D230A v2 UAV Gamma-Ray Spectrometer

User's Guide

Ver. 2.0
June 2020



Terraplus
empowering discovery

your source for geophysical instruments

Table of Contents

Chapter 1: Introduction

1.1 General Information Page 3

Chapter 2: The D230A v2

2.1 Specifications Page 4

2.2 Features Page 5

2.3 Layout Page 6

2.4 Controls Page 7

2.5 Menus Page 7

2.6 LCD Display / Notification Icons Page 8

Chapter 3: Operating the D230A v2

3.1 Battery Installation Page 10

3.2 Power Page 11

3.2.1 Power On Page 11

3.2.2 Power Off Page 11

Chapter 4: Software

4.1 MapView Page 12

4.1.1 Installation Page 12

4.2 MapView Interface Page 17

4.3 MapView OFFLINE Mode (without Radio Link) Page 21

4.3.1 Data Download Page 22

4.3.2 Operating Parameters Page 26

4.4 MapView ONLINE Mode (with Radio Link) Page 27

4.4.1 MapView – Settings Menu Page 27

4.4.2 Map List Implementation Page 31

4.4.3 Recording ON / OFF Function Page 31

4.4.4 Dashboard – Status Panel Page 31

Product Warranty Page 33

Chapter 1

Introduction

1.1 General Information

The D230A is a modular gamma-ray spectrometer designed specifically for UAVs and is manufactured by Georadis S.R.O. in the Czech Republic. The system allows operators to simultaneously measure the dose rate, total intensity of gamma radiation, and intensity of the energy windows corresponding to potassium, uranium, thorium, plus a wide range of man-made radionuclides.

The standard D230A system utilizes two fully independent 1024 channel gamma-ray spectrometers, each with its own detector, and a small lightweight data acquisition and control unit. The D230A uses an advanced method of automatic gain stabilization using natural background radiation. This unique stabilization method eliminates the need for an additional radioactive check source.

The number of detectors included in the D230A system can be reduced to one to minimize the system's weight or increased to three or four to improve its sensitivity. Detectors are available in either Bismuth Germanate Oxide (BGO) or Sodium Iodide (NaI/TI) configurations. BGO detectors offer 3x greater sensitivity and are ideal for mineral exploration. NaI/TI detectors are more lightweight and offer improved spectral resolution.

Spectra from each detector are accumulated and saved separately, with a sampling rate adjustable from one second up to one minute. Each detector contributes an integrated spectrum during monitoring activities, including dose rate.

Chapter 2

The D230A v2

2.1 Specifications

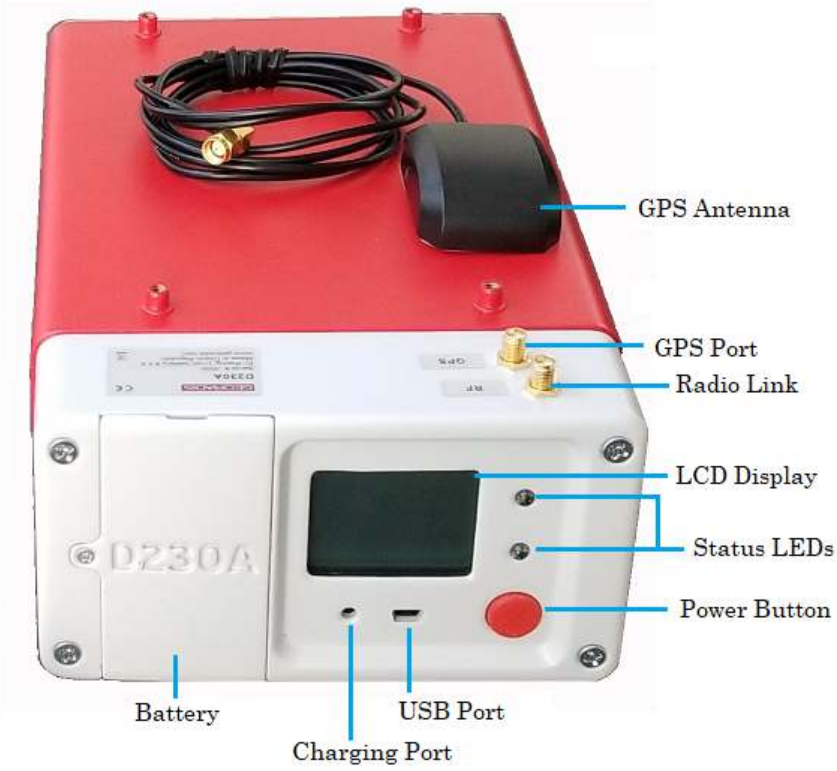
Detector Size:	2”x2” (51x51 mm) with volume of 6.3 in^3 (104 cm^3) per detector
BGO Detector(s):	Bi-alkali PMT Sensitivity 2 x 160 cps / MBq / m (Cs-137) Resolution max 11.5% FWHM (661 keV)
NaI/TI Detector(s):	Bi-alkali PMT Resolution max 8% FWHM (661 keV)
Spectrometer(s):	1024 channels, 40 MHz DSP, Linear Energy corrected, Pile-up rejecter, 200 ns Resolution, Max throughput 250,000 cps per detector
Sampling Rate:	User Selectable, minimum 1 per second Each spectrum in separate data file and total accumulated spectrum
Energy Range:	25 keV – 3,000 keV
Dose Rate:	Fully energy compensated (from 30 keV – 1,500 keV), linear up to 100 micro Sv/h, Complies with IEC 60486-1, Sensitivity 1 nSv/hr
Operating Time:	Limited by drone
Display:	LCD black & white graphical display with resolution of 104 x 81 pixels
Control:	Single button operation
Data Storage:	32 GB, capable of storing 40,000 samples with full spectra, including GPS coordinates Stabilization spectra and system message logs are also recorded Memory size expandable
External GPS:	Navigate down to -162 dBm and -148 dBm coldstart, Precision of 2m
Communication:	Data transfer, remote control, and diagnostic by USB 2.0
Power:	Rechargeable Li-Ion 7.2V/2200 mAh (minimum 4 hours of operation at 20°C)
System Dimensions:	145 x 78 x 260 mm for 1-2 Detector Systems (excluding drone) Additional detectors are 78 x 78 x 260 mm each and are mounted to the console
Operating Temperature:	-10°C to 50°C
Rating:	IP40 (not dust and water resistant)
Weight:	Varies based on number and type of detectors, as indicated in the chart below:

	Detector Types	
# of Detectors	*BGO*	*NaI/TI*
1x	2.5 kg	2.1 kg
2x	3.5 kg	2.7 kg
3x	5.3 kg	4.1 kg
4x	7.0 kg	5.4 kg

2.2 Features

- Allows operators to complete surveys more efficiently than comparable ground instruments without the increased cost of large airborne systems;
- Systems available with one to four BGO or NaI/TI detectors to accommodate a variety of applications and UAV payloads;
- Ability to directly identify naturally occurring and man-made radionuclides with the Nuclide Identification feature;
- Optional telemetric module for real-time wireless transmission of data;
- No radioactive sources required for proper operation; and
- Supports all standard drones with adequate lift power.

2.3 Layout


GPS Antenna
GPS Port
Radio Link
LCD Display
Status LEDs
Power Button
D230A
Battery
USB Port
Charging Port


Radio Link
USB Port
Status LEDs
Antenna

2.4 Controls

The **D230A v2** uses a single red PUSH-BUTTON to operate the system, which is located on the front panel of the console.



The Button has 2 primary actions:

Short Button Press: is a single short push of the button – used to navigate through the menu options.

Long Button Press: hold the button for more than two seconds or until a reaction appears on the display – used to make a menu selection.

2.5 Menus

The following menu options are available. Use the  to scroll through the menu options. When the desired option is highlighted, press and hold  to make a selection.

Main: This is where survey data can be found. Individual counts from the two detectors are displayed, as shown in the screen capture below, along with the average dose rates.



Figure 1: Main

Start Logging: Select this option to start recording survey data to internal memory.



Figure 2: Start Logging

There are three visual cues for operators to verify that data storage/recording is in progress: A blinking green LED light on the **D230A v2** console, a Diskette icon within the notifications area of the

display, and a “Logging” bar at the bottom of the display, as shown in the screen capture above.

GPS: In this menu, GPS status & parameters (such as number of satellites, latitude and longitude, and elevation) can be reviewed, as shown in the screen capture below.



Figure 3: GPS

Sensors: This menu displays the status of the **D230A v2**, such as battery voltage, capacity, pressure, and altitude, as shown in the screen capture below.



Figure 4: Sensors

Radio: The status and parameters of the Radio Link to base station are displayed in this menu, as shown in the screen capture below.



Figure 5: Radio (Radio Link Status)

Shutdown: Select this option to power OFF the **D230A v2** console

2.6 LCD Display / Notification Icons

The LCD display of the **D230A v2** shows survey data as well as a series of status icons in the notification area at the top of the screen.



Figure 6: Display / Notification Icons

The time and battery indicator are displayed in this location and are displayed permanently during operation of the instrument. Below you will find a list of the other icons you will see used on the meter and the meaning for each of them.



Figure 7: Display / Notification Area

1.		**Battery Gauge:**	This shows the current status of the battery. A solid black battery icon indicates a fully charged battery.
2.		**Stabilization:**	The D230A uses an advanced method of automatic gain stabilization using natural background radiation. Once the D230A has been powered on and has been stabilized, this icon appears in the notification area, next to the battery gauge, to indicate that stabilization is complete. **Note:** Automatic stabilization typically takes 5-10 minutes, depending on local conditions.
3.		**GPS:**	A solid crosshair icon indicates that GPS is enabled and is connected to a satellite. A flashing crosshair icon indicates that GPS is in the process of connecting.
4.		**Recording:**	The diskette icon indicates that readings are being recorded.
5.		**Telemetry:**	For operators with the Telemetric Module, the wifi icon indicates that data is being broadcasted for remote monitoring.
6.		**Time:**	The local time is displayed, as set by the user via the D230A v2 MapView software.

Chapter 3

Operating the D230A v2

3.1 Battery Installation

The **D230A v2** is powered by a battery pack with two Lithium-Ion 3.6v type batteries. The rechargeable battery kit supplied includes a battery pack and universal charger (110/220VAC).



Figure 8: Battery

Battery Installation:

- Remove the single screw securing the battery lid;
- Carefully insert the battery pack connector; and
- Close the battery cover by screwing the lid back into place.

** Ensure that the internal battery pack is charged prior to operating the device.

Note: If you are going to store your D230A v2 for a long a period of time, please remove the batteries from the unit to prevent damage from electrolyte leakage. It is also recommended that you visually inspect the batteries after any long storage interval.

3.2 Power

3.2.1 Power ON

To power the unit ON, press and hold  button for two seconds.

3.2.2 Power OFF

To power the unit OFF, use the  button to navigate to the “Shutdown” menu option and then press and hold the  button until the console turns off.

Chapter 4

Software

4.1 MapView

MapView is an easy-to-use data logging software that facilitates online communication between a Windows PC or laptop and the D230A UAV spectrometer. It enables the setup of the D230A v2's operating parameters and allows data in the system's memory – including health status, diagnostics, and logs – to be downloaded, viewed, and stored.

Through the use of the included Nuclide Identification library, the software can automatically identify a wide-range of naturally occurring and man-made radionuclides.

For users with the optional telemetric module, MapView also supports real-time communication with the D230A v2 through the use of a radio modem. Measured spectra, dose rate, elevation, atmospheric pressure and GPS position are broadcasted every second over the radio modem and are easily readable in graphical and numerical format.

Users with the telemetric module can also use MapView to set a variable threshold for the total count rate above which an audio alarm will sound. The audio sound and pitch, emitted from the Windows PC/laptop, will then fluctuate proportionally to the real-time variations in radiation measured by the system above the set threshold. Drone pilots can use this audio cue to easily identify areas of interest and follow a "hot track".

4.1.1 Installation

To install MapView, locate the install package provided to you on the USB key. The file is titled **mapview_d230av2-0.18.0-win32.exe** and will be approximately 15.9 MB in size. Double click the icon to run the installation package.

IMPORTANT: You must be an administrator to install the software; you will be prompted for this information if your Windows user account does not have administrator credentials.

If this is the first time connecting a D230A v2 to a PC, it is recommended to install the USB driver first prior to installing the MapView software. To begin installation of the USB driver, locate the geousb.exe file and double click the icon to run the installation package.

USB Driver Installation

Please ensure that the D230A is not connected to the PC via USB prior to driver installation.

When selecting Install Georadis USB driver, a Device Driver Installation Wizard (**Figure 9**) will be presented. Select **Next>** to continue the installation, or **Cancel** to exit.



Figure 9: Start Driver Installation

When the driver installation is complete, the following screen will be shown (**Figure 10**).

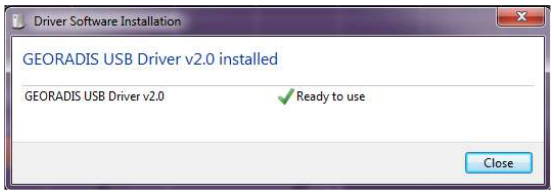


Figure 10: Complete Driver Installation

At this time, plug the **D230A v2**'s USB cable into the computer to have Windows recognize the drivers and copy the files to the appropriate location. Windows will respond by indicating that a new USB device has been recognized.

If Windows fails to recognize the new hardware, a New Hardware Wizard will appear (**Figure 11**).



Figure 11: Windows New Hardware Wizard

An internet connecting is not required as the previous step has already copied the files to the PC; select **No, not this time**, then select **Next>**.

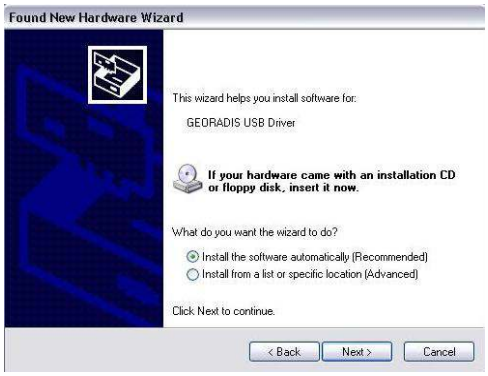


Figure 12: Install Automatically

Select **Install the software automatically (Recommended)**, then press **Next>**.

The drivers will start to be copied to the Windows/system32/drivers folder (**Figure 13).** A warning may be presented indicating that the drivers have not passed Windows Verification (**Figure 14)**. In this event, select **Continue Anyway.**



Figure 13: Start File Copy



Figure 14: Continue Anyway

The files will then be copied to your PC and you will be able to establish communication between the PC and the **D230A v2.**



Figure 15: Driver Files Copied

MapView Installation

Once the USB driver has been installed, you may proceed with the MapView software installation. When selecting **Install Georadis MapView,** a **Setup Wizard** will be presented (**Figure 16**). Select **Next>** to continue the installation, or **Cancel** to exit.

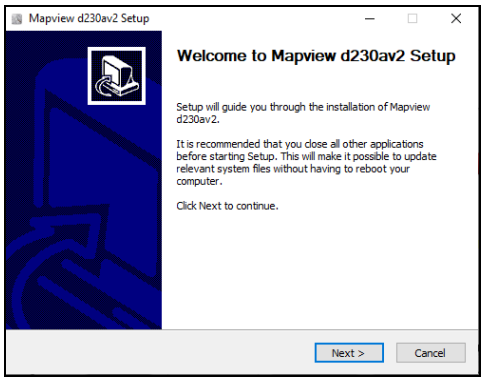


Figure 16: Begin Installation

Clicking **Next>** will display a prompt screen to select the location of the installation directory (**Figure 17**). A default location path is chosen (C:\Program Files (x86)\), but it can be changed using the **Browse…** button. Select **Next>** once the correct path has been chosen.

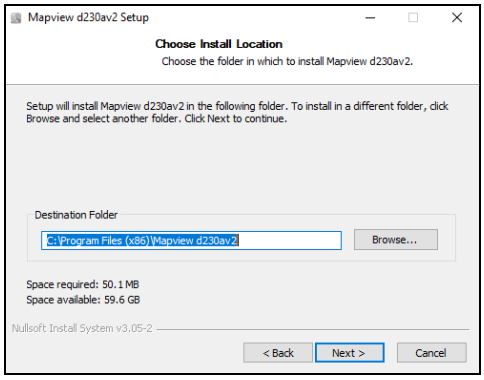


Figure 17: Install to Location

Confirm the destination folder by selecting **Next>**. If you wish to change the location, select **<Back** to make the necessary changes.

The next screen will present a prompt to "Choose a Start Menu Folder for the MapView Shortcuts" (**Figure 18**). Click **Install** to continue with the software installation.

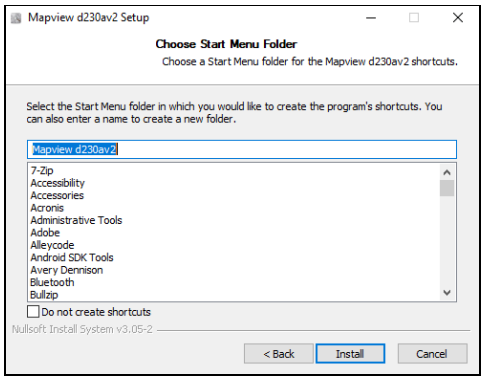


Figure 18: Start Menu Folder

An installation progress window (**Figure 19**) will be presented, followed by a confirmation text (**Figure 20**). Selecting **Finish** completes the installation process.

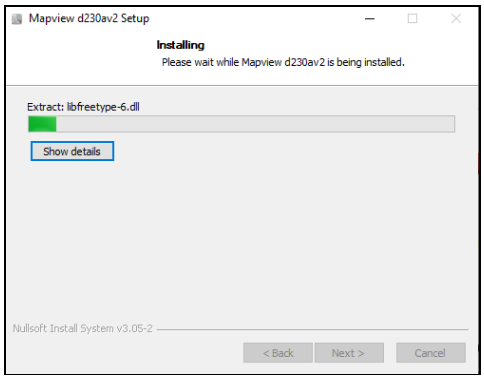


Figure 19: Installation Progress

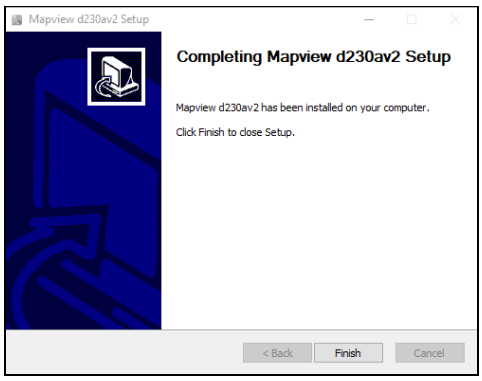


Figure 20: MapView Installation Complete

4.2 MapView Interface

To start using MapView, double-click on the software's icon on your PC.

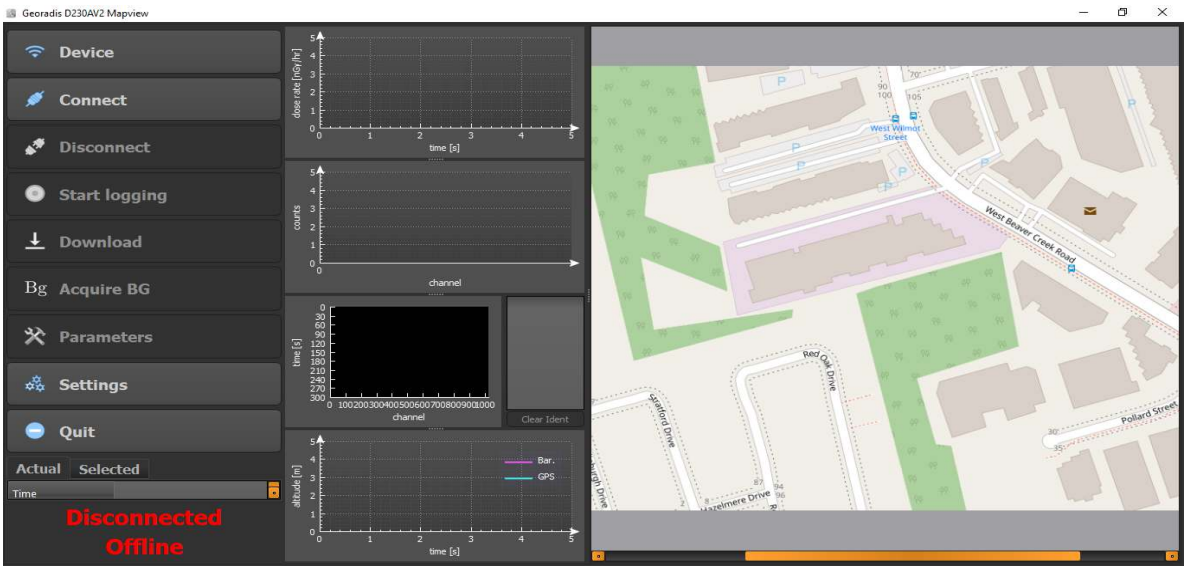


Figure 21: MapView Interface

The software interface is vertically divided into three columns, listed below from left to right:

- The Device Menu to download data and set the D230A v2's operating parameters;
- Real-time data plots for use with the telemetric module; and
- The flight map overlay, also for use with the telemetric module.

Device Menu

The **Device Menu** contains the following options: **Device**, **Connect**, **Disconnect**, **Start/Stop logging**, **Download**, **Acquire BG**, **Parameters**, **Settings**, **Quit**, and **Digital Dashboard**, which are explained in further detail below.



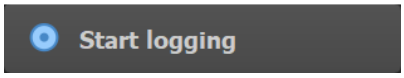
Device: to connect the MapView software to a D230A v2 console for offline data download. Or, for users with the optional telemetric module, to connect to the radio link base for real-time data acquisition.



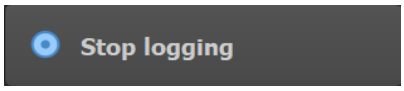
Connect: to establish connection to the selected **Device**.



Disconnect: to terminate the connection with a **Device**.

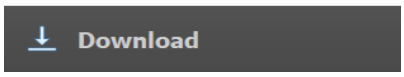


OR

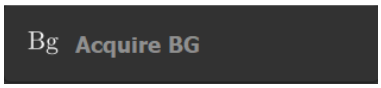


Start logging: to initiate recording of survey data, primarily for Radio link operation.

When logging is enabled, the button turns into **Stop logging**, which allows the user to stop recording data.



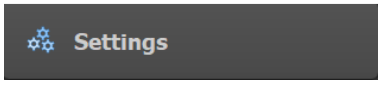
Download: to download data from a connected D230A v2 to the MapView software.



Acquire BG: to reset the system background threshold for the audio alarm feature (available only with the telemetric module).



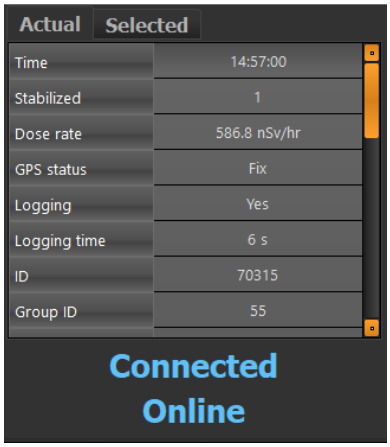
Parameters: to make changes to the D230A v2 operating parameters.



Settings: to set/modify data storage and map file settings.



Quit: to exit the MapView software.

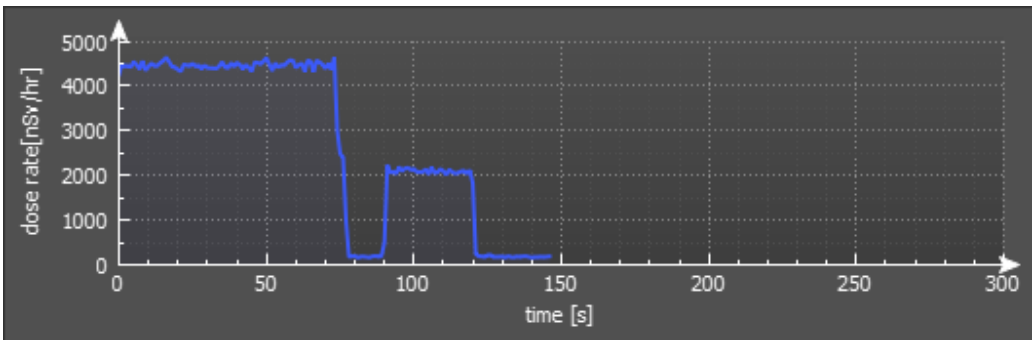


Digital Dashboard: to view the connection status and numerical data obtained in real-time, when the telemetric module is in use.

Real-time Data Plots

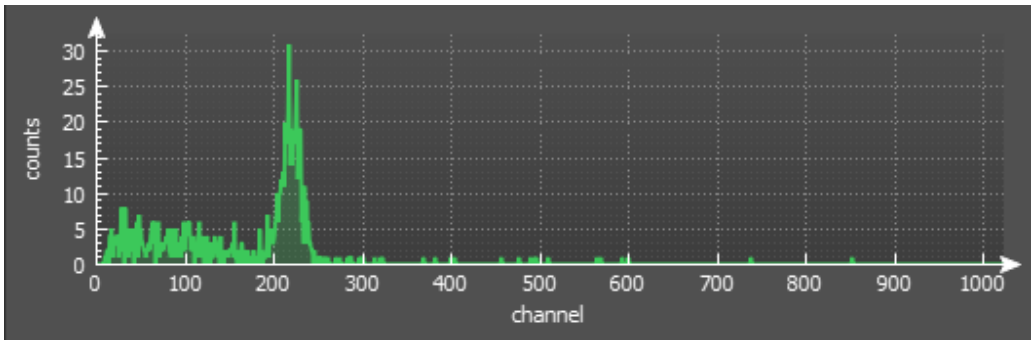
The middle section of the MapView software is where users can view **real-time data plots**, when using the optional telemetric module. Data graphs of the **Dose Rate** [nSv/hr], **Spectra**, **Waterfall of last measured spectrum**, and **GPS Altitude & Atmospheric Pressure** are plotted and displayed here.

Dose Rate: real-time plot of measured Dose Rate profile.



Dose Rate Profile

Spectra: real-time plot of measured spectra.

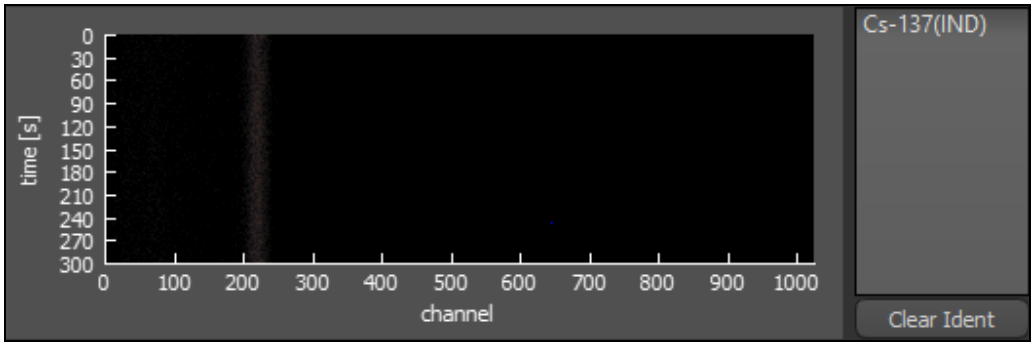


Spectra Plot

Waterfall: records intensities within energies of received spectra. The chart rolls from top to bottom. Users can see the history of intensities for gamma photons received in the last 300 seconds within channels of spectra. Intensities are indicated in the form of a heat map, with black corresponding to the actual background level; grey, purple, and pink colors representing greater and greater increases in significance; and red colors indicating a very high rate of photon income. The color selection and its range can be edited by the user as desired.

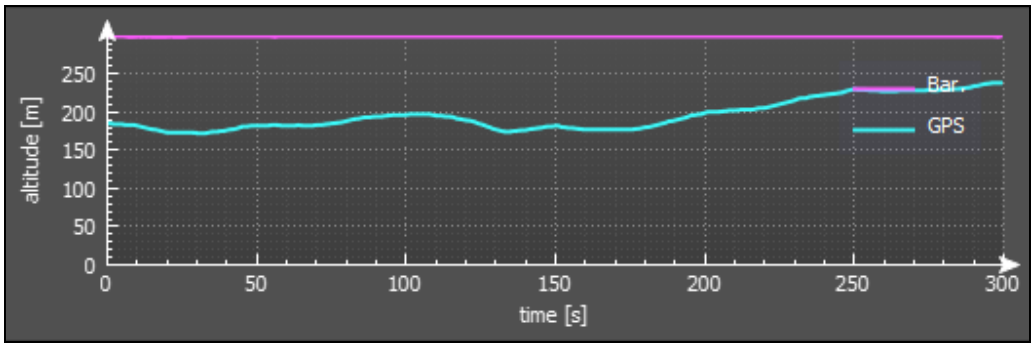
The "Waterfall" is a powerful tool that allows users to interpret the radiation situation in three parameters. Information about the energy of photons allows users to directly identify the radionuclide, intensity of radiation and time.

The box to the right of the waterfall plot displays the names of identified radioisotopes. The "**Clear Ident**" button below allows users to clear the list of found radioisotopes.



Waterfall Plot

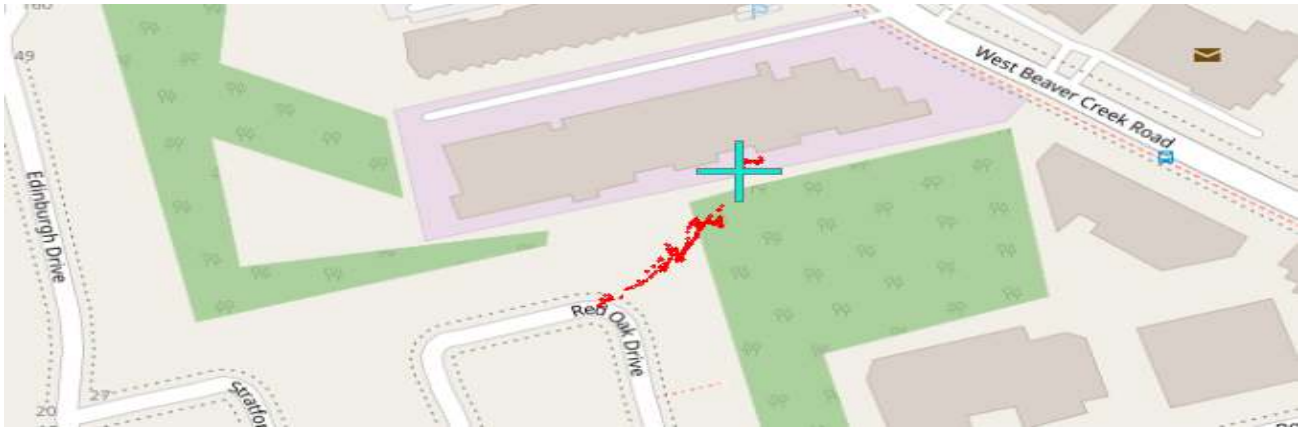
GPS Altitude & Atmospheric Pressure: this plot displays the altitude of the instrument above sea level, determined using GPS (blue line) and the profile of atmospheric pressure from the D230A v2's sensor.



GPS Altitude & Atmospheric Pressure Plot

Flight Map Overlay

The final portion of the software interface is devoted to the flight map overlay for use with the telemetric module. The flight map overlay displays the real-time **Dose Rate** track of the survey. MapView supports any map created in JPG or PNG format that is accommodated with coordinate calibration files. It supports the WGS84 coordinate system. Configuration of the map file, color scheme for Does Rate intensities, and the size of the track are found in the **Settings** menu.



MapView – Dose Rate Track Plot

4.3 MapView OFFLINE Mode (without Radio Link)

MapView in OFFLINE mode allows operators to download recorded data and make changes to the D230A v2's parameter settings.

First, connect the **D230A v2** to a computer using the USB cable provided. Use the Device button and select the system's serial number as shown in **Figure 22**.

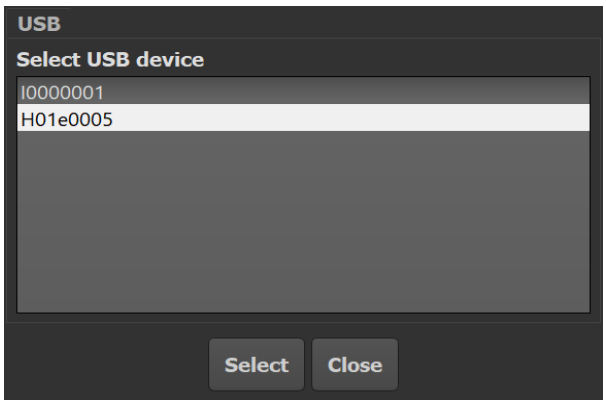


Figure 22: Select D230A v2

A successful connection will activate the Disconnect button and deactivate the Connect button.

4.3.1 Data Download

To download the system's data, press the Download button. Once the download process begins, a synchronization window will appear (**Figure 23**).

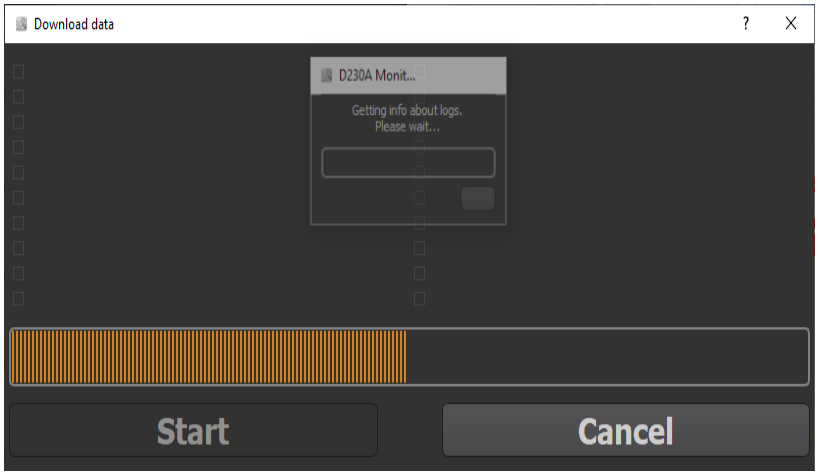


Figure 23: Synchronization with Device

After synchronization with the D230A v2, a list of the collected data will be displayed, as shown in **Figure 24** below. By default, the entire data list is selected for the user to download. Click the Start button to download the selected data.

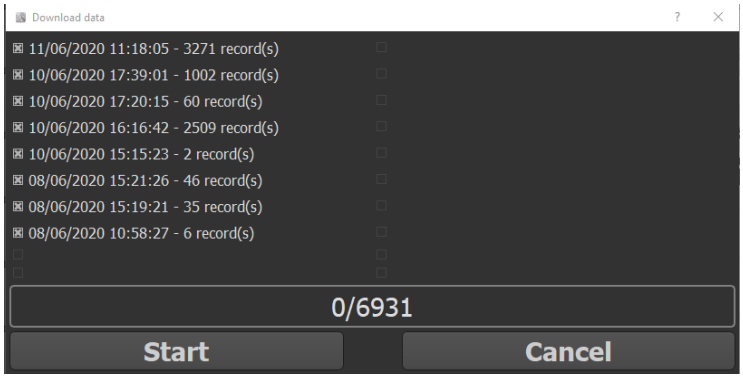


Figure 24: Data Download

Please note that a valid export to location/directory must be specified prior to downloading data for the first time. Click the Settings button to create a "save to" location under the "**Export dir**" field within the "**General**" tab.

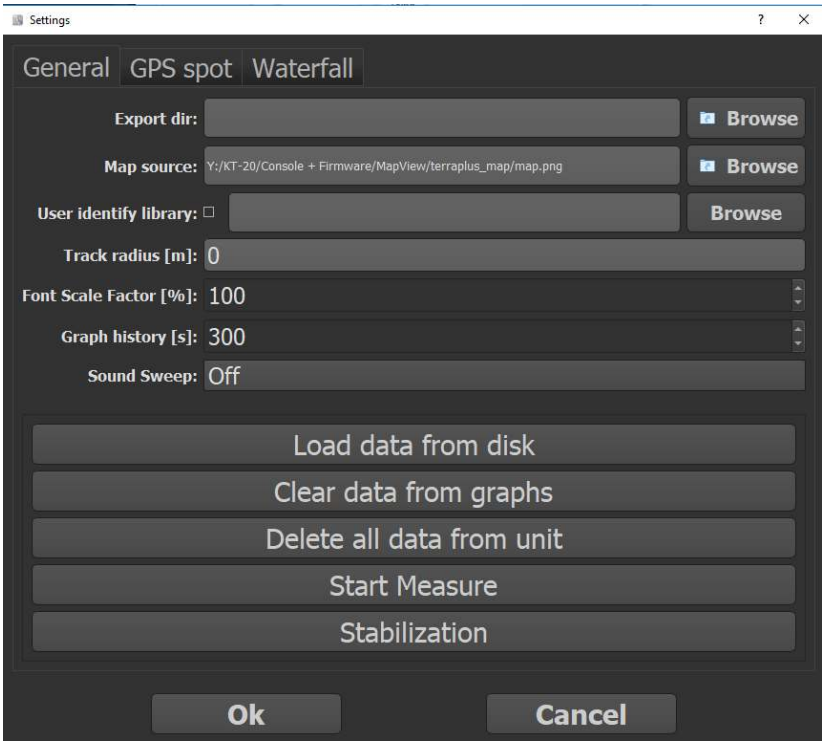


Figure 25: Data Export Location

File Structure

Due to the large volume of data, the exported record files are organized in a combination of files and folders. Saved data is organized based on the following file structure:

D230A

- **group0000j**
- **group0000k**
  - meas_log.csv — *measurement log, including dose rates*
  - spect_0000220.spc — *spectrum ID 220 from detecors 1 & 2*
  - spect_0000221.spc — *spectrum ID 221 from detecors 1 & 2*
  - **spectra**
    - **det1**
      - spect_acc.spc — *cumulated spectrum from detector 1*
      - spect_0000220.spc — *single spectrum ID 220 from detector 1*
      - spect_0000221.spc — *single spectrum ID 221 from detector 1*
    - **det2**
      - spect_acc.spc — *cumulated spectrum from detector 2*
      - spect_0000220.spc — *single spectrum ID 220 from detector 2*
      - spect_0000221.spc — *single spectrum ID 221 from detector 2*
    - spect_acc.spc — *cumulated spectrum from detectors 1 & 2*

Subfolders for each recording event are created, called groups (**Figure 26**).

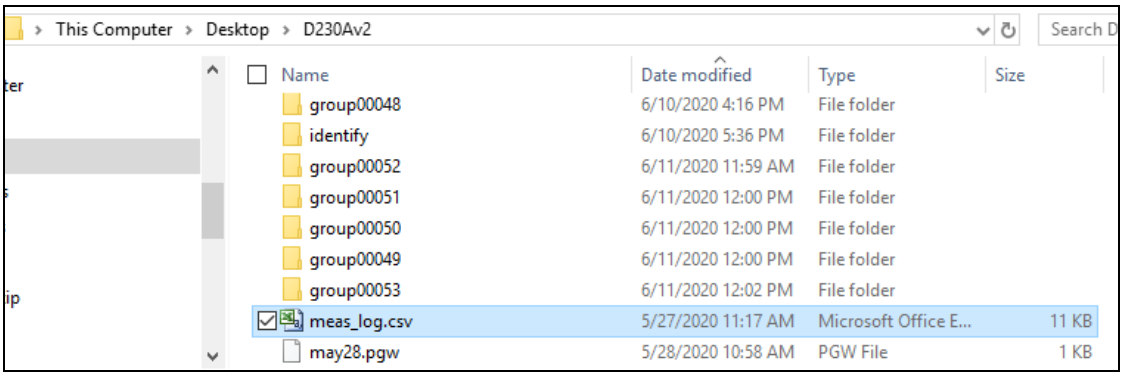


Figure 26: Exported Data – Root Folder

Each group folder includes a measurement log in csv format, spectra files for each one second reading (combining both detectors), and a spectra folder with additional measurement data (**Figure 27**).

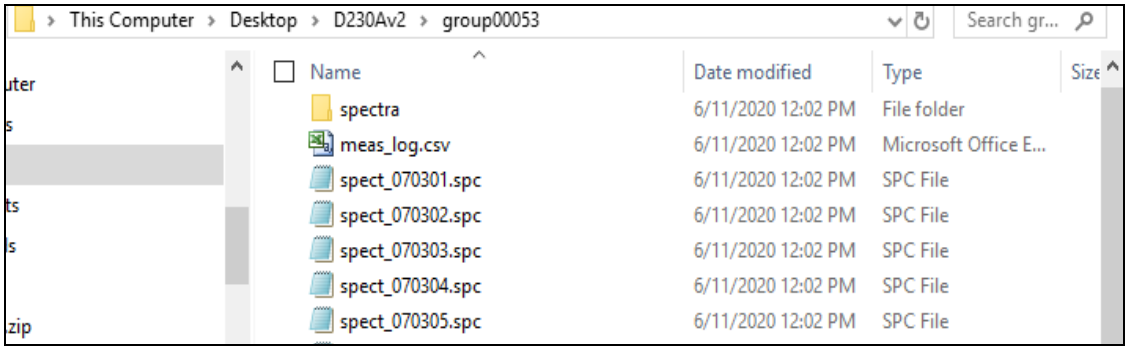


Figure 27: Exported Data – Group ID # 53

The spectra folder includes a cumulated spectrum for both detectors, spect_acc.spc, along with additional sub-folders, det1 and det2, breaking down the data per detector (**Figure 28**).

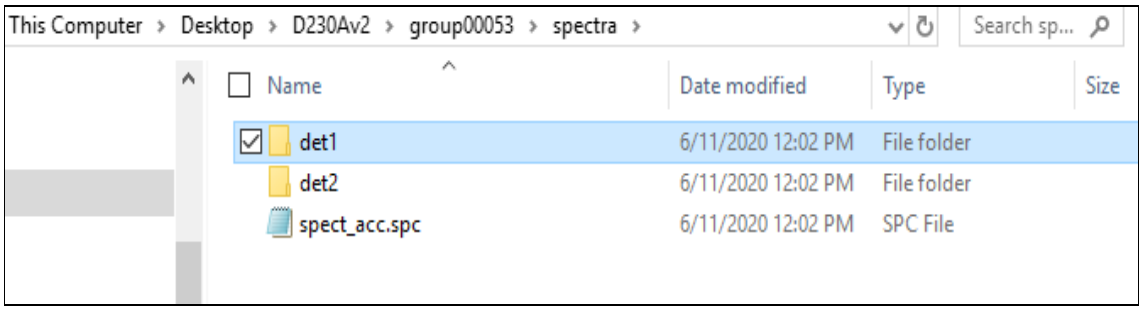


Figure 28: Exported Data – Group ID # 53 – Spectra Sub-Folder

The det1 and det2 folders include the cumulated spectrum and single spectrum per one second reading for detector 1 and detector 2, respectively (Refer to **Figure 29**).

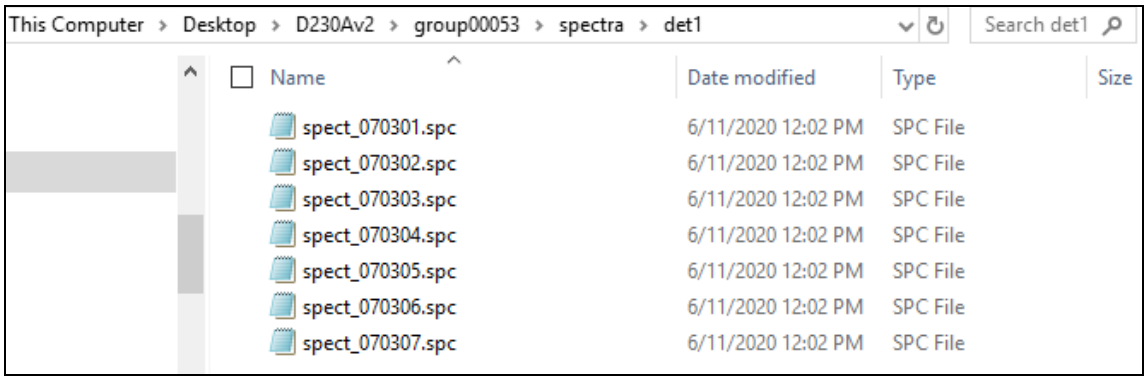


Figure 29: Exported Data – Group ID # 53 – Spectra for Individual Detector

Data Files

The spectra data files are saved in .spc format, similar to a simple txt file. Within the file, the following data is saved in a string (shown in sequential order):

1. Life time in microseconds;
2. Clock time in microseconds;
3. 1024 channels of spectra;
4. GPS stamp; and
5. Data for calibration purposes.

The cumulated spectrum from all detectors can be imported into the user's preferred visualization software.

The measurement log csv file includes dose rate information along with sequential identification numbers; GPS date, time, and coordinates; altitude; and barometric (i.e. atmospheric) pressure (**Figure 30**).

meas_log.csv

	A	B	C	D	E	F	G	H	I	J
1	ID	GroupID	Date	Time	Stabilized	Latitude	Longitude	Altitude	DoseRate[nSv/hr]	Bar. Altitude
2	70307	53	11/6/2020	12:02:43	1	43.849789	-79.39303	211.7	620.978	212.195
3	70306	53	11/6/2020	12:02:42	1	43.849788	-79.39303	211.4	605.769	212.184
4	70305	53	11/6/2020	12:02:41	1	43.849795	-79.393021	211.1	606.245	212.136
5	70304	53	11/6/2020	12:02:40	1	43.8498	-79.393018	210.4	613.373	212.174
6	70303	53	11/6/2020	12:02:39	1	43.8498	-79.393017	210.1	626.368	212.032
7	70302	53	11/6/2020	12:02:38	1	43.849807	-79.393011	209.2	628.123	212.015
8	70301	53	11/6/2020	12:02:37	1	43.849812	-79.393004	208.7	617.016	212.2

Figure 30: Example Data – meas_log.csv

4.3.2 Operating Parameters

The D230A v2's operating parameters are also accessible in OFFLINE mode. Clicking on the Parameters button enables quick access to the parameters menu (**Figure 31**). Some of the parameters that can be enabled or disabled within this menu are as follows:

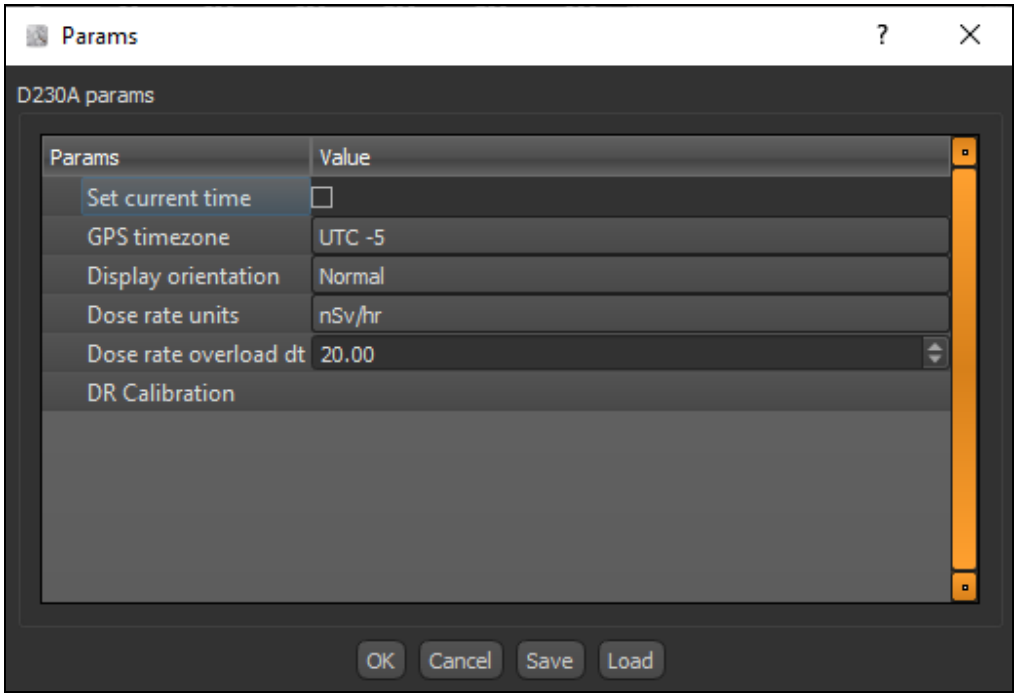


Figure 31: Parameters Setup

Set current time: Synchronizes the PC's time with the **D230A v2**

GPS timezone: UTC offset for the local area

Display orientation: Allows the orientation of the LCD display to be inverted

Dose rate unit: Unit of measure for Dose Rate can be set to Gy/hr or Sv/hr

Dose rate overload dt: QC parameter – indicates over exposure

DR Calibration: Dose rate calibration coefficients k, a, b, and c

4.4 MapView ONLINE Mode (with Radio Link)

MapView in ONLINE mode allows operators to monitor data and control the **D230A v2** in real-time via the telemetric module. Data download or changes to the **D230A v2** are not permitted in this mode. Measured data are always recorded on the **D230A v2's** internal SD memory card to prevent any data loss in case of radio communication dropouts.

To establish a radio link with the **D230A v2**, connect the **Radio Modem** to a computer via the USB cable provided. Use the Device button and select the serial number of the Radio Modem as shown in **Figure 32**.

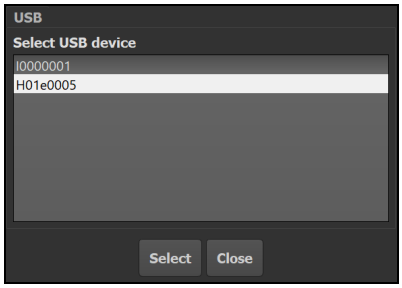


Figure 32: Select Radio Modem

A successful connection will activate the Disconnect button and deactivate the Connect button. Another confirmation of the active connection can be found at the bottom of the **Digital Dashboard** section.

If logging is enabled, the numerical data will be populated in the **Digital Dashboard**.

For correct map path and Waterfall interpretation, it is essential to preset the desired thresholds and colors. Use the Settings button and then **GPS Spot** and **Waterfall** tabs to edit these settings.

4.4.1 MapView – Settings Menu

Use the Settings menu configure general properties for the MapView software and adjust color and scales for **GPS Spot** and **Waterfall**.

Settings Menu – General

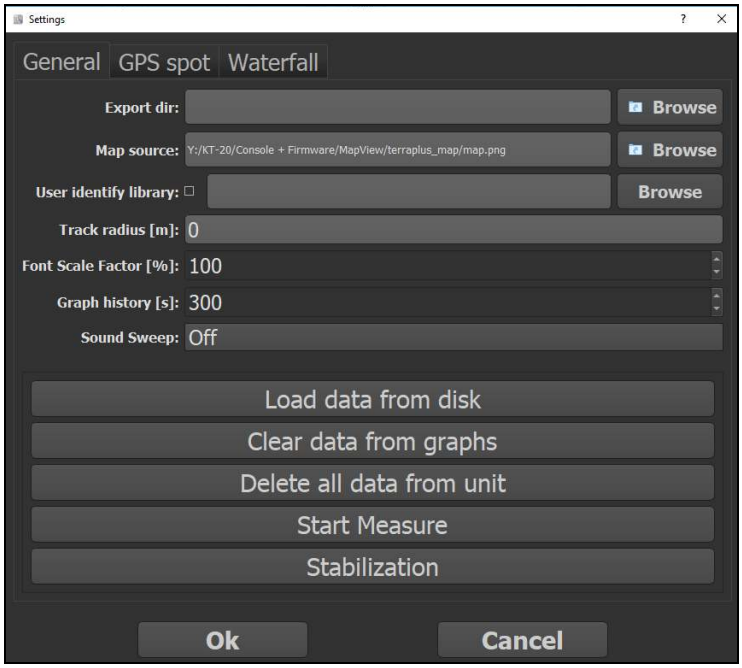


Figure 33: Settings Menu – General

Export Dir: directory location data storage

Map source: directory location of the map file

User Identify Library: directory location of library used for Nuclide Identification

Track radius [m]: to set size spot size of GPS track

Font Scale Factor [%]: N/A

Graph history [s]: to set time graph history time for the "Waterfall" plot

Sound Sweep: audio pitch enable / disable

Load data from disk: N/A

Clear data from graphs: to clear "**Waterfall**" plot

Delete all data from unit: to erase data from memory of the **D230A v2**

Start Measure: N/A

Stabilization: to retrieve stabilization log file for each detector(s) in OFFLINE

Settings Menu – GPS Spot

This menu is used to configure the data range and color for the real-time flight track overlay on a local map. The default range for dose rate and color is shown below, but can be customized by the user by double clicking on the dose rate or color to make changes.

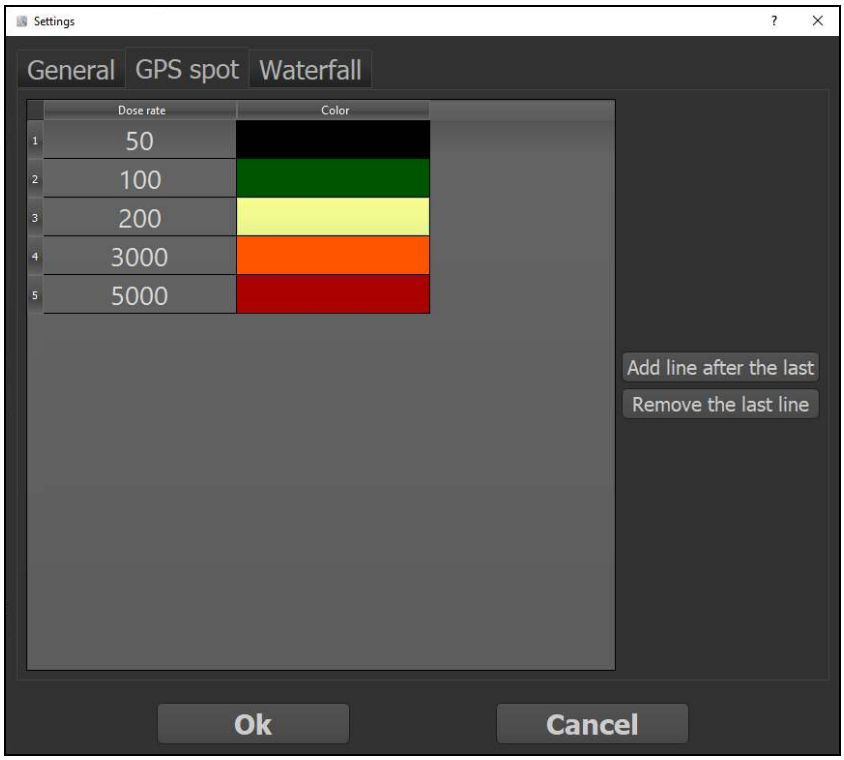


Figure 34: Settings Menu – GPS Spot

Add line after the last: allows user to insert a new row/line

Remove the last line: allows user to remove the last row/line

Settings Menu – Waterfall

This menu is used to configure the data range and color for the “Waterfall” plot. The default range for total counts and color is shown below, but can be customized by the user by double clicking on the count or color to make changes.

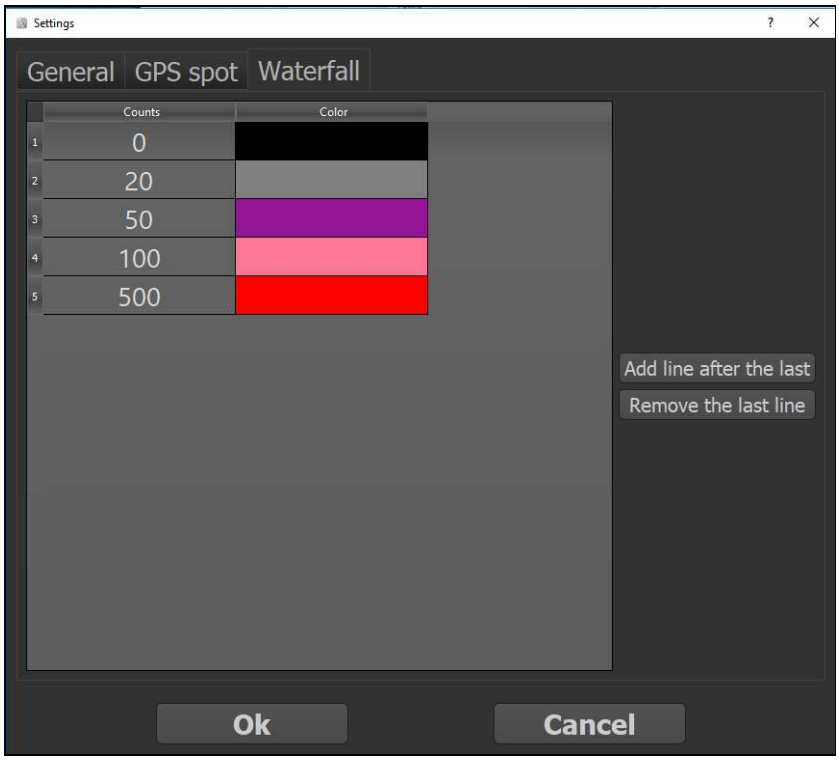


Figure 35: Settings Menu – Waterfall

Add line after the last: allows user to insert a new row/line

Remove the last line: allows user to remove the last row/line

4.4.2 Map List Implementation

Calibrated map lists are exportable from various Map applications, such as Gooogle Earth or QGIS.

The exported bitmap file must be accompanied with a calibration file of the same name, with suffix pgw. Both files have to be located in the same folder. Also, provided on the USB key, is a file with *.ppr extension which will have to be copied to the same folder as the map file and must have the same file name as the *.pgw and *.png files.

4.4.3 Recording ON / OFF Function

Data recording is controlled by the Start logging button. Each time the "**Start logging**" is pressed, a new group ID number is created and recording is turned ON. All measurements are stored to this active group. The "**Start logging**" button changes to Stop logging when recording is in progress. Click the "**Stop logging**" button to turn OFF recording.

An active logging mode is also indicated by a green LED light on the front panel of the **D230A v2** console. The ID number of the actual Group is visible on both the **D230A v2** display and the MapView software. It is very important to synchronize the Group ID number with the performed task for faster orientation of measured data. It is suggested to keep a log of the groups used while collecting data.

4.4.4 Dashboard – Status Panel

The Digital Dashboard is the most important source of real-time information from the **D230A v2** during flight operation.

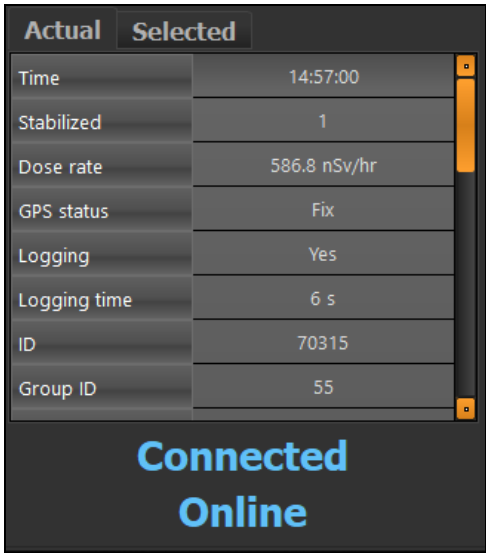


Figure 36: Dashboard – Status panel

The following information is displayed in the Digital Dashboard. The full list of data can be viewed by scrolling.

Time:	Actual system time
Stabilized:	Yes / No (1 / 0) *Gain stabilization for all detectors*
Dose rate:	Actual dose rate
GPS status:	Fixed or Not Fixed
Logging:	ON/OFF
Logging Time:	Duration/number of measurements performed in active group at rate of 1/second
ID:	Current ID of last spectrum
Group ID:	ID of the active group
RF Online:	Yes / No – Status of Radio Link
RF RSSI:	Measure of radio signal quality
RF LQI:	Measure of radio signal quality
Channel Main:	Debug item Radio Link
Channel Backup:	Debug item Radio Link
Channel Last Used:	Radio Link – Connection details
Latitude:	From GPS
Longitude:	From GPS
Altitude:	From GPS
Bar. Altitude:	From Barometer
Battery status:	Battery voltage level
DC In:	Yes / No – Charger connection
USB connected:	Yes / No – USB connection
Meas HV:	Measurement of the high voltage
Temperature:	D230A v2 internal temperature
Pressure:	Atmospheric pressure
FWHM:	Detectors resolution FWHM

Warranty

Terraplus warrants that all new models of the D230A v2, when shipped, will be free of defects in materials, workmanship, and function for a period of **12 months** from the date of shipment.

The scintillation detector(s) within the system are ruggedized for their intended use. However, due to the fragile nature of the crystal detector assemblies and potential harsh operating environments, the warranty does not include breakage of the crystal(s) for any reason. Terraplus does warrant that the detector(s) will be complete and fully operational to their published specifications at the time of shipment and will maintain the minimum resolution and performance under normal operating conditions for the duration of the 12-month warranty period.

This warranty is only valid if the Purchaser has used, handled, stored and operated the D230A v2 with sound practice and within the operating specifications and instructions supplied by Terraplus. No responsibility is assumed for failures or damages resulting from misuse, whether by fault, negligence, or otherwise; damage from peripheral power sources or equipment not delivered with the original system; conditions resulting from any modifications or repairs to the unit other than those made by or with the express instruction from Terraplus or Georadis; or failures or damages resulting from accidents / force majeure events.

As the Purchaser, you warrant to have done the necessary preparation to become familiar with the use, handling, shipping, and storage of the D230A v2 as well as its interface with the UAV, and assume all risks for the care and use of the unit.

Warranty repairs will be performed by Terraplus or Georadis at no charge, subject to the limitations herein. All non-warranty repairs will be invoiced for parts, labour, and other expenses to restore the unit(s) to operating condition. The Purchaser is responsible for the costs of sending any units to and from Terraplus' facility (whether for warranty repairs or otherwise) as well as the risk of loss during shipment. For international shipments, the Purchaser is also responsible for any customs clearance costs.

Purchasers who need to send their D230A to Terraplus for repair must complete a Return Material Authorization (RMA) form on the Support page of the Terraplus website and ship the respective unit(s) to the Terraplus repair facility in accordance with Terraplus' instructions.

Terraplus
empowering discovery

Terraplus Inc.
120 West Beaver Creek Rd, Unit #15
Richmond Hill, Ontario, Canada
L4B 1L2

terraplus.ca
1.905.764.5505
sales@terraplus.ca
support@terraplus.ca

your source for geophysical instruments