tap the desired program.

Alternatively, if you wish to choose one of the applications to auto-start when the Micro-trans-SPEC is rebooted, just mark the checkbox beside the desired application.

Figure 1 illustrates the Launcher screen for a Micro-trans-SPEC on which the **UF6 Enrichment** program also installed. Note that the Micro-trans-SPEC application is marked for auto-start.⁴ (Note that the Launcher may have multiple pages if many applications are installed; tap the scroll/paging indicator as needed.)

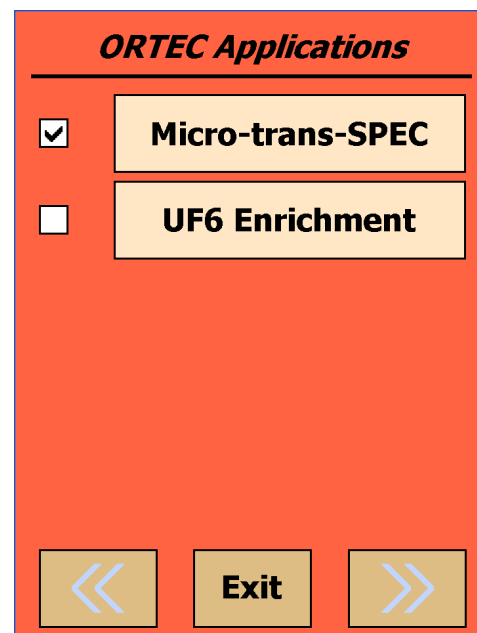


Figure 1. The Launcher Screen.

1.7. Should You Take a Computer Into the Field?

The Micro-trans-SPEC is designed so that you don't need a computer to operate it, especially in the field. But, there are a few situations where a laptop is of use in field operations. One use is for advanced analysis of the spectra where the Nuclide Report does not show enough detail. In this case, software such as GammaVision, ISOTOPIC, or other specialist applications can be used to process the spectra at the work site. The second is to provide storage for more spectra than the Micro-trans-SPEC stored-spectrum memory capacity. However, high-capacity SD cards typically make this unnecessary.

⁴If, on reboot, the Microsoft® Windows® Mobile desktop is displayed instead of the Launcher or a spectroscopy application, tap **Start** then **Launcher**. Alternatively, you can bypass the Launcher and start either program by tapping **Start, Programs**, and the application name.

2. THE MICRO-TRANS-SPEC

This chapter takes you through the setup and startup procedures.

IMPORTANT

The Micro-trans-SPEC is designed to function with the Regional Settings in Windows Mobile set to the English (United States) region and all of its default settings, as discussed in Section 6.10. Using other than the factory default settings can cause operational problems.

2.1. Unpacking and Setup

When you receive the Micro-trans-SPEC, the shipping box contains the following components:⁵

- The Micro-trans-SPEC portable identifier and USB cable
- Padded carrying strap
- The ac power adapter/charger
- The Micro-trans-SPEC *User's Manual* (P/N 931041)
- Automobile accessory adapter to operate and cool the Micro-trans-SPEC from a 12-V battery

Any options will be packaged separately, and will include instructions for that option.

2.2. Features

Figure 2 shows the Micro-trans-SPEC's features.

2.2.1. Front Panel

- **ON/OFF Button** Located below the touchscreen, on the base of the bezel. When you turn on the PDA, it initializes, then automatically starts the Micro-trans-SPEC program. To reboot the PDA, press and hold the power button for ~3 seconds and release, displaying a menu that allows you to shut down, reset (reboot), align the touchscreen, and so on. Tap the **Reset** button (the cooler will stay on) to reboot. To put the PDA in energy-saving mode, press and release the ON/OFF button; the display will go dark. Press and release the ON/OFF button to reactivate the PDA.

⁵Subject to change.

- **SD Card Slot** This is located on the front panel under the protective dust cover. To release the cover, press and rotate by a quarter turn the two captured, bayonet-mount screws. The SD slot is keyed so the memory card can only be inserted in one orientation. Insert the card and close the protective cover.

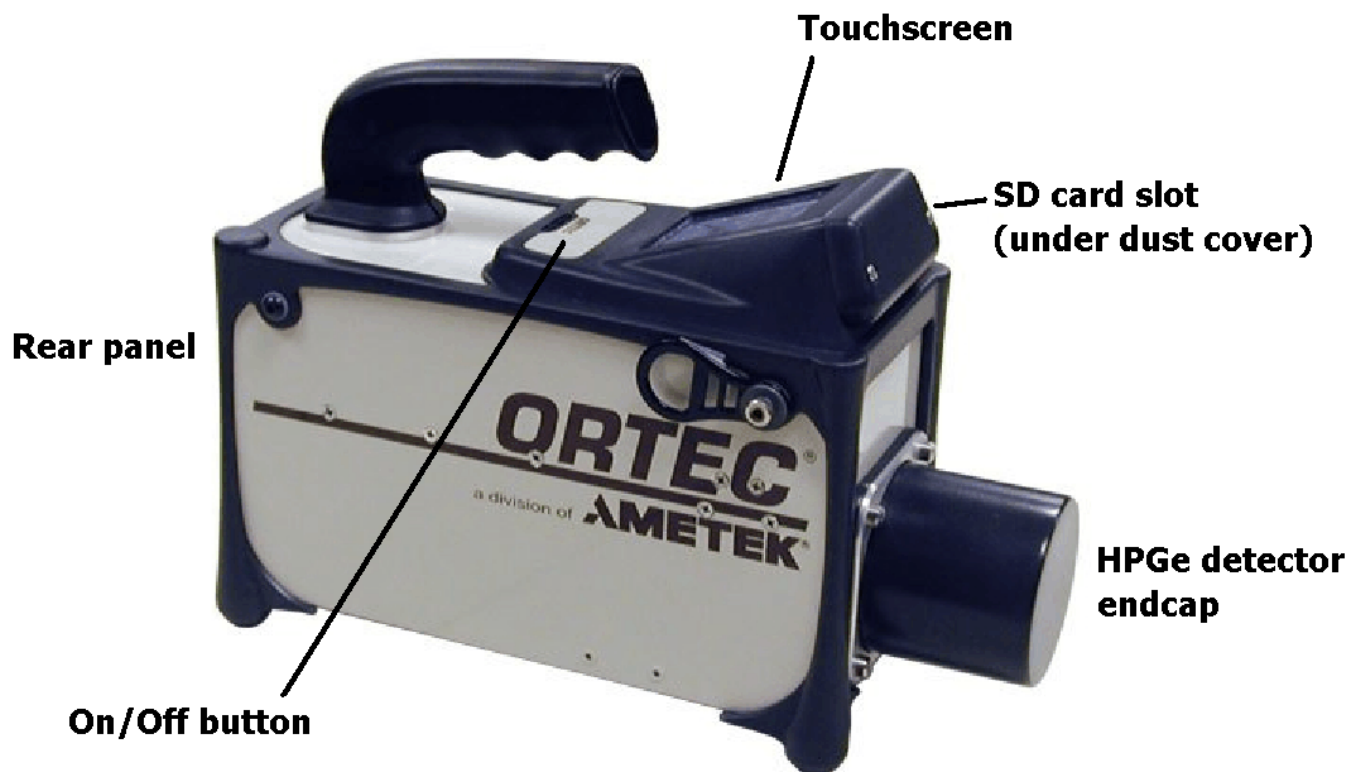




Figure 2. Micro-trans-SPEC Features.

NOTE *We strongly recommend that the dust cover be fastened in place at all times to protect the card slots from moisture and particulates.*

2.2.2. Rear-Panel Connectors

- **INPUT POWER** — Supplies external power for operating the Micro-trans-SPEC and recharging the internal battery.
- **USB port** () — Used to connect the Micro-trans-SPEC's microprocessor to a computer to retrieve stored spectra in **ActiveSync** mode; and to connect to the Micro-trans-SPEC's MCA board in **MCA Mode**. See Section 4.1.7.4.
- **Headphone jack** () — For audio dose and count-rate warning signals. The speaker volume can be adjusted as described in Section 4.1.6.7.

Each connector includes a dust cover. *Keep them closed when using the instrument outdoors or where moisture or particulates might contaminate the connectors.*

2.2.3. The Touchscreen

Figure 3 shows an example of the Micro-trans-SPEC's user interface as displayed on the touchscreen. The Micro-trans-SPEC has a high-resolution color touchscreen for viewing data acquisitions as well as monitoring and changing the instrument settings.

To select a function, tap it with your finger or a stylus (*pens, pencils, and other objects will scratch the touchscreen and should not be used*). In fields where an alphanumeric input is needed, tap in the field to open a "soft keyboard" at the bottom of the screen (see Fig. 23 on page 26).

In situations where the spectrum should not be viewed by the operator, the spectrum display can be disabled (Section 4.1.7.3).

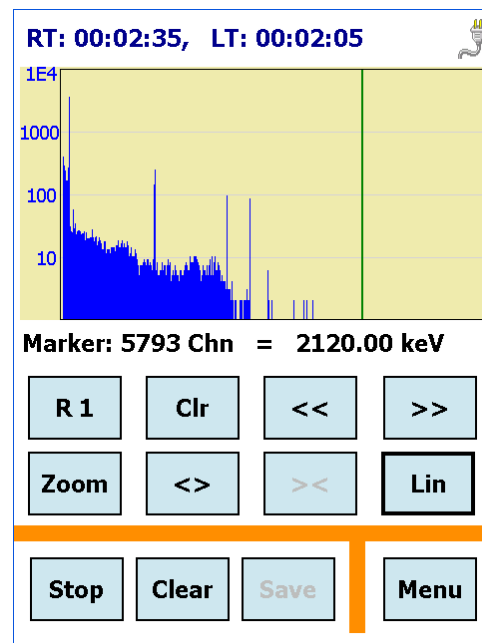


Figure 3. The Micro-trans-SPEC Display.

2.2.4. Attaching the Carrying Strap

The carrying strap (Fig. 4) should be installed on the top-diagonal corners of the Micro-trans-SPEC; that is, looking down on the display panel, the strap should be anchored to the left-front and right-rear corners or vice versa.

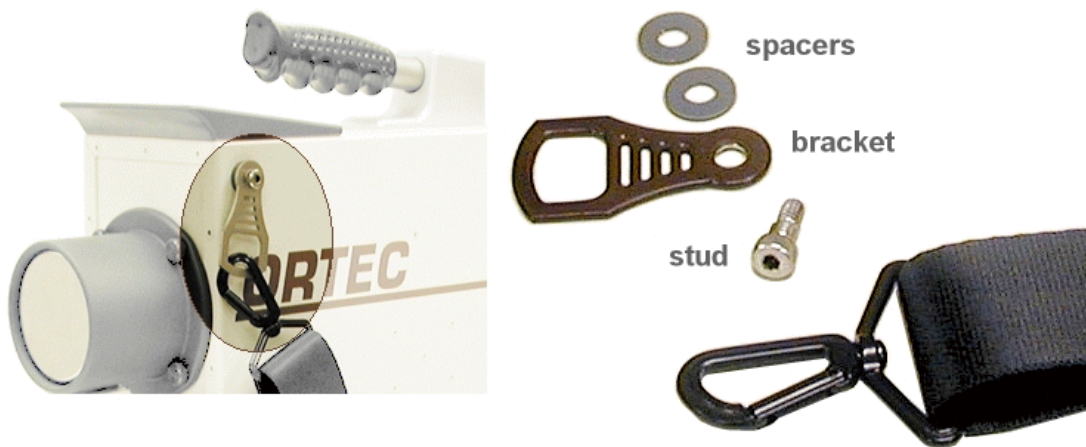


Figure 4. Carrying Strap Attachment.

If you wish to change the factory orientation, use a 5/32-in. hex wrench to exchange positions of the strap-hanger studs and the regular hex-head screws. Thread the strap-hanger stud through the hanger bracket, followed by the two spacers, then insert the stud into the Micro-trans-SPEC and tighten until the hanger bracket resists rotation but still turns (*do not overtighten*).

2.3. Internal vs. External Power

The Micro-trans-SPEC uses power in these ways:

- The internal battery provides 3+ hours of operation. The internal battery can start the cooler but its charge is not sufficient to cool the detector from room temperature; external power is required. The transition from internal to external power is automatic and does not interfere with data collection. When recharging an exhausted internal battery, keep in mind that the battery does not begin charging until *after the detector is cooled down to operating temperature*. At that point, fully recharging the battery takes 3–4 hours.
- The power adapter provides external power to start, cool, and operate the Micro-trans-SPEC, as well as charge the internal battery. It can be powered from ac mains or a 12 V source.
- Other external power (supplied by external battery belt or 12 V automobile battery) can start, cool, and operate the Micro-trans-SPEC, as well as charge the internal battery. When connected to an external battery, the Micro-trans-SPEC relies on external power until the external voltage drops below 9 V. It then switches to the internal battery. The instrument makes the transition smoothly, and there is no effect on the energy resolution. If you begin with both batteries fully charged, the sum of the two battery capacities will be achieved. If the external battery has its own charge indicator, this can be used to determine when the changeover will occur. The Micro-trans-SPEC battery monitor indicates the available capacity in the internal battery, and when the switchover occurs, this indicator runs down in the usual manner.

NOTE If you are using a standard automobile battery as the external power source, note that detector cooling can significantly discharge the battery.

The icon in the upper right corner of the screen (Fig. 5) shows whether the Micro-trans-SPEC is operating on battery power or the charger.

When all power is exhausted, the high voltage and cooler shut down and the detector begins to warm. The Micro-trans-SPEC cannot be used again until the unit has cooled enough that the high voltage automatically switches on.

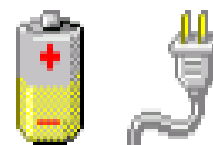


Figure 5.
Power Source
Indicators.

If you wish, you can select the **Battery Time Remaining** monitor for display on the Home screen's status line (Section 4.1.7.7).

2.3.1. The Internal Battery

The internal battery typically lasts 3–5 years. See Appendix A for instructions on replacing it. Note that the battery hatch and memory card drive cover are the only parts of the Micro-trans-SPEC case that can be opened without voiding the warranty.

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3. STARTUP AND OPERATION

3.1. Startup

Before using the Micro-trans-SPEC:

- Connect it to the power adapter/charger or other external power source. This will boot up the PDA, start the cooler, and start the Micro-trans-SPEC software application at the Home screen.
- Wait for the detector to cool down to operating temperature.
- Depending on your power source options, charge the internal battery for 3–4 hours.
- Check the detector calibration.
- Set the data storage location.
- Choose the indicators for the Status Line and Marker Line.
- Confirm the unit's state-of-health (SOH) indicators are all **OK**.

3.1.1. Connecting the Micro-trans-SPEC to External Power and Turning It On

- First, be sure to read the cautions in Section 3.2.1 (page 16).
- The next step is to connect the Micro-trans-SPEC to the power adapter/charger to start the cooler and begin chilling the detector. Attach the power adapter's output cable to the Micro-trans-SPEC INPUT POWER connector.
- As soon as power is applied, the PDA boots automatically, the cooler begins running, and the Micro-trans-SPEC software application starts up at the Home screen (Fig. 10). The software requires a few seconds to complete initialization, then becomes active. If a user password has been set, enter the password according to Section 4.1.7.1.
- As noted above, the internal battery does not charge until the detector is cooled to operating temperature, which requires up to 12 hours. After that, the battery typically reaches full charge in 3–4 hours. If the cooler does not start by itself, see the next section.

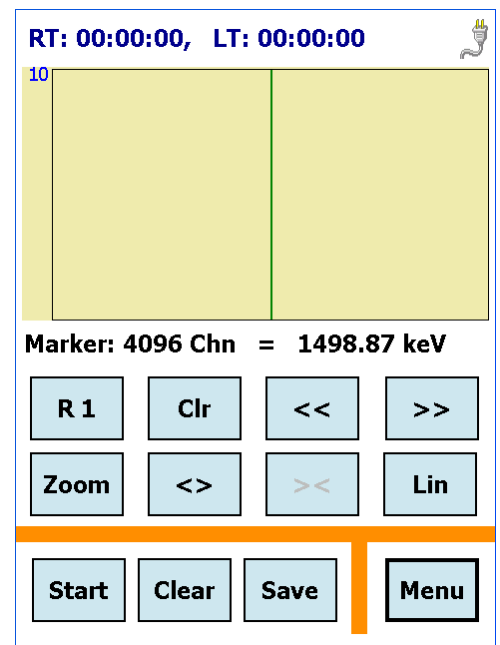


Figure 6. The Home Screen at Startup.

3.1.1.1. Manually Turning the Cooler On

The mechanical cooler should automatically turn on when the power is applied to the unit. If it does not, turn it on manually by tapping **Menu**, then **Turn Cooler On**. Tap **Back** to return to the Home screen.

3.1.1.2. Cooldown

The cooler requires approximately 12 hours to cool the Micro-trans-SPEC to operating temperature. When the detector reaches operating temperature, the Micro-trans-SPEC bias voltage automatically turns on. To see if the bias voltage is on or off, tap **Menu**, **View Status**, and check the **Bias Voltage (Volts)** entry. Figure 7 shows the status readouts for a room-temperature unit (thus, the HV is off) with a discharged battery.

NOTE You can turn the cooler off for a brief period (e.g., 10 to 20 minutes) without significantly warming the detector. As soon as the cooler is restarted, the Micro-trans-SPEC is typically ready within a few seconds. Note also that the cooler can be restarted at any time, without harming the detector crystal, regardless of whether the detector is warm, partially cooled, or cooled to the operating temperature range.

View Status	
Live Time	00:00:00
Real Time	00:00:00
% Dead Time	0.00
Battery Time	0 Min
Bias Voltage (Volts)	-2
Fine Gain	0.55
Coarse Gain	2
Detector Temp	268.90

Figure 7. Instrument Warm, HV Off, Battery Discharged.

3.1.2. Selecting the Data Storage Location

Choose the spectrum file storage location by tapping **Main**, **Spectra**, then the **Data Location** field. Select **My Documents** or **Storage Card** (the latter is only displayed if a card is present), then tap **Back** as needed to return to the Home screen. See also Section 4.1.8.2.

3.1.3. Configuring the Marker and Status Lines

See Section 4.1.7.7 for instructions on selecting the Status Line and Marker Line parameters to be displayed, respectively, above and below the spectrum. Figure 8 illustrates the real time and live time readouts on the Status Line, and the marker position in channels and in energy on the Marker Line.

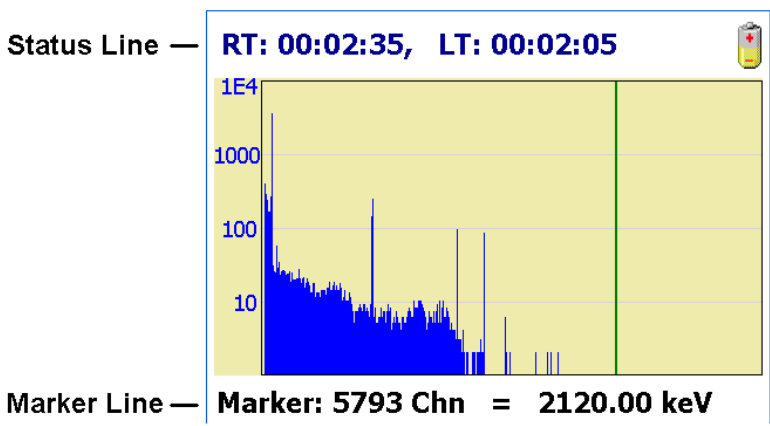


Figure 8. Configure the Status and Marker Line Readouts.

3.1.4. Calibration

Once the Micro-trans-SPEC is cooled down and the bias voltage turns on, the next step is to calibrate the instrument. See Section 4.1.7.5.

3.1.5. Checking Detector State of Health (SOH)

The last step is to confirm that all detector SOH readouts are **OK**. Tap **Menu**, **MCA Settings**, and **State of Health** (Fig. 9).

<i>State Of Health</i>	
+12 V	OK
-12 V	OK
+3.3 V	OK
Detector Temperature	OK
Body Temperature	OK
ColdTip Temperature	OK
HV Voltage	OK

Figure 9. Check SOH.

3.2. Operation Overview

This section discusses:

- Operating cautions
- Moving through the menus and screens
- Spectrum display controls

3.2.1. Cautions

- Remember that there are no user-serviceable parts inside the Micro-trans-SPEC. Opening the Micro-trans-SPEC (except the battery hatch and the SD card drive's dust cover) voids the warranty.
- The cooler and detector are shock-sensitive, with a maximum tolerance of 20 g, so be careful not to drop the Micro-trans-SPEC. A shock in excess of this value will void the warranty.
- The Micro-trans-SPEC's enclosure is sealed with polymer o-rings and gaskets. However, care should generally be taken to protect it from prolonged or heavy rainfall and from immersion. Heat is dissipated from the cooler via the Micro-trans-SPEC baseplate; therefore, do not place the unit in mud, loose soil or sand, standing water, dense grass, or on thick carpet. Wrap or cover the unit to keep it clean and dry. Where possible, avoid placing it on warm surfaces, such as sun-heated pavement, for extended periods. The front-panel memory card slots and rear-panel connectors include dust caps; *keep the card slots and all unused connectors capped.*
- The power adapter/charger should not be exposed to water. When in use, it should ideally be placed on a dry, flat, dust-free surface. When not in use, it should be disconnected from the ac power supply and covered to protect it from moisture and dirt. Any covering must be completely removed before reconnecting the power adapter to the input power source. Make sure the recharging connector on both the Micro-trans-SPEC and power adapter are clean and dry before connecting to an the input power supply.
- The Micro-trans-SPEC is designed for use at temperatures between -10°C to $+40^{\circ}\text{C}$, at a relative humidity $<90\%$ at 35°C , non-condensing.
- To avoid damaging the cooler by overheating it (and, where applicable, to comply with transportation regulations), be sure the cooler is turned off before shipping the Micro-trans-SPEC (see Section 3.1.1). The unit can be shipped as soon as the cooler is turned off; there is no need to wait until the detector warms up.

- For best results, we recommend that you not allow the instrument's internal battery to become exhausted, and that you read Section 2.3 on the Micro-trans-SPEC's internal and external power sources.

NOTE You can turn the cooler off for a brief period (e.g., 10 to 20 minutes) without significantly warming the detector. In addition, the cooler can be restarted at any time without harming the detector crystal, regardless of whether the detector is warm, partially cooled, or cooled to the operating temperature range.

3.2.2. Moving Through the Menus

The movement through the dialogs is done by tapping on the displayed soft buttons with a stylus or your finger. The functions available are shown on the buttons.

NOTE *Do not use pens, pencils, or other objects as a stylus. They will scratch the touchscreen.*

The Micro-trans-SPEC is simple to use:

- When you first turn the unit on, it starts on the Home screen, as shown in Fig. 10. Tap **Menu** to open the main Menu.
- To select a command or option, tap it with a stylus or your finger.
- To return to the preceding menu or screen, tap **Back**. For example, tapping **Back** from the Main Menu returns you to the Home screen.
- To create or modify a setting, tap in the field to display a soft keyboard at the bottom of the screen. Tap on the desired character, then tap **Set**.
- To erase characters in an entry, tap to position the cursor then tap the **<Backspace>** soft key. Change the entry as needed, then tap **Set**.
- If you open a dialog by mistake, simply tap **Back** to return to the previous screen without changing any values. If you enter a field by mistake, leave the entry unchanged and tap **Set**. to leave the value unchanged.

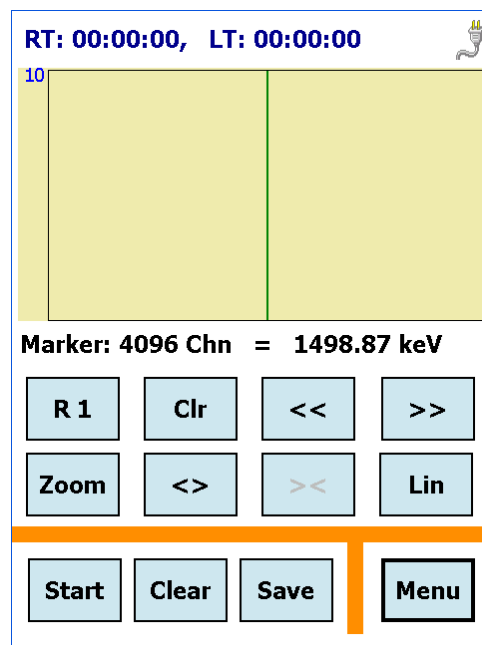


Figure 10. The Home Screen.

3.2.3. Using the Controls

Figure 11 shows the Home screen, a typical spectrum display, the data acquisition and spectrum display controls, and the **Menu** button, which accesses all menu commands.

3.2.3.1. Data Acquisition Controls

The **Start** button controls data acquisition in conjunction with the real time and live time presets (if any are entered). The button label changes to **Stop** during acquisition.

To pause an acquisition, press **Stop** without **Clearing**. As long as you do not **Clear** the spectrum, the spectrum will be retained in live-spectrum memory.

The **Clear** button deletes the spectrum and all associated information except marked ROI channels.

The **Save** button is only active when the unit is not acquiring data. This saves the current spectrum information to the current **Data Location** in the current **Save File Format** (Section 4.1.8).

3.2.3.2. Spectrum Window

The spectrum window is patterned after the MAESTRO display. You can select logarithmic or linear vertical scaling, mark ROIs, move from one ROI to ROI, zoom in/out, and check ROI peak information. Note the Status Line and Marker Line readouts, respectively above and below the spectrum window; see Section 4.1.7.7 for the list of readout options available.

Note the vertical marker line in the spectrum window. To move the marker, tap the desired position. The marker will jump to that location and the Status Line values will update correspondingly. You can also press on the display area and drag the marker left or right to the new location.

The spectrum display area is limited so a modified version of scientific notation is used when labeling the Y axes for numbers greater than or equal to 10,000: The number of trailing zeros in the number is replaced by “E” followed by the number of zeros. Some examples: 10,000 becomes **1E4**; 12,000 becomes **12E3**.



Figure 11. Spectrum Display Controls.

3.2.3.3. Spectrum Display Controls

The spectrum display control buttons are just below the spectrum window. You can use them to show the spectrum in different ways for better interpretation of the spectrum.

Zoom / Full

Zoom expands the spectrum around the current view's center channel. **Full** restores the display to a view of all channels in the spectrum. In this way, you can easily look at the peaks in the spectrum in detail (**Zoom in**) and move quickly from energy to energy in Full mode.

<> — Zoom In

The **Zoom In** button expands the display by halving the number of channels in the current spectrum view, so the peaks appear wider. The marker position becomes the center channel of the new view. The vertical scaling does not change.

>< — Zoom Out

The **Zoom Out** button contracts the display by doubling the number of channels, so the peaks appear narrower. The marker position becomes the center channel of the new view. The vertical scaling does not change.

Lin / Log

This button toggles between logarithmic vertical scaling and linear mode with automatic vertical limits. The **Lin** button changes to **Log** in the linear mode, and vice versa.

R1 / R2 — Marking ROIs

The Micro-trans-SPEC allows you to mark any number of ROIs in the spectrum. To do this, tap to position the cursor at one end of the region, then tap **R1**. The button label will change to **R2**. Tap to position the cursor at the other end of the region, then tap **R2**. The ROI will be indicated in red, and will be saved in the spectrum file.

NOTE These ROIs are associated with the spectrum display, and are used in conjunction with features such the **Peak Info** command (Section 4.1.5) and the ROI Peak and ROI Integral presets (Section 4.1.6.3). They are not the same as the peak regions designated for the Nuclide Report (Section 4.1.6.6).

Marked ROI channels remain active until unmarked with the **Clr** button: if you **Clear** a spectrum in which you have marked ROIs, the ROI channels will still be marked in the next spectrum you acquire. In addition, they will remain active if you switch to MCA Mode and connect

to a computer running MAESTRO or similar applications. Likewise, if you mark ROIs in MCA Mode, then disconnect and return to standalone mode, those ROIs will remain active on the Micro-trans-SPEC Home screen until unmarked.

<< / >> — Next/Previous ROI

Tap to move to the next lower-energy (<<) or higher-energy (>>) ROI.

Clr — Unmarking ROIs

To unmark an ROI, tap or press << or >> to position the cursor in the desired ROI, then tap **Clr**.

3.2.3.4. Restricting Access to Advanced Settings and the Spectrum Display

The Micro-trans-SPEC allows you to assign a user password that prevents unauthorized use of the unit, and an administrator password that gives access to the instrument but blocks access to advanced settings; see Section 4.1.7.1.

In addition, the **Lock Display** command (Section 4.1.7.3) allows you to hide the spectrum display. In this mode, all commands are available except **Peak Info**. A unit in the **Lock Display** mode cannot communicate with a computer (otherwise the viewing restriction could be sidestepped).

4. MENU COMMANDS

This chapter describes the Micro-trans-SPEC menus, commands, and status screens in stand-alone (ActiveSync) mode.

4.1. The Main Menu

The main **Menu** screen is shown in Fig. 12.

4.1.1. Exit

The **Exit** button closes the trans-SPEC application and takes you to the operating system. To restart the application, tap **Start, Programs, trans-SPEC**.

4.1.2. About

About displays version information for the software application and instrument firmware.

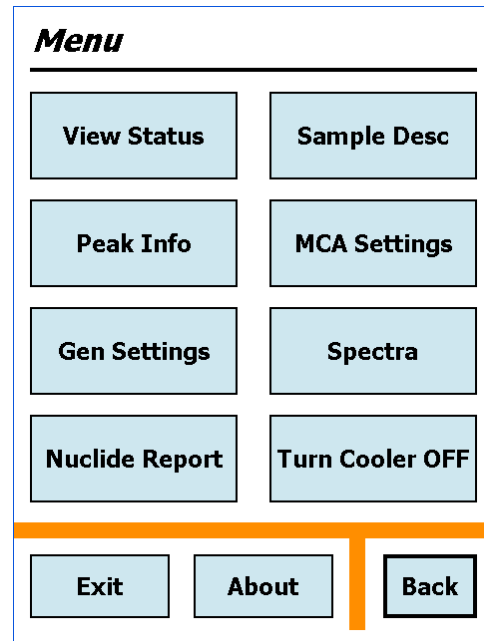


Figure 12. The Main Menu.

4.1.3. View Status

The status screen (Fig. 13) displays all of the major MCA settings at one time. Tap **Back** to return to the Main Menu.

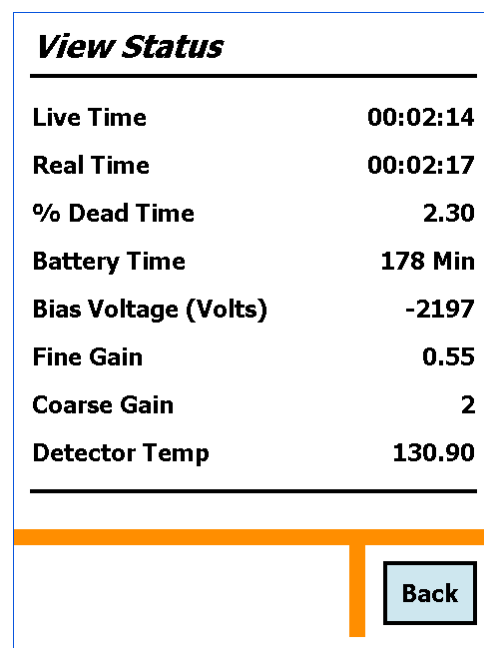


Figure 13. View Status.

4.1.4. Enter Sample Desc

Allows you to enter an alphanumeric identifier, up to 63 characters long, to describe the sample (Fig. 14). If you mark the **Ask for Sample Description** option on the Spectra Settings screen (Section 4.1.8.1), the description entered here will be displayed, for optional modification, each time a spectrum is saved.

Tap in the field to open the soft keyboard, then tap **Set** to complete the entry and close the keyboard, then tap **Back** to return to the previous menu.

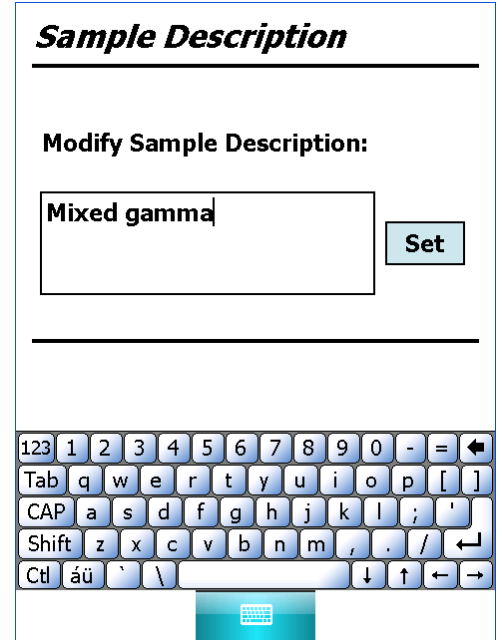


Figure 14. Enter Sample Description.

4.1.5. Peak Info

This dialog (Fig. 15) reports the centroid, FWHM, and net and gross counts for the region identified by the marker position. Access is denied when the spectrum display is locked. If the marker is not in an ROI, all values are shown as **N/A**.

Peak Info	
Peak Centroid	660.85 keV
FWHM	2.14 keV
Net Counts	4597
Gross Counts	4945
ROI Start Channel	1795
ROI End Channel	1816
Net Peak Rate (cps)	13.15
Back	

Figure 15. Peak Info.

4.1.6. MCA Settings

Figure 16 shows the MCA Settings menu.

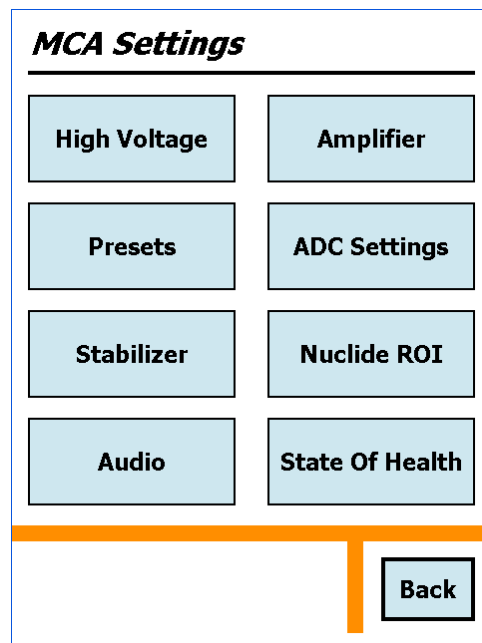


Figure 16. MCA Settings.

4.1.6.1. High Voltage

This dialog (Fig. 17) displays the HV on/off setting, the target and actual bias, and the live detector temperature.

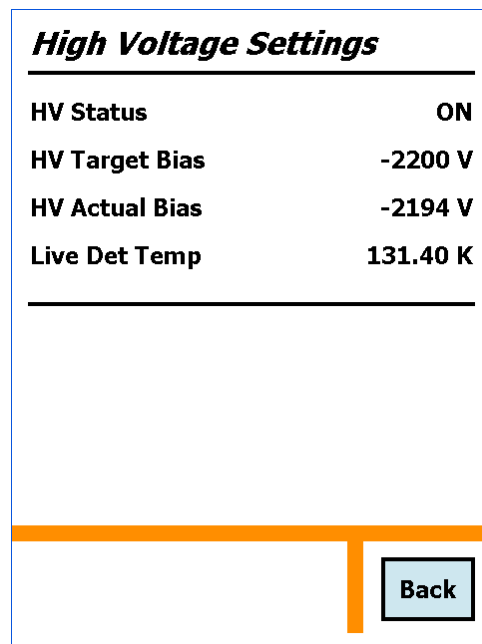


Figure 17. High Voltage Settings.

4.1.6.2. Amplifier

Allows you to set and/or review the various amplifier settings (Fig. 18).

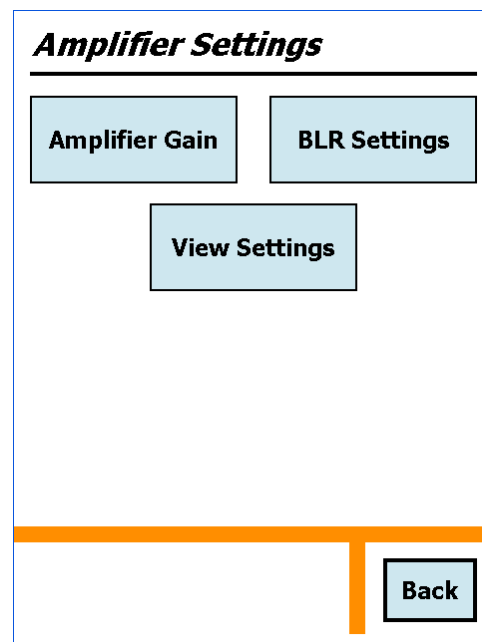


Figure 18. Amplifier Settings.

Amplifier Gain

This screen (Fig. 19) allows you to adjust the amplifier gain before or during acquisition. Click the up/down arrows to set the **Coarse Gain** to $\times 1$, $\times 2$, $\times 4$, $\times 8$, $\times 16$ or $\times 32$. Tap or click-and-drag the slider to set the **Fine Gain** to any value between 0.45 and 1.00.

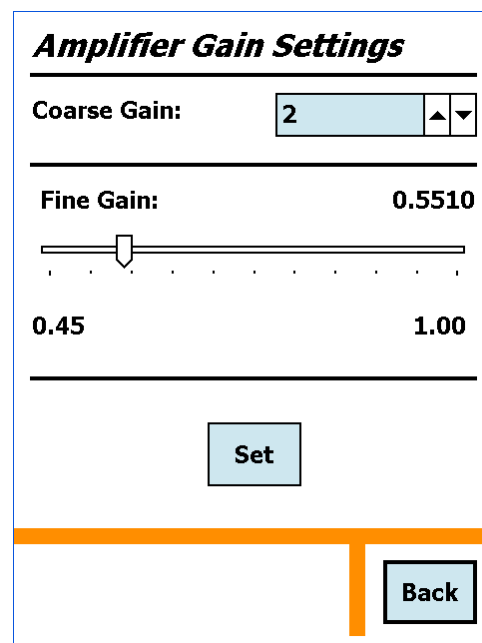


Figure 19. Amplifier Gain Settings.

BLR (Baseline Restorer) Settings

Choose a BLR setting (Fig. 20). **Auto** is the normal setting, **Fast** is typically used for high-count-rate situations, and **Slow** is typically for low-count-rate situations.

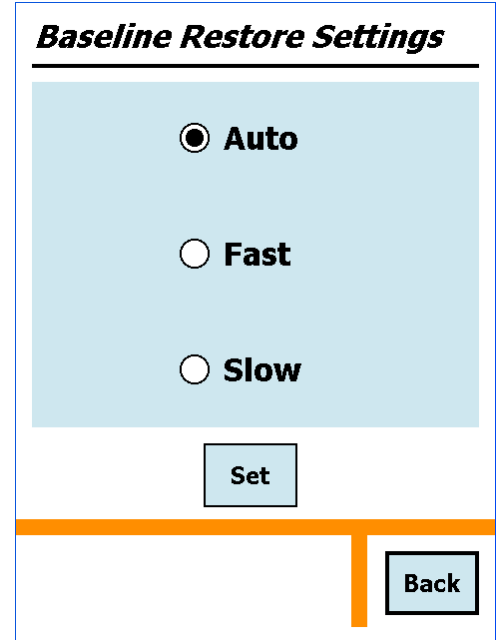


Figure 20. Set the BLR.

View Settings

This displays all the current amplifier settings (Fig. 21). The rise time can be adjusted in MCA Mode with MAESTRO.

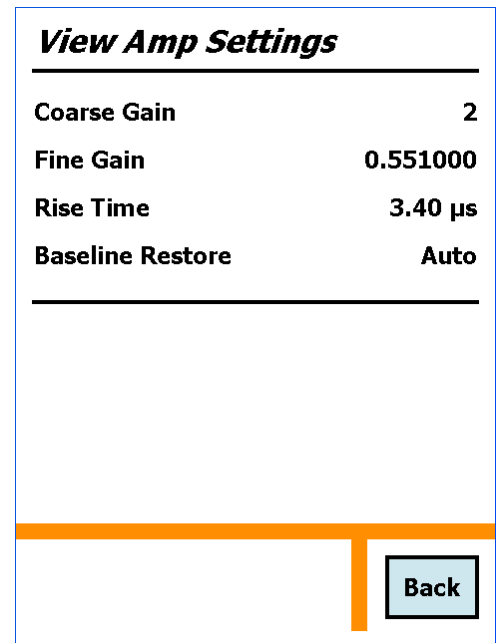


Figure 21. The Main Menu.

4.1.6.3. Presets

Figure 22 shows the Preset Settings menu.

Live Time, Real Time, ROI Integral, ROI Peak

These four preset screens all function in the same way: Tap inside the preset field to display the soft keyboard, enter the preset value, then tap **Set** to complete the entry and close the soft keyboard. To clear a preset, delete or backspace over the entry, or enter zero.

The **Live Time** preset stops acquisition when the live time reaches the specified value.

The **Real Time** preset stops acquisition when the real time reaches the specified value.

The **ROI Integral** preset stops acquisition when the sum of all counts in all ROIs in the spectrum⁶ reaches the specified value.

The **ROI Peak** preset stops the acquisition when any channel in any ROI reaches the specified value.

Figure 23 shows an example of the **Live Time** screen.

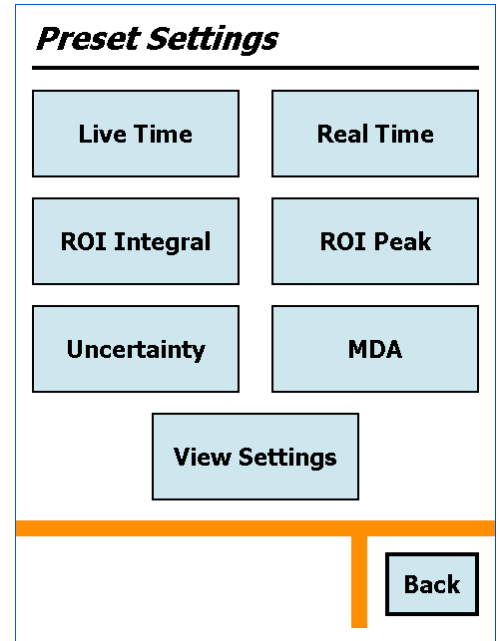


Figure 22. Presets Menu.

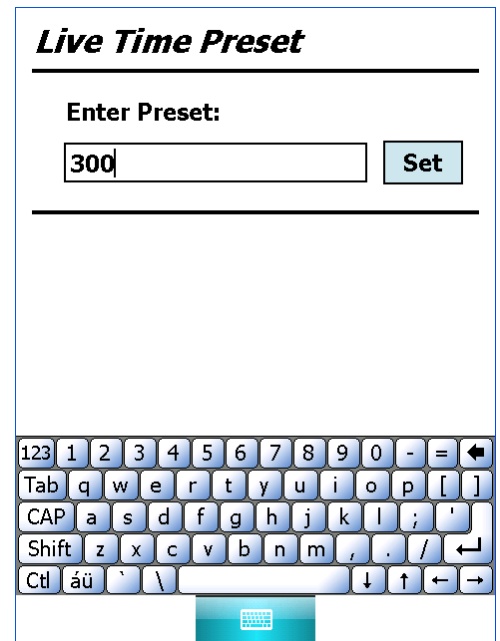


Figure 23. The Live Time Preset.

⁶As distinguished from any ROIs specified for the Nuclide Report.

Uncertainty Preset

The **Uncertainty** preset screen is shown in Fig. 24. This preset stops acquisition when the uncertainty of the selected peak reaches the specified value. The calculation is described in Section 7.1.

Enter the **Start Channel** of the peak and the peak **Width** (in channels). The region specified here should include *three channels of background on each side of the peak*. The region should not be wider than necessary, as the added width will increase the uncertainty value.

Enter the **Preset in %**, and tap **Set**.

Figure 24. The Uncertainty Preset.

MDA Presets

This screen (Fig. 25) lets you establish MDA presets for up to 20 nuclides. The details of the calculations and the definitions of the coefficients are explained in Section 7.2. If a particular preset is not defined, it is marked as **(DISABLED)**. Setup can alternatively be performed with GammaVision or other ORTEC applications.

Data acquisition stops when the MDAs of all of the specified peaks reach their set value. The screen also shows the enable/disable status of the MDA presets. Scroll down to see the MDA preset for nuclides 11–20.

The presets must be set in numerical order beginning with **MDA - 0**. That is, you cannot skip an MDA entry; **MDA - 1** must be next.

Figure 25. MDA Presets.

To define the three MDA coefficients used in the MDA calculation, tap **Coefficients**. This will display Fig. 26. Enter the coefficients as decimal numbers. These coefficients will be used for all MDA calculations. The values you enter will depend on the MDA formula you are using. You can enter any coefficients here, but to have the values correspond to the MDA value calculated

in GammaVision (or other ORTEC analysis applications), use the values shown on GammaVision's MDA Preset tab under **Acquire/MCB Properties**.

To set up an MDA preset, tap to highlight the next available entry, then tap **Edit** to open the screen shown in Fig. 27.

- **Preset (User)** — This value is the preset in activity units (Bq or μCi). GammaVision, MAESTRO, etc., also store this product in the Micro-trans-SPEC memory.
- **EfficYield** — Enter the product of the detector efficiency and the gamma-ray yield (branching ratio). If you use MAESTRO, GammaVision, or other ORTEC applications to set up the MDA preset(s), the value for **EfficYield** is automatically entered. The yield is found in the gamma library file, and the efficiency can be calculated in GammaVision or similar programs.

MDA Coefficients

Coefficient A: 0.50000000

Coefficient B: 0.25000000

Coefficient C: 2.00000000

Set

Figure 26. Define the MDA Coefficients.

MDA Preset 0

Preset (User): 100.00000000

EfficYield: 1.00000000

Start Channel: 1799

Length: 15

Nuclide: Cs-137

Set

Figure 27. Set Up an MDA Preset.

- **Start Channel** — This is the low-energy starting point for the MDA peak. The region specified here should include *three channels of background on each side of the peak*. The region should not be wider than necessary, as the added width increases the MDA value.
- **Length** — Enter the number of channels for the peak region. The region should be wide enough to end in the background on the high-energy side of the peak. The three right-most channels should be background. The region should not be wider than necessary, as the unnecessary width increases the background and the MDA value.

- **Nuclide** — Enter the nuclide name to be displayed in the MDA table and in the software display.

Tap **Set** to complete entry, and **Back** to return to the MDA Preset screen.

Disabling an MDA Preset

To disable an MDA preset, tap to highlight the desired preset, tap the **Edit** button, then tap **Clear** and confirm that you wish to delete. This clears the **Preset (User)** field for the displayed preset and switches the status to **Disabled**. Note that the MDA **Coefficients** are *not* affected by this operation.

View Settings

This screen (Fig. 28) displays the values for all the current presets, including a listbox that allows you to see all of the MDA presets.

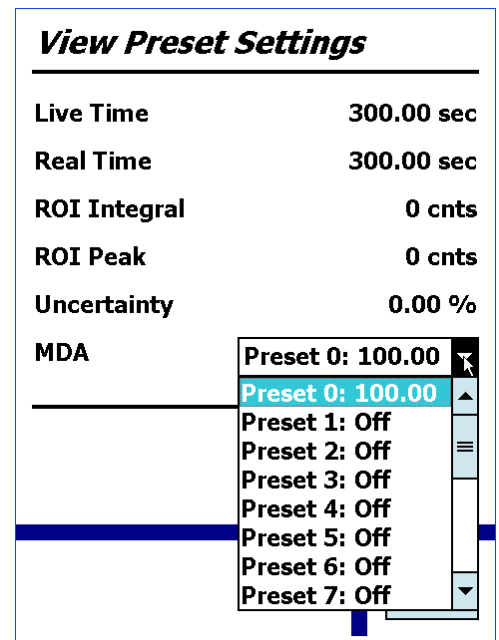


Figure 28. View All Presets.

4.1.6.4. ADC Settings

The dialog is shown in Fig. 29.

- **LLD** — This is the lower-level discriminator. It should be set to reject any low-level noise but not any useful peaks. We recommend a minimum setting of **40** because the Micro-trans-SPEC has a mechanical cooler.
- **ULD** — This is the upper-level discriminator. It is normally set to the conversion gain value. It is automatically set to the last channel when the conversion gain is changed.
- **Conversion Gain** — This is the number of channels in the spectrum. Select from 512, 1024, 2048, 4096, 8192, and 16384.

Figure 29. ADC Settings.

4.1.6.5. Stabilizer Settings

This menu (Fig. 30) allows you to set the stabilizers and view the current stabilizer settings. Gain and zero stabilization are discussed in the MAESTRO user manual.

Gain Stabilizer and Zero Stabilizer Settings

Both dialogs function in the same way. Figure 31 shows the Gain Stabilizer Settings dialog.

Before setting up the stabilizer, tap **Initialize** to reset the stabilizer adjustment to zero percent and clear the **Center** and **Width** entries (if any).

- **Center** — This is the center channel of the region used for the stabilization. The peak will be centered in this region by the stabilizer operation. The peak should be in the upper half of the spectrum and isolated from other peaks.

Figure 30. Stabilizer Settings.

- **Width** — This is the width (in channels) of the peak region to be used. It should be only *slightly* wider than the peak.
- **Stabilizer Enabled** — When you have entered the **Center** and **Width**, tap to mark this box and enable the stabilizer.

View Settings

This screen (Fig. 32) displays the gain and zero stabilizer settings currently in use.

Gain Stabilizer Settings

Center:

Width:

Stabilizer Enabled

Figure 31. Gain Stabilizer Setup.

View Stabilizer Settings

Gain Stabilizer:

Center Channel	3992
Width	82
Enabled	Yes

Zero Stabilizer:

Center Channel	0
Width	1
Enabled	No

Figure 32. View Stabilizer Settings.

4.1.6.6. Nuclide ROI Settings

Figure 33 shows the ROI list for the Nuclide Report (see Sections 4.1.9 and 7.1). Each ROI is designated as **ACTIVE** (the ROI will be reported) or **DISABLED** (the ROI will not be listed in the nuclide report).

To set up a nuclide ROI, tap to highlight the desired entry, then tap **Edit** to open the screen shown in Fig. 34.

NOTE These peak regions are not the same as the ROIs set in the spectrum window, as discussed on page 19.

- **Label** — Nuclide label for this ROI, to a maximum of 6 characters.

- **Units** — Reporting units for all entries in the Nuclide Report, to a maximum of 6 characters. The most recently entered **Units** label for any ROI is used for all ROIs in the next Nuclide Report.
- **Start Channel** — The start channel of the ROI.
- **Length** — The number of channels in the ROI.
- **Constant** — The multiplier for the net peak area for the report, which reflects the detector efficiency and the nuclide yield (branching ratio) as described in Section 7.1. Enter a value of 1 to report the net peak count rate.

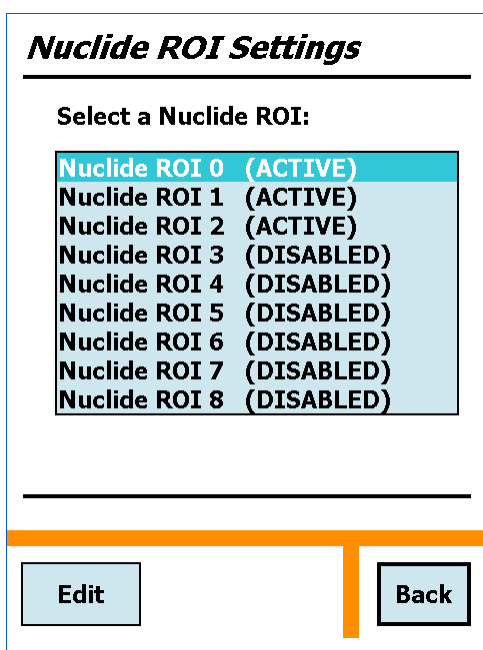


Figure 33. Nuclide Report ROIs.

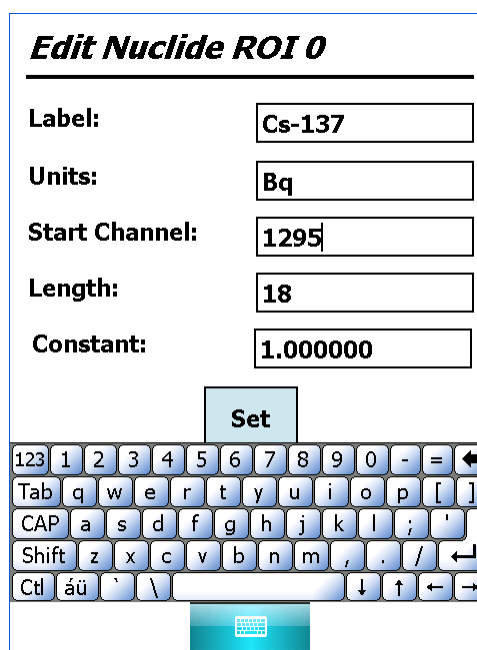


Figure 34. Set Up Nuclide Report ROIs.

Disabling a Nuclide Report Entry

To disable a Nuclide Report ROI, tap to highlight the desired ROI, tap the **Edit** button, then tap **Clear**. This clears all five fields and removes the nuclide from the Nuclide Report screen.

Viewing the Nuclide Report ROI Setup

For an overview of the active Nuclide Report ROIs and corresponding **Constant** values, see the listbox on the View Preset Settings screen (Fig. 28).

4.1.6.7. Audio

Drag the slider, or tap on the desired slider position to adjust the volume for the speaker and headphones (Fig. 35).

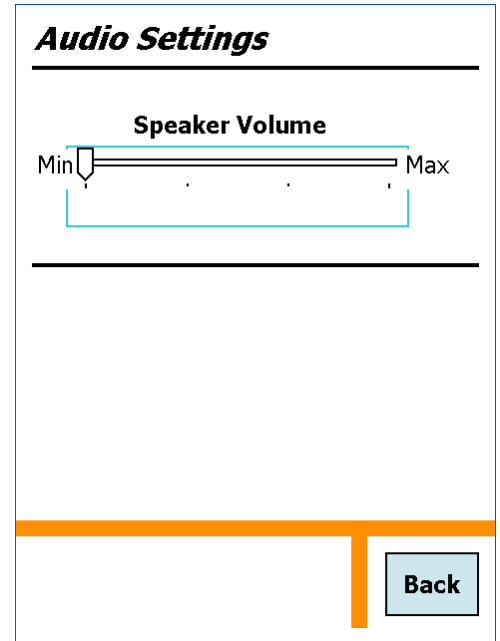


Figure 35. Audio Settings.

4.1.6.8. State of Health

Shows the Micro-trans-SPEC's current (live) diagnostic status (Fig. 36).

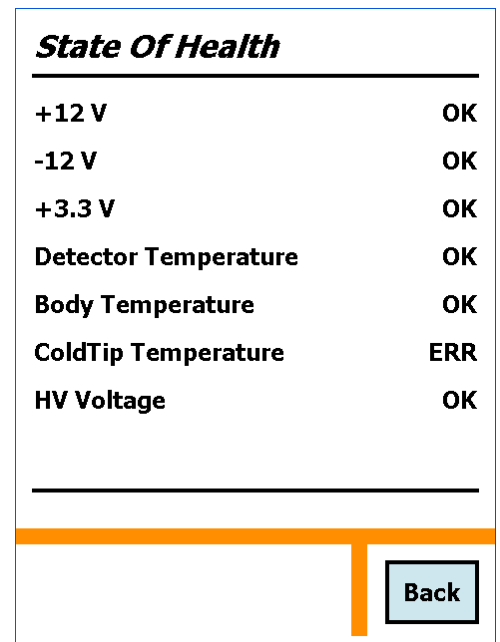


Figure 36. State of Health.

4.1.7. General Settings

These commands (Fig. 37) control user access, spectrum display security, calibration, and the communication mode for the USB port.

4.1.7.1. Set User Pwd and Set Admin Pwd

Both password screens function in the same way. Fig. 38 shows the screen for setting the administrator password. The “enter password” screen is identical except for the screen title. To enter a password, tap the number buttons, then tap **Done**. After a brief delay, the software will start up. If you make a mistake, tap **Clear** and try again.

NOTE *There is no master administrator password.*
If you lose this password, contact your ORTEC service representative.

Set Admin Pwd — Setting an administrator password allows non-administrators to start the Micro-trans-SPEC application, but prevents them from changing the current Micro-trans-SPEC settings. The password is limited to 9 digits. When the administrator password has been set, non-administrators can view the current settings and the spectrum, unless the display is locked. They can also start and stop data acquisition, and save, clear, and view spectra. However, any attempt to change settings displays an “Access denied” message.

Set User Pwd — Setting a user password prevents unauthorized use of the Micro-trans-SPEC program. The password is limited to 9 digits. When the user password has been set, the Micro-trans-SPEC prompts for it on power-up (i.e., on program startup).

- Only administrators can create or clear passwords.

- **Create** — To create a password, tap the number buttons, tap **Done**, then back out to the Main Menu and tap **Exit**. Finally, put the password into effect by tapping **Start, Programs, trans-SPEC**.

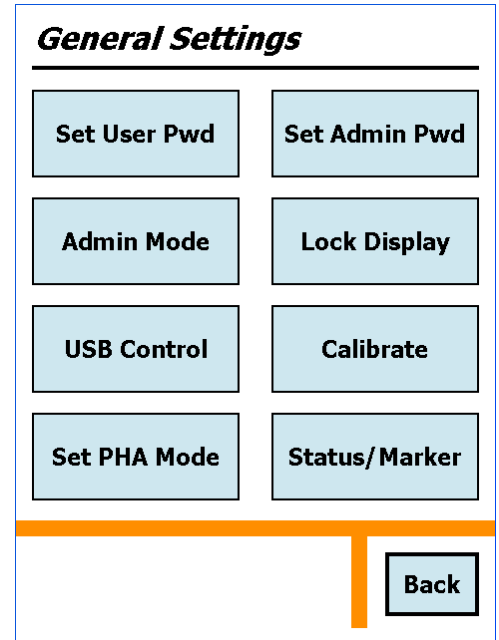


Figure 37. General Settings.

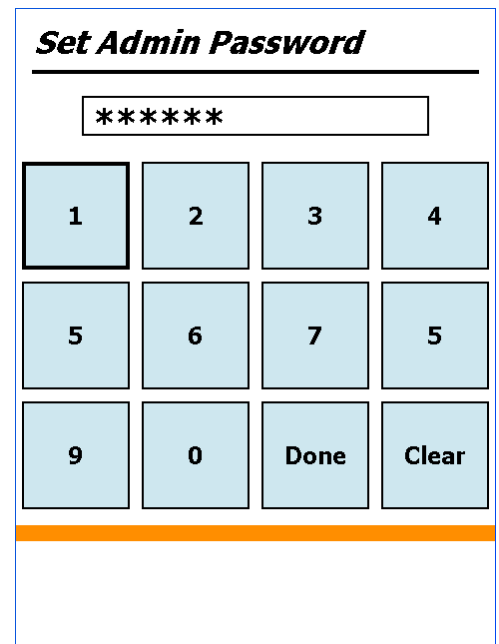


Figure 38. Create Password.

— **Clear** — To clear either password, open the desired screen and tap **Clear** then **Done**. It is not necessary to exit and restart the Micro-trans-SPEC application.

- If the administrator password *is not set*, entering the user password grants full administrator access to all functions.
- If the administrator password *is set*, entering the user password on application startup grants limited access. Entering the administrator password in the “user password” screen grants full access.
- If the user and administrator passwords *are identical*, entering either password grants full access.

4.1.7.2. Admin Mode

This command allows you to enter the administrator password so you can switch from user mode to administrator mode and change Micro-trans-SPEC settings. It is not necessary to exit and restart the Micro-trans-SPEC application.

4.1.7.3. Lock/Unlock Display

This locks (turns off) or unlocks (displays) the spectrum display and **Peak Info** command. The unit must be in Administrator Mode. To put the display lock in effect, you must return to the Main Menu and **Exit** the application, then restart it by tapping **Start, Programs, trans-SPEC**. Figure 39 shows the appearance of a locked display.

NOTE When the display is locked, the unit will not respond to software commands when connected to a computer in **MCA Mode** (see Section 4.1.7.4).

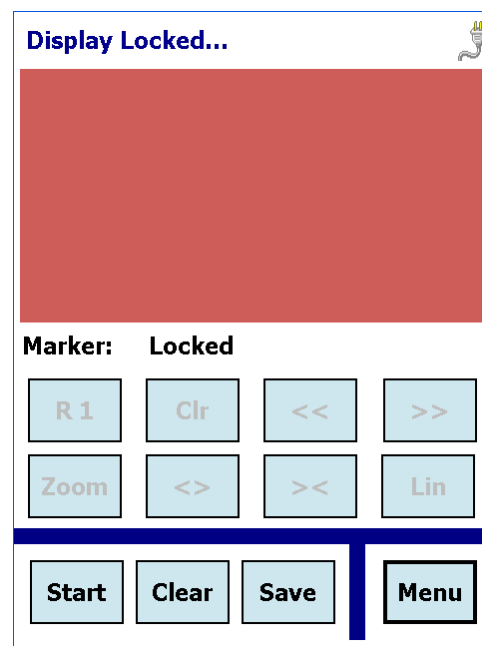


Figure 39. Display (and Peak Info Command) Locked.

4.1.7.4. USB Control

Use the screen shown in Fig. 40 to set the USB port to access the PDA (**Active Sync** mode) for file transfer or the MCA board (**MCA Mode**) for use with MAESTRO or other software applications.

Active Sync mode allows you to move through and/or exit the Micro-trans-SPEC software application. In **MCA Mode**, the screen and all functions except the On/Off button are disabled until you switch back to **Active Sync** mode. When you switch modes, the unit beeps, then takes a few seconds to initialize in the new mode.

4.1.7.5. Calibrate

This function allows you to energy calibrate the Micro-trans-SPEC from multiple peak energy/ channel pairs. Figure 41 shows the table of calibration points. Figure 42 shows the entry screen for each point.

When the Micro-trans-SPEC is connected to a computer, the software application (e.g., MAESTRO, GammaVision) will read this calibration.

If you destroy the calibration in MAESTRO or GammaVision, when you disconnect and return to standalone (**ActiveSync**) mode, the spectrum on the Home screen will indicate only channel numbers, and the energy for all channels will be displayed as 0.00 keV. Note, however, that the calibration page will retain the table calibration points last entered. If you have not changed the gain, you can simply tap **Recalibrate** and the Micro-trans-SPEC will be recalibrated according to the points in the table.

Creating a Calibration

There are two ways to calibrate:

- 1) Determine all the peak centroid energies and corresponding channel numbers to be used, and enter them in the calibration table all at one time. To do this:

For each point, tap **Add**, enter the calibration point and tap **Set**, then tap **Back**. Repeat until all values have been entered and are displayed on the Energy Calibration screen, then tap **Calibrate** before returning to the General Settings menu. *If you leave the Energy Calibration screen without tapping **Calibrate**, all your entries will be lost.*

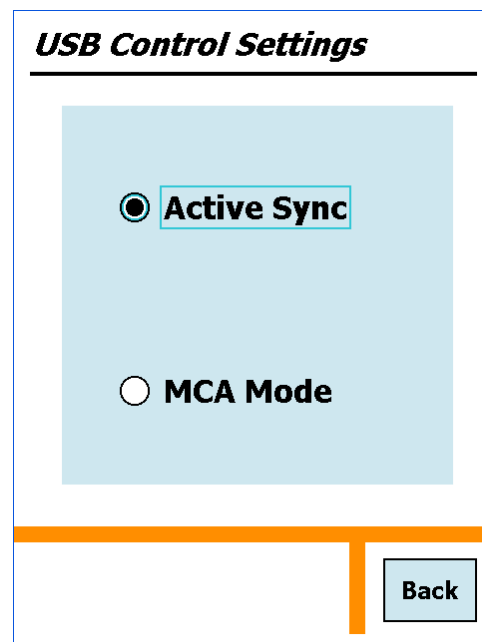


Figure 40. Display Stored Spectrum File.

Energy Calibration	
Energy (keV)	Channel
59.5400	163.0000
661.6200	1808.0000
1173.2000	3206.0000
1332.5000	3641.0000

Figure 41. Table of Calibration Points.

Enter Calibration Point	
Energy:	<input type="text" value="59.54"/>
Channel:	<input type="text" value="163"/>
Units:	<input type="text" value="keV"/>

Figure 42. Display Stored Spectrum File.

- 2) Determine each peak centroid energy and channel individually, and enter it in the calibration table one-at-a-time. To do this:

Obtain the peak information for the first point, then tap **Add**, enter the calibration point and tap **Set**, **Back**, and **Calibrate** (*again, if you leave the Energy Calibration screen without tapping Calibrate, all your entries will be lost*). Back out to the Home screen, obtain the information for the next point, return to the calibration screen, and repeat as for the first point. Repeat until all values have been entered and added to the calibration table displayed on the Energy Calibration screen.

Editing Calibration Points

To edit a point in the calibration table, tap to highlight the entry, then tap **Edit**. Make the desired changes, then tap **Set**, **Back**, and **Calibrate**.

Deleting Calibration Points

To delete a point, tap the calibration table to highlight the entry, then tap **Delete**. *Note that this removes the selected entry without warning, and there is no “undo.”*

4.1.7.6. Set PHA Mode

Sets the operation mode to pulse-height analysis (PHA). This is only needed when you disconnected from the host computer with the Micro-trans-SPEC in the ORTEC Insight™ Virtual Oscilloscope mode, which is discussed in the MAESTRO user manual.

4.1.7.7. Status/Marker

This menu (Fig. 43) accesses the Status Line and Marker Line setup screens. Figure 44 shows the Status Line, above the spectrum display, and the Marker Line just below the spectrum. Each of these can be configured to show up to two parameter each, as follows.

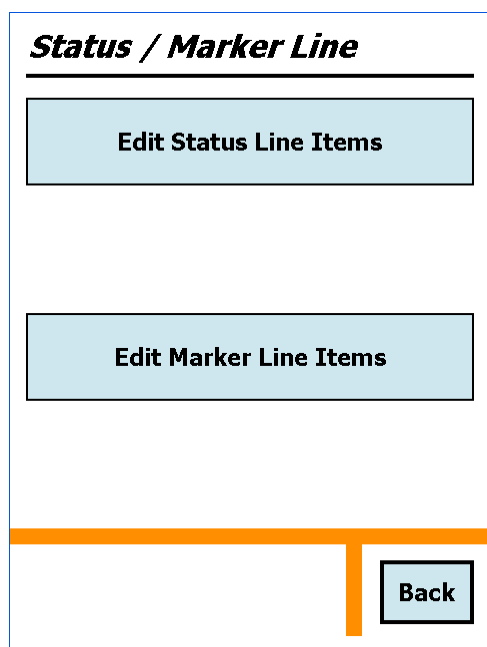


Figure 43. Select Status Line and Marker Line Displays.

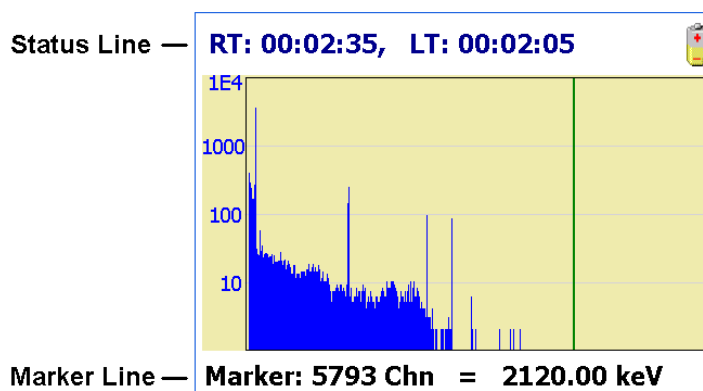


Figure 44. Status and Marker Line Readouts.

The order in which you select the parameters determines which is displayed on the left side of the screen and which is displayed on the right. When you mark the first item, a **1** appears beside your first selection. This parameter is displayed on the left. The second item is marked with **2** and is displayed on the right.

Status Line parameters

- Live Time
- Real Time
- Live Time Remaining
- Real Time Remaining
- Battery Time Remaining
- Count Rate
- Count Rate in ROI

Marker Line parameters

- Marker Location (Energy)
- Marker Location (Channel)
- Marker Counts

4.1.8. Spectra

Figure 45 shows the Spectra Settings screen. These options allow you to view and manage the spectra stored on the Micro-trans-SPEC, select the file format and storage location, and specify whether or not to ask for a sample description each time a spectrum is saved.

4.1.8.1. Ask for Sample Description

If you mark this checkbox, each time a spectrum is saved, the **Default Sample Description** shown here will be displayed, for optional modification. The default description can be modified here or on the Sample Description screen (Section 4.1.4).

When you save a spectrum and the default description is displayed, you can:

- Tap **Set** to save the spectrum with the current default description.
- Edit the default description and tap **Set** to save with the spectrum and the modified description.
- Remove the description by tapping **<Backspace>** and **Set**.
- Tap **Back** to return to the previous menu without saving the spectrum.

Figure 45. Spectra Settings.

4.1.8.2. Data Location

The Micro-trans-SPEC allows you to store spectra in the PDA's **My Documents** folder or on a removable **Storage Card** (the latter is only displayed if a card is present). Tap to open the list, then tap to choose the location. This can be changed at any time.

4.1.8.3. File Save Format

Tap to select the **ORTEC Integer .Spc** or **ORTEC Integer .Chn** spectrum file format.

4.1.8.4. Displaying a Stored Spectrum

To display a stored spectrum, select the desired **Data Location**, then tap **Display** to show the list of spectra for that location (Fig. 46). Tap to highlight the desired file, then tap **Choose** to display it (Fig. 47). The display screen show the filename and spectrum, and provide a subset of the Home screen's display control buttons.

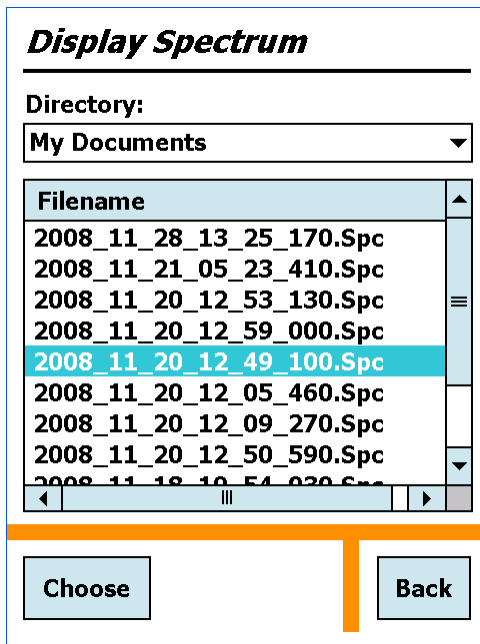


Figure 46. Choose the Spectrum to be Displayed.

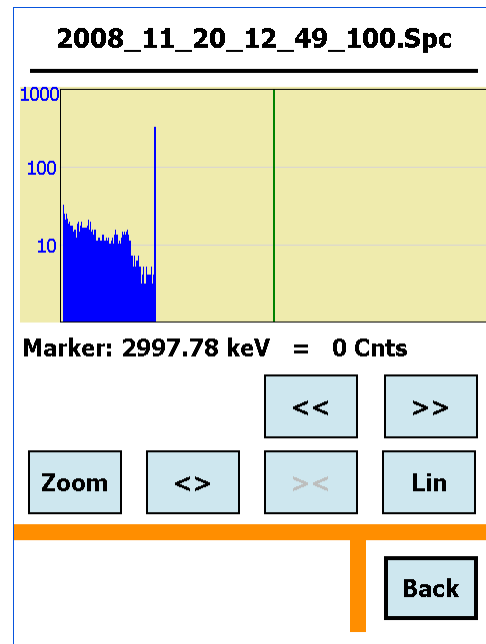


Figure 47. Display Stored Spectrum File.

NOTE Choosing to display a stored spectrum does not load it into (overwrite the current spectrum in) the detector's live-spectrum memory.

4.1.8.5. Deleting a Spectrum File

To permanently remove a spectrum file, select the desired **Data Location**, then tap **Delete** to display the list of available files (Fig. 48). Tap to highlight the desired file, tap **Choose**, then tap **Yes** to confirm that you wish to delete. *There is no “undo” for this operation.*

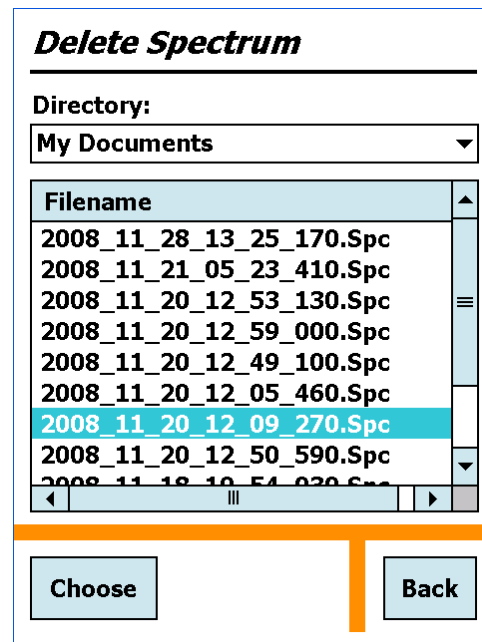


Figure 48. Choose the Spectrum to be Deleted.

4.1.9. Nuclide Report

The Nuclide Report (Fig. 49) is a very useful tool for monitoring nuclide count rates and activities in the field. The display is updated in real time so you can have a “live” reading of the selected nuclides. You can select up to nine gamma-ray energies located anywhere in the spectrum. The display shows the nuclide name, the energy, and the calculated value. The calculated value is the peak net area multiplied by a constant divided by the live time. (The details of the calculations are explained in Section 7.1.) The **Constant** is user-entered as discussed in Section 4.1.6.6, page 31. If you use a value of **1**, the calculated value is the net peak count rate. If the efficiency and yield (branching ratio) are included in the factor, the calculated value is the activity.

Nuclide Report

Nuclide	keV	Bq	±%
Be-7	477.8	0.00E+000	0.0
K-40	1462.6	1.6E+002	3.6
Ru-103	30.9	0.00E+000	0.0

Back

Figure 49. View the Nuclide Report.

4.1.10. Turn Cooler OFF/ON

This is a simple on/off toggle for the mechanical cooler (Fig. 50). The button label changes to reflect the next available action. For more information on the cooler, see Section 3.1.1.

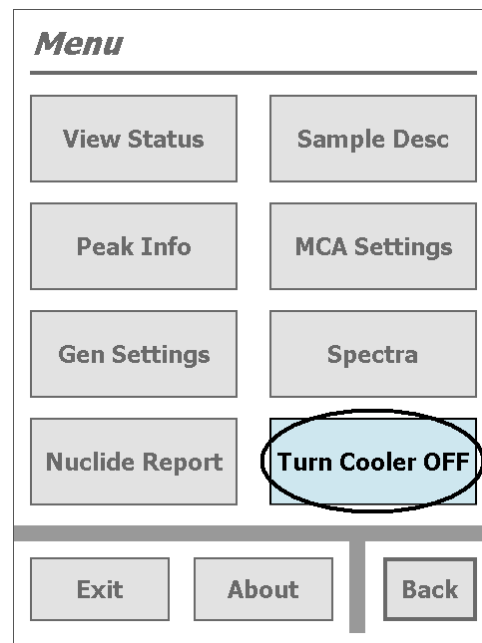


Figure 50. Cooler is On.

5. FILE TRANSFER TO COMPUTER

The Micro-trans-SPEC stores Identification Mode spectra in the ORTEC .SPC file format, and Search Mode spectra in the simpler .CHN format. Once you have downloaded the spectrum files, you can view and analyze them with CONNECTIONS programs such as MAESTRO, Gamma-Vision, and ISOTOPIC. The file transfer method depends on your computer operating system and where your spectrum files are stored on the Micro-trans-SPEC.

- Spectra stored on the SD card (recommended) — The simplest method is to move the card to a computer with a memory card reader and Windows Explorer. Otherwise, transfer files using the Windows Mobile Device Center or ActiveSync as described below.
- Spectra stored in the Micro-trans-SPEC's *My Documents* folder:
 - **Windows 7/8:** You must download and install Windows Mobile Device Center, as described in Section 5.1, then copy files via Windows Explorer.
 - **Windows XP:** You must download and install Microsoft ActiveSync driver, as described in Section 5.2, then copy files via Windows Explorer.

IMPORTANT *Before connecting the Micro-trans-SPEC to a computer for the first time, install Windows Mobile Device Center or ActiveSync **first**. Otherwise, the Micro-UF6 may not be able to communicate properly with the computer. Contact our Global Service Center if you need assistance.*

5.1. Windows 8 and 7

- 1) Download and install the free Windows Mobile Device Center from the Microsoft Download Center. Follow the wizard prompts, restart the computer, then start the Windows Mobile Device Center program.
- 2) If the Micro-trans-SPEC is in MCA Mode, tap the **Data (ActiveSync)** option to return it to stand-alone identifier mode (see Section ?).
- 3) Connect the Micro-trans-SPEC's USB port to the computer. If this is the first time the Micro-trans-SPEC has been connected to this computer, Windows 7 and 8 will indicate that the hardware driver has been installed. Windows XP will display a series of "new hardware" messages indicating a mobile device (e.g., the Micro-trans-SPEC computer) has been detected and its driver installed. Windows Mobile Device Center will then take several seconds to communicate with the Micro-trans-SPEC and indicate the its integrated computer is

Connected (Fig. 51). If Windows Mobile Device Center cannot connect to the Micro-trans-SPEC, see the troubleshooting steps in Section 6.8.

- 4) Click **Connect without setting up your device**. This will prevent the host computer and Micro-trans-SPEC from automatically synchronizing (i.e., exchanging files). ***Do not modify the Program and Services, transfer graphics or music to the Micro-trans-SPEC computer, or change the Mobile Device Settings.***

IMPORTANT *Remember that the Micro-trans-SPEC is not to be used for purposes beyond the monitoring tasks described in the user manual, and no changes should be made to the operating system settings.*

- 5) Hover over **File Management** to expand its topics, and click **Browse the contents of your device** (Fig. 52).

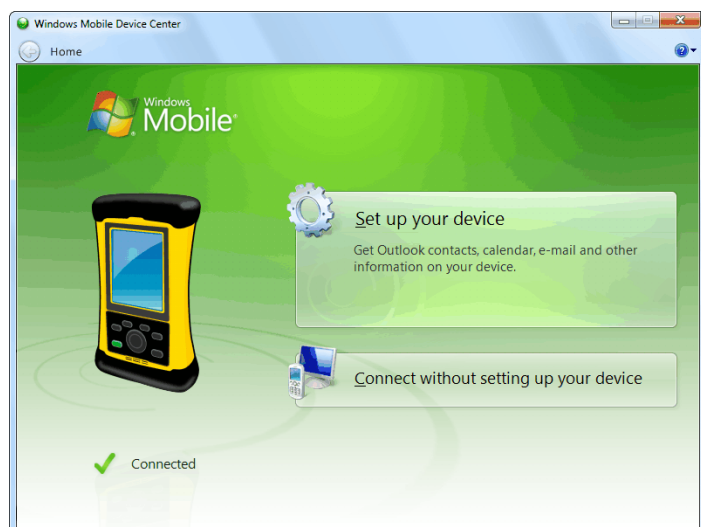


Figure 51. The Micro-trans-SPEC is Connected to the Computer.



Figure 52. Choose the File Management Browse Option.

- 6) Windows Explorer will open and the Micro-trans-SPEC's computer will be listed as shown in Fig. 53. Stored search and identification files will be located in the SD card's **Data** folder or in the **My Documents** folder, depending on the location set on the Spectra dialog (see Section 4.1.8.2).
- 7) If your files are stored on the SD card, select the **Storage Card** and open the **Data** folder. If your files are in the **My Documents** folder, select the **Documents** item on the left sidebar. Identification Mode spectra in the **.SPC** format have a "spectrum" icon with a green background. Search Mode files in the **.CHN** format have a "spectrum" icon with a gray background. Text files have the default file icon.

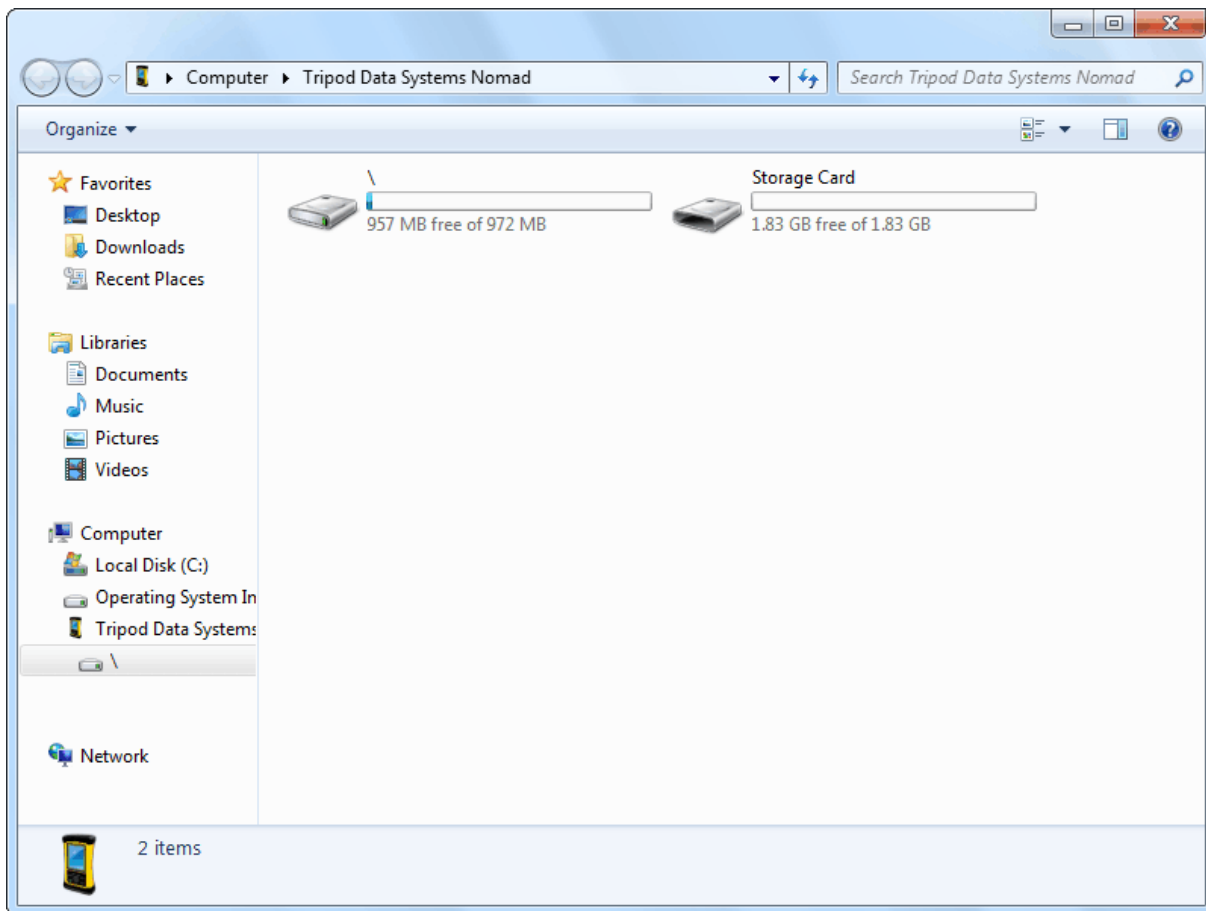


Figure 53. The Micro-trans-SPEC Computer’s Top-Level File Structure.

5.2. Windows XP

- 1) Download the free ActiveSync v4.5 or higher from the Microsoft Download Center. When download is complete, select **Run**. This will automatically start installation. Follow the wizard prompts and restart the computer.
- 2) If the Micro-trans-SPEC is in MCA Mode, tap the **Data (ActiveSync)** option to return it to standalone identifier mode (Section 4.1.7.4).
- 3) Connect the Micro-trans-SPEC’s USB port to the computer. If this is the first time the Micro-trans-SPEC has been connected to this computer, Windows will display a series of “Found New Hardware” messages indicating a mobile device (e.g., the Micro-trans-SPEC computer) has been detected. The Synchronization Setup Wizard will start. Follow the wizard prompts for a standard partnership according to step (4).

- 4) On the Synchronization Options screen, **unmark ALL checkboxes, scrolling down as needed to ensure all items have been deselected** (Fig. 54). This will prevent the host computer and Micro-trans-SPEC from automatically exchanging files.

IMPORTANT Remember that the Micro-trans-SPEC is not to be used for purposes beyond the monitoring tasks described in the user manual, and no changes should be made to the operating system settings. Doing so could void your warranty.

- 5) Continue with installation as directed. At the end of the wizard, the ActiveSync dialog will indicate the Micro-trans-SPEC computer is **Connected** (Fig. 55). If ActiveSync cannot connect to the Micro-trans-SPEC, see the troubleshooting steps in Section 6.8.

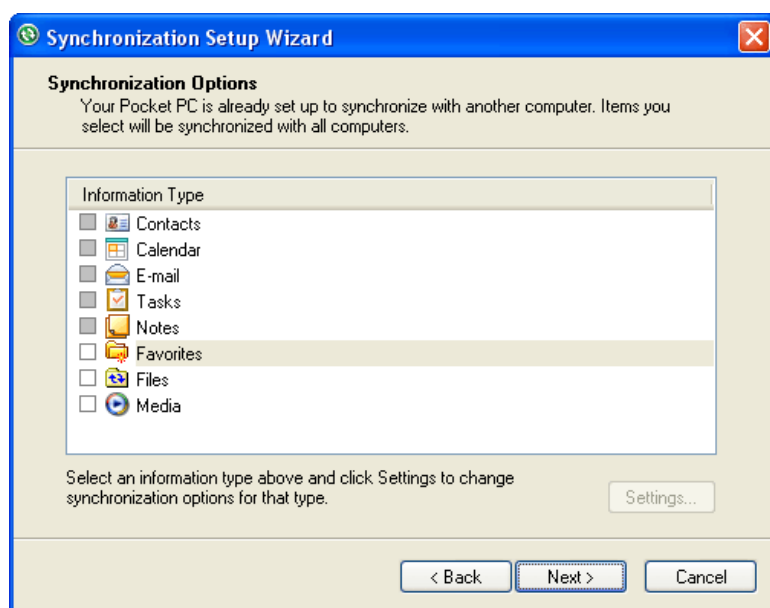


Figure 54. Unmark All Synchronization Options.

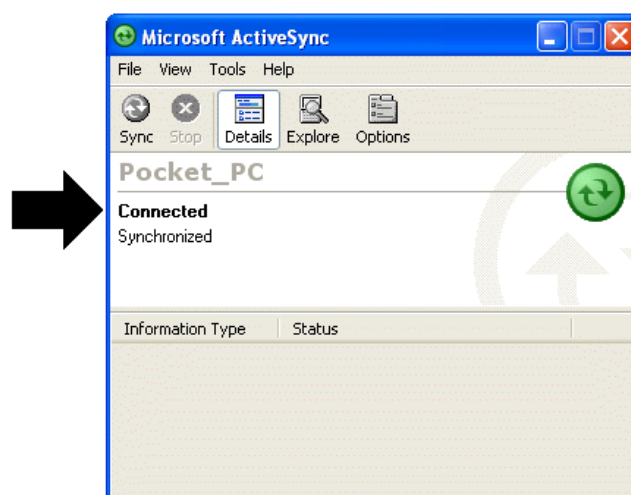


Figure 55. Connection Established.

- 6) You can now click the **Explore** toolbar button in the ActiveSync dialog to open Windows Explorer and view the new connection and its menu tree.

From the host computer, the Micro-trans-SPEC is displayed as **My Windows Mobile-Based Device** in the **Mobile Device** folder under **My Computer** (Fig. 56). Stored search and identification files will be located in the SD card's **Data** folder or the **My Documents** folder or, depending on the location set on the Spectra dialog (see Section 4.1.8.2). These locations are indicated by arrows in Fig. 56.

Identification Mode spectra in the .SPC format have a “spectrum” icon with a green background. Search Mode files in the .CHN format have a “spectrum” icon with a gray background. Text files have the default file icon.

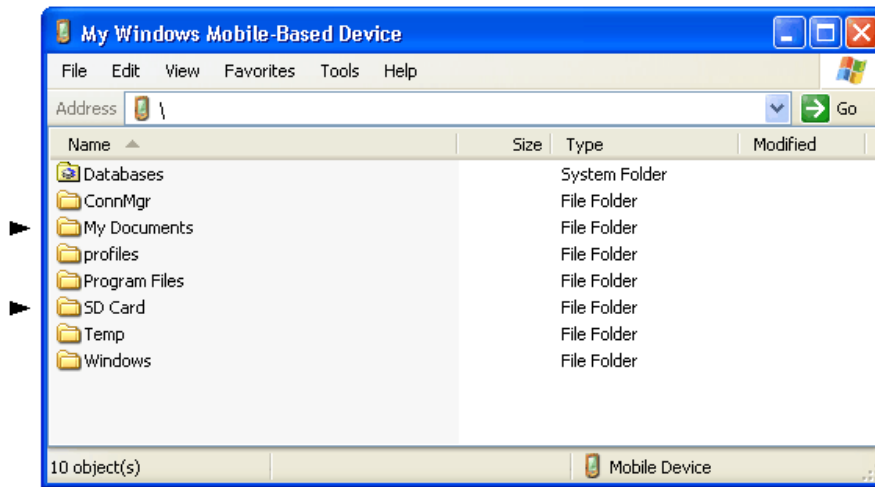


Figure 56. Exploring the Micro-trans-SPEC Computer’s Files from the ActiveSync Window.

5.3. When File Transfer Is Complete

To return the Micro-trans-SPEC to standalone service, simply disconnect it from the USB cable and navigate back to the home screen.

[Intentionally blank]

6. TROUBLESHOOTING

6.1. “Error Saving Spectrum File” Message

This message is generated if the spectrum storage location is set to a removable card drive and no card is in the specified drive. Insert the card and tap **Save** again. If you do not have a card for the specified drive, go to the Spectra screen and select a valid location. The spectrum will be retained in live-spectrum memory until you clear it or start another acquisition.

6.2. If the Micro-trans-SPEC Program Stops

The Micro-trans-SPEC incorporates a PDA running the Windows Mobile operating system. Occasionally, the operating system will stop responding to external commands. The power button is located below the display on the base of the PDA. Press and hold the power button for several seconds until the PDA shuts down and restarts (the mechanical cooler will continue running). This will reset the operating system and automatically relaunch the Micro-trans-SPEC application.

6.3. If You Drop the Micro-trans-SPEC

The Micro-trans-SPEC has been designed to be a rugged instrument, and should survive reasonable levels of mechanical abuse. It has been drop-tested to destruction in development and is known to have a high degree of survivability to “normal” shock and vibration.

If the instrument is dropped:

- Turn off the MCA electronics (not the cooler): to do this, disconnect from any external power source, disconnect any USB connection, press and hold the **On/Off** button for approximately 3 seconds, then release to display the PDA’s Power Menu. Select **Shut-down**. Wait 5 seconds, then turn the unit back on. This should reset any mechanical relays that might have been deactivated by the drop.
- Inspect the exterior for evidence of mechanical damage or distortion.
- *Listen* to the cooler: If you hear any unusual noises (rattling or pinging) emanating from the cooler, contact your ORTEC representative or our Global Service Center.
- Monitor the View Status screen for the next few hours to ensure that the cooler and bias voltage are functioning properly, and ensure that it is still calibrated. If the calibration is significantly changed, this could indicate a problem.

If the unit fails in one or more of these respects or if any message boxes indicate a failure, contact your ORTEC representative or our Global Service Center for further assistance.

Remember that there are no user-serviceable parts inside the Micro-trans-SPEC and opening the case will void the warranty.

6.4. If the Micro-trans-SPEC Will Not Turn On

- Connect the Micro-trans-SPEC to an external power source. It should automatically boot up, turn the cooler on, and start the Micro-trans-SPEC software application. (If the cooler does not automatically restart, go to the Main Menu and tap **Turn Cooler ON**.)
- If the internal batteries are exhausted but can still hold a charge, see the next section.
- If the battery does not hold a charge, ensure that it is properly installed. If properly installed, the battery must be replaced according to the instructions in Appendix A.

6.4.1. Starting from an Exhausted Battery

If the internal battery is completely exhausted, try recharging it. Connect the Micro-trans-SPEC to external power. The cooler will start automatically. If the detector has warmed up, it will cool to operating temperature before the battery begins recharging. If the battery is completely discharged, it will typically reach full charge in 3–4 hours after the detector is cool. If the cooler does not automatically restart, go to the Main Menu and tap **Turn Cooler ON**.

6.5. If the Display is Lost or Posts a “Display Disabled” Message

Press and hold the on/off button, located on the base of the display, until the shutdown warning screen counts down and the display goes dark. Wait 15–20 seconds, then press the on/off button to restart the PDA. When restart is completed, the Micro-trans-SPEC software will automatically start and the unit will be ready for use.

For further assistance, contact your ORTEC representative or our Global Service Center.

6.6. If You Forgot the Administrator Password

There is no master password. Contact your ORTEC representative or our Global Service Center for assistance.

6.7. GPS Issues

6.7.1. Delayed Display of Location Coordinates

If your GPS has not received signals from GPS satellites for >30 days (e.g., if it has not been in use or has been used continuously indoors), it may take 10–15 minutes for the unit to update and begin displaying location information.

6.8. Windows Connectivity Problems

Typically, if ActiveSync or Windows Mobile Device Center cannot find the Micro-trans-SPEC, it is because the Windows connectivity software was not installed *first*, before the unit was connected to the computer. If the Windows connectivity software has not been installed, when you attach the Micro-trans-SPEC to the computer for the first time, the “new hardware” bubbles in the lower right corner of the screen will indicate that device driver installation failed.

- Confirm the USB cable is good. If connecting via a USB hub, ensure that it is correctly connected and functioning. If this does not resolve the issue, go to the next step.
- In Control Panel, open the Device Manager and check for an **Unknown Device** entry that disappears when you disconnect the Micro-trans-SPEC from the computer. If such an entry exists, reconnect the Micro-trans-SPEC, right-click the **Unknown Device**, select **Uninstall**, and confirm that you wish to uninstall the instrument. Disconnect the Micro-trans-SPEC from the computer.
- Download and install (or uninstall and reinstall) the ActiveSync or Windows Mobile Device Center software, making sure you have downloaded the correct version; restart the computer; and start the connectivity program.
- Restart the Micro-trans-SPEC by pressing and holding the On/Off button for 5 seconds, until the screen goes dark and the instrument reboots. When the Micro-trans-SPEC program has fully reinitialized, reconnect to the computer. You should see one or more “new hardware” bubble messages indicating the Micro-trans-SPEC was successfully detected.
- If these steps do not resolve the issue, contact your ORTEC representative or our Global Service Center. In the meantime, if your spectrum files are stored in the instrument’s **My Documents** folder, you may wish to exit the Micro-trans-SPEC program, use the Windows Mobile File Explorer program to copy the spectra to an SD card, then mount the SD card in the computer and transfer the files that way.

6.9. Troubleshooting MAESTRO-Related Problems

6.9.1. MAESTRO Does Not Connect with the Micro-trans-SPEC

If properly installed and functioning MAESTRO software (or other CONNECTIONS programs) cannot find and communicate with the Micro-trans-SPEC when it is connected via the USB port and being used as an MCA:

- Make sure the USB cable is properly connected to both the Micro-trans-SPEC and computer.
- Make sure USB hubs are correctly connected and functioning.
- Make sure the Micro-trans-SPEC is turned on, the USB Control setting is **MCA Mode**.
- Run the MCB Configuration program according to the instructions in the MAESTRO user manual.

6.10. Other Problems with the Micro-trans-SPEC

Should the Micro-trans-SPEC exhibit other unusual behavior, confirm that the Regional Settings in the Windows Mobile operating system are set correctly, and restore them if necessary. The Micro-trans-SPEC is designed to function with Windows Mobile set to the **English (United States)** region and its default values for decimal symbol, digit grouping symbol, and time and date formats, as described below. *Using other than the factory default settings can cause operational problems.*

To check these settings:

- On the Main Menu screen, tap **Exit**, then confirm that you wish to end the Micro-trans-SPEC program.
- On the Windows desktop, tap the **Start** square in the upper left corner of the screen, then tap **Settings**.
- In the Settings dialog, tap the System tab, then select **Regional Settings**.
- On the Region tab, select **English (United States)** from the droplist.
- On the Number tab, choose the period (.) for the **Decimal symbol** and the comma (,) for the **Digit grouping symbol**.

- On the Time tab, select *h:mm:ss tt* as the **Time style** and the full colon (:) as the **Time separator**.
- On the Date tab, use *M/d/yy* as the **Short date**, the forward slash (/) as the **Date separator**, and the **Long date** format *dddd, MMMM dd, yyyy*.
- Tap the upper right **OK** circle, then the upper right **X** circle to return to the Windows desktop.
- Restart the Micro-trans-SPEC application by tapping **Start, Programs, trans-SPEC**.

For further assistance, contact your ORTEC representative or our Global Service Center.

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7. CALCULATIONS

7.1. The Nuclide Report

The Nuclide Report displays the activity of up to 9 user-selected peaks. Once the report is set up you can view the Nuclide Report at any time. The peak area calculations are the same as the calculations in MAESTRO and other ORTEC software, so the Nuclide Report contents can be duplicated using the spectra stored in the computer. The calculated value is computed by multiplying the net peak count rate by a user-defined constant. If the constant includes the efficiency and branching ratio, the displayed value will be activity. The nuclide label and the activity units are entered by the user.

The report has this format:

Nuclide	keV	Bq	±%
CO-60	1332.5	1.21E+01	10.2
CO-60	1173.2	1.09E+01	12.3
CO-57	122.1	1.48E+00	86.2

7.1.1. Calculations

These are the calculations used to generate the Nuclide Report's activity, uncertainty, and peak values.

7.1.1.1. Activity

Activity is calculated as follows:

$$\text{Activity} = \frac{\text{NetCounts} \times \text{Constant}}{\text{LiveTime}}$$

where:

Constant is the **Constant** value entered on the Edit Nuclide ROI screen (Section 4.1.6.6). This is normally the inverse of the product of the efficiency and the yield (branching ratio). Note that the efficiency is the absolute counting efficiency for the source-detector geometry being used. Thus, in order to get meaningful activity results, as in any counting situation, you must have efficiency factors appropriate to the actual counting geometry. If *Constant* is set to 1, you will get the peak count rate on the display.

LiveTime is the current live time.

NetCounts is computed with the following equation:

$$\mathit{NetCounts} = \mathit{GrossCounts} - \mathit{Background}$$

GrossCounts is the sum of the counts in the ROI, excluding the first and last 3 channels of the ROI.

Background is:

$$\mathit{Background} = \frac{\mathit{AvgCount\ first\ 3\ chan} + \mathit{AvgCount\ last\ 3\ chan}}{2} \cdot \mathit{ROIWidth}$$

ROIWidth is:

$$\mathit{ROIWidth} = \mathit{EndChannel} - \mathit{StartChannel} + 1 - 6$$

7.1.1.2. Uncertainty

Uncertainty (in percent) is calculated as follows:

$$\mathit{Uncertainty} = \frac{\sqrt{\mathit{GrossCounts} + \mathit{Background} \cdot \frac{\mathit{ROIWidth}}{6}}}{\mathit{NetCounts}} * 100$$

7.1.1.3. Peak

Peak is the position of the maximum count and is computed with the following equation:

$$\mathit{Peak} = \mathit{MaximumROIChan} * \mathit{EnergySlope} + \mathit{EnergyIntercept}$$

where:

MaximumROIChan is the channel in the ROI with the most counts. If there are no data, the center channel of the ROI is used.

EnergySlope and *EnergyIntercept* are the energy calibration values as entered on the touchscreen (in standalone mode) or by software (when connected to a computer). If the values are not present, the result is given in channels.

7.2. MDA Preset Calculation

The formula for the MDA can be represented as follows:

$$MDA_i = \frac{a + \sqrt{b + c * Counts\ in\ ROI_i}}{Live\ time * Eff_i * Yield}$$

where:

MDA_i	=	Minimum detectable activity for the i^{th} nuclide (Bq)
a, b, c	=	Constants
$Counts\ in\ ROI_i$	=	Gross counts in i^{th} ROI
$LiveTime$	=	Counting live time (sec)
$Yield$	=	Branching ratio (gammas/Bq)
Eff_i	=	Detection efficiency for the i^{th} nuclide

The MDA values in the MCB are calculated, in becquerels, given the constants a , b , and c . i is an index from 0 to 19 that represents the 20 unique nuclides. The constants a , b , and c ; MDA_i ; Eff_i ; and $Yield$ are loaded into the MCB by the user.

The expected (preset) value is $Eff_i * Yield * MDA_i$. The calculated value is:

$$\left(a + \sqrt{b + c * Counts\ in\ ROI_i} \right) / Live\ time$$

The calculated values are compared with the expected values and when all are lower, acquisition is stopped. Note that a , b , and c are common for all nuclides while the ROI and the expected value are unique for each of the nuclides.

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8. SPECIFICATIONS⁷

8.1. HPGe Detector

Gamma-Ray Detector Internal, coaxial HPGe detector. P-type high-purity germanium, 50 mm diameter × 30 mm deep (nominal).

- Relative efficiency: 15% 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).

If you must test the dose-rate measurement capability with a point source, especially at close range, it is important to know the reference points of the unit's detector, since test procedures such as ANSI or IAEA prescribe use of point sources at specified distances from the reference point of the instrument. The reference point is the geometric center of the Ge detector endcap disk (see Fig. 57).

8.2. MCA Specifications

Display Color LCD touchscreen provides live spectrum display, status information, and analysis results.

Full Display and Zoom Modes Display of multiple ROIs.

Status Line User-configurable parameter display; choice of two from: live time, real time, live time remaining, real time remaining, battery life remaining, count rate, count rate in ROI, and counts.

Marker Line User-configurable parameter display; choice of two from marker location in energy, marker location by channel, and counts per channel at marker.

Energy Calibration Multi-point energy calibration using peak channel and energy.

Real-Time Activity Calculation (Nuclide Report) Onscreen reporting of real-time activity and uncertainty for up to 9 user-defined regions. Activity is calculated as net count-rate divided by user supplied efficiency factor.

⁷Subject to change without notice.

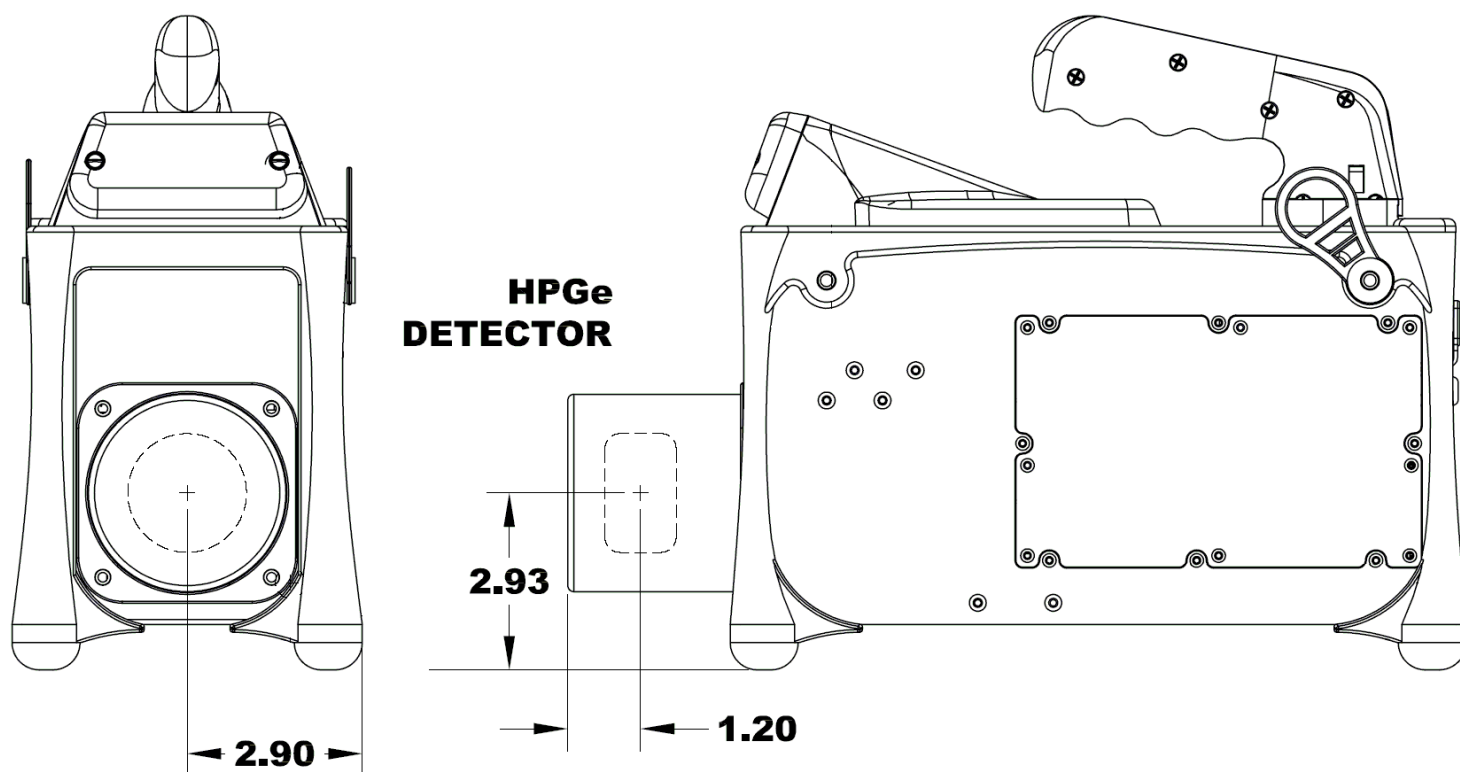


Figure 57. Reference Points for the HPGe Detector (all measurements in inches).

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

System Gain Settings

- Conversion gain: Software controlled from 512 to 16k.
- Coarse gain: 1, 2, 4, 8, 16, or 32.
- Fine gain: 0.45 to 1.

With the available range of gain settings, the achievable full-scale energy range is 187 keV to ~7 MeV.

Shaping-Time Constants

- Rise time: 0.8 μ s to 23 μ s.
- Flattop: 0.3 μ s to 2.4 μ s width.

Dead-Time Correction Extended live-time correction according to Gedcke-Hale method.⁸
Accuracy: area of reference peak changes $<\pm 3\%$ from 0 to 50000 cps.

Linearity

- Integral Nonlinearity: $<\pm 0.025\%$ over top 99.5% of spectrum, measured with a mixed source (⁵⁵Fe at 5.9 keV to ⁸⁸Y at 1836 keV).
- Differential Nonlinearity: $<\pm 1\%$ (measured with a BNC pulser and ramp generator).

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

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 $\times 1000$ overload in 2.5 non-overloaded pulse widths. (Measured using the InSight Virtual 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).

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 computer screen.

Presets Multiple presets can be set within MAESTRO for any or all of the following:

- **Real Time** Stops data collection when the real time reaches this value (in increments of 1 s).
- **Live Time** Stops data collection when the live time reaches this value (in increments of 1 s).

⁸Ron Jenkins, R. W. Gould, and Dale Gedcke, *Quantitative X-Ray Spectrometry* (New York: Marcel Dekker, Inc.), 1981, pp. 266–267.

- **ROI Integral** Integral count stops data collection when the sum of all ROI channels reaches this value.
- **ROI Peak** Peak count stops data acquisition when any ROI channel reaches this value (maximum value of $2^{32} - 1$ counts [4×10^9]).
- **Uncertainty** Sets the required statistical accuracy on a key peak (for example: stop counting when the activity of ^{60}Co is known to be better than 5%).
- **MDA** Stops data collection when the value of the minimum detectable activity (MDA) for up to 20 user-specified MDA nuclides reaches the needed value. The presets are implemented in hardware so the computer does not have to poll the Micro-trans-SPEC for the preset to operate. See Section 7.2 for details on the MDA preset calculation.

Low Frequency Rejector (LFR) Filter⁹ The digital signal processor incorporates ORTEC's exclusive LFR filter, designed to reduce microphonic and low-frequency periodic noise from germanium detector output signals, thereby producing significant improvement in spectral resolution. The LFR is specifically beneficial in systems cooled by mechanical coolers, which are known to often contribute microphonic noise to the spectrum (thereby degrading spectral resolution). The LFR is also capable of reducing any periodic noise signal resulting from surrounding electronics and equipment or ground loops.

Cooler Ricor Cryogenics K529 SPB-L, high-reliability, low-power Stirling cooler, split linear design. Initial cooldown time depends on ambient temperature, but is typically <12 hours at 25°C.

Stored-Spectrum Memory The Micro-trans-SPEC can store spectrum files on removable SecureDigital cards.¹⁰ The number of spectra stored on an individual card depends on the capacity of the card.

Wireless Communication Built-in IEEE 802.11b wireless hardware; third-party software can be used to implement this option.

GPS Internal NMEA-compliant WAAS-capable.

⁹Patent pending.

¹⁰Note that the PDA also has a CF type II CompactFlash slot. However, the dust cover, which must be in place to prevent contaminating the card slots, blocks full insertion of the CF card.

8.3. Electrical and Mechanical

Dimensions

- **Maximum Overall Dimensions** 37.4 cm L × 16.6 cm W × 27.9 cm H (14.7 in. × 5.8 in. × 11 in.) including handle, Ge detector endcap, neutron detector and shock absorbers.
- **Weight** 6.9 kg (15.2 lb).

Maximum Shock Tolerance 20 g. An accelerometer inside the instrument tracks the maximum shock to which the Micro-trans-SPEC has been subjected, and a shock in excess of 20 g will void the warranty.

Ambient Operating Environment -10°C to +40°C, at a relative humidity <90% at 35°C, non-condensing.


Internal Battery Rechargeable, nominal 14.4-V lithium-ion battery pack, ORTEC Part No. 931520. Charging circuitry and battery management circuitry internal to the power adapter/charger. Battery lifetime 3–5 years. The compartment is semi-sealed and protects against penetration of dirt and moisture. See Appendix A for instructions on replacing the battery.

Battery Life >3 hours at 25°C when HPGe detector is cold. <4 hr charge time. Battery life can be extended indefinitely by the use of optional, external battery belt. The unit is expected to be kept running once cold. (Note that using an automobile battery to cool the detector could significantly discharge the auto battery.)


Power Usage Greatest during cooldown: <100 W. While charging battery: 5 A nominal. Cold with fully charged battery: <2 A.

CE Conforms to CE standards for radiated and conducted emissions, susceptibility, and low-voltage power directives.

8.4. Connectors

USB () Rear-panel Universal Serial Bus connector, with dust cover, for communication with computer for file transfer with the **Data (ActiveSync)** setting and for use as an MCA with the **Control (MCA Mode)** setting.

INPUT POWER Rear-panel external power input, with dust cover, 12–17 V dc, 60 W, or from battery or ac power adapter/charger.

Headphones () Rear-panel female connector, with dust cover, accepts standard male headphone jack. Headphone volume controllable from the Micro-trans-SPEC touchscreen. Note that the audible high-dose-rate alarm sounds whether or not headphones are connected to the Micro-trans-SPEC. This alarm is not routed through the headphones and its volume is independent of the headphone volume setting.

8.5. Computer Prerequisites

In addition to completely independent, standalone operation, the Micro-trans-SPEC can also be operated as a benchtop MCA, in conjunction with ORTEC spectroscopy software such as MAESTRO on any computer running Microsoft Windows 8, 7, or XP Professional SP3.

8.6. Shipping the Micro-trans-SPEC

To avoid damaging the cooler by overheating (and, where applicable, to comply with transportation regulations), be certain to turn the cooler off before shipping the Micro-trans-SPEC. To do this, go to the Main Menu and tap **Turn Cooler OFF**. The unit can be shipped as soon as the cooler is turned off. There is no need to wait until the detector warms up.

8.7. Feature Mask Bits

The following table describes the feature bits from the SHOW_FEATURES command discussed on page 103. If the feature is supported in the Micro-trans-SPEC the bit is set to 1; if the feature is not supported, the bit is 0.

<u>Bit</u>	<u>Meaning</u>
0	Software-selectable conversion gain
1	Software-selectable coarse gain
2	Software-selectable fine gain
3	Gain stabilizer
4	Zero stabilizer
5	PHA mode functions available
6	MCS mode functions available
7	List mode functions available
8	Sample mode functions available
9	Digital offset (e.g., 920)
10	Software-selectable analog offset
11	HV power supply
12	Enhanced HV (SET_HV, SET/SHOW_HV_POL, SHOW_HV_ACT)

Bit	Meaning
13	Software-selectable HV range (ENA_NAI, DIS_NAI)
14	Auto PZ (START_PZ_AUTO)
15	Software-selectable manual PZ (SET/SHOW_PZ)
16	Battery-backed, real-time clock (SHOW_DATE/TIME, SHOW_DATE/TIME_START)
17	Sample changer support (SET/SHOW_OUTPUT, SHOW_INPUT)
18	One-button acquisition (ENA/DIS/SHOW_TRIG_SPEC, MOVE)
19	Nomadic (likely to move between opens)
20	Local app data (SET_DATA_APP, SHOW_DATA_APP)
21	Software-retrievable serial number
22	Power management commands
23	Battery status support (SHOW_STAT_BATT)
24	Software-selectable AMP polarity (SET/SHOW_GAIN_POLAR)
25	Support for flattop optimization (ENA/DIS_OPTI)
26	Stoppable AutoPZ (STOP_PZ_AUTO)
27	Network support (e.g., DSPEC)
28	Multi-drop serial support (e.g., MicroNOMAD ^{®2})
29	Software-selectable DPM address (SET_DPM_ADDR)
30	Multiple devices (e.g., 919)
31	Software-selectable ADC gate mode (SET_GATE...)
	<i>Begin second word</i>
32	Software-downloadable firmware
33	Time histogramming functions available (e.g., 9308)
34	Software-selectable lower level discriminator
35	Software-selectable upper level discriminator
36	MCS-mode SCA input available
37	MCS-mode positive TTL input available
38	MCS-mode fast-negative NIM input available
39	MCS-mode discriminator input available
40	Software-switchable MCS-mode discriminator edge
41	Software-programmable MCS-mode discriminator level
42	Software-programmable SCA upper and lower thresholds
43	Software-selectable MCS-mode input sources
44	Uncertainty/statistical preset (SET_UNCERT_PRES)
45	Features vary by input (SHOW_FEATURES depends on device/segment; multi-input MCBs only)
46	Software-selectable HV shutdown mode (SET/SHOW/VERI_SHUT)
47	Software-selectable shaping time constants (SET_SHAP)

Bit	Meaning
48	Explorable shaping time constants (SHOW_CONFIG_SHAP)
49	Advanced shaping time (SET_SHAP_RISE, SET_SHAPE_FLAT, etc.)
50	Software-selectable BLR (ENA/DIS/SHO_BLR_AUTO SET/SHO/VERI_BLR)
51	SHOW_STATUS command supported (returns \$M record)
52	Overflow preset (ENA/DIS/SHO_OVER_PRES)
53	Software-enabled, MicroNOMAD-style audio clicker (ENA/DIS_CLICK)
54	Software-readable thermistor (SHOW_THERM)
55	Floating-point fine gain (SET/SHO/VERI/LIST_GAIN_FINE)
56	Software-enabled pileup rejector. (ENA/DIS/SHO_PUR, SET/VERI_WIDT_REJ)
57	Alpha-style HV power (SHOW_HV_CURRENT)
58	Software-readable vacuum (SHOW_VACUUM)
59	Acquisition alarms (ENA/DIS/SHO_ALARM)
60	Hardware acquisition trigger (ENA/DIS/SHO_TRIG)
61	Ordinal numbers for shaping times (SET_SHAP 0, SET_SHAP 1, ...)
62	Query gain ranges (LIST/VERI_GAIN_FINE, ..._COAR, ..._CONV)
63	Routable inputs (SET/SHOW_INPUT_ROUTE)
<i>Begin third word</i>	
64	External dwell support (ENA/DIS_DWELL_EXT)
65	Selectable SUM or REPLACE MCS modes (ENA/DIS_SUM)
66	External start of pass support (ENA/DIS/SHO_START_EXT)
67	Explorable with MCS list commands (LIST_SOURCE, LIST_LLSCA & LIST_ULSCA)
68	Device supports the MDA preset
69	Software-selectable ADC type (Matchmaker™)
70	Has ability to daisy-chain MCBs (DART)
71	ZDT functions available (DSPEC® Plus)
72	DSPEC Plus-style Insight triggering (LIST/SET_TRIG_SAMP)
73	Multiple inputs per connection (for example, OCTÊTE® Plus)
74	Hardware count-rate meter (SH_CRM)
75	Has multiple ZDT modes (SET/SHOW/LIST_MODE_ZDT)
76	Has multi-nuclide MDA preset
77	Has MCS Replace then Sum Mode (SET_RPLSUM)
78	Has programmable external dwell voltage capability
79	No Peak Preset feature (M ³ CA and OASIS)
80	Programmable pulser (OASIS)
81	Programmable Vacuum/HV interlock (OASIS)
82	Programmable Current/HV interlock (OASIS)

Bit	Meaning
83	Explorable Stabilizer (LIST_GAIN_ADJU,LIST_ZERO_ADJU)
84	Has programmable input impedance (MCS)
85	Advanced shaping-time feature has no CUSP (Micro-trans-SPEC)
86	Selectable HV rise-time (SET/SHOW/LIST_HV_RISE) (SBS-60)
87	—
88	Monitor command support (SHOW_MONI_MAX/LABEL/VALUE)
89	SMART-1 Detector support (SHOW_SMART_DET, SHOW_SNUM_DET, SHOW_HV_RECO)
90	Nuclide report (SET/SHOW_NUCL_COEF, SET/SHOW_ROI_NUCL, ...)
91	Interactive Display Features Such as Nuclide Report
92	Advanced Stored Spectra (SH_SPEC_COUNT, SET/SHOW_SPEC_ID, MOVE)
93	SET/SHOW_VIEW in MCBs with Dual-Port Memory or printer port interfaces, LIST_VIEW in all MCBs
94	Connected to MCB via RS-232 (slow) port
95	No SET_HV_POSI, SET_HV_NEGA, ENA_NAI and DIS_N
	<i>Begin fourth word</i>
96	Low Frequency Rejecter (ENA/DIS/SHOW_LFR)
97	Resolution Enhancer (ENA/DIS/SH_RENHANCER, SET/SHOW_RETABLE idx,val)
98	SET_MODE_RELIST for Resolution Enhancer List Mode
99	Readable Sample mode time per channel (SH_TIME_SAMPLE)
100	Adjustable Sample mode time per channel (SET/LIST_TIME_SAMPLE)
101	List Mode data streamed and formatted as in digiBASE
102	Supports ETP mode (ENA/DIS/SHOW_ETP)
103	List Mode data streamed and formatted as in DSPEC Pro
104	SET/SHOW/LIST_PZ using floating point microseconds
105	Rise time, flattop width and cusp not changeable from property page
106	HV not user changeable from property page (requires Bit 12)
107	Coarse and fine gain not user changeable from property page
108	PZ and flattop tilt not user-selectable from property page
109	LFR not user changeable from property page (requires Bit 96)
110	Portal Monitor style List Mode Synch is available
111	DSPEC-Pro Auxilliary BNC input available
112	SET_DISPLAY is NOT used to select ZDT data view (requires Bit 93)
113	ID Reports (DO_ID, SHOW_REPORT, SHOW_REPO_LINES)
114	Has neutron detector (SHOW_CRM 2 returns valid number)

<u>Bit</u>	<u>Meaning</u>
115	—
116	—
117	—
118	—
119	—
120	—
121	—
122	—
123	—
124	—
125	—
126	—
127	Extended feature mask available (SH_FEAT_EXT)

9. USING THE MICRO-TRANS-SPEC WITH ORTEC SPECTRUM ANALYSIS PROGRAMS

The Micro-trans-SPEC is intended for completely independent operation, with no computer required. However, when you connect it to a computer running ORTEC spectroscopy applications such MAESTRO or GammaVision, you can use it as a high-performance HPGe spectrometer/digital MCA.

Be sure to install the accompanying CONNECTIONS Driver Update Kit (P/N 797230) and MAESTRO MCA Emulator. These contain the most up-to-date drivers for the Micro-trans-SPEC and other ORTEC hardware. If you have any questions about software/hardware compatibility, contact your ORTEC representative or our Global Service Center. The MAESTRO user manual contains complete instructions on software installation, network protocol setup, and configuration of the MCBs attached to your computer. When installing MAESTRO, choose the **USB-Based Instruments** selection to install the correct driver for the Micro-trans-SPEC.

When you disconnect from the computer and exit its MCA Mode, any changes made to the hardware settings via computer remain in effect until changed from the touchscreen.

9.1. Connecting the Micro-trans-SPEC to a Computer

From the Home screen, tap **Menu**, General Settings, USB Control, then tap the **MCA Mode** radio button (Fig. 58). This sets the Micro-trans-SPEC's USB port so the instrument's MCA can be connected to a host computer. The other Micro-trans-SPEC features are disabled. The Micro-trans-SPEC can then be used as a high-performance HPGe MCA controlled by MAESTRO and other ORTEC CONNECTIONS spectroscopy applications.

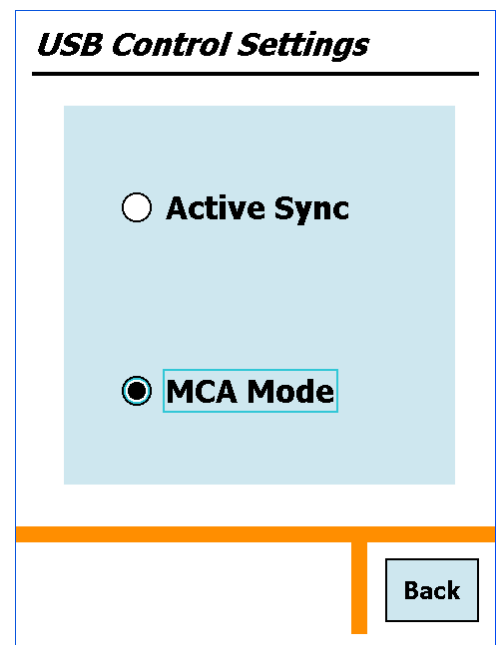


Figure 58. Micro-trans-SPEC in MCA Mode.

The first time this Micro-trans-SPEC is connected to a particular computer for use as an MCB, Windows will note that new hardware has been found. In Windows 8 and 7, the driver will install without a wizard. In XP, the new hardware installation wizard will open. Click **Next**, indicate you *do not* wish to connect to the internet or the Microsoft website to locate the driver, choose the “automatically locate driver” option, and follow the remaining prompts to completion.

The final step is to run the **MCB Configuration** program accompanying MAESTRO to build **Master Instrument List** of all ORTEC MCBs accessible to the computer.

To monitor the battery time remaining from within MAESTRO, go to the Status tab under **Acquire/MCB Properties...**

To return the Micro-trans-SPEC to standalone operation, simply tap the **Active Sync** radio button. Within a few seconds, the touchscreen will become active in the normal standalone mode. Any changes made to the hardware settings via the computer will remain in effect until changed from the touchscreen.

NOTE MAESTRO and other ORTEC CONNECTIONS programs have a **Lock/Unlock Detector** command to prevent unauthorized users from changing detector settings, starting and stopping data acquisition, and clearing the detector memory. This locking command functions separately from the Micro-trans-SPEC passwords. If the Micro-trans-SPEC is password-locked within MAESTRO, you can still use it in the field without knowing the password; however, you cannot reconnect it to a computer and erase its memory. In addition, the next time you use it in MCA Mode with MAESTRO, it will still be locked. *Also note that if the Micro-trans-SPEC's display is locked, it cannot communicate with a computer* (Section 4.1.7.3).

9.2. Quantitative Analysis of Micro-trans-SPEC Spectra in GammaVision and ISOTOPIC

The Micro-trans-SPEC can be used to collect data for quantitative analysis, either as a stand-alone field instrument or a benchtop MCB connected to a computer. In both usage modes, the data are stored as **.SPC**-format spectrum files. The **.SPC** files can then be quantitatively analyzed on a computer using GammaVision or ISOTOPIC. Note, however, that the Micro-trans-SPEC is not designed to store efficiency information in the **.SPC** files it creates. Therefore, for quantitative determinations, special attention is needed to prepare the calibration (**.CLB**) file so GammaVision or ISOTOPIC will add the efficiency information during processing.

To prepare this calibration file, load a Micro-trans-SPEC calibration spectrum into GammaVision or ISOTOPIC. Use the software application's **Calibration Wizard** to obtain the addi-

tional efficiency calibration, keeping the existing energy calibration. After the efficiency calibration is computed, save the complete set of calibrations as a `.CLB` file.

To add the efficiency information to an existing `.SPC` file (typically from a standalone Micro-trans-SPEC):

- Transfer the `.SPC` file from the Micro-trans-SPEC to the computer (see Chapter 5).
- Recall the `.SPC` file in GammaVision or ISOTOPIC.
- Load the `.CLB` file containing the proper efficiency information. This can be done either with the application's **Recall Calibration** command; or by specifying the `.CLB` file as the calibration override in the GammaVision analysis options (`.SDF`) file or the ISOTOPIC configuration.
- Save the `.SPC` file with or without further analysis.

NOTE If the `.CLB` file is specified in the GammaVision `.SDF` file or ISOTOPIC configuration, the `.An1` file generated during analysis will contain the proper calibration information but the original `.SPC` file (without the efficiency information) will not change.

To load the efficiency information before acquiring a new spectrum (with the Micro-trans-SPEC attached to a computer):

- Load the `.CLB` file either with the **Recall Calibration** command; or by specifying the `.CLB` file as the calibration override in the GammaVision `.SDF` file or ISOTOPIC configuration.
- Acquire a new spectrum and save it in `.SPC` format.

9.3. Micro-trans-SPEC MCB Properties in MAESTRO

This section discusses the hardware setup dialogs you will see within MAESTRO when you use the **MCB Properties...** command on the **Acquire** menu. The MCB Properties dialog contains all of the instrument controls including acquisition presets, high voltage, hardware status indicators, and amplifier settings. To view the hardware parameters and Identification Mode reports for spectra downloaded from the Micro-trans-SPEC, simply move from tab to tab. Click on **Close** when finished.

When setting up a data acquisition, note that as you enter characters in the data-entry fields the characters will be underlined until you move to another field or until 5 seconds have lapsed without keyboard input. During the time the entry is underlined, no other program can modify this value.

NOTES The changes you make on most property tabs take place immediately. There is no cancel or undo option for this dialog.

In MAESTRO, the **Download Spectra** and **View ZDT Corrected** commands on the **Acquire** menu and the **Smooth** and **Strip** commands on the **Calculate** menu are disabled for this instrument.

9.3.1. Amplifier

Figure 59 shows the Amplifier tab, which displays the **Coarse** and **Fine Gain** and **Pole Zero** controls.

Gain

Set the amplifier coarse gain by selecting from the **Coarse** droplist, then adjust the **Fine** gain with the horizontal slider bar or the edit box, in the range of 0.45 to 1.00. The resulting effective gain is shown at the top of the **Gain** section. The two controls used together cover the entire range of amplification from 0.45 to 32.

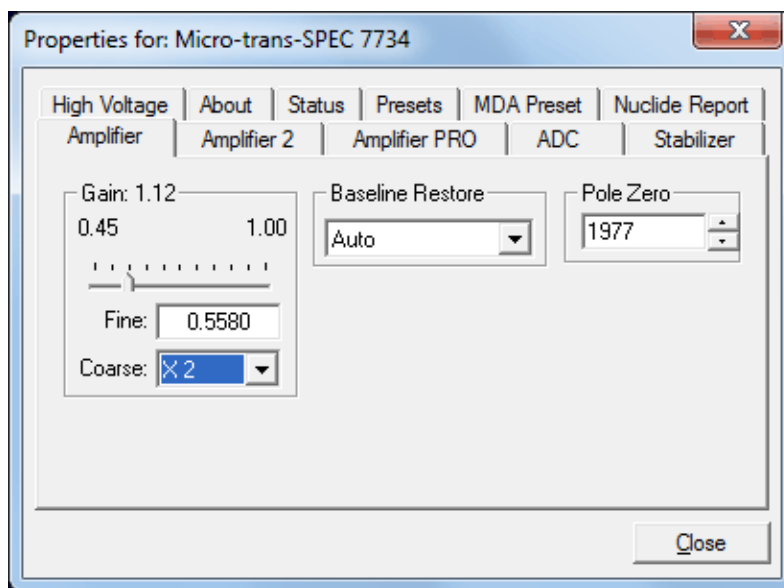


Figure 59. Micro-trans-SPEC Amplifier Tab.

Baseline Restore

The **Baseline Restore** is used to return the baseline of the pulses to the true zero between incoming pulses. This improves the resolution by removing low frequency noise such as dc shifts or mains power ac pickup. The baseline settings control the time constant of the circuit that returns the baseline to zero. There are three fixed choices (**Auto**,¹¹ **Fast**, and **Slow**). The fast setting is used for high count rates, the slow for low count rates. **Auto** adjusts the time constant as appropriate for the input count rate. The settings (auto, fast, or slow) are saved in the trans-SPEC even when the power is off. The time constant can be manually set on the InSight Virtual Oscilloscope display on the Amplifier 2 tab.

¹¹U.S. Patent No. 5,912,825.

You can view the time when the baseline restorer is active on the InSight display as a **Mark** region. In the automatic mode, the current value is shown on the InSight sidebar. For a low-count-rate system, the value will remain at about 90. See the accompanying MAESTRO user manual for complete information on InSight Mode.

Pole Zero Adjustment

To maintain optimum energy resolution and peak position stability to high counting rates, it is important to enter the correct value for the pole-zero cancellation. Use the default value as the starting point.

To make a fine adjustment of the **Pole Zero** setting:

- 1) Use a radioactive source that produces a well-defined peak near the upper limits of the energy spectrum. At low counting rates, note the symmetry of the peak.
- 2) Move the source closer to the detector to achieve much higher counting rates. If the peak maintains the symmetry observed at low counting rates no further adjustment of the **Pole Zero** is needed. If high counting rates generate a tail on the high energy side of the peak, slightly decrease the pole-zero value until the tail disappears. If high counting rates generate a tail on the low-energy side of the peak, slightly increase the pole-zero value until the tail disappears.
- 3) Make a final adjustment to balance the symmetry of the peak as closely as possible to the symmetry observed at low counting rates. This will result in the optimum pole-zero adjustment.

9.3.2. Amplifier 2

Figure 60 shows the Amplifier 2 tab, which accesses the advanced shaping controls including the InSight Virtual Oscilloscope mode.

The many choices of **Rise Time** allow you to precisely control the tradeoff between resolution and throughput. Starting with the default value, you should increase values of the rise time for better resolution for expected lower count rates, or when unusually high count rates are anticipated, reduce the rise time for higher throughput with somewhat worse resolution.

Use the up/down arrows to adjust the **Rise Time** within the range of 0.8 to 23.0 μ s.

For the more advanced user, the InSight mode allows you to directly view all the parameters and adjust them interactively while collecting live data. To access the InSight mode, go to the **Insight** section on the Amplifier 2 tab and click on **Start**. The InSight mode is discussed in detail in the MAESTRO user manual.

The **Rise Time** value is for both the rise and fall times; thus, changing the rise time has the effect of spreading or narrowing the quasi-trapezoid symmetrically.

The **Flattop** controls adjust the top of the quasi-trapezoid. The **Width** adjusts the extent of the flattop (from 0.3 to 2.4 μ s). The **Tilt** adjustment varies the “flatness” of this section slightly. The **Tilt** can be positive or negative (range: -1.0 to +0.99219). Choosing a positive value results in a flattop that slopes downward; choosing a negative value gives an upward slope.

The dead time per pulse is $(3 \times \text{Rise Time}) + (2 \times \text{Flattop Width})$.

When you are satisfied with the settings, **Close** the Properties dialog and prepare to acquire data.

Once data acquisition is underway, the advanced user might wish to return to the Amplifier 2 tab and click on the **Insight** section's **Start** button to adjust the shaping parameters interactively with a “live” waveform showing the actual pulse shape.

9.3.3. Amplifier PRO

Figure 61 shows the Amplifier PRO tab, which contains the **Low Frequency Rejector** (LFR) filter control. Turning it off causes shifting and/or broadening of peaks in addition to the acquisition of noise in the lowest-energy channels. We strongly recommend the LFR be enabled during all data acquisitions. Note, however, that you must turn the LFR *off* to pole-zero the Micro-trans-SPEC. Subsequent measurements can then be taken with the LFR filter on.

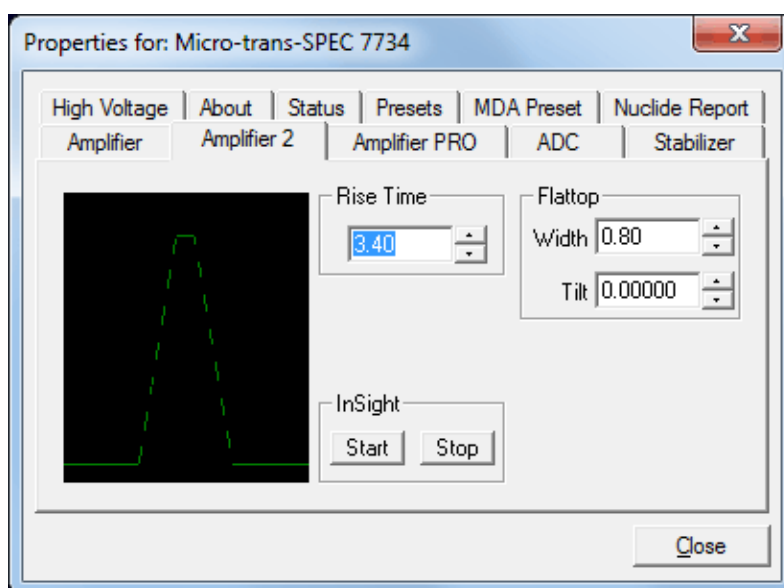


Figure 60. Micro-trans-SPEC Amplifier 2 Tab.

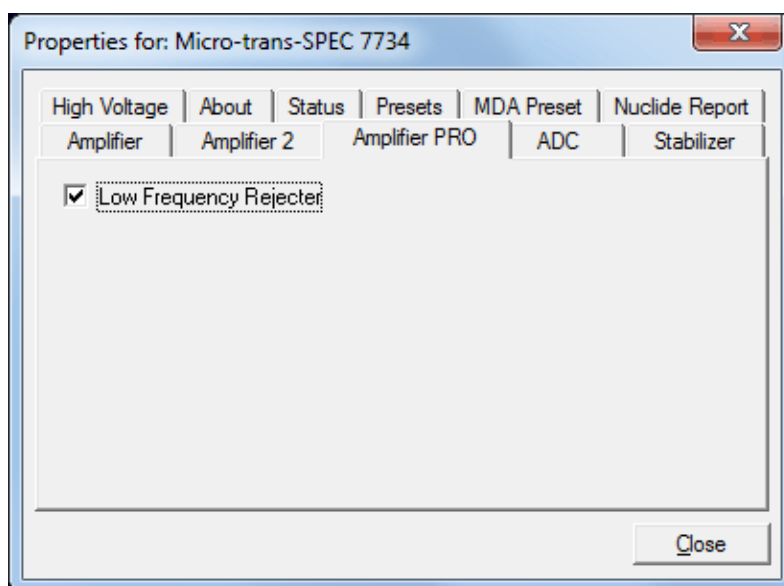


Figure 61. Micro-trans-SPEC Amplifier PRO Tab.

9.3.4. ADC

This tab (Fig. 62) contains the **Conversion Gain**, **Lower Level Discriminator**, and **Upper Level Discriminator** controls. In addition, the current real time, live time, and count rate are monitored at the bottom of the dialog.

The **Conversion Gain** sets the maximum channel number in the spectrum. If set to 16384, the energy scale is divided into 16384 channels. This parameter is entered in powers of 2 (e.g., 8192, 4096, 2048, 1024, 512). The up/down arrow buttons step through the valid settings.

The **Lower Level Discriminator** sets the level of the lowest amplitude pulse that will be stored. This level establishes a lower-level cutoff by channel number for ADC conversions. Because of the mechanical cooler, we recommend a minimum setting of 40 (in addition to leaving the LFR on at all times).

The **Upper Level Discriminator** sets the level of the highest amplitude pulse that will be stored. This level establishes an upper-level cutoff by channel number for storage.

9.3.5. Stabilizer

The Micro-trans-SPEC has both a gain stabilizer and a zero stabilizer. See the MAESTRO user manual for a more detailed discussion of each.

The Stabilizer tab (Fig. 63) shows the current values for the stabilizers. The value in each **Adjustment** section shows how much adjustment is currently applied. The **Initialize** buttons set the adjustment to 0. If the value approaches 90% or above, the amplifier gain should be adjusted so the stabilizer can continue to function — when the

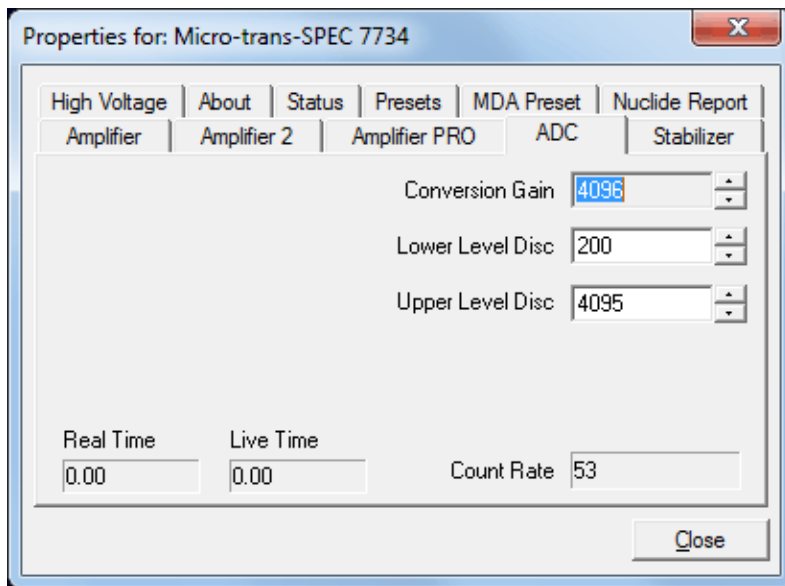


Figure 62. Micro-trans-SPEC ADC Tab.

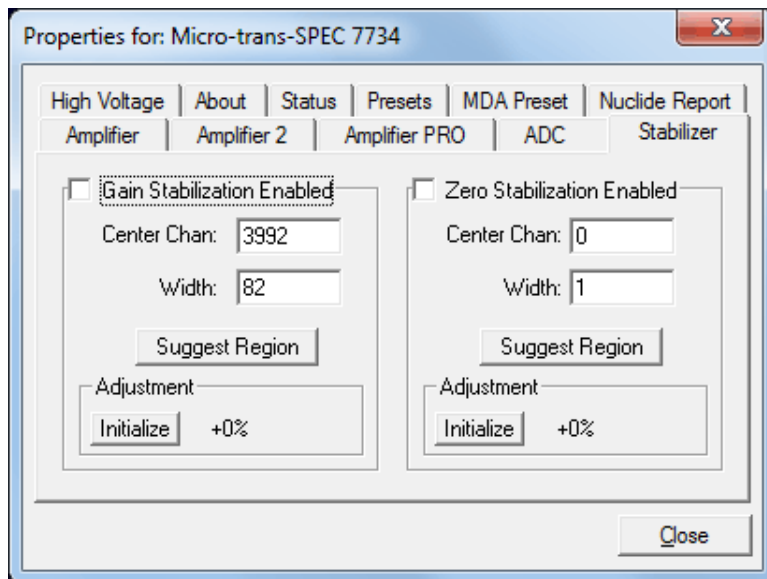


Figure 63. Micro-trans-SPEC Stabilizer Tab.

adjustment value reaches 100%, the stabilizer cannot make further corrections in that direction. The **Center Channel** and **Width** fields show the peak currently used for stabilization.

To set up the stabilizer, enter the **Center Channel** and **Width** values manually or click on the **Suggest Region** button. **Suggest Region** reads the position of the marker and inserts values into the fields. If the marker is in an ROI, the limits of the ROI are used. If the marker is not in an ROI, the center channel is the marker channel and the width is 3 times the FWHM at this energy.

Now click on the appropriate **Enabled** checkbox to turn the stabilizer on. Until changed in this dialog, the stabilizer will stay enabled even if the power is turned off. When the stabilizer is enabled, the **Center Channel** and **Width** cannot be changed.

9.3.6. High Voltage

Figure 64 shows the High Voltage tab, which allows you to turn the bias voltage off and on, and monitor the **Actual** bias. You cannot adjust the bias voltage or polarity, nor can you change the **Shutdown** mode, which is fixed as **SMART**.¹²

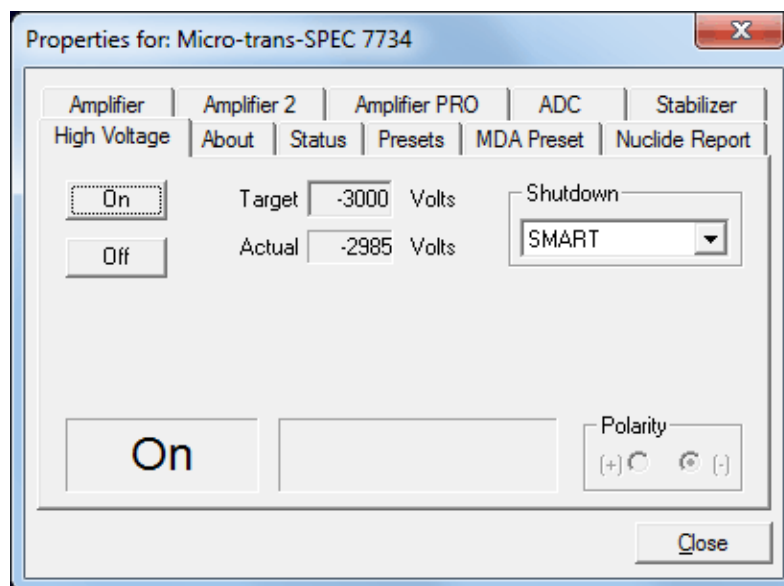


Figure 64. Micro-trans-SPEC High Voltage Tab.

¹²This is a reference to the Micro-trans-SPEC's SMART-1™ detector technology. For more information on SMART-1, see the ORTEC catalog or visit www.ortec-online.com.

9.3.7. About

This tab (Fig. 65) displays hardware and firmware information about the Micro-trans-SPEC as well as the data **Acquisition Start Time**. In addition, the **Access** field shows whether the MCB is currently locked with a password by MAESTRO. **Read/Write** indicates the MCB is unlocked and **Read Only** means it is locked. See the MAESTRO user manual for more information.

Use the **Firmware Revision** field to determine the instrument type and firmware version. This parameter is formatted *DETH-*nnn**, where *nnn* is the firmware version. In the accompanying illustration, *DETH-005* indicates a Micro-trans-SPEC running firmware v5. You can also use the About tab to view this information for .SPC-format spectra downloaded from the Micro-trans-SPEC.

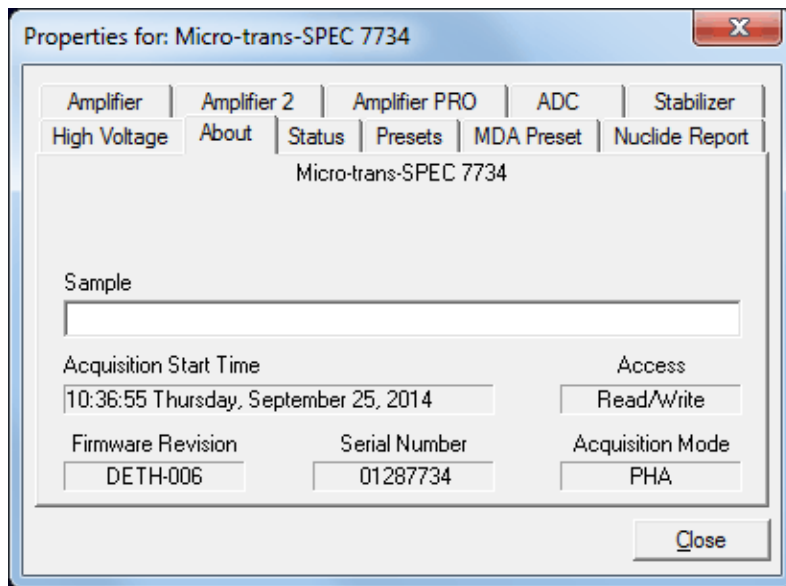


Figure 65. Micro-trans-SPEC About Tab.

9.3.8. Status

Figure 66 shows the Status tab. Ten parameters are continuously monitored in real time. Satisfactory status is reported as **OK** or a numerical value. A failure is reported as **ERR** or a descriptive message. Use the droplists to select any six parameters to be displayed simultaneously on the Status tab. You can change the selected parameters at any time.

The monitored parameters are:

- **Detector State of Health** — reported as **OK** or **ERR**.
- **Gamma Dose Rate** — reported in $\mu\text{Sv/h}$.

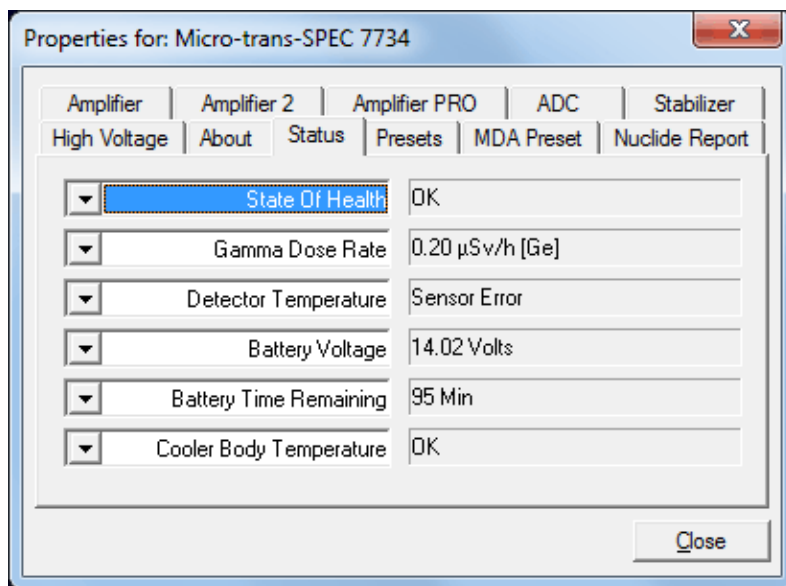


Figure 66. Micro-trans-SPEC Status Tab.

- **Detector Temperature** — reported as OK or ERR.
- **Battery Voltage** — reported in volts.
- **Battery Time Remaining** — in minutes.
- **Cooler Body Temperature** — OK or ERR.
- **Cooler Drive Voltage** — OK or ERR.
- **Cold-Tip Temperature** — OK or ERR.
- **HV Bias** — in volts.
- **ID Table Version** — not used by the Micro-trans-SPEC.

To resolve status problems, refer to Chapter 6. For further assistance, contact your ORTEC representative or our Global Service Center.

9.3.9. Presets

Figure 67 shows the Presets tab. The presets can only be set when the Micro-trans-SPEC is not acquiring data (during acquisition the preset field backgrounds are gray indicating that they are inactive). You can use any or all of the presets at one time. To disable a preset, enter a value of zero. If you disable all of the presets, data acquisition will continue until manually stopped.

When more than one preset is enabled (set to a non-zero value), the first condition met during the acquisition causes the MCB to stop. This

can be useful when you are analyzing samples of widely varying activity and do not know the general activity before counting. For example, the **Live Time** preset can be set so that sufficient counts can be obtained for proper calculation of the activity in the sample with the least activity. But if the sample contains a large amount of this or another nuclide, the dead time could be high, resulting in a long counting time for the sample. If you set the **ROI Peak** preset in addition to

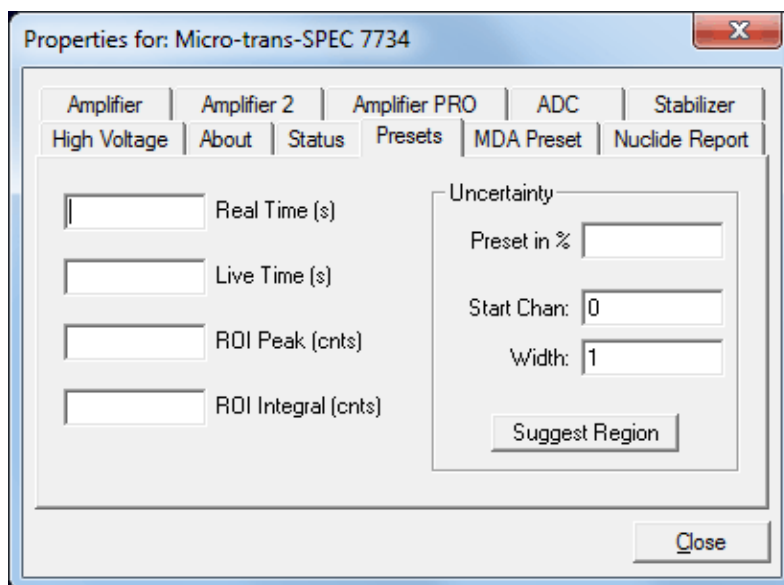


Figure 67. Micro-trans-SPEC Presets Tab.

the **Live Time** preset, the low-level samples will be counted to the desired fixed live time while the very active samples will be counted for the ROI peak count. In this circumstance, the **ROI Peak** preset can be viewed as a “safety valve.”

The values of all presets for the currently selected MCB are shown on the Status Sidebar. These values do not change as new values are entered on the Presets tab; the changes take place only when you **Close** the Properties dialog.

Enter the **Real Time** and **Live Time** presets in units of seconds and fractions of a second. These values are stored internally with a resolution of 20 milliseconds (ms) since the MCB clock increments by 20 ms. *Real time* means elapsed time or clock time. *Live time* refers to the amount of time that the MCB is available to accept another pulse (i.e., is not busy), and is equal to the real time minus the *dead time* (the time the MCB is not available).

Enter the **ROI Peak** count preset value in counts. With this preset condition, the MCB stops counting when any ROI channel reaches this value unless there are no ROIs marked in the MCB, in which case that MCB continues counting until the count is manually stopped.

Enter the **ROI Integral** preset value in counts. With this preset condition, the MCB stops counting when the sum of all counts in all channels for this MCB marked with an ROI reaches this value. This has no function if no ROIs are marked in the MCB.

The **Uncertainty** preset stops acquisition when the statistical or counting uncertainty of a user-selected net peak reaches the value you have entered. Enter the **Preset in %** value as percent uncertainty at 1 sigma of the net peak area. The range is from 99% to 0.1% in 0.1% steps. You have complete control over the selected peak region. The region must be at least 7 channels wide with 3 channels of background on each side of the peak. Note that MAESTRO calculates this preset once per 40 seconds. Therefore, the software will continue data acquisition up to 40 seconds after the preset has been reached, and the uncertainty achieved for a high count-rate sample may be lower than the preset value.

Use the **Start Channel** and **Width** fields to enter the channel limits directly, or click on **Suggest Region**. If the marker is positioned in an ROI around the peak of interest, **Suggest Region** reads the limits of the ROI with the marker and display those limits in the **Start Chan** and **Width** fields. The ROI can be cleared after the preset is entered without affecting the uncertainty calculation. If the marker is not positioned in an ROI, the start channel is 1.5 times the FWHM below the marker channel and the width is 3 times the FWHM.

The net peak area and statistical uncertainty are calculated in the same manner as for the **MAESTRO Peak Info** command.

9.3.10. MDA Preset

The MDA preset (Fig. 68) can monitor up to 20 nuclides at one time, and stops data collection when the values of the minimum detectable activity (MDA) for *all* of the user-specified MDA nuclides reach the needed value. Presets are expressed in Bq, and are evaluated every 40 seconds. The detector must be calibrated for energy in all ORTEC spectroscopy applications, and for efficiency in all applications but MAESTRO.

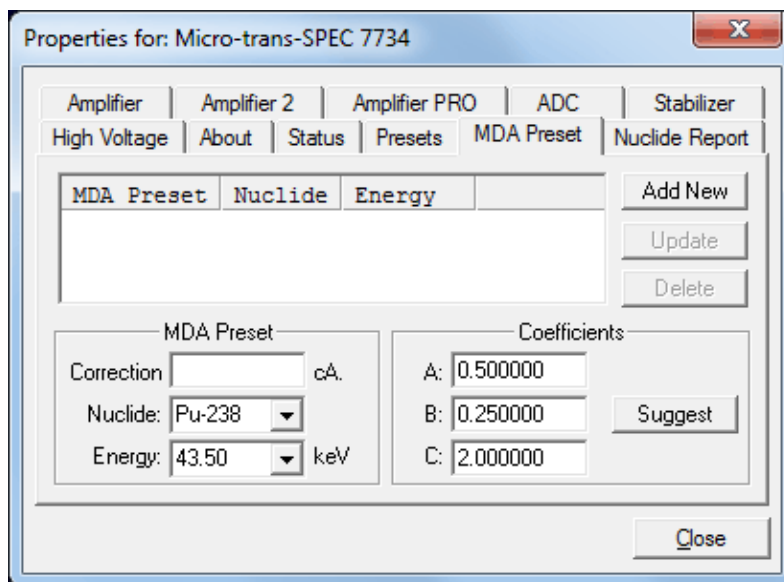


Figure 68. Micro-trans-SPEC MDA Preset.

The MDA presets are implemented in the MCB (i.e., the entries you make on this screen are saved in the MCB memory), and have no direct link to MDA methods selected in the analysis options for applications such as GammaVision, ScintiVision, ISOTOPIC, etc. The MDA preset calculation uses the following formula:

$$MDA = \frac{a + \sqrt{b + c * Counts}}{Live\ time * (CorrectionFactor)}$$

where:

a, *b*, and *c* are determined by the MDA criteria you choose.

Counts is the gross counts in an ROI that is 2.5×FWHM around the target peak energy.

Live time is evaluated in 40 second intervals for the MDA presets.

CorrectionFactor is the product of the calibration efficiency at the specified peak energy and the peak's branching ratio (yield) as listed in the working (active) library.

NOTE MAESTRO does not support efficiency calibration. The efficiency component in the *CorrectionFactor* is set to 1.0; the preset field is labeled **Correction** instead of **MDA**; and the preset is based on counting activity (**cA**) instead of becquerels. You can enter the MDA preset either in counts; or corrected for factors such as sample volume, attenuation, or calculated efficiency. For example, if you manually

calculate the efficiency for a peak, you can enter a corrected MDA target value by multiplying the desired MDA value times the calculated efficiency, and entering the product as the **Correction**.

To add an MDA preset, enter the preset value in the **MDA** or **Correction** field; select the **Nuclide** and **Energy**; enter the desired values for coefficients *a*, *b*, and *c*; then click **Add New**.

To edit an existing preset, click to highlight it in the table. This will load its **Nuclide**, **Energy**, and coefficients in the lower sections of the dialog. Change as needed, then click **Update**.

To remove a preset, click to highlight it in the table, then click **Delete**.

IMPORTANT These MDA presets *are not dynamically calculated*. Each time you add an MDA preset to this table, its *CorrectionFactor* value is calculated and stored in the MCB's memory. If you then load a different library, change the efficiency calibration, or change the system geometry, the spectroscopy application *will not update* the existing *CorrectionFactors*, and your MDA presets may no longer be applicable.

When using spectrum analysis applications such as GammaVision and Scinti-Vision, you can create an analysis options file (.SDF or .SVD file) for each system geometry that you use; and include in it a set of MDA presets specific to that geometry, efficiency calibration, and nuclide library. You can then recall this tailored analysis options file as needed.

9.3.11. Nuclide Report

Figure 69 shows the Nuclide Report tab. The Nuclide Report displays the activity of up to 9 user-selected peaks. Once the report is set up you can view the Nuclide Report at any time on the Micro-trans-SPEC display. The peak area calculations in the hardware use the same methods as the MAESTRO **Peak Info** calculation, so the Nuclide Report display is the same as the **Peak Info** display on the selected peak in the spectra stored in the computer. The calculated value is computed by multiplying the net peak count rate by a user-defined constant. If the

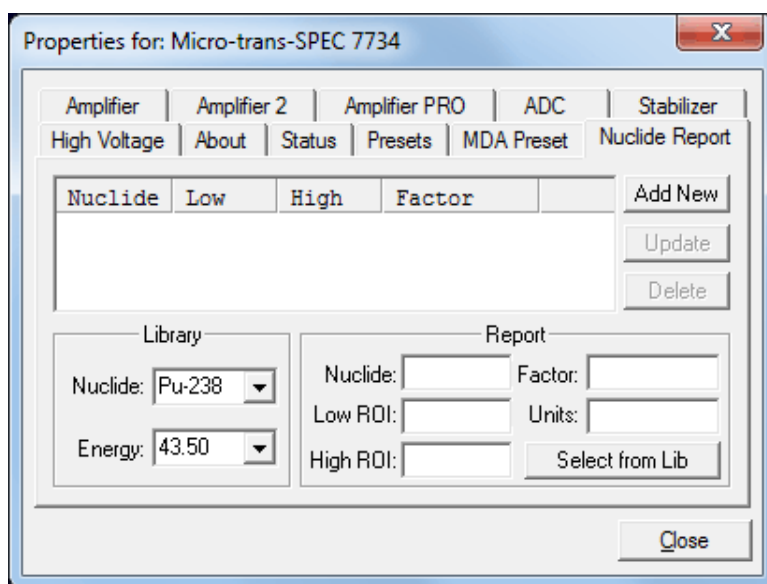


Figure 69. Micro-trans-SPEC Nuclide Report.

constant includes the efficiency and branching ratio, the displayed value is the activity. You enter the nuclide label and the activity units.

The report format and calculations are discussed in detail in Section 7.1.

9.3.11.1. Add New

Manual Add

Nuclides can be added to the list using the library to assist in the region definition or manually. To add a nuclide manually, enter the nuclide name, ROI start and end channels, multiplicative factor and units in the Report section. Now press **Add New** to add this nuclide to the list. The units need only be entered once, since they are the same for all nuclides in the table.

Library Add

To use the library to aid in the definition, select the nuclide from the library nuclide droplist. Now select the gamma-ray energy from the Energy drop down list. This defines what gamma ray to use. Now Press the **Select from Lib** button in the Report section. This will update all the entries in this section and show (as a yellow band) the region to be used in both the expanded spectrum and the full window. Now press **Add New** to add this nuclide to the list.

Edit

To change any of the current nuclides, select the nuclide in the list (use the scroll bars if needed). This will show the current settings for this nuclide. Make any changes needed. Any or all of the entries can be changed. When finished with the changes, click on **Update**.

Delete

To remove an entry, select the entry and press **Delete**.

When you close the Properties dialog, all the values entered are written to the Micro-trans-SPEC and are used when you view the Nuclide Report on the Micro-trans-SPEC display.

10. FIRMWARE COMMANDS AND RESPONSES

Most software communication with the Micro-trans-SPEC will be through the CONNECTIONS software layer. CONNECTIONS is used by all ORTEC software and can be accessed for other software development with our CONNECTIONS Programmer's Toolkit with Microsoft ActiveX® Controls (A11-BW). Use the DLL interface call `MIOComm` or the ActiveX control UCONN's `Comm` method to send commands to instruments and receive responses.

10.1. Command Format

The commands consist of a command header that may be followed by numeric parameter values. The header consists of a verb; a verb and noun; or a verb, noun, and modifier; each separated by underscores. The first four letters of a word in a command will always be enough to uniquely identify that word when composing commands for the instrument. For example, the command **ENABLE_GAIN_STABILIZATION** can be abbreviated to **ENAB_GAIN_STAB**.

Numeric parameters are unsigned integer numbers that follow the command header separated by one or more spaces. Specific commands require multiple parameters, separated by commas, that specify numeric quantities related to the operation of the MCB, such as live time or conversion gain. The command **SET_WINDOW 0,8192** has two parameters, 0 and 8192, which set the window of interest to start at channel 0 and continue for 8192 channels.

Some parameters are optional and are delimited by square brackets in the command prototype line to distinguish them from mandatory parameters (e.g., `SET_WINDOW [start,length]`). Commands with optional parameters can be sent to the MCB without the optional parameters, in which case the instrument behavior will be explained in the command description.

10.2. Error Codes

On each completion of the command, the MCB returns a macro error code and micro error code. The macro error code represents the general class of error with 0 meaning no error, and the micro error code represents the sub-class of error with 0 meaning no error. In case of error condition, you can use the `MIOGetLastError` (DLL interface) or `GetErrMajor`, `GetErrMinor` (ActiveX control interface).

Macro error codes:

0	Success
1	Power-up just occurred
2	Battery-backed data lost
129	Command syntax error

131	Command execution error
132	Invalid Command

For macro code 129 (syntax error) or 131 (execution error), the following apply:

1	Invalid Verb
2	Invalid Noun
4	Invalid Modifier
128	Invalid first parameter
129	Invalid second parameter
130	Invalid third parameter
131	Invalid fourth parameter
132	Invalid number of parameters
133	Invalid command
134	Response buffer too small
135	Not applicable while active
136	Invalid command in this mode
137	Hardware error
138	Requested data not found

Micro error codes:

0	Success
1	Input already started/stopped
2	Preset already exceeded
4	Input not started/stopped
64	Parameter was rounded (for decimal numbers)
128	No sample data available

10.2.1. Dollar Response Records

SHOW and STEP commands respond with a single dollar response record followed immediately by a percent response record. All valid dollar response records for each command are listed in the command dictionary.

The following list provides the general form of each dollar response record for the MCB API. In this list, lower case letters represent numeric values. The letters “ccc” always represent an 8-bit

unsigned checksum of all characters on the record up to but not including the checksum characters, and <CR> represents the ASCII carriage return character.

\$Axxxccc<CR>	xxx is a single 8-bit unsigned number.
\$Cxxxxccc<CR>	xxxxx is a single 16-bit unsigned number.
\$Dxxxxxyyyyccc<CR>	xxxxx and yyyyy are 16-bit unsigned numbers.
\$Exxxxxccc<CR>	xxxxx is a single 16-bit alarm mask.
\$Fsss...<CR>	sss... is a variable length ASCII character sequence (no checksum is sent with this record).
\$Gxxxxxxxxccc<CR>	xxxxxxxx is a single 32-bit unsigned number.
\$IT<CR>	True response to a SHOW command (no checksum).
\$IF<CR>	False response to a SHOW command (no checksum).
\$Jxxxxxyyyy...ccc<CR>	Response to SHOW_CONFIGURATION command.
\$Mxxxxxxxx...ccc<CR>	Response to SHOW_STATUS command.
\$Nxyyyzzzccc<CR>	xxx, yyy, and zzz are 8-bit unsigned numbers.

10.2.2. MCB Commands

This section lists each command with a description of its operation. The descriptions include a list of any error codes that may result. As described in the two preceding sections, the usual response is a macro error code of 0 and a micro error code of 0 (no errors). Though syntax and communication error responses may result from any command, in practice, these error responses rarely occur on systems with reliable communication hardware running debugged software.

The commands are listed in alphabetical order, each starting with a command prototype line. Uppercase letters, numeric digits, blank space, and special symbols such as the underscore “_” and comma “,” in the prototype line are *literal text to be sent to the MCB exactly as they appear*. Lowercase letters in the prototype line represent numeric values as described in the accompanying text; they should not be sent literally to the MCB but should be replaced by an appropriate numeric value. In this section the term <CR> represents the ASCII carriage return character, decimal value 13; and the character “_” represents the ASCII underscore character, decimal value 95.

CLEAR

The channels of spectral data in the window of interest (see SET_WINDOW command) are set to zero. The live time and true time counters are also set to zero. This command is equivalent to the combination of CLEAR_COUNTERS and CLEAR_DATA commands.

CLEAR_ALL

This command is equivalent to the combination of CLEAR_COUNTERS, CLEAR_DATA, CLEAR_PRESETS, and CLEAR_ROI commands.

CLEAR_DATA

The channels of spectral data in the window of interest (see SET_WINDOW command) are set to zero. The ROI flags are not changed, nor are the presets changed.

CLEAR_HV_HEALTH

Clears (resets) the state-of-health bits.

CLEAR_MDA_PRESET

Clears all MCA preset values. This command is used to quickly clear the list of MDA preset values.

CLEAR_NUCLIDE [PeakNumber]

Clears all parameters for a specific nuclide peak number. This command is used to quickly clear the list of nuclide values.

CLEAR_NUCLIDE_ALL

Clears all nuclide values. This command is used to quickly clear the list of nuclide values.

CLEAR_PRESETS

The live time, true time, ROI integral, ROI peak, and overflow presets are all set to zero (disabled).

CLEAR_ROI

The region-of-interest flags for the channels in the window of interest (see SET_WINDOW command) in the currently selected device (see SET_DEVICE command) are cleared.

CLEAR_SPECTRUM_ALL

Clears all stored spectra from stored spectrum memory.

COMP

Selects the computer mode for the communication replies.

DISA_CLICKER

Turns off audio clicker.

DISABLE_BLRE_AUTOMATIC

Disables the automatic determination of baseline restorer time constant. See also `ENABLE_BLRE_AUTOMATIC`, `SET_BLRE`, and `SHOW_BLRE`.

DISABLE_DISPLAY

Disables the spectrum display when the Micro-trans-SPEC is disconnected from the computer.

DISABLE_GAIN_STABILIZATION

Stops stabilization of the gain peak while data is being acquired. The gain stabilization adjustment is held at its current value until either gain stabilization is reenabled with the `ENABLE_GAIN_STABILIZATION` command or reinitialized with the `INITIALIZE_GAIN_STABILIZATION`, `SET_GAIN_PEAK` or `SET_GAIN_WIDTH` command. See also `SHOW_GAIN_STABILIZATION`.

DISABLE_HV

Turns off the high-voltage enable signal of the Micro-trans-SPEC. See the section on the bias supply for more information about the high-voltage output. See also `ENABLE_HV` and `SHOW_HV`.

DISABLE_OPTI_NEED

Disables the reporting of an error when the Micro-trans-SPEC has not been optimized.

DISABLE_OVERFLOW_PRESET

Disables the overflow preset. Channels that receive a count when they contain 2147483647 counts, the maximum number of counts, will roll over to zero counts if the overflow preset is disabled. See also `ENABLE_OVERFLOW_PRESET` and `SHOW_OVERFLOW_PRESET`.

DISABLE_PZ_NEED

Disables the reporting of an error when the Micro-trans-SPEC has not been pole zeroed.

DISABLE_REMOTE

Disables the recognition of commands on the alternate communication path. See also `ENABLE_REMOTE` and `SHOW_REMOTE`.

DISABLE_THRESHOLD_AUTOMATIC**DISABLE_THRESHOLD_SAMPLE****DISABLE_TRIGGER_SPECIAL**

No function in the Micro-trans-SPEC; included for backward compatibility.

DISABLE_ZERO_STABILIZATION

Stops stabilization of the zero peak while data is being acquired. The zero stabilization adjustment is held at its current value until either zero stabilization is reenabled with the `ENABLE_ZERO_STABILIZATION` command or reinitialized with the `INITIALIZE_ZERO_STABILIZATION`, `SET_ZERO_CHANNEL` or `SET_ZERO_WIDTH` commands. See also `SHOW_ZERO_STABILIZATION`.

ENABLE_BLRE_AUTOMATIC

Enables the automatic determination of baseline restorer time constant. See also `DISABLE_BLRE_AUTO`, `SHOW_BLRE`, and `SET_BLRE`.

ENAB_CLICKER

Turns on audio clicker. Clicker makes a “Click” sound for each predefined number of gamma rays that strike the detector. (See `CLICKER_SENSITIVITY`).

ENABLE_DISPLAY

Enables the spectrum display when the Micro-trans-SPEC is disconnected from the computer.

ENABLE_GAIN_STABILIZATION

Enables the stabilization of the gain peak by the previously selected method, either Gauss mode or point mode (see `SET_MODE_GAUSS` and `SET_MODE_POINT`). See also `DISABLE_GAIN_STABILIZATION`, `SHOW_GAIN_STABILIZATION`, and `INITIALIZE_GAIN_STABILIZATION`.

ENABLE_GATE_ROUTE

Included for backward compatibility.

ENABLE_HV

Turns on the high-voltage enable output of the Micro-trans-SPEC. See also `DISABLE_HV` and `SHOW_HV`.

Execution Errors:

`%131137085<CR>`

The high voltage could not be enabled due to a high voltage shutdown condition.

ENABLE_OPTI_NEED

Enables the reporting of an error when the Micro-trans-SPEC needs optimizing.

ENABLE_OVERFLOW_PRESET

Enables the overflow preset. Channels that receive a count when they contain 2147483647 counts, the maximum number of counts, will stop the acquisition if the overflow preset is enabled. The channel that caused the preset to complete will contain 2147483647 counts.

See also `DISABLE_OVERFLOW_PRESET` and `SHOW_OVERFLOW_PRESET` commands.

ENABLE_PZ_NEED

Enables the reporting of an error when the Micro-trans-SPEC needs pole zeroing.

ENABLE_REMOTE

Enables the recognition of commands on the alternate communication path. If this command is sent to the Micro-trans-SPEC via Ethernet, it enables command recognition on the serial line.

ENABLE_THRESHOLD_AUTOMATIC

Enables automatic determination of the positive and negative thresholds. See also `DISABLE_THRESHOLD_AUTO`, `SHOW_THRESHOLD_AUTO`, `SET_THRESHOLD_NEGATIVE`, and `SET_THRESHOLD_POSITIVE`.

ENABLE_THRESHOLD_SAMPLE

ENABLE_TRIGGER_SPECIAL

No function; included for backward compatibility.

ENABLE_ZERO_STABILIZATION

Enables the stabilization of the zero peak by the previously selected method, either Gauss mode or point mode (see `SET_MODE_GAUSS` and `SET_MODE_POINT`). See also `DISABLE_ZERO_STABILIZATION`, `SHOW_ZERO_STABILIZATION`, and `INITIALIZE_ZERO_STABILIZATION`.

INITIALIZE

Returns the Micro-trans-SPEC to the factory default settings.

Execution Errors:

The `INITIALIZE` command simulates a power-down/power-up cycle for the MCB after a simulated loss of battery-backed-up memory.

Response:

%003000072<CR> MCB Power-up occurred/Memory lost/No selftest errors
(Normal Response for `INITIALIZE` command).

INITIALIZE_GAIN_STABILIZATION

Resets the gain peak stabilization adjustment to unity (no adjustment). This value is reported as 2048 by the `SHOW_GAIN_ADJUSTMENT` command. See also `SET_GAIN_ADJUSTMENT`, `ENABLE_GAIN_STABILIZATION`, and `DISABLE_GAIN_STABILIZATION`.

INITIALIZE_ZERO_STABILIZATION

Resets the zero peak stabilization adjustment to unity (no adjustment). This value is reported as 2048 by the SHOW_ZERO_ADJUSTMENT command. See also SET_ZERO_ADJUSTMENT, ENABLE_ZERO_STABILIZATION, and DISABLE_ZERO_STABILIZATION.

LIST_BLRE

Lists the valid settings of the baseline restore function.

LIST_CLICKER_SENSITIVITY

List all possible sensitivity settings.

LIST_CORR_FLAT

Lists the valid settings of the flattop width.

LIST_GAIN_COARSE

Lists the valid coarse-gain settings.

LIST_GAIN_FINE

Lists the valid fine-gain settings.

LIST_HV

Lists the valid high-voltage settings.

LIST_ROI_SAMPLE

Lists the valid ROI sample settings.

LIST_SHAP_CUSP

Lists the valid cusp shape settings.

LIST_SHAP_FLAT

Lists the valid flattop width settings.

LIST_SHAPE_RISE

Lists the valid rise-time settings.

LIST_SHUT

Lists the valid shutdown settings.

LIST_TRIG_SAMPLE

Lists the valid sample trigger settings.

MOVE <spectrum number>

This command copies the specified stored spectrum, calibration, and all parameters to the live memory along with the live time, real time, start time and date, live-time preset, real-time preset, ROI-integral preset, ROI-peak preset, and data ID string, if any (see SET_ID). Spectrum number can be any value from 1 to the number of spectra stored.

OFF

Turns the Micro-trans-SPEC off.

OPEN_FILE “filename.ext”

A filename is needed to open a file. Begins the download of a file to the RAM Disk by opening filename.ext on the RAM Disk. See WRITE_FILE and CLOSE_FILE.

OPEN_FILE_FLASH

Begins the download of a new FLASH (ROM DISK). This command removes all files on the RAM Disk except autoexec.bat and ini83905.exe to make room for ROMDISK.ABS. It also stops all acquisitions which are in progress. See WRITE_FILE_FLASH and CLOSE_FILE_FLASH. Not normally used.

RESET

Resets the Micro-trans-SPEC to the state just after power is applied. This command responds with a % response that indicates power-up just occurred.

RESET_REMOTE

Resets any UART error conditions when sent to the Micro-trans-SPEC via the Ethernet.

SAMPLE

Sending this command causes another waveform to be captured in InSight mode. This command is invalid when not in InSight mode.

SET_BLRE baseline

This sets the baseline restorer time constant to the value baseline. Baseline is in microseconds with a range from 10 to 100. The specified value is only used if automatic baseline restorer mode is disabled. See also ENABLE_BLRE, DISABLE_BLRE, and SHOW_BLRE.

SET_DATA [start, chans],value

If the optional start and chans parameters are included in this command, the range of channels specified by start and chans is loaded with value. If start and chans are not specified, sets all channels of spectral data in the window of interest (see SET_WINDOW command) to the specified value. ROI flags are not affected.

SET_DATA_APPLICATION "string1","string2"

This is used to store information in the Micro-trans-SPEC internal memory that can be used by other programs, such as sample descriptions and energy calibrations. The Unified MCB Interface (UMCBI) structure and ORTEC CONNECTIONS make use of this feature. String1 = the data identifier, 32 bytes maximum; string2 = the data, 128 bytes maximum.

SET_DATE day,month,year

Sets the date stored in the battery backed-up system clock to the specified values. Day can be any value from 1–31; month any value from 1–12; and year any value from 0–99. The current date and time are stored for a device when an acquisition is started. See also SHOW_DATE, SET_TIME, and SHOW_TIME.

SET_DATE_START day,month,year

Sets the start date to the specified values. Normally the start date and time are set automatically whenever a device is started with the START command. See also SHOW_DATE_START, SET_TIME_START, and SHOW_TIME_START.

SET_DELAY_COLLECTION value

Controls the pileup rejector by setting a width threshold such that if a fast channel discriminator pulse is wider than value, the pulse is rejected. This portion of the pileup rejector rejects pulses that are too close together to be detected separately by the fast channel. Value is in microseconds with a range from 0.250 to 1.6 in steps of 0.05. See also SHOW_DELAY_COLLECTION.

SET_DELAY_SAMPLE num

Delays the waveform collected in InSight mode by num points. Num must be between 0 and 65535. See also SHOW_DELAY_SAMPLE.

SET_DEVICE**SET_DISPLAY****SET_FRONT_BYPASS**

No function in the Micro-trans-SPEC; included for backward compatibility.

SET_GAIN_ADJUSTMENT value

Sets the gain stabilization adjustment to an arbitrary value from –65535 to 65535. This adjustment is usually made only by the gain stabilizer, and reset to 0 with the INITIALIZE_GAIN_STABILIZATION command. See also SHOW_GAIN_ADJUSTMENT.

SET_GAIN_CHANNEL chan

Sets the center channel for the stabilizer gain peak. If a gain channel is chosen such that the beginning channel or ending channel would be below channel 0 or above the maximum channel as determined by the conversion gain, the gain peak width is reduced until the peak fits the device boundaries. A gain channel and width must be set before gain stabilization can be enabled.

SET_GAIN_COARSE num

This sets the coarse gain to num, which must be 1, 2, 4, 8, 16, or 32. See also **SHOW_GAIN_COARSE**.

SET_GAIN_CONVERSION chans

Sets the conversion gain. The conversion gain defines the number of channels within the device that will be used for spectral data. This has the effect of altering the resolution of the ADC from 15 bits (conversion gain = 32768) to 9 bits (conversion gain = 512) for the device. See also **SHOW_GAIN_CONVERSION**.

Legal Commands:

SET_GAIN_CONVERSION 0<CR>	Conversion gain set to default (16384).
SET_GAIN_CONVERSION 512<CR>	Conversion gain set to 512 channels.
SET_GAIN_CONVERSION 1024<CR>	Conversion gain set to 1024 channels.
SET_GAIN_CONVERSION 2048<CR>	Conversion gain set to 2048 channels.
SET_GAIN_CONVERSION 4096<CR>	Conversion gain set to 4096 channels.
SET_GAIN_CONVERSION 8192<CR>	Conversion gain set to 8192 channels.
SET_GAIN_CONVERSION 16384<CR>	Conversion gain set to 16384 channels.
SET_GAIN_CONVERSION 32768<CR>	Conversion gain set to 32768 channels.

SET_GAIN_FINE value

Sets the fine gain to value. Value is a floating point value from 0.45 to 1.0. See also **SHOW_GAIN_FINE**.

SET_GAIN_NEGATIVE

Sets the amplifier input polarity to negative.

SET_GAIN_POSITIVE

Sets the amplifier input polarity to positive.

SET_GAIN_PRESET count

Sets the Gauss mode stabilization preset for the gain peak. The preset represents the minimum number of incremental counts that must be collected in any one channel of the gain peak before the gain is evaluated by the stabilizer and potentially adjusted. See also **SHOW_GAIN_PRESET**.

SET_GAIN_WIDTH chans

Sets the width in channels for the stabilizer gain peak. The gain width must be chosen such that the beginning channel is no lower than channel 0 and the ending channel is no higher than the maximum channel as determined by the conversion gain. The gain channel and width must be set before gain stabilization can be enabled. The absolute minimum width for the gain peak is 3 channels, and the absolute maximum width for the gain peak is 256 channels in Gauss mode. In point mode there is no maximum peak width, though the chosen width must allow the peak to fit within the device's channel limits as stated above. See also `SHOW_GAIN_WIDTH`, `SET_GAIN_CHANNEL` and `SHOW_GAIN_CHANNEL`.

SET_GATE_ANTICOINCIDENT

Causes the Micro-trans-SPEC to use the ADC gate input signal in anticoincident mode. See also `SET_GATE_OFF`, `SET_GATE_COINCIDENT`, and `SHOW_GATE`.

SET_GATE_COINCIDENT

Causes the Micro-trans-SPEC to use the ADC gate input signal in coincident mode. See also `SET_GATE_OFF`, `SET_GATE_ANTICOINCIDENT`, and `SHOW_GATE`.

SET_GATE_OFF

Causes the Micro-trans-SPEC to ignore the state of the ADC gate input signal. See also `SET_GATE_COINCIDENT`, `SET_GATE_ANTICOINCIDENT`, and `SHOW_GATE`.

SET_HV value

This sets the HV bias to value, in volts.

SET_ID “<id string>”

Sets the sample id string. This string can be up to 16 characters long and can be set to any arbitrary value. The id string is intended to uniquely identify the sample being analyzed. The id string is also set by the `BARCODE` command and is stored with each spectrum acquired in field mode. See also `SHOW_ID`.

Example:

SET_ID “Site 123”

SET_INTEGRAL_PRESET count

Sets the ROI integral preset to the specified count. During data acquisition when the sum of the counts contained in the channels that have the ROI flag set reaches the integral preset count, the preset is complete and the acquisition is stopped. The actual number of counts in the ROI integral may exceed the preset value by up to 512 counts due to the pipelined architecture of the Micro-trans-SPEC. Setting an integral preset to 0 counts disables the preset. The integral preset may be set to from 0 (disabled) to 4294967295 counts. See also `CLEAR_PRESETS` and `SHOW_INTEGRAL_PRESET`.

SET_LENGTH_SAMPLE length

Sets the number of points in the Insight mode display to the specified value. Normally this setting would remain at 1000.

SET_LIVE ticks

Sets the live-time counter to the specified number of ticks. The number represents live time in units of 20 ms (50 ticks/s). Normally this value is set by the Micro-trans-SPEC during data acquisition. See also CLEAR_COUNTERS and SHOW_LIVE.

SET_LIVE_PRESET ticks

Sets the live-time preset to the specified number of ticks (20 ms/tick). During data acquisition when the live-time counter reaches the preset number of ticks, the preset is complete and the acquisition is stopped. The preset should always be set to a multiple of 1 second. Setting a live-time preset to 0 ticks disables the preset. See also CLEAR_PRESETS and SHOW_LIVE_PRESET.

SET_LLD chan

Sets the lower level discriminator to chan, which must be between 0 and 16383. See also SHOW_LLD.

SET_MDA_COEF a,b,c

Sets the coefficients in the MDA preset calculation to the specified values. A, b, and c are floating-point values. The MDA preset checks for the following condition to be met:

$$MDA\ Preset_i > \frac{a + \sqrt{b + c * Counts\ in\ ROI_i}}{Live\ Time}$$

The calculation is performed once every 30 seconds with i starting at 0 and advancing through each of up to 20 unique MDA presets. i only advances once the preset has been met. Note that a, b, and c are the same for each of the unique presets. Only the ROI range and the MDA preset change when i advances. Once i reaches 20 or $MDAPreset_i$ equals 0, the acquisition terminates.

SET_MDA_PRESET MDAPreset,[PeakNumber]

Sets or reports the MDAPreset PeakNumber value as shown in the equation in the SET_MDA_COEF description above. MDAPreset is usually the product of the desired MDA, the yield and the efficiency. PeakNumber is a parameter that specifies which of up to 20 (0–19) MDA presets to change. If PeakNumber is omitted in the set command, all MDA preset values will be set to 0 (disabled), and the supplied value will be applied to MDA Preset 0. This provides compatibility with old GammaVision products.

SET_MODE_PHA

The mode is set to PHA.

SET_MODE_SAMPLE

Starts InSight Virtual Oscilloscope mode.

SET_NUCLIDE_COEF NucCoef, [PeakNumber]

Sets or reports the NucCoef PeakNumber value as shown in the equation above. NucCoef is usually the product of the yield and the efficiency. PeakNumber is a parameter that specifies which of up to 9 (0–8) peaks to change. The coefficient can be any value from 0 to 65535.996 in steps of 1/256. (The add-in will convert the value to an unsigned long with a binary point between the left of the least significant byte.)

SET_NUCLIDE_DESC PeakNumber, "NucLabel"

Sets the nuclide label for the specified peak to the specified value. The label must be 6 characters or less.

SET_NUCLIDE_UNITS "units"

Sets the activity units to the specified string. The string may be no more than 6 characters.

SET_PEAK_PRESET count

Sets the ROI peak preset to the specified count. During data acquisition when the contents of any channel of a device that has the ROI flag set reaches the peak preset count, the preset is complete and the acquisition is stopped. The actual number of counts in the ROI peak may exceed the preset value by a small number of counts due to the pipelined architecture of the Micro-trans-SPEC. Setting a peak preset to 0 counts disables the preset. The peak preset may be set to from 0 (disabled) to 2147483647 counts. See also CLEAR_PRESETS and SHOW_PEAK_PRESET.

SET_RADIX_BINARY

Not used; included for backward compatibility.

SET_ROI start_chan,number_of_chans

Sets the ROI flags for the specified channels. This command can be used multiple times to set ROI flags without affecting previously set flags. ROI flags specify channels within a device that are considered for ROI integral and ROI peak presets.

SET_ROI_MDA start,numchans, [PeakNumber]

Sets the region to use to compute the gross counts in the MDA calculation. PeakNumber is an optional parameter (assumed 0 if not present) that specifies which of up to 20 (0–19) MDA Presets to change.

SET_ROI_NUCLIDE start,numchans, [PeakNumber]

Sets the region to use to compute the net counts in the activity calculation. PeakNumber is an optional parameter (assumed 0 if not present) that specifies which of up to 9 (0–8) peaks to change.

SET_ROI_SAMPLE num

Selects which controls signals are displayed as an ROI on the captured waveform. Only a single bit can be turned on at a time. The following signals can be selected with the associated bit.

Bit 0:	Pileup reject.
Bit 1:	Negative baseline threshold.
Bit 2:	Baseline restorer gate.
Bit 3:	Positive baseline threshold.
Bit 4:	Busy.
Bit 5:	Gate.
Bit 6:	Reserved.
Bit 7:	Peak detect.
Bit 8:	Reserved.

SET_ROI_UNCERTAINTY start, chans

Sets the region to be used for the uncertainty preset calculation. See also SHOW_ROI_UNCERTAINTY.

SET_SEGMENT**SET_SHAPE_CUSP**

No function in the Micro-trans-SPEC; included for backward compatibility.

SET_SHAP_FLAT value

Sets the width of the flattop to value. Value is in microseconds, ranging from 0.3 to 2.4 in steps of 0.1. See also SHOW_SHAP_FLAT.

SET_SHAP_RISE value

Sets the rise time to value. Value is in microseconds, ranging from 0.2 to 23 in steps of 0.2. See also SHOW_SHAP_RISE.

SET_THRESHOLD_NEGATIVE value

Sets the negative threshold to value. The negative threshold is normally set automatically by the Micro-trans-SPEC. See also ENABLE_THRESHOLD_AUTOMATIC and SHOW_THRESHOLD_NEGATIVE.

SET_THRESHOLD_POSITIVE value

Sets the positive threshold to value. The positive threshold is normally set automatically by the Micro-trans-SPEC. See also `ENABLE_THRESHOLD_AUTOMATIC` and `SHOW_THRESHOLD_POSITIVE`.

SET_TIME hour,min,sec

Sets the time stored in the battery backed-up system clock to the specified values. hour can be any value from 0–23; min and sec can be any value from 0–59. The current date and time are stored for a device when an acquisition is started. See also `SHOW_TIME`, `SET_DATE`, `SHOW_DATE`, `SET_TIME_START`, and `SHOW_TIME_START`.

SET_TIME_START hour,min,sec

Sets the start time to the specified values. Normally the start date and time are set automatically whenever a device is started with the `START` command. See also `SHOW_TIME_START`, `SET_DATE_START`, `SHOW_DATE_START`, `SET_DATE`, and `SET_TIME`.

SET_TRIG_SAMPLE setting

Selects the triggering source in Insight Mode. See `LIST_TRIG_SAMP` for legal trigger sources.

SET_TRUE ticks

Sets the true-time counter to the specified number of ticks. The number represents true time in units of 20 ms (50 ticks/sec). Normally this value is set by the Micro-trans-SPEC during data acquisition. See also `CLEAR_COUNTERS` and `SHOW_TRUE`.

SET_TRUE_PRESET ticks

Sets the true-time preset to the specified number of ticks (20 ms/tick). During data acquisition when the true-time counter reaches the preset number of ticks, the preset is complete and the acquisition is stopped. Setting a true-time preset to 0 ticks disables the preset. The preset should always be set to a multiple of one second. See also `CLEAR_PRESETS` and `SHOW_TRUE_PRESET`.

SET_ULD value

This sets the upper level discriminator to value, in channels.

SET_UNCERTAINTY_PRESET percent

Sets the uncertainty preset to the specified value in percent. percent is a floating point value from 0–99.9999. See also `SHOW_UNCERTAINTY_PRESET`.

SET_WINDOW [start, length]

Sets the window of interest to the specified start channel and number of channels. The channels of spectral data in the window of interest are affected by commands such as CLEAR, SET_DATA, and WRITE. If neither start nor length is provided, the window is set to the maximum size allowed by the conversion gain specified. The window of interest is always set to the maximum size after a SET_DEVICE command or a SET_SEGMENT command.

SET_ZERO_ADJUSTMENT value

Sets the zero stabilization adjustment to an arbitrary value from -65535 to 65535. The total range of the adjustment value represents ± 256 channels. This adjustment is usually only made by the gain stabilizer, and reset to 0 with the INITIALIZE_ZERO_STABILIZATION command. See also SHOW_ZERO_ADJUSTMENT.

SET_ZERO_CHANNEL chan

Sets the center channel for the stabilizer zero peak. If a zero channel is chosen such that the beginning channel or ending channel would be below channel 0 or above the maximum channel, as determined by the conversion gain, the zero peak width is reduced until the peak fits the device boundaries. A zero channel and width must be set before zero stabilization can be enabled. See also ENABLE_ZERO_STABILIZATION.

SET_ZERO_PRESET count

Sets the Gauss mode stabilization preset for the zero peak. The preset represents the minimum number of incremental counts that must be collected in any one channel of the zero peak before the zero offset is evaluated by the stabilizer and potentially adjusted. See also SHOW_ZERO_PRESET.

SET_ZERO_WIDTH chans

Sets the width in channels for the stabilizer zero peak. The zero width must be chosen such that the beginning channel is no lower than channel 0 and the ending channel is no higher than the maximum channel as determined by the conversion gain. The zero channel and width must be set before zero stabilization can be enabled. The absolute minimum width for the zero peak is 3 channels, and the absolute maximum width for the zero peak is 256 channels in Gauss mode. In point mode there is no maximum peak width, though the chosen width must allow the peak to fit within the device's channel limits as stated above.

SHOW_ACTIVE

Returns a 1 if the Micro-trans-SPEC is active (i.e., acquiring spectral data) or 0 if it is not active.

Responses:

\$C0000087<CR>

Not active.

\$C00001088<CR>

Active.

SHOW_ADC_CONV

Returns the ADC conversion gain.

SHOW_BLRE

Shows the baseline restorer time constant in microseconds. See also SET_BLRE.

Responses:

BLUE 000000000000091 Time constant is 91 μ s.

SHOW_BLRE_AUTOMATIC

Shows whether automatic selection of the baseline restorer constant is off or on.

Responses:

\$IT<CR> Automatic baseline is enabled.

\$IF<CR> Automatic baseline is disabled.

SHOW_CLICKER

Shows state of audio clicker.

Responses:

\$IT<CR> Clicker is enabled.

\$IF<CR> Clicker is disabled.

SET_CLICKER_SENSITIVITY sens

Sets sensitivity of clicker. Sens is an index into the list of sensitivity settings. Valid sens values are: 0, 1, 2, or 3 which correspond to Maximum, High, Medium, Low respectively.

SHOW_CLICKER_SENSITIVITY

Reports clicker sensitivity. Possible values are 0, 1, 2, or 3.

SHOW_CONFIGURATION

Returns a record that indicates the hardware configuration of the MCB. The record contains information about the number of segments in an MCB device (always 1 for the Micro-trans-SPEC), and the current conversion gain for each segment. The record is organized as follows:

\$J1638400001aaaaa00000[65 zeros here for total of 75 zeros]00000ccc

where **aaaaa** represents the conversion gain for the one and only segment in the currently selected device, and **ccc** represents the record checksum. See the section on response records in this chapter for more information about response records and checksums.

SHOW_CONFIGURATION_MASK

Returns two masks, the first of which can be “anded” with data from the MCB to clear the ROI bit from the data. When the second mask value is “anded” with data from the MCB, the data bits are removed and only the ROI bit remains.

Response:**CONF_MASK 02147483647 02147483648****SHOW_CONFIGURATION_UART**

Reports the baud rate, parity option, number of data bits, and number of stop bits for the serial interface.

Responses:

\$F09600N81	9600 baud, no parity, 8 data bits, 1 stop bit.
\$F19200E82	19200 baud, even parity, 8 data bits, 2 stop bits.
\$F02400O71	2400 baud, odd parity, 7 data bits, 1 stop bits.

SHOW_CORRECTION_FLAT

Shows the flattop correction value. See also SET_CORR_FLAT.

Responses:**CORR_FLAT 0000000000000000****SHOW_CRM**

Returns the current reading of the count-rate meter.

Response:**\$G0000050781096** Current input count rate is 50781 counts/s.**SHOW_DATA_APPLICATION** “string”

If string matches “string1” in a previous SET_DATA_APPLICATION command, then string2 from that command is returned. The response is a \$F record.

SHOW_DATE

Returns the day, month, and year of the current date as maintained in the battery-backed-up real time clock, in the form dddmmmyyy. The day is returned as a 3-digit integer number from 001–031, month as a 3-digit integer number from 001–012, and year as a 3-digit integer number from 000–099. See also SET_DATE_START.

Responses:

\$N001001088052<CR>	Date reported as Jan 1, 1988.
...	...
\$N031012099059<CR>	Date reported as Dec 31, 1999.
\$N001001000036<CR>	Date reported as Jan 1, 2000.
...	...
\$N031012087056<CR>	Date reported as Dec 31, 2087.

SHOW_DATE_START

Returns the day, month and year of the acquisition start date in the form dddmmmyyy. The day is returned as a 3-digit integer number from 001–031, month as a 3-digit integer number

from 001–012, and year as a 3-digit integer number from 000–099. See also SET_DATE_START.

Responses:

\$N001001088052<CR>	Date reported as Jan 1, 1988
...	...
\$N031012099059<CR>	Date reported as Dec 31, 1999
\$N001001000036<CR>	Date reported as Jan 1, 2000
\$N031012087056<CR>	Date reported as Dec 31, 2087

SHOW_DEBUG

Shows the debug level of the software.

SHOW_DELAY_COLLECTION

Shows the width of the PUR signal setting. See also SET_DELAY_COLLECTION.

Responses:

DEL_COLL 0000000000001.6

SHOW_DELAY_SAMPLE

Shows the Delay Sample setting. See also SET_DELAY_SAMPLE.

Responses:

\$C00003090 The sample number is 00003, and 090 is the checksum.

SHOW_DET_SMART

Indicates whether the detector is SMART-1 and the shutdown mode is set for a SMART-1 detector. Responses are true and false.

Responses:

\$IT<CR>	SMART-1 shutdown set.
\$IF<CR>	TTL or ORTEC shutdown set.

SHOW_DET_SNUM

This command responds with the detector serial number stored in the DIM.

Response:

\$FP40175 Serial number P40175.

SHOW_DET_VERSION

Returns the DIM firmware version.

Examples:

\$FNAID000	NaI DIM firmware version.
\$FSMDT000	SMART-1 firmware version.

SHOW_DEV

Shows the currently selected device. Always 1 for Micro-trans-SPEC.

SHOW_FEATURES

Responds with four 32-bit masks indicating which features are present in the MCB. See Section 8.7 for a complete description of each bit in the mask.

Example Response:

FEATURES 02285062207 02014941185 00000000000 00000000000

SHOW_GAIN_ADJUST

Returns the gain-stabilize amplifier setting.

SHOW_GAIN_CHANNEL

Reports the current center channel for the stabilizer gain peak. See also SET_GAIN_CHANNEL.

Responses:

\$C0000087<CR>	Gain channel has not been set.
\$C00002089<CR>	Gain channel is channel 2 (lowest possible channel).
...	...
\$C16382107<CR>	Gain channel is channel 16382 (highest possible channel).

SHOW_GAIN_COARSE

Returns the coarse gain for the Micro-trans-SPEC internal amplifier. In operation, the resulting signal gain is the product of the coarse gain, the fine gain, and the super-fine gain (used by stabilizer). The coarse gain is returned in terms of an integer gain multiplier.

Responses:

\$C00001088<CR>	Coarse gain reported as 1.
\$C00002089<CR>	Coarse gain reported as 2.
\$C00004091<CR>	Coarse gain reported as 4.
\$C00008095<CR>	Coarse gain reported as 8.
\$C00016094<CR>	Coarse gain reported as 16.
\$C00032092<CR>	Coarse gain reported as 32.

SHOW_GAIN_CONVERSION

This command returns the conversion gain.

Responses:

\$C00512095<CR>	Conversion gain reported as 512 channels.
\$C01024094<CR>	Conversion gain reported as 1024 channels.
\$C02048101<CR>	Conversion gain reported as 2048 channels.
\$C04096106<CR>	Conversion gain reported as 4096 channels.
\$C08192107<CR>	Conversion gain reported as 8192 channels.

\$C16384109<CR> Conversion gain reported as 16384 channels.
\$C32768113<CR> Conversion gain reported as 32768 channels.

SHOW_GAIN_FINE

Returns the current fine gain setting. See SET_GAIN_FINE.

Sample Response:

GAIN_FINE 000000000000.5 Gain is 0.5.

SHOW_GAIN_POLARITY

Returns the polarity of the amplifier input as \$F records.

Responses:

\$INEG<CR> The amplifier input is set to negative.

\$IPOS<CR> The amplifier input is set to positive.

SHOW_GAIN_PRESET

Reports the Gauss mode stabilization preset for the gain peak. The preset represents the minimum number of incremental counts that must be collected in any one channel of the gain peak before the gain is evaluated by the stabilizer and potentially adjusted. See also SET_GAIN_PRESET and CLEAR_PRESETS.

Responses:

\$G0000000010076<CR> Gain preset currently 10 counts (minimum).

\$G0000000011076<CR> Gain preset currently 11 counts.

...

...

\$G2147483647121<CR> Gain preset currently 2147483647 counts (maximum).

SHOW_GAIN_STABILIZATION

Reports the state of gain peak stabilization. See also ENABLE_GAIN_STABILIZATION and DISABLE_GAIN_STABILIZATION.

Responses:

\$IT<CR> Gain stabilization is currently enabled.

\$IF<CR> Gain stabilization is currently disabled.

SHOW_GAIN_WIDTH

Reports the current width for the stabilizer gain peak. See also SET_GAIN_WIDTH, SET_GAIN_CHANNEL, and SHOW_GAIN_CHANNEL.

Responses:

\$C00001088<CR> Gain width has not been set.

\$C00003089<CR> Gain width is 3 channels (lowest possible width).

\$C00256100<CR> Gain width is 256 channels (highest possible width in Gauss mode).

...

...

\$C16383108<CR>

Gain width is 16383 channels (highest possible width in point mode with gain channel set to 8192).

SHOW_GATE

Reports the current mode of operation of the ADC gate input. See also SET_GATE_OFF, SET_GATE_COINCIDENT, and SET_GATE_ANTICOINCIDENT.

Responses:**\$FOFF<CR>**

Reports the ADC gate is off or ignored.

\$FCOI<CR>

Reports the ADC gate is in coincident mode.

\$FANT<CR>

Reports the ADC gate is in anticoincident mode.

SHOW_HV

Reports the current high voltage and the status of the high voltage power supply in the form:

\$Dvvvvvsssssccc<CR>

Where vvvvv represents the current output voltage if the high voltage is enabled, or the rear-panel high voltage setting if the high voltage is disabled. sssss represents the status of the high voltage bias supply as a 16-bit decimal number with the following bit definitions:

Bit 0 (LSB):

Bias supply polarity (0=positive, 1=negative).

Bit 1:

Bias supply overload (0=overload, 1=normal).

Bit 2:

High voltage enabled (0=disabled, 1=enabled).

Example Responses:**\$D0200000003077<CR>**

2000 V, negative, not overloaded, disabled.

\$D0200000002076<CR>

2000 V, positive, not overloaded, disabled.

\$D0200000007082<CR>

2000 V, negative, not overloaded, enabled.

SHOW_HV_ACTUAL

Returns the value of HV actually on the detector.

SHOW_HV_HEALTH

Returns the status of the state of health for the detector as reported by the DIM or SMART-1.

SHOW_HV_RECOMMEND

Returns HV, in ASCII, from SMART-1 detectors.

SHOW_HV_TARGET

Under normal operation, the HV will go to this value when the HV is enabled. Reports the current HV setting (see SET_HV) and the status of the HV power supply in the form:

\$Dvvvvvsssssccc<CR>

where vvvvv represents the HV setting, and sssss represents the status of the HV bias supply as a 16-bit decimal number with the following bit definitions:

Bit 0 (LSB): Bias supply polarity (0=positive, 1=negative).
Bit 1: Bias supply overload (0=overload, 1=normal).
Bit 2: HV enabled (0=disabled, 1=enabled).

Example Responses:

\$D0200000003077<CR> 2000 V, negative, not overloaded, disabled.
\$D0200000002076<CR> 2000 V, positive, not overloaded, disabled.
\$D0200000007082<CR> 2000 V, negative, not overloaded, enabled.

SHOW_HV_POLARITY

This returns the HV polarity setting in the Micro-trans-SPEC as a \$F record.

Responses:

\$INEG<CR> The HV is set to negative.
\$IPOS<CR> The HV is set to positive.

SHOW_ID

Reports the sample ID string as was previously set by the SET_ID command. The sample ID string is stored with each spectrum acquired in field mode and is restored with the field mode spectral data by the MOVE command.

Example Responses:

\$FSite 123<CR> ID set to "Site 123".
\$FSample 123456789<CR> ID set to "Sample 123456789".

SHOW_INTEGRAL [start_chan,number_of_chans]

Reports the sum of the specified group of spectral data channels. If start_chan and number_of_chans is not provided, SHOW_INTEGRAL reports the sum of all channels in the currently selected segment that have their ROI flag set.

Responses:

\$G0000000000075<CR> Integral reported as 0.
 ...
\$G4294967294131<CR> Integral reported as 4294967294.
\$G4294967295132<CR> Integral reported as greater than or equal to 4294967295 (maximum reportable value).

SHOW_INTEGRAL_PRESET

Reports the current ROI integral preset value. For more information about the ROI integral preset, see SET_INTEGRAL_PRESET. See also SHOW_INTEGRAL.

Responses:

\$G0000000000075<CR> Integral preset reported as 0.
 ...
\$G4294967295132<CR> Integral reported as 4294967295.

SHOW_INTEGRAL_REMAINING

Reports the current ROI integral remaining value. For more information about the ROI integral remaining, see SET_INTEGRAL_REMAINING. See also SHOW_INTEGRAL.

Responses:

\$G0000000000075<CR> Integral remaining reported as 0.

...

\$G4294967295132<CR> Integral reported as 4294967295.

SHOW_LENGTH_SAMPLE

Reports the number of points in the Insight Mode Waveform.

Response:

\$C010000088 1000 points in the waveform.

SHOW_LIVE

Reports the contents of the live-time counter in units of 20 ms (50 ticks/s). See also CLEAR_COUNTERS and SET_LIVE.

Responses:

\$G0000000000075<CR> Live time reported as 0 ticks.

\$G0000000001076<CR> Live time reported as 1 tick (20 ms).

...

\$G4294967295132<CR> Live time reported as 4294967295 ticks (over 23000 days).

SHOW_LIVE_PRESET

Reports the current live-time preset in units of 20 ms (50 ticks/s). See also CLEAR_PRESETS and SET_LIVE_PRESET.

Responses:

\$G0000000000075<CR> Live-time preset reported as disabled.

\$G0000000001076<CR> Live-time preset reported as 1 tick.

...

\$G4294967295132<CR> Live-time preset reported as 4294967295 ticks.

SHOW_LIVE_REMAINING

Reports the current live-time remaining in units of 20 ms (50 ticks/s). See also SET_LIVE_REMAINING.

Responses:

\$G0000000000075<CR> Live-time remaining reported as disabled.

\$G0000000001076<CR> Live-time remaining reported as 1 tick.

...

\$G4294967295132<CR> Live-time remaining reported as 4294967295 ticks.

SHOW_LLD

Shows the lower level discriminator setting. See also SET_LLD.

Responses:

\$C00050092 The LLD is 50.

SHOW_MARKER

Returns the channel number of the marker.

SHOW_MDA [PeakNumber]

Reports current MDA for the MDA Preset selected by PeakNumber. PeakNumber is assumed to be 0 if not supplied.

Example response:

MDA 0000000000010.7

SHOW_MDA_COEF

Reports the current settings for coefficients a, b, and c used for the MDA calculation. See SET_MDA_COEF.

Example Responses:

MDA_COEF 000000000002.71 0000000000000000 00000021.700001

Coefficient a = 2.71, b = 0, and c = 21.7.

SHOW_MDA_PRESET [PeakNumber]

Reports MDA preset PeakNumber. If PeakNumber is omitted, 0 is assumed.

Example Response:

MDA_PRES 0000000000025.7

SHOW_MODE

Reports the current mode of operation (PHA or Sample [InSight Virtual Oscilloscope]). See also SET_MODE_PHA and SET_MODE_SAMPLE.

Responses:

\$FPHA<CR> PHA mode.

\$FSAM<CR> Sample mode (InSight).

SHOW_MODE_STABILIZATION

Reports the current stabilization mode of operation. See also SET_MODE_POINT and SET_MODE_GAUSS.

Responses:

\$FPOINT<CR>

\$FGAUSS<CR>

SHOW_MODE_TEST

Reports whether the Micro-trans-SPEC is in test mode and, if in test mode, which test mode is it in. This command is normally only used for testing at the factory.

Responses:

\$A000ccc Not in test mode.
\$A001ccc ADC test mode.

SHOW_MONI_LABEL num

Returns with an ASCII string label designation for the monitor num.

SHOW_MONI_MAX

Returns with the number of monitors available for viewing.

SHOW_MONI_VALUE num

Returns with an ASCII representation of the value for the monitor.

SHOW_NEXT

Used in conjunction with the SHOW_ROI command, SHOW_NEXT reports the next continuous group of channels that have the ROI flag set. The response is of the form:

\$Dssssnnnnccc<CR>

where ssss represents an integer number that is the number of the first channel of the “next” group of channels that all have their ROI bit set, and nnnnn represents an integer number that is the number of channels in the group. If no more channels have their ROI bit set, SHOW_NEXT returns a first channel of 0 and a number of channels of 0. The SHOW_ROI command is used to report the “first” group of channels that all have their ROI bit set.

Example Responses:

\$D0100000050078<CR> Next ROI group starts at channel 1000 and is 50 channels long.
\$D0215000150086<CR> Next ROI group starts at channel 2150 and is 150 channels long.
\$D0000000000072<CR> No other ROI groups to report.

SHOW_NUCLIDE [PeakNumber]

Reports current activity and uncertainty for the nuclide selected by PeakNumber. PeakNumber is assumed to be 0 if not supplied.

Example:

NUCLIDE 0000000000010.7 000000000001.2 Activity is 10.7 and uncertainty is 1.2%.

SHOW_NUCLIDE_COEFFICIENT [PeakNumber]

Reports the coefficient for a specific peak as a floating-point number that corresponds to the number set with SET_NUCLIDE_COEF.

Example:

NUCLIDE_COEF 000000000010.7

SHOW_NUCLIDE_DESC PeakNumber

Reports the nuclide label for the specified peak in a \$F record.

SHOW_NUCLIDE_UNITS

Reports the nuclide activity units in a \$F record.

SHOW_OVERFLOW_PRESET

Reports the state of the overflow preset.

Responses:

\$IT<CR> Overflow preset enabled.

\$IF<CR> Overflow preset disabled.

SHOW_PEAK

This command returns the contents of the ROI channel with the largest number of counts. An ROI channel is a channel that has the ROI flag set. The maximum possible value is 2147483647, which is the maximum number of counts that can be stored in a 31-bit channel.

Responses:

\$G0000000000075<CR> Maximum count in an ROI channel is zero or no ROI channels were found.

\$G0000000001076<CR> Maximum count in an ROI channel is 1.

...

\$G2147483646120<CR> Maximum count in an ROI channel is 2147483646.

\$G2147483647121<CR> Maximum count in an ROI channel is 2147483647.

SHOW_PEAK_CHANNEL

This command returns the number of the ROI channel with the largest number of counts. An ROI channel is a channel that has the ROI flag set. The lowest number ROI channel with the largest count is reported if more than one channel contains the largest number of counts. Channel 32767 is the highest numbered channel in any device.

Responses:

\$C00000087<CR> Maximum count was found in channel 0 or no ROI channels were found (see errors below).

\$C00001088<CR> Maximum count was found in channel 1.

...

\$C16383108<CR> Maximum count was found in channel 16383.

SHOW_PEAK_PRESET

Reports the value of the ROI peak preset. See SET_PEAK_PRESET for information about the ROI peak preset.

Responses:

\$G0000000000075<CR>	Peak preset disabled.
\$G0000000001076<CR>	Peak preset set to 1 count.
...	...
\$G2147483646120<CR>	Peak preset set to 2147483646 counts.
\$G2147483647121<CR>	Peak preset set to 2147483647 counts.

SHOW_PZ

Displays the PZ setting. See also SET_PZ.

Responses:

PZ_ENA 002200	Pole zero enabled and set to 2200.
PZ_DIS 001000	Pole zero disabled and set to 1000.

SHOW_RADIX**SHOW_RATE_ZDT****SHOW_REMOTE**

Not used; included for backward compatibility.

SHOW_ROI

Used in conjunction with the SHOW_NEXT command, SHOW_ROI reports the first continuous group of channels that have the ROI flag set. The response is of the form

\$Dssssnnnnccc<CR>

where ssss represents an integer number that is the number of the first channel of the “first” group of channels that all have their ROI bit set, and nnnnn represents an integer number that is the number of channels in the group. The SHOW_NEXT command is used to report the “next” group of channels that all have their ROI bit set.

Responses:

\$D0100000050078<CR>	First ROI group starts at channel 1000 and is 50 channels long.
\$D0215000150086<CR>	First ROI group starts at channel 2150 and is 150 channels long.
\$D0000000000072<CR>	No ROI groups to report.

SHOW_ROI_MDA

Reports the start channel and number of channels used in the MDA preset calculation.

Example Response:

\$D0700000050ccc	Calculation is performed on channels 7000–7049.
-------------------------	---

SHOW_ROI_NUCLIDE [PeakNumber]

Reports the region to use to compute the counts in the activity calculation. PeakNumber (assumed 0 if not present) specifies which of up to 9 (0–8) peaks to report.

Example Response:

\$D0083200052092 Region starts at channel 832 and is 52 channels wide.

SHOW_ROI_SAMPLE

Displays the ROI Sample setting. See also SET_ROI_SAMPLE.

Responses:

\$C00001088

SHOW_ROI_UNCERTAINTY

Reports the start channel and number of channels used in the uncertainty preset calculation. See also SET_ROI_UNCERTAINTY.

Response:

\$D0700000050ccc Calculation is performed on channels 7000–7049.

SHOW_SEGMENT

Returns the current segment number. Always 1 for the Micro-trans-SPEC.

SHOW_SHAP_FLAT

Reports the width of the flattop in μs . See also SET_SHAP_FLAT.

Responses:

SHAP_FLAT 0000000000001.2

SHOW_SHAP_RISE

Displays the rise-time setting in μs . See also SET_SHAP_RISE.

Responses:

SHAP_RISE 0000000000003.2

SHOW_SHUTDOWN

Shows the type of HV shutdown selected (only SMART-1) is available.

Responses:

\$FSM1 SMART-1 mode selected

SHOW_SHUT_ACTUAL

Returns the current status of the bias remote shutdown input signal. This command is valid whether the bias supply is turned on or off.

Responses:

\$IT Shutdown is active (supply is shut down or can't be turned on).

\$IF Shutdown is inactive (supply is on or can be turned on).

SHOW_SNUM

Responds with a \$F record indicating the serial number of the Micro-trans-SPEC.

Response:

\$F100 Serial number is 100.

SHOW_SOH

Returns the state-of-health word for the detector.

SHOW_SPECTRUM num

Copies the desired spectrum (num) from the stored spectrum memory to the active spectrum memory. (num) is a number between 0 and the value returned by SHOW_SPECTRUM_COUNT.

SHOW_SPECTRUM_COUNT

Returns with a response, where the number indicates the number of spectra in the stored spectrum memory.

SHOW_STATUS

Returns system status information in the following format:

\$MlllllllllTTTTTTTTtaaaaahhhhccc<CR>

where **lllllllll** represents the live time as returned by the SHOW_LIVE command, **TTTTTTTT** represents the true time for the current device as returned by the SHOW_TRUE command, **aaaaa** represents the active device mask as returned by the SHOW_ACTIVE_DEVICES command, and **hhhhh** represents the hardware status, which is an ASCII representation of a 16 bit decimal number with the following bit definitions:

Bit 0 (LSB):	Bias supply polarity (0=positive, 1=negative)
Bit 1:	Bias supply overload (0=overload, 1=normal)
Bit 2:	High voltage enabled (0=disabled, 1=enabled)
Bit 3:	Unused
Bit 4:	Amplifier PZ'd since initialization (0=normal, 1=needs PZ'ing)
Bit 5	Optimization since initialization (0=normal, 1=needed)
Bits 6–7:	Unused
Bit 8:	Amplifier automatic PZ (1=Auto PZ in progress, 0=normal)
Bit 9:	Optimization (0=normal, 1=in progress)

Bits 10–14: Unused
Bit 15 (MSB): Reserved

SHOW_THRESHOLD_AUTOMATIC

See also SET_THRESHOLD_AUTOMATIC.

Responses:

\$IT<CR> Automatic threshold is enabled.
\$IF<CR> Automatic threshold is disabled.

SHOW_THRESHOLD_NEGATIVE

See also SET_THRESHOLD_NEGATIVE.

Responses:

THR_NEG 0000379791 Negative threshold is 379791.

SHOW_THRESHOLD_POSITIVE

See also SET_THRESHOLD_POSITIVE.

Responses:

THR_POS 00000126811 Positive threshold is 126811.

SHOW_TIME

Reports the time from the battery backed-up system clock in the form

\$Nhhmmssccc<CR>

where hhh represents a 3-digit integer hour (0–23), mmm represents a 3-digit integer minute (0–59), and sss represents a 3-digit integer second (0–59). See also SET_TIME, SET_DATE, and SHOW_DATE.

Example Responses:

\$N010054017052<CR> Time returned 10:54:17 (10 h, 54 min, 17 s).
\$N020013037050<CR> Time returned 20:13:37 (20 h, 13 min, 37 s).

SHOW_TIME_START

Reports the time of the last START command in the form

\$Nhhmmssccc<CR>

where hhh represents a 3-digit integer hour (0 through 23), mmm represents a 3-digit integer minute (0 through 59) and sss represents a 3-digit integer second (0 through 59). See also SET_TIME_START, SET_DATE_START, and SHOW_DATE_START.

Example Responses:

\$N010054017052<CR> Time returned 10:54:17 (10 h, 54 min, 17 s).
\$N020013037050<CR> Time returned 20:13:37 (20 h, 13 min, 37 s).

SHOW_TRIG_SAMPLE

Reports the trigger source in Insight Mode.

Responses:

\$F0LLD	LLD is source.
\$F1PKD	Peak-detect is source.
\$F2RANDOM	Trigger happens randomly.
\$F3Gate	Gate Input triggers the waveform.

SHOW_TRIGGER_SPECIAL

Not used; included for backward compatibility.

SHOW_TRUE

Reports the contents of the true-time counter in units of 20 ms (50 ticks/s). See also CLEAR_COUNTERS and SET_TRUE.

Responses:

\$G0000000000075<CR>	True time reported as 0 ticks.
\$G0000000001076<CR>	True time reported as 1 tick (20 ms).
...	...
\$G4294967295132<CR>	True time reported as 4294967295 ticks (over 23000 days).

SHOW_TRUE_PRESET

Reports the current true-time preset in units of 20 ms (50 ticks/s). See also CLEAR_PRESETS and SET_TRUE_PRESET.

Responses:

\$G0000000000075<CR>	True time preset reported as disabled.
\$G0000000001076<CR>	True time preset reported as 1 tick.
...	...
\$G4294967295132<CR>	True time preset reported as 4294967295 ticks.

SHOW_TRUE_REMAINING

Reports the current true time remaining in units of 20 milliseconds (50 ticks per second). See also SET_TRUE_REMAINING.

Responses:

\$G0000000000075<CR>	True time remaining reported as disabled.
\$G0000000001076<CR>	True time remaining reported as 1 tick.
...	...
\$G4294967295132<CR>	True time remaining reported as 4294967295 ticks.

SHOW_ULD

Returns the value of the ULD in channels, as a \$C record.

SHOW_UNCERTAINTY

Returns the current value of the uncertainty for the peak in the uncertainty preset. See also SET_UNCERTAINTY.

Responses:

UNCE 0000000000008.5 Uncertainty of the peak is 8.5%.

SHOW_UNCERTAINTY_PRESET

Returns the current uncertainty preset setting. See also SET_UNCERTAINTY_PRESET.

Responses:

UNCE_PRES 00000000000000 No preset.
UNCE_PRES 0000000000008.5 Preset set to 8.5%.

SHOW_VERSION

Reports the Micro-trans-SPEC firmware version number in the form:

Fmmmm-vvv<CR>

where mmmm is a 4-character model designator and vvv is a 3-character version designator.

Example Responses:

\$FDETH-005<CR> Model Micro-trans-SPEC firmware version 5 reported.

SHOW_WINDOW

Reports the start channel and number of channels in the window of interest, in the form

\$Dxxxxxyyyyyccc<CR>

where xxxxx is the start channel (0–16383) and yyyyy is the number of channels (1–16384).

See SET_WINDOW for more information about the window of interest.

Example Responses:

\$D0000016384094<CR> Window of interest reported as starting at channel 0 and continuing for 16384 channels.

\$D0000008192092<CR> Window of interest reported as starting at channel 0 and continuing for 8192 channels (first 1/2).

\$D0819208192112<CR> Window of interest reported as starting at channel 8192 and continuing for 8192 channels (last 1/2).

SHOW_ZDT

No function in the Micro-trans-SPEC; included for backward compatibility.

SHOW_ZERO_ADJ

Returns the value of the zero offset for the zero stabilizer.

SHOW_ZERO_CHANNEL

Reports the center channel for the stabilizer zero peak. See also SET_ZERO_CHANNEL, SET_ZERO_WIDTH, and SHOW_ZERO_WIDTH.

Responses:

\$C00000087<CR>	Zero channel has not been set.
\$C00002089<CR>	Zero channel is channel 2 (lowest possible channel).
...	...
\$C16382107<CR>	Zero channel is channel 16382 (highest possible channel).

SHOW_ZERO_PRESET

Reports the Gauss mode stabilization preset for the zero peak. The preset represents the minimum number of incremental counts that must be collected in any one channel of the zero peak before the zero offset is evaluated by the stabilizer and potentially adjusted. See also SET_ZERO_PRESET and CLEAR_PRESETS.

Responses:

\$G0000000010076<CR>	Zero preset currently 10 counts (minimum).
\$G0000000011076<CR>	Zero preset currently 11 counts.
...	...
\$G2147483647121<CR>	Zero preset currently 2147483647 counts (maximum).

SHOW_ZERO_STABILIZATION

Reports the state of zero peak stabilization. See also ENABLE_ZERO_STABILIZATION and DISABLE_ZERO_STABILIZATION.

Responses:

\$IT<CR>	Zero stabilization is currently enabled.
\$IF<CR>	Zero stabilization is currently disabled.

SHOW_ZERO_WIDTH

Reports the current width for the stabilizer zero peak. See also SET_ZERO_WIDTH, SET_ZERO_CHANNEL, and SHOW_ZERO_CHANNEL.

Responses:

\$C00001088<CR>	Zero width has not been set.
\$C00003089<CR>	Zero width is 3 channels (lowest possible width).
...	...
\$C00256100<CR>	Zero width is 256 channels (highest possible width in Gauss mode).
...	...
\$C16383108<CR>	Zero width is 16383 channels (highest possible width in point mode with zero channel set to 8192).

START [seg-mask]

Starts the acquisition of spectral data. The optional segment mask is provided for compatibility with other MCBs and may be any value from 0 to 65535 but is ignored by the Micro-trans-SPEC.

STOP [seg-mask]

Stops the acquisition of spectral data. The optional segment mask is provided for compatibility with other MCBs and may be any value from 0 to 65535 but is ignored.

TERM

Sets the Micro-trans-SPEC to terminal mode; included for backward compatibility.

VERIFY_CORR_FLAT**VERIFY_SHAP_FLAT****VERIFY_SHAP_RISE**

These test the argument against the list of valid settings and return true if valid.

WRITE_SPECTRUM

Directs the Micro-trans-SPEC to write the current active spectrum into stored spectrum memory. Same function as the STORE button.

APPENDIX A. CHANGING THE INTERNAL BATTERY

The typical service life of the Micro-trans-SPEC's 14.4 V lithium ion battery is 3–5 years. When the internal battery no longer retains a charge, it must be replaced with the appropriate ORTEC battery replacement kit. This is a straightforward operation that takes just a few minutes, so the detector does not significantly warm up during the procedure. *If you connect the Micro-trans-SPEC to external power, the battery can be “hot swapped” without shutting down the program or computer.* After battery change (unless the battery has been pre-charged), the Micro-trans-SPEC must remain connected to external power for 3–4 hours to charge the replacement battery. For more information, contact your ORTEC representative or our Global Service Center.

- 1) If external power is available, connect the Micro-trans-SPEC to the power source. Otherwise, shut down its computer by pressing and holding the on/off button for 1–3 seconds to display the power menu, then tapping the **Shutdown** option.
- 2) Figure 70 shows the quick-release battery hatch. The two release latches are located on the top edge. Slide the latches up and open the hatch as shown in Fig. 71.
- 3) The end of the battery closest to the HPGe detector endcap has a pull tab. Gently pull it outward, as if opening a book cover or door, until the battery slips off the connector terminals at the lower rear of the compartment. Figure 72 shows the pull tab on the front side of the battery and the connector terminals on the lower back edge.
- 4) Guide the new battery onto the connector terminals and press it into place, then close the hatch and slide the latches closed.
- 5) If the Micro-trans-SPEC was connected to external power when you changed the battery, the unit is ready for use.



Figure 70. Quick-Access Battery Hatch, Closed.

If you powered off the Micro-trans-SPEC, restart it by pressing the on/off button, then wait for the unit to start and fully initialize (this will take several minutes). If you did not turn the cooler off, it will restart by itself. Once the program is fully initialized, wait another 5 minutes for any alarms to clear. Typical alarms may include a warm detector error, a

detector bias voltage error, and/or a detector gain stabilizer error. If a gain stabilizer error is posted, wait another 5 minutes to see if it clears. If it does not, run a background measurement.

In both cases, unless the new battery was pre-charged, it must charge for 3–4 hours before the Micro-trans-SPEC is ready for extended, standalone use without external power.



Figure 71. Quick-Access Latches Up and Hatch Open.

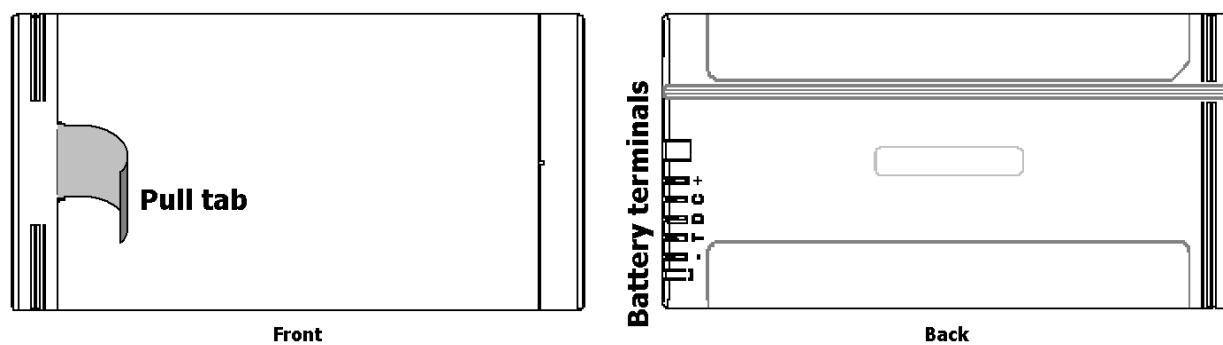


Figure 72. Front and Back of Internal Battery.

- 6) Return the old battery to ORTEC for recycling.

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