User and Maintenance Manual

Spartan Portal

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Rev. 1

Spartan Portal: ED19578

Table of Contents

Figures

Tables

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1 Introduction of Spartan Portal

1.1 Introduction

There are several devices on the market that are designed to detect and identify radiation sources. The widely used approach is to use sensitive scintillation or semiconductor detectors together with software algorithms to get the alarm on-site in real time. The devices can be used in covert operations during major public events such as international sports or political meetings. Screenings and surveys are probe to false alarms due to the variance in natural radiation or legal radiation sources such as radioisotopes that have been used to recently treat patients.

Not every user is expected to have the knowledge to interpret spectrometric signals so the task should be left to a nuclear specialist to prevent misinterpretation of the results given by the instrument. The consequences for false alarms can be dramatic and therefore the correct handling of alarms is a key capability from an operational point of view.

The Environics has commercialized the measurement and analysis concept developed by STUK (Radiation and Nuclear Safety Authority in Finland). This concept includes high performance spectrometric analysis, local and remote data analysis, including wireless online connection to expert systems, and expert support allowing Multi-User-Single-Expert operation.

The Environics' Spartan product family utilizes the best features of different types of fixed radiation measurement stations, mobile unnoticeable radionuclide identifiers, mobile vehicle solutions, radiological measurement databases with full reach back capability and control centers. The Environics' Spartan system provides the user with the abilities to efficiently assess and address threats caused by nuclear and other radioactive substances in addition to detecting and verifying orphan sources. It also provides the means to assist police, customs and border with detection, analysis of possible findings and screening of people.

The heart of the total solution comes from the ability to handle all measurement data from fixed and mobile units and from analyzing that database with software that is partly automatic and partly interactive. This allows the utilization of the full potential of the spectral analysis for radiological measurements. Spartan system can be built to accommodate the different demands and specifications of small or wide scale solutions. Spartan products are the best solution to ensure the radiological safety for any facility, mass event or even a country.

1.2 For Your Safety

Tab. 1-1 Declarations, warnings and cautions

DECLARATIONS
Strictly follow the Instructions for Use
Any use of the instrument requires full understanding and strict observation of these instructions. The Instrument is only to be used for purposes specified here. WB Johnson Instruments accepts no liability for any consequential loss, injury or damage resulting from the use or misuse of the supplied information, or from any errors or omissions to this manual.
It shall be the sole responsibility of the purchaser to ensure the suitability of the product for a particular application. It is also the purchaser's responsibility to use and maintain the product in accordance with the procedures and recommendations described in this User and Maintenance Manual.
Liability for proper function or damage
The liability for the proper function of the instrument is irrevocably transferred to the owner or operator to the extent that the instrument is serviced or repaired by personnel not employed or authorized by Environics Service or if the instrument is used in a manner not conforming to its intended use.
WB Johnson Instruments cannot be held responsible for damage caused by noncompliance with the recommendations given above.
The warranty and liability provisions of the terms of sale and delivery of WB Johnson Instruments are likewise not modified by the recommendation given above.
WARNING A WARNING calls attention to a condition or possible situation that could cause injury to the operator.
Rechargeable lead acid battery
The battery should never be opened or disassembled.
Lead acid battery must be disposed properly in accordance with local regulations.
CAUTION A CAUTION calls attention to a condition or possible situation that could damage or destroy the product or the operator's work.
Maintenance
Maintenance performed without training by WB Johnson Instruments will void warranty.
DO NOT remove module covers unless instructed by the manufacturer.
Do not perform maintenance while the device is connected to a power supply.

CAUTION
A CAUTION calls attention to a condition or possible situation that could damage or destroy the product or the operator's work.

Handling precautions

In order to ensure that the detector continues to operate at maximum performance, it is suggested that you:

- Read all instructions carefully before operating Spartan Portal system
- Always wear personal protective equipment when handling potentially hazardous material

Storage precautions

- Storage temperature range is from -40… +71°C (-40… +160°F)
- Recommended storage temperature range is from +10… +30°C (+50… 86°F)
- Recommended relative humidity range is from 30%... 90% (Without condensation)
- In a case of long storage period, longer than 3 months, charge the battery to 25… 50% of its capacity before storage

Operation in Rain

When the Spartan Portal is used in rain, make sure that the device is installed upright.

The warranty and liability provisions of the terms of sale and delivery by WB Johnson Instruments are likewise not modified by the recommendations given above.

1.3 Definition of Terms

Tab. 1-2 Abbreviations

Abbreviation	Description
ANSI	American National Standard Institute
APN	Access Point Node
CPS	Counts Per Second
GPS	Global Positioning System
GNSS	Global Navigation Satellite System
MCA	Multichannel Analyzer
NORM	Naturally Occurring Radioactive Materials
RMA	Return Material Authorization
SNM	Special Nuclear Materials
UV	Ultra Violet

1.4 Technical Description

The Spartan Portal is a real-time gamma radiation detector. The system is based on proven scintillation technology:

1. Radiation source energy-photons are absorbed in crystal's a scintillator, triggering the release of UV- photons
2. UV-photons are converted into photoelectrons
3. Photoelectrons are multiplied in the photomultiplier
4. The Multichannel analyzer analyses the signals and the information is shown on Spartan Portal Software user interface

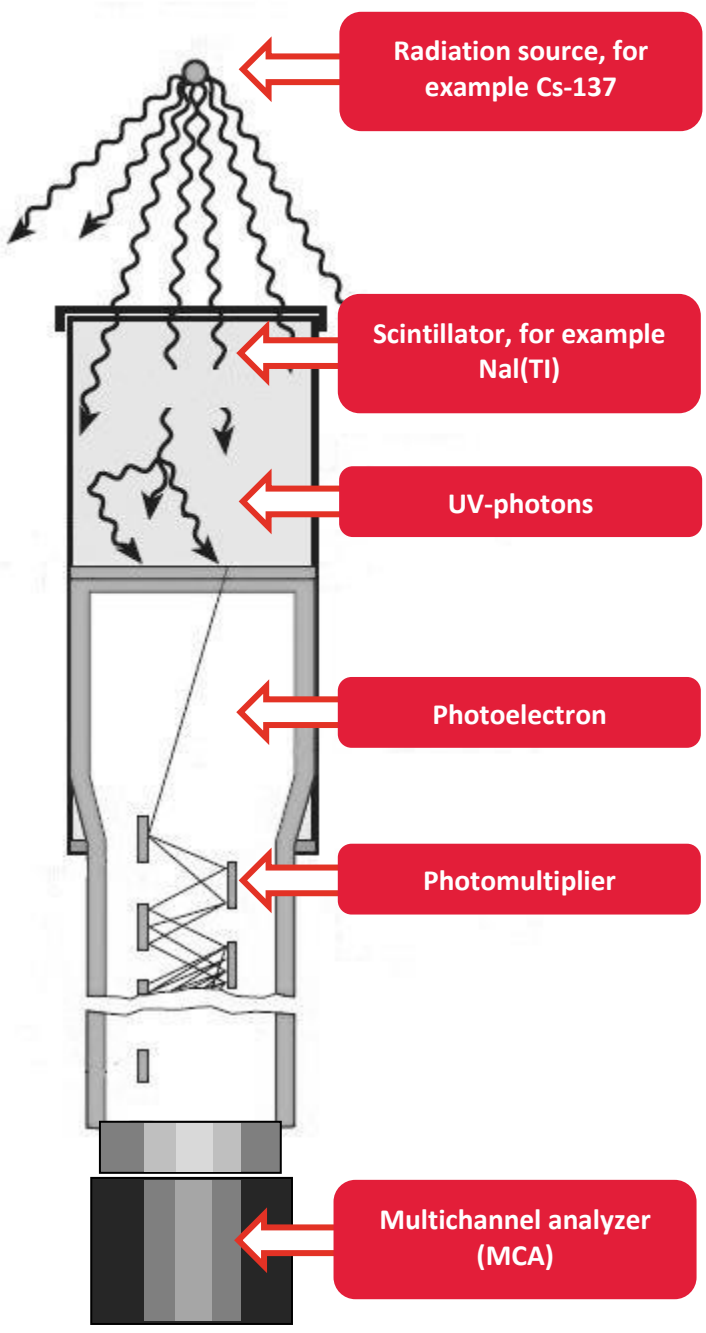

Fig. 1-1 Scintillator operational principle

1.5 Technical Data

Tab. 1-3 Spartan Portal technical data

Description	Value
Size (H x W x D):	998mm x 247mm x 247mm (39.3" x 9.7" x 9.7")
Approx. weight:	30 kg (66,1 lbs) without back-up battery 39 kg (86 lbs) with back-up battery for 12 hours of operation
Power:	9… 36VDC (vehicle power) 100…250VAC 50… 60Hz
Back-up battery:	Rechargeable lead acid battery 12V, 20Ah
Communication:	Ethernet Wi-Fi (802.11 b/g/n) 4G
GPS:	Built-in sensor
Alarm Unit (optional):	Buzzer Red light (gamma radiation alarm) Blue light (neutron radiation alarm) Green light (normal)
Operational Temperature	-20… 50°C Extended temperature range with protective cover is -30… 50°C
Storage temperature range:	-20… 50°C
Waterproof:	IP55

1.6 Performance Specifications

Tab. 1-4 Performance specifications

Description	Value
Gamma and neutrons:	4” x 4” 16” Nal(TI) detector
Resolution:	<8% at 662keV
Energy range:	30keV… 8MeV
Multichannel Analyzer (MCA):	Configurable as 2048, 1024, 512 or 256 channels Maximum Count Rate >250k cps
Nuclide identification and categorization:	Designed to fulfill and exceed standard N42.34 ANSI Isotope list Medical, industrial, SNM and NORM nuclide categorization Customizable user defined nuclides and ROIs
Functions:	Dose rate calculation Nuclide identification Spectrum analysis Comprehensive radionuclide database

1.7 Key Elements

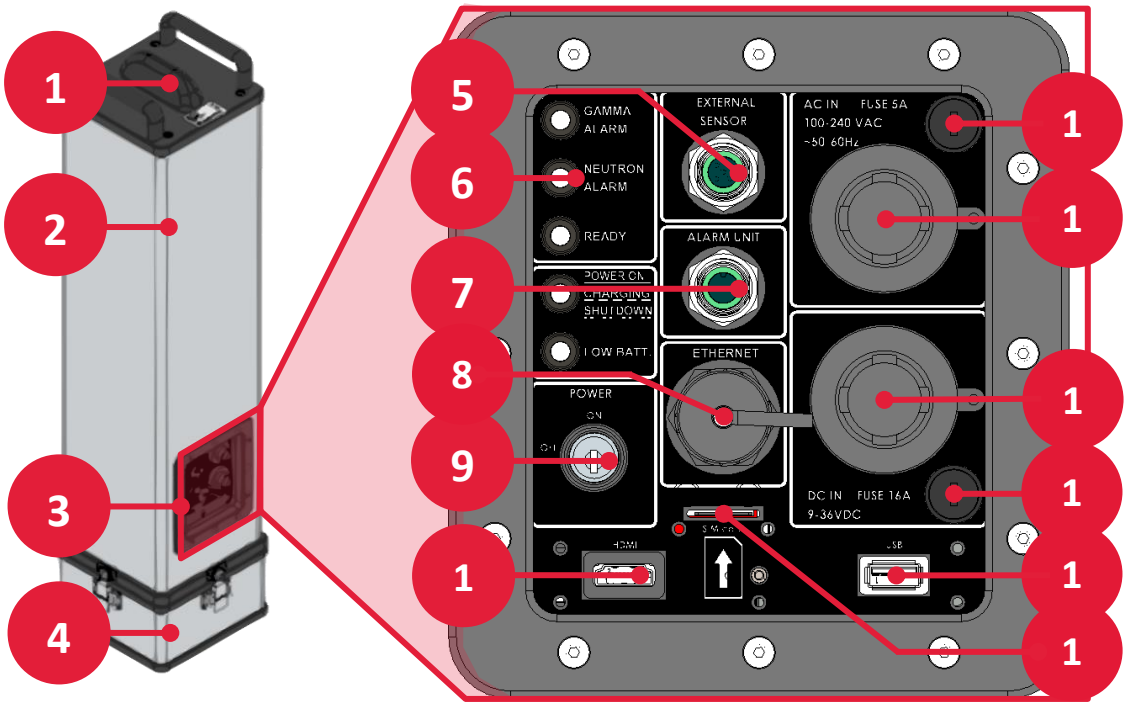

Fig. 1-2 Key elements of Spartan Portal

1. Combination antenna
2. Aluminum case
3. Connector panel
4. Battery unit
5. External sensor (optional, not in use)
6. Alarm and status LEDs
7. Alarm unit connector (optional)
8. RJ-45 Ethernet connector
9. Key operated power switch
10. HDMI connector
11. Fuse (AC)
12. AC in connector
13. DC in connector
14. Fuse (DC)
15. USB 3.0 connector
16. SIM card slot

1.8 LED Indications

All LED indications of the Spartan Portal are described in the table below:

Tab. 1-5 Spartan Portal status LED indications

Status of the Spartan Portal	LED name	LED colour	LED state
Power on / startup	Power on	Green	
Ready to measure	Ready	Green	
Gamma alarm	Gamma alarm	Red	
Neutron alarm	Neutron alarm	Blue	
Battery charging	Power on	Green	
Low battery	Low battery	Yellow	
Shutting down	Power on	Green	

1.9 Transport Case

The Spartan Portal will be delivered in the Explorer Case 13527BE transport case.

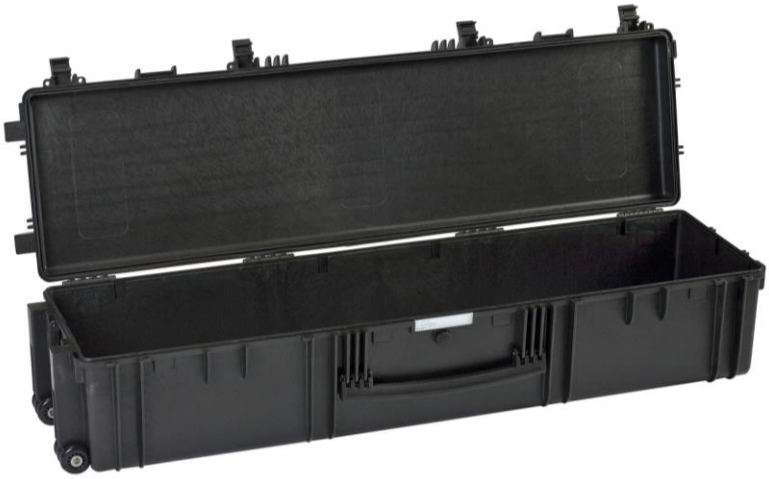

Fig. 1-3 Spartan Portal transit case

- **Technical Data:**
  - Size: 330mm x 1145mm x 410mm (13” x 45.1” x 16.1”)
  - Weight: 12,5kg (27,6 lbs)
  - Manufacturer/Model: SKB Cases/3i-4213-12b-e
  - Three rugged handles
  - Integrated Automatic Pressure Equalization Valve
  - Six polyurethane wheels with ball bearings and nylon hubs
  - Open cell core, polymer wall construction
  - Stainless steel hardware and padlock protectors
  - Watertight, crushproof and dust proof
  - Easy open Double Step latches

- O-ring seal

2 System Description

Spartan Portal gamma spectrometric detection unit consists of aluminum case, scintillator detector, MCA, data processing unit (master module) with radionuclide identification software and power electronics. GPS, 3G/4G communication and visual alarms can be implemented to complement the radiation monitoring system.

Detector design has been optimized for easy relocation and removal of the back-up battery unit has been made convenient. Spartan Portal gamma spectrometric detection unit provides the monitoring system with dose rate measurements, radio nuclide identification and alarms.

The Spartan Portal is an advanced portal detector that is designed for demanding environments which complements the Environics' Spartan product family. The Spartan Portal housing is modifiable which enables integration of the portal monitor into various types of environments (e.g. vehicles or other mobile systems and fixed installations). It is also possible to camouflage the Spartan Portal to fit the surrounding environment. The basic structure of the Spartan Portal is protected well against external shocks and outdoor environment.

The optional external sensor and alarm unit can be mounted near the detector. The alarm unit consists of alarm lights and an audible buzzer that can be configured separately.

Fig. 2-1 Spartan Portal

The base of the Spartan Portal contains the embedded computer, router, control board, power supply and rechargeable battery. Bottom panel is easily accessible for installation of a SIM card. All cables (power, Ethernet) are connected to the connection panel. The mains power supply input must be between 100… 230VAC and 50… 60Hz. Spartan Portal also works with a 9… 36VDC vehicle power supply.

The detector unit communicates via Ethernet, wireless LAN (Wi-Fi) or 3G/4G. A GPS /GNSS location coordinate data is also available for Spartan Portal.

2.1 Standard Functionality

The Spartan Portal measurement data is handled with a radionuclide identification software which is installed on the unit's master module. Software will handle the energy stabilization, dose rate calculation, nuclide identification and the collection of the spectral data.

2.2 Automatic Energy Stabilization

The Spartan Portal utilizes the switch-on principle for ease of use and has a high quality internal stabilization based on the natural gamma radiation of ^{40}K nuclide.

The spectrum of a NaI(Tl) detector has a tendency to drift depending on the ambient temperature. This feature of scintillator detectors is compensated for and it allows the manifestation of advantages like increased peak stability and lower false alarm rate.

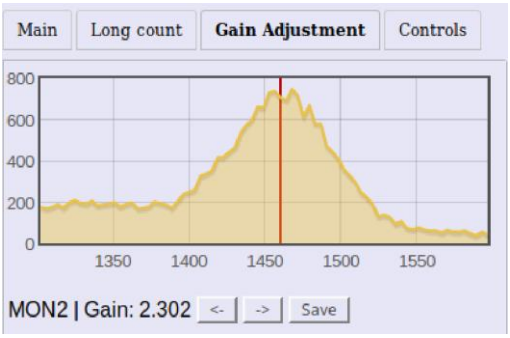

Fig. 2-2 Gain adjustment window

2.2.1 Software Operation

Spartan Portal system is designed to operate automatically. Once the unit is switched and the initialization has completed, the detector begins measuring and storing the acquired measurement data to its database. The data acquisition uses three different modes simultaneously; Long modes (monitoring 1 and 2) enable maximum sensitivity and the short mode (search) enables short response times. All modes are shown in the figure below:

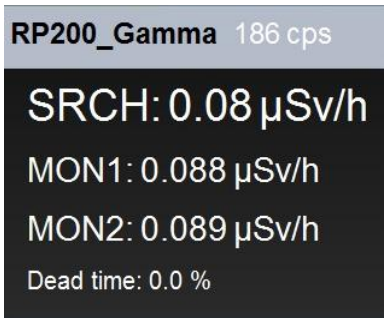

Fig. 2-3 Data acquisition window

2.2.2 Detector Unit Database

Spartan Portal unit has in own LINSSI database onboard. The LINSSI database is a MySQL based database designed for storing spectral data. The database stores the background, monitoring and control measurements. The only limitation for the size of the database is the capacity of the computer's hard drive.

The measured spectral data can be uploaded to the central server. The standard format of the measurements is .lml-file (linssi markup language) which is xml based data format.

2.2.3 Radio Nuclide Identification

Radio nuclide identification software performs a peak detection algorithm on the incoming spectra. The peak detection data is then used to confirm or deny the hypothesis that a given nuclide is present based on an identification rule for the nuclide.

An identification rule for a nuclide defines the key lines that must be present as peaks in the spectrum for the nuclide to be considered present. Secondary lines can also be specified, these are not required to be present, but may bolster the confidence of the identification. Identification rules for nuclides that may cause interference in the identification may be specified for a given rule. These exclusion rules are then evaluated together with the rule under consideration to mitigate the effects of interference.

Neutron detection capability is also a basic feature of Spartan Portal.

2.2.4 Radionuclide Library

In built radionuclide identification library is designed to fulfill and exceed the isotope list defined by standard N42.34 ANSI. It categorizes Medical and Industrial Special Nuclear Material and Normal types of radio nuclides.

Customizable user defined radio nuclides and ROIs can also be added to the nuclide identification list.

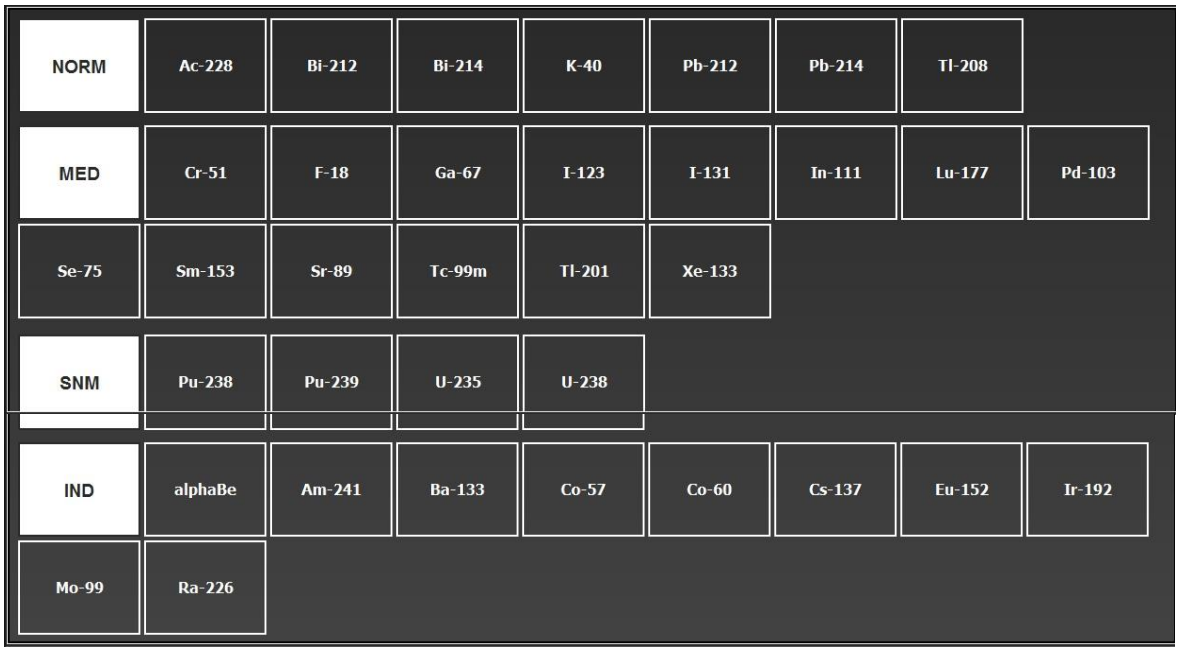

Fig. 2-4 Radionuclide identification library window

2.3 GPS Location

The Spartan Portal includes GPS/GNSS that uses the Global Positioning System to determine the precise location of the unit. if the Spartan Portal is connected to a control center with the EnviScreen Operix software, the location coordinates are automatically sent there and the unit can be seen on a map.

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3 Normal Operation of Spartan Portal

3.1 Startup

Tab. 3-1 Startup procedure

STARTUP	
Description	**Picture**
Turn the power switch to **ON** -position Startup process lasts a couple of minutes. During the initialization: 1. **Power on** LED illuminates 2. **Operating system** initializes 3. **Alarm** LEDs illuminate simultaneously and turn off one by one 4. **Nauta** monitoring software initializes 5. **Ready** LED illuminates signaling that the detector is now operable **Note!** If the battery has a low charge, the yellow **Low battery** LED illuminates (A) **Note!** When the Mains Power cord is connected and the battery is not fully charged, charging will start automatically and **Power on** LED will start blinking	

3.2 Charging of the Battery

Tab. 3-2 Charging of the battery

CHARGING OF THE BATTERY	
Description	**Picture**
Connect the Mains Power cord to the detector **Note!** If the battery has a low charge, the yellow **Low battery** LED illuminates **Note!** When the Mains Power cord is connected and the battery is not fully charged, charging will start automatically and **Power on** LED will start blinking **Note!** The time required to charge the battery from empty to full will take approximately 12 hours	

3.3 Shutdown

Tab. 3-3 Shutdown procedure

SHUTDOWN	
Description	**Picture**
Turn the power switch to **OFF** -position Shutdown procedure lasts approximately for a minute. During the shutdown: 1. **Power on** LED starts blinking 2. **Nauta** monitoring software shuts down 3. **Operating system** shuts down	

3.4 Local and Mobile User Interfaces

The Spartan Portal includes the Nauta monitoring software that can be used with a web browser. The Nauta software offers an interface with the following functions:

- Monitor radiation measurements
- View identified nuclides and their alarms
- View spectrum data
- Perform long count measurement
- Display and adjust the energy calibration

Note! The Nauta monitoring software can also be operated by using a web browser with a mobile phone. Communication is created by using Wi-Fi.

The main window provides some common measurements values in graphical format:

- **CPS Sequence view:**
  - Counts per Second (CPS) values from gamma neutron detectors
- **Dose Rate view:**
  - Dose rate values [µSv/h]

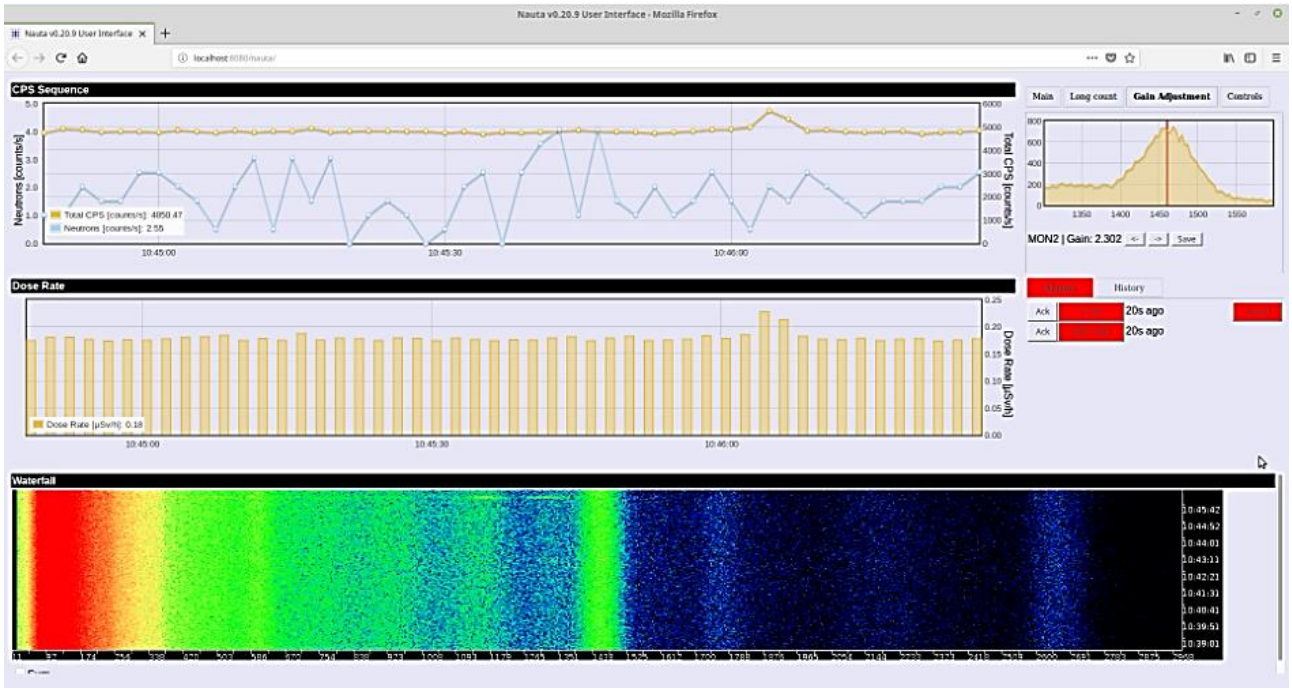
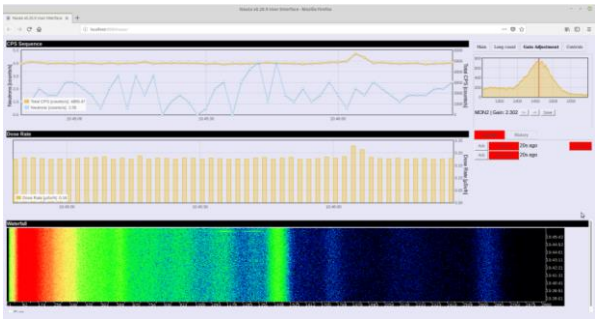


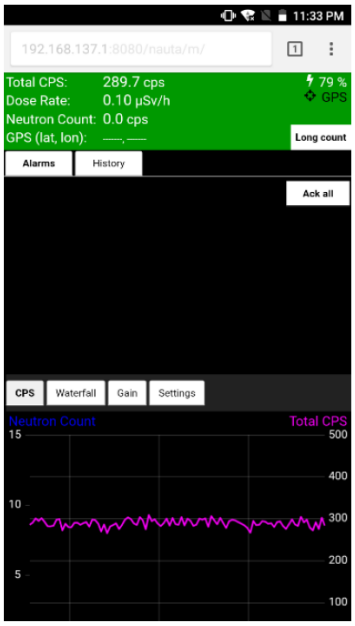
Fig. 3-1 Nauta local interface main window

Tab. 3-4 Opening local user interface

LOCAL USER INTERFACE	
Description	**Picture**
1. Make sure that the Spartan Portal is in the normal measuring mode ▪ **Ready** LED is illuminated 2. Connect a PC to the detector with an Ethernet cable 3. Set the IP address space of the PC to match the IP address space of the detector 4. Open a web browser 5. Enter the IP address of the detector with the following added after it: **":8080/nauta/"** For example: **http://172.16.3.130:8080/nauta/**	

Spartan Portal can be operated with a mobile user interface. Spartan Portal must be turned on and the detector software must be running before the Wi-Fi network is established and remote control unit can be connected. Spartan Portal offers a web-client which can be used over the Wi-Fi conenction with a web-browser.

Tab. 3-5 Opening mobile user interface

MOBILE USER INTERFACE	
Description	**Picture**
1. Make sure that the Spartan Portal is in the normal measuring mode ▪ **Ready** LED is illuminated 2. Connect remote control unit to the Wi-Fi network ▪ Example network: **SpartanPortMobile-xxx** (xxx = last three digits of the serial number) ▪ Default password: **12345678** 3. Open a web-browser in the remote control unit 4. Enter the IP address of the detector with the following added after it: **":8080/nauta/m/"** For example: **http://192.168.13.130:8080/nauta/m/**	

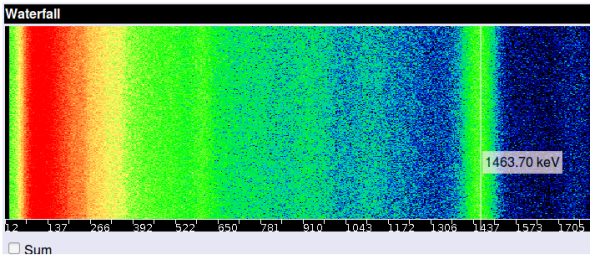
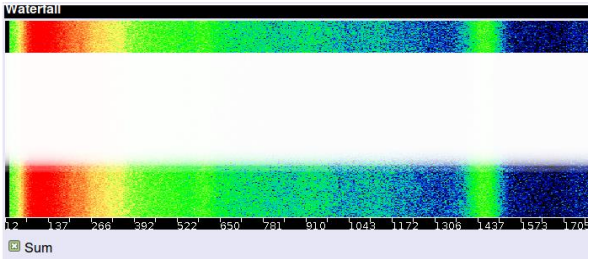
Note! Make sure that the Spartan Portal computer and remote control unit have Wi-Fi enabled. The status of the Wi-Fi can be checked from the network settings of the devices.

3.4.1 Spectrogram

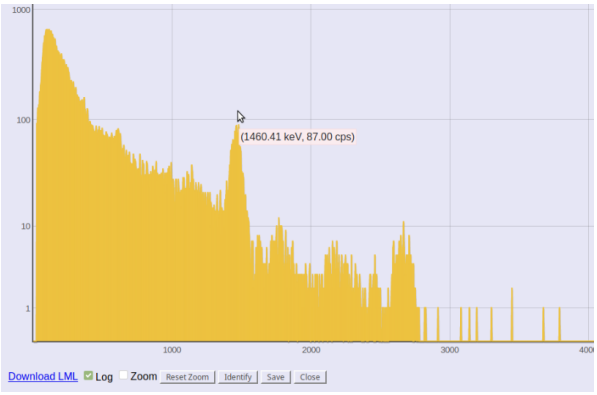
The spectrogram view displays a plot of spectra called waterfall. Latest spectrum appears as the topmost line with the previous spectrums below it. The energy from low to high is from left to right. The intensity of the radiation is represented as colours.

It is possible to plot the sum of the spectra from interest area. It is also possible to view the energy values by pushing the waterfall.

Tab. 3-6 Spectrogram

SPECTROGRAM	
Description	**Picture**
Viewing the energy values on the waterfall	
Press the waterfall to view the energy values of a specific point	
Drawing the sum of the spectra	
▪ Check the **SUM** button ▪ Select the area of interest by dragging ▪ When the area of interest has been selected, the sum spectra opens in a new window	
Functions of the sum spectra	

SPECTROGRAM

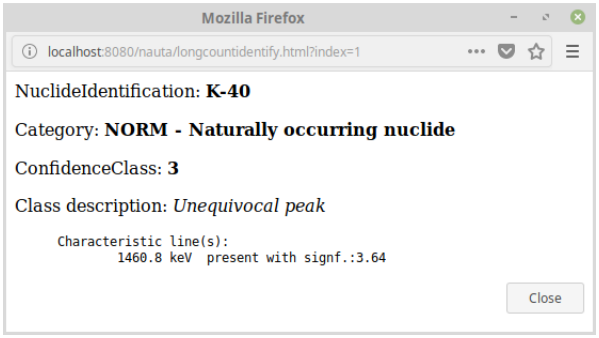
Description	Picture
▪ It is possible to change view of the spectra from linear presentation to a logarithmic one by checking the **Log** button ▪ Press the spectrum to view the energy values of a specific point ▪ It is possible to zoom in on the spectra by checking the **Zoom** button and selecting the area of interest by dragging **Note!** Return to the original sum spectra view by pressing the **Reset Zoom** button	

Identification details

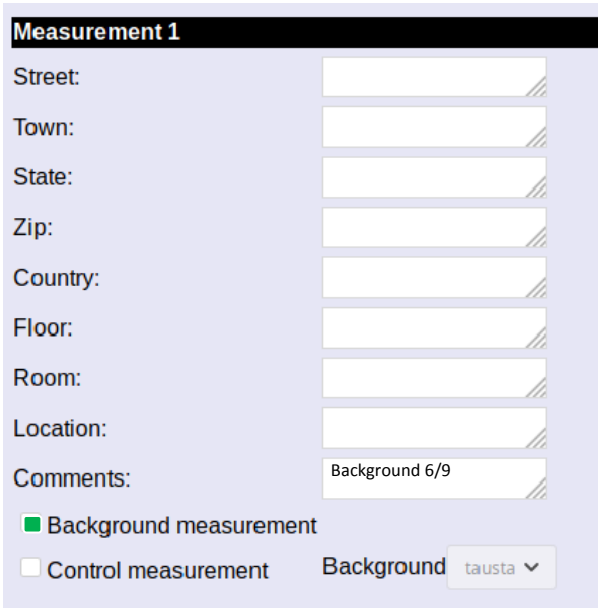
Identification results of the nuclides will be shown in a new window by pressing the **identify** button

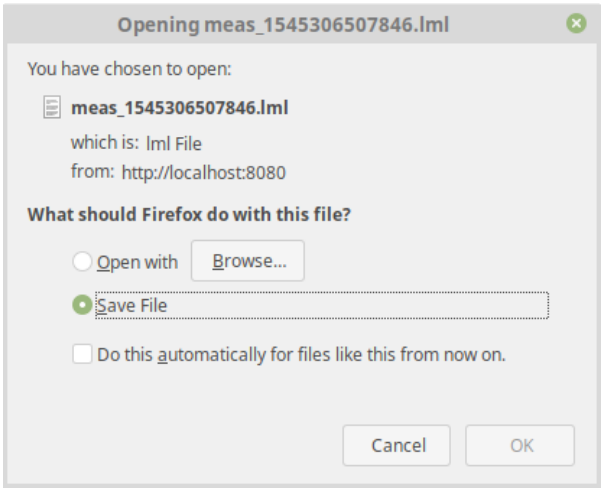
1. The first line shows the name of the nuclide
2. The second line shows the category of the nuclide
3. The third line shows the confidence level of the nuclide identification
4. The fourth line shows the class description

The following lines contain information about the peak used in identification



Saving the spectra to the database

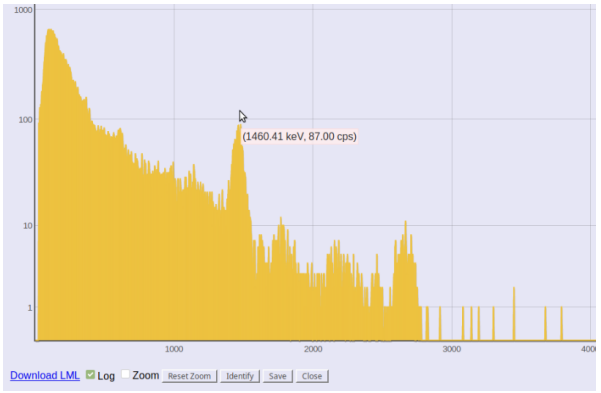
SPECTROGRAM	
Description	**Picture**
The spectra can be saved to the Spartan Portal database by pressing the **Save** button All available information fields must be filled before the save operation can be completed Push the **Save Measurement** button to finish	

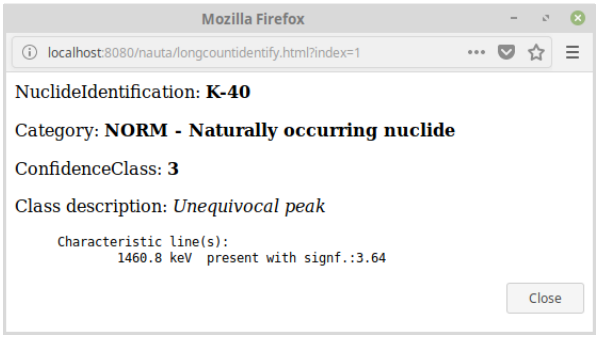
Downloading an LML -file	
The spectra can also be downloaded into an LML file by pressing **Download LML** button	

3.4.2 Long Count

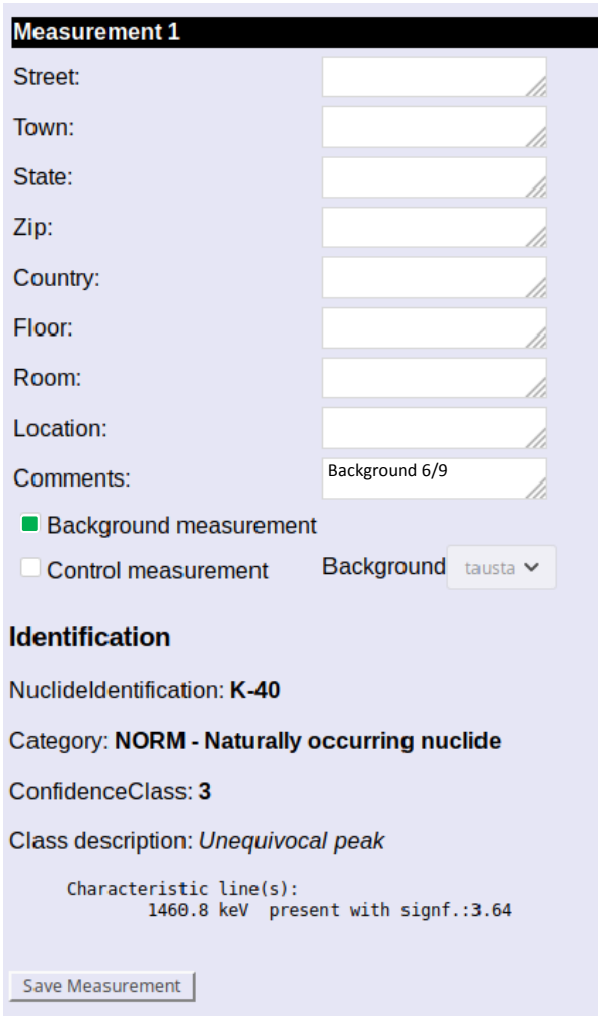
The long count is used to do a long measurement that can be saved to the database.

Tab. 3-7 Long count

LONG COUNT	
Description	**Picture**
Doing a long measurement	
1. Start the measurement by opening the **Long Count** -tab and press the **Collect** button **2.** The spectrum is collected while the live time, acquisition time and dose rate are being displayed **3.** Long count can be stopped by pressing **Done** button **4.** When the long count has been stopped, the measurement ling "**Meas**" appears on the window **5.** The measurement spectra can be viewed by pressing the **Meas -**link which opens it in a new window **6.** The spectra can be saved in this new window	
Functions of the long count spectra	
▪ It is possible to change view of the spectra from linear presentation to a logarithmic one by checking the **Log** button ▪ Press the spectrum to view the energy values of a specific point ▪ It is possible to zoom in on the spectra by checking the **Zoom** button and selecting the area of interest by dragging **Note!** Return to the original sum spectra view by pressing the **Reset Zoom** button	
Identification details	

LONG COUNT	
Description	**Picture**
Identification results of the nuclides will be shown in a new window by pressing the **identify** button **1.** The first line shows the name of the nuclide **2.** The second line shows the category of the nuclide **3.** The third line shows the confidence level of the nuclide identification **4.** The fourth line shows the class description The following lines contain information about the peak used in identification	

Saving the spectra to the database

LONG COUNT	
Description	**Picture**
By pushing the **Save** -button the spectra can be saved to the database of the Spartan Portal Before the save operation the all available information must be filled to the fields Finally pushed the **Save Measurement** -button	

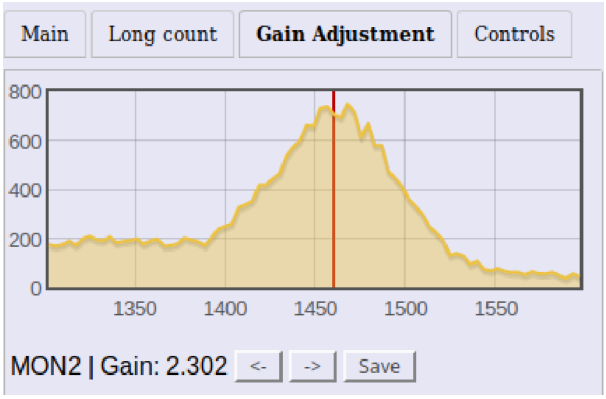
3.4.3 Gain Adjustment

The Gain Adjustment -tab displays the state of the gamma detector's energy calibration. Here it is possible to adjust the energy calibration peak should there be a need for it.

The energy peak should always be present and visible with the red line marking its highest peak. If the peak cannot be seen in this view or the red line does not hit the highest peak, the gain adjustment must be done.

Note! The Spartan Portal does the automatic energy calibration adjustment online in MON2 mode. If the energy calibration peak differs too much from a set point, the automatic adjustment cannot be done.

Tab. 3-8 Gain adjustment

GAIN ADJUSTMENT	
Description	**Picture**
1. The energy calibration peak can be adjusted by changing the gain value from **Arrow** buttons: ▪ **Decreasing** the gain value moves the red line from left to right ▪ **Increasing** the gain value moves the red line from right to left 2. Save the gain value by pressing the **Save** button **Note!** You need to wait until a new measurement has been done after performing gain adjustment	

3.4.4 Alarms and Alarm History

Fig. 3-2 Main view alarm area

The alarm section of the main window contains the ongoing alarms and alarm history.

Alarm tab displays the unacknowledged nuclide or heightened count rate alarms. When an alarm is triggered a pulsating color will attract the user's attention. Three background colors are used to indicate the alarm status:

- Grey indicates that there are no unacknowledged alarms
- Yellow pulsation indicates a detected dose rate
- Red pulsation indicates a dangerous dose rate

Use **Acknowledge** button to acknowledge an alarm or **Acknowledge all** button to acknowledge all alarms.

Note! Duplicates of the same radionuclide / region of interest in the same mode need to be acknowledged before further alarms of the same type are displayed.

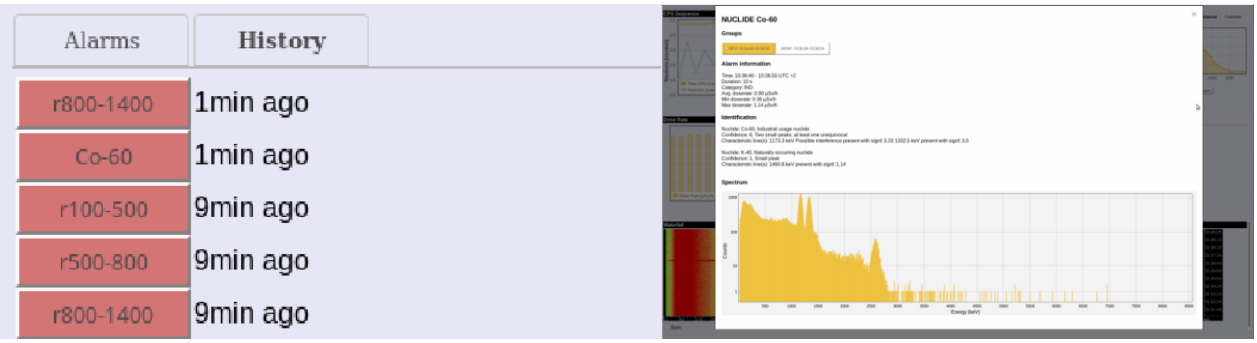


Fig. 3-3 Alarm history and alarm information

Alarm History tab displays the alarm history of the last 60 minutes. An entry to the alarm history is added each time a radionuclide is detected and identified with sufficient confidence (i.e. it causes an alarm). The name of the nuclide and the elapsed time from the alarm are shown here.

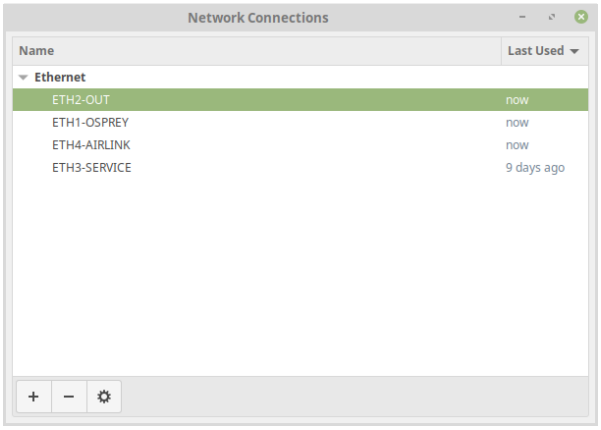
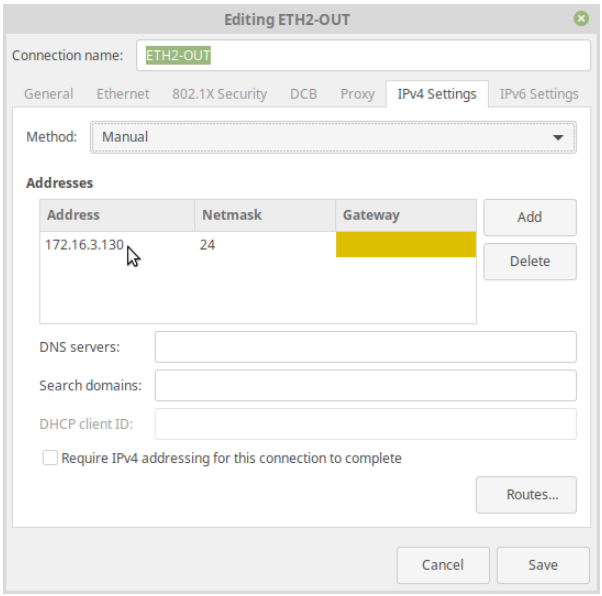
By clicking on a nuclide name, an overview of the observations of this specific nuclide is shown on a timeline. This overview contains the elapsed time from the initial alarm and the mode in which the observation was made are shown here. Entries of this specified nuclide can be opened to reveal the individual measurements of the intervals.

3.5 Setting Up LAN Network

The Spartan Portal includes "Linux" operating system. Settings of the operating system can be set with the VNC connection. It is possible to open the VNC view on an external display via HDMI port and use it with keyboard and mouse via USB port and hub.

Tab. 3-9 Setting up the LAN network

LAN NETWORK	
Description	**Picture**
1. Make sure that the Spartan Portal is in the normal measuring mode ▪ **Ready** LED is illuminated 2. Connect a PC to the Spartan Portal with an Ethernet cable 3. Set the IP address of the PC to match the detector's ▪ For example: **http://172.16.3.100**	
4. Open the **TightVNC Viewer** software or download it if you don't have it already 5. Enter the IP address of the Spartan Portal ▪ For example: **http://172.16.3.130:5901** 6. Enter the VNC Authentication password and the main view of the operating system appears ▪ By default: **user00** 7. Unlock the screensaver with user password if necessary ▪ By default: **EOy2019!**	

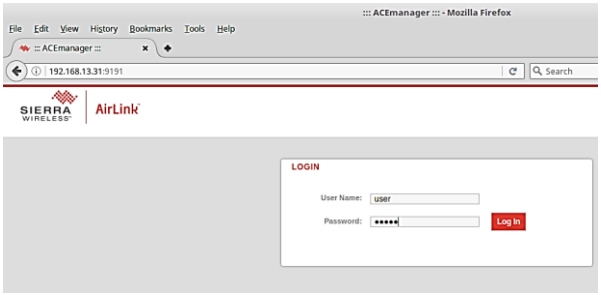
LAN NETWORK	
Description	**Picture**
8. Navigate to Network Settings ▪ Choose ETH2-OUT ▪ Open Settings	
9. Add an address: ▪ Insert the **Address, Netmask** and **Gateway** information and press **apply** to save changes ▪ **Note!** Write down the changed Network Settings **10.** Save the changes	

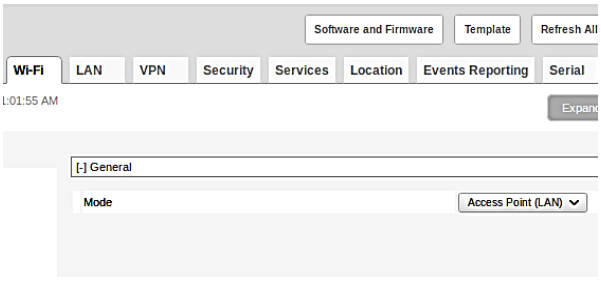
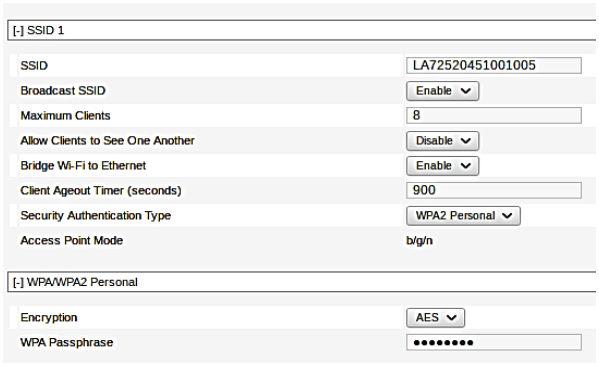
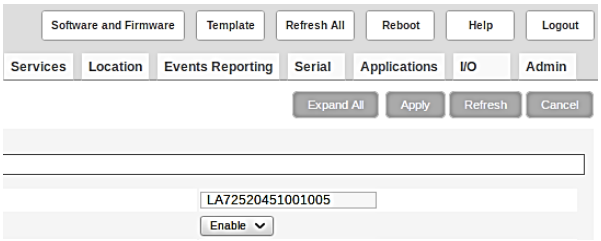
3.6 Setting up WLAN Network

Spartan Portal includes a router with Wi-Fi that can operate in WLAN access point mode (LAN), client mode (WAN) or a mode that combines the previous two. In the combined mode, the router acts as an access point for other devices and can be connected to other configured access points as a Wi-Fi client.

The detector offers the same services in the wireless network as it does using LAN once the wireless settings have been set.

Tab. 3-10 Setting up the WLAN network

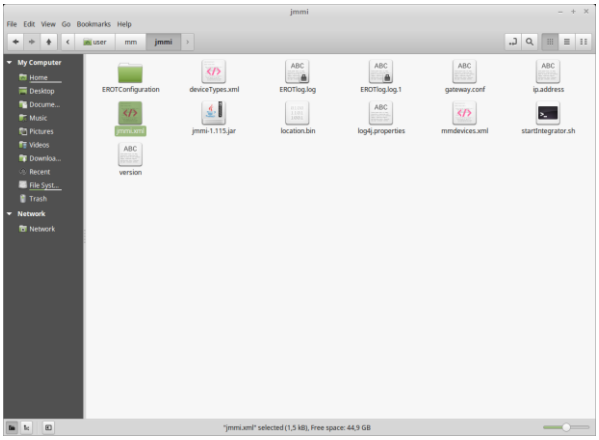
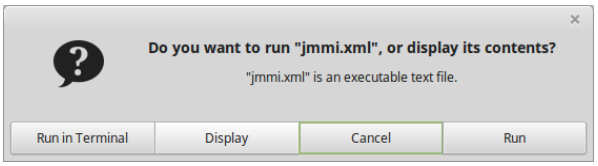
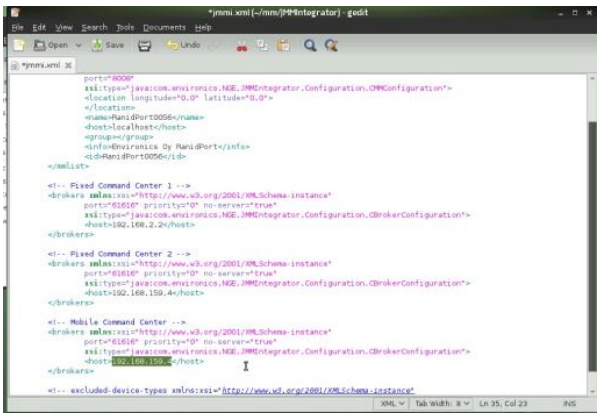
WLAN NETWORK	
Description	**Picture**
1. Make sure that the Spartan Portal is in the normal measuring mode ▪ **Ready** LED is illuminated 2. Connect a PC to the Spartan Portal with an Ethernet cable 3. Set the IP address of the PC to match the detector's ▪ For example: **http://172.16.3.100**	
4. Open the **TightVNC Viewer** software or download it if you don't have it already 5. Enter the IP address of the Spartan Portal ▪ For example: **http://172.16.3.130:5901** 6. Enter the VNC Authentication password and the main view of the operating system appears ▪ By default: **user00** 7. Unlock the screensaver with user password if necessary ▪ By default: **EOy2019!**	
8. Open a web browser 9. Enter the IP address of the router and port ▪ Port: "**:9191**" ▪ Default address: **http://192.168.13.31:9191** 10. Enter the password and press **Login** button ▪ By default: **12345**	

WLAN NETWORK	
Description	**Picture**
11. Open the **Wi-Fi** tab **12.** Change the mode from **Access Point (LAN)** to **Wi-Fi**	
13. Insert the default **Wi-Fi Settings:** ▪ SSID = **Global ID** ▪ Bridge Wi-Fi to Ethernet: **Enable** ▪ Security Authentication type: **WPA2 Personal** ▪ WPA Passphrase: **12345678** **14.** Press **Apply** button to apply the changes and then **Ok** button to confirm them	
15. Press the **Reboot** button to reboot the system and then **Ok** button to confirm the reboot ▪ **Note!** Write down the Wi-Fi settings for future use	

3.7 Configuration of EnviScreen Integrator

When the Spartan Portal is connected to EnviScreen Operix by using either hardwired Ethernet or wireless network, the IP address of the EnviScreen Server must be set in the detector's software. Once the IP address of the EnviScreen Server has been set in the detector's "**jmmi.xml**" file, status and measurement data can be sent to the server in question. It is possible to add several different IP addresses if the system includes several servers.

Tab. 3-11 Configuration of EnviScreen Integrator

ENVISCREEN INTEGRATOR	
Description	**Picture**
1. Open VNC connection which is described in chapter 3.5: Setting Up LAN Network **2.** Open folder: **user/mm/JMMI**	
3. Open "**jmmi.xml**" file for editing and choose **display**	
4. Enter the IP address of the EnviScreen Server ▪ For example: **<host>192.168.2.123</host>** ▪ **Note!** It is possible to add several IP addresses if the system includes several servers **5.** Save the "**jmmi.xml**" file **6.** Restart the Spartan Portal by turning the power switch from **ON** to **OFF** and back to **ON**	

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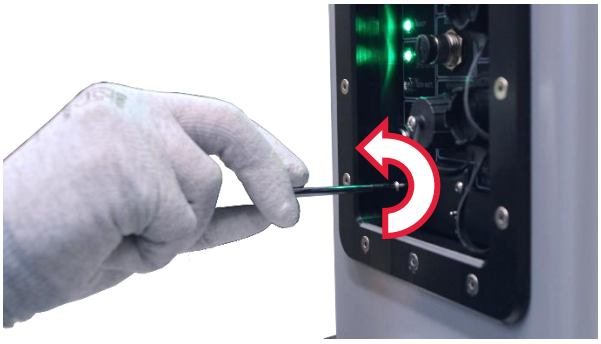
4 3G/4G Settings

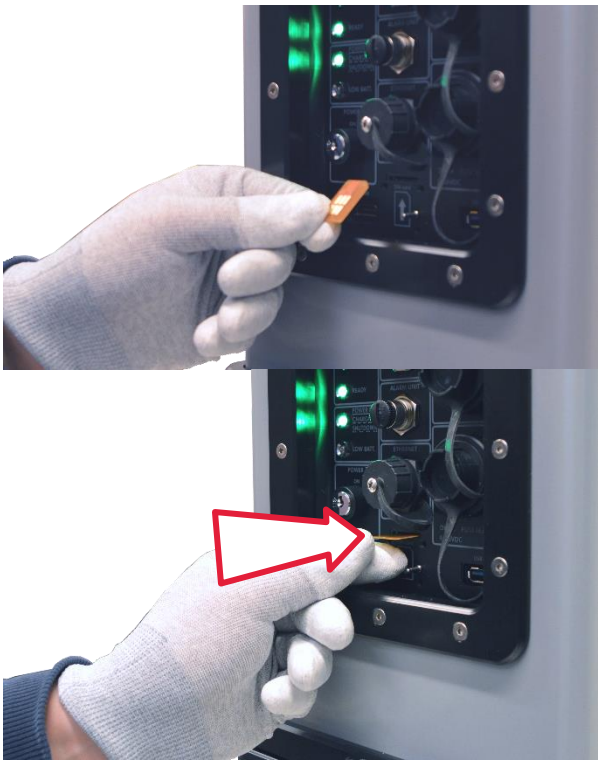
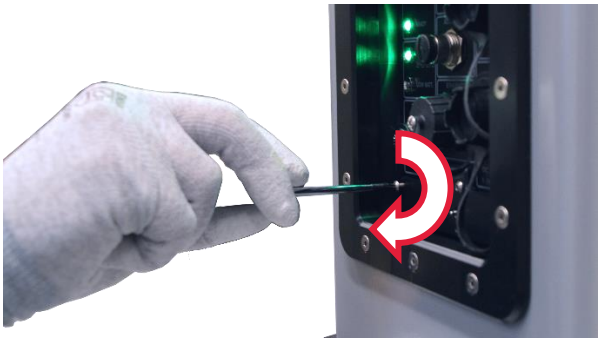
Spartan Portal includes 3G/4G router for wireless communication via mobile network to command center (EnviScreen Server). The router supports GSM/GPRS/EDGE/WCDMA/LTE networks. The router is located inside the Spartan Portal case. The router need a SIM -card and additional configuration before it is ready to operate. The SIM -card can be installed in the front panel.

Transferring wireless IP -data usually requires a special service from the local mobile operator. The special service enables wireless 3G/4G connection between different data terminal equipment. The special service includes Access Point Node (APN) which gives the equipment static IP addresses when connection is activated.

4.1 Installation of SIM Card to the Router

Tab. 4-1 Installation of the SIM card to the Router

ROUTER SIM -CARD INSTALLATION	
Description	**Picture**
1. Remove the cover plate (**7 screws**)	

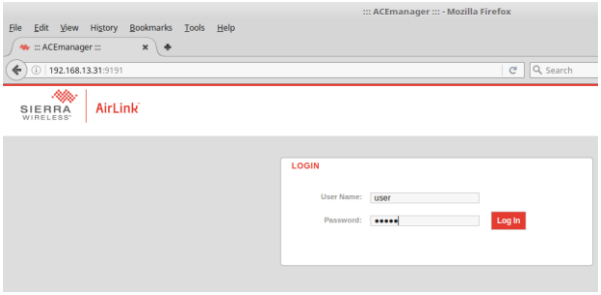
ROUTER SIM -CARD INSTALLATION	
Description	**Picture**
2. Insert the SIM card **Note!** The SIM card needs to be pushed to the bottom for it to latch. If you have trouble, you can use a screwdriver.	
3. Install the cover plate (**7 screws**)	

4.2 The 3G/4G Router Configurations

Note! Router setting changes will not take effect until they have been introduced and the router is restarted.

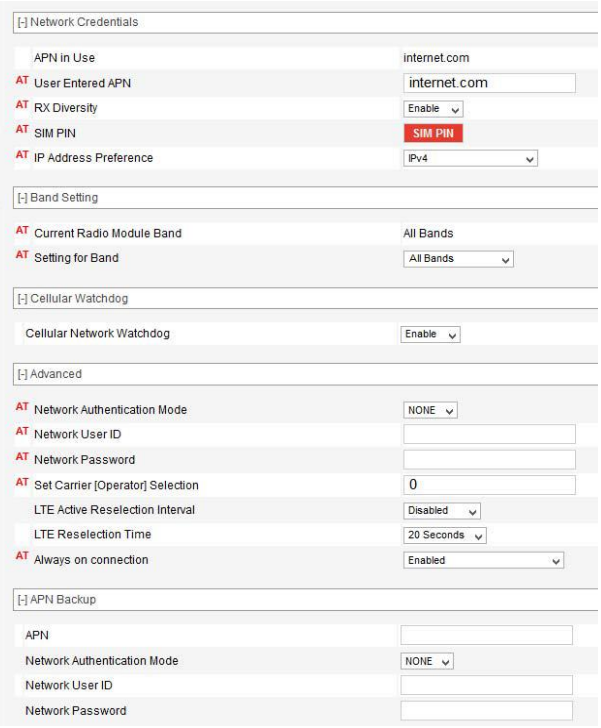
4.2.1 Router Web Console

Tab. 4-2 Router web console

ROUTER WEB CONSOLE	
Description	**Picture**
1. Make sure that the Spartan Portal is in the normal measuring mode ▪ **Ready** LED is illuminated 2. Connect a PC to the Spartan Portal with an Ethernet cable 3. Set the IP address of the PC to match the detector's ▪ For example: **http://172.16.3.100**	
4. Open the **TightVNC Viewer** software or download it if you don't have it already 5. Enter the IP address of the Spartan Portal ▪ For example: **http://172.16.3.130:5901** 6. Enter the VNC Authentication password and the main view of the operating system appears ▪ By default: **user00** 7. Unlock the screensaver with user password if necessary ▪ By default: **EOy2019!**	
8. Open a web browser 9. Enter the IP address of the router and port ▪ Port: "**:9191**" ▪ Default address: **http://192.168.13.31:9191** 10. Enter the password and press **Login** button ▪ By default: **12345** **Note!** If the IP address of the router is unknown, the default IP address can be returned by resetting the router by pushing the **Reset** button on the front.	

4.2.2 Router APN Settings

Tab. 4-3 Router APN settings

ROUTER APN SETTINGS	
Description	**Picture**
1. Navigate to BWAN/Cellural\Cellural\General 2. Enter the SIM -card PIN code 3. Enter the APN: ▪ Name ▪ Network User ID ▪ Network password 4. Press **Apply** button to apply the changes and then **Ok** button to confirm them 5. Press **Reboot** button to reboot the router and then **Ok** button to confirm it **Note!** Write down the APN Settings for future use	

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5 Maintenance and Troubleshooting

5.1 Maintenance

Spartan Portal has been designed to be rugged, reliable and to only have a small number of maintenance actions that can be performed at the operator level.

Normal operator level maintenance actions are:

- Calibration check
- Replacement of the fuse
- Replacement of the battery unit
- Detector cleaning and decontamination

CAUTION

The device must be turned off during maintenance work unless otherwise indicated.

Maintenance may ONLY be performed by the technicians trained by WB Johnson Instruments. Maintenance performed without training by WB Johnson Instruments will void the warranty. Detailed instructions to perform maintenance are provided in training. Supplies to perform maintenance are available from WB Johnson Instruments. Supplies to perform maintenance are available from WB Johnson Instruments.

5.1.1 Calibration Check

Calibration check is used to verify the detector's state of the energy calibration and the condition of the crystal.

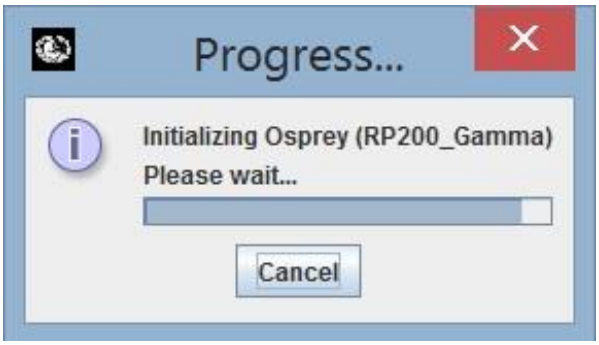
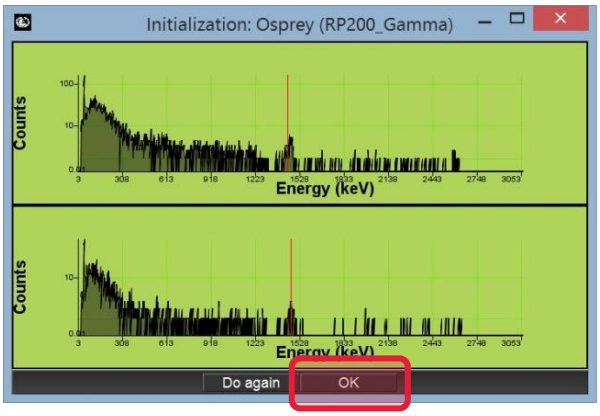
The calibration check has been divided into three steps:

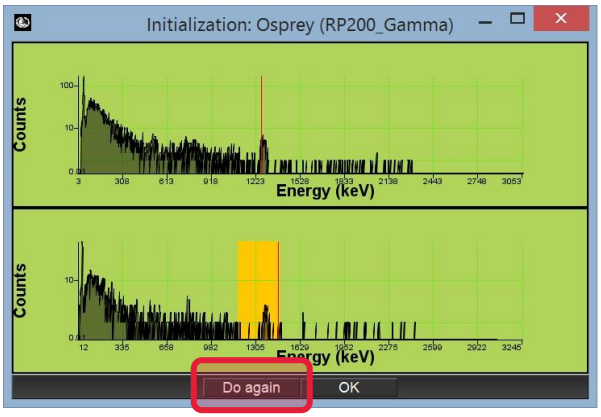
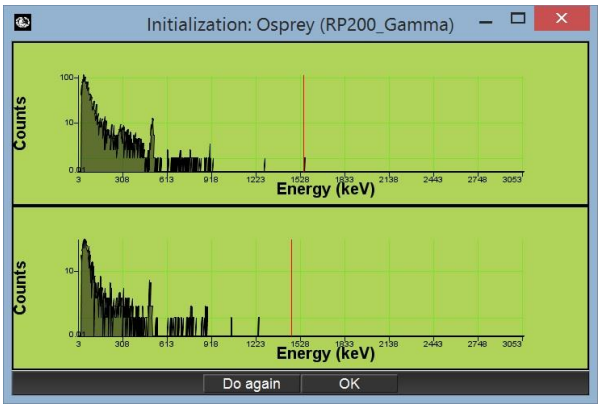
1. Initialization
2. Gain adjustment
3. Energy calibration and crystal condition check
    - Crystal condition check is only applicable for gamma detectors

Detector's measurement data is only reliable when the calibration check has been completed successfully. If the calibration check has failed, the energy calibration must be done. If the results of the crystal condition check indicate that the crystal has a poor resolution, the energy resolution is poor and replacing the crystal is highly recommended.

5.1.1.1 Step 1 – Initialization

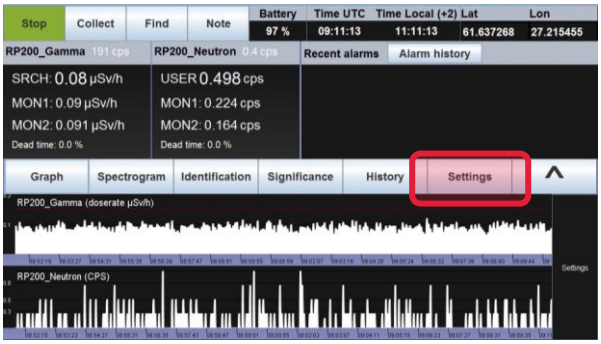
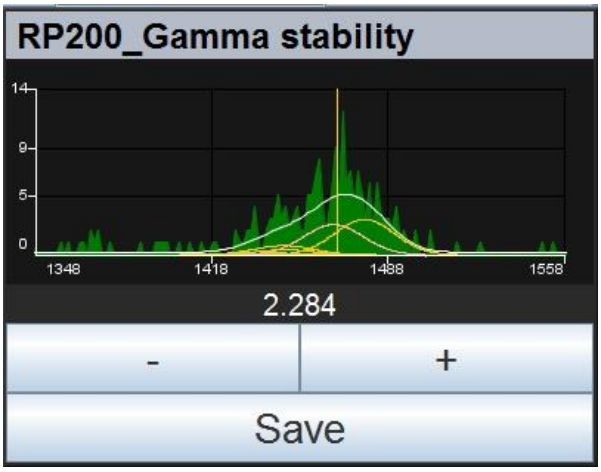
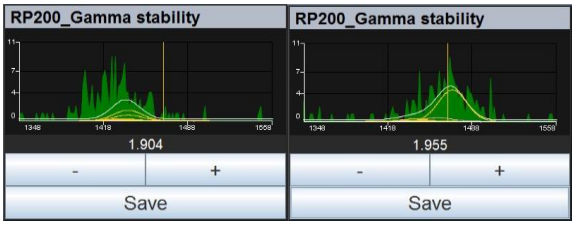
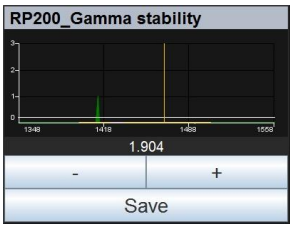
Tab. 5-1 Step 1 –Energy calibration initialization

INITIALIZATION	
Description	**Picture**
1. Make sure that the Spartan Portal is in the normal measure ▪ **Ready** LED is illuminated	
2. Open the VNC connection by following the instructions in chapter 3.5: Setting Up LAN Network	
3. Open the **Vasikka** software	
4. Visually check that the red line is aligned correctly with the energy peaks in both spectra: ▪ NaI(TI) peak: 1460.8keV ▪ $LaBr_3$ peak: 1468keV **5.** Depending on the result of the energy calibration: ▪ If the result is satisfactory continue to step 2 by pressing **Ok** button ▪ Otherwise continue to action 6	

INITIALIZATION	
Description	**Picture**
6. If the lower spectrum red line does not align with the peak: ▪ Paint the correct peak ▪ Press **Do Again** button ▪ If necessary repeat this action once more	
7. If the upper spectrum red line differs too much from the correct energy peak: ▪ Gain adjustment won't be enough to correct the situation ▪ Restart the detector and start from the beginning once more If this does not resolve the issue, the gamma detector's settings are false and **the setting file must be replaced**. If the setting file is correct and the issue persists, **calibration check is rejected and the detector must be calibrated**.	

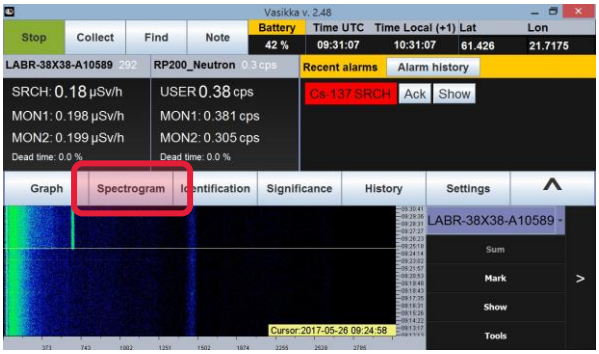
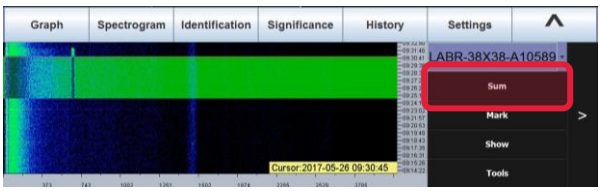
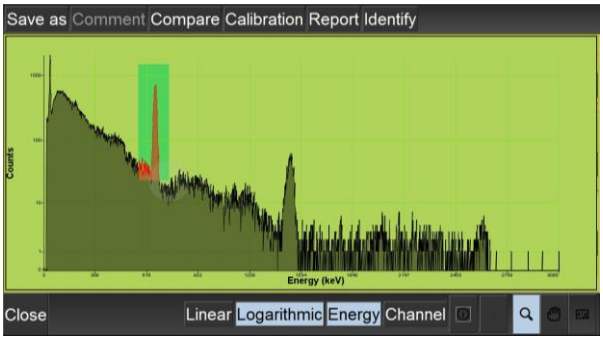
5.1.1.2 Step 2 – Gain Adjustment

Tab. 5-2 Step 2 – Energy calibration gain adjustment

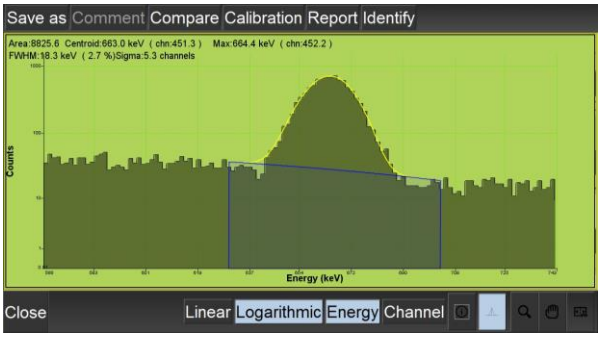
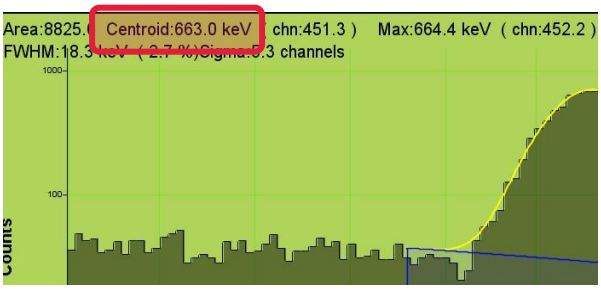
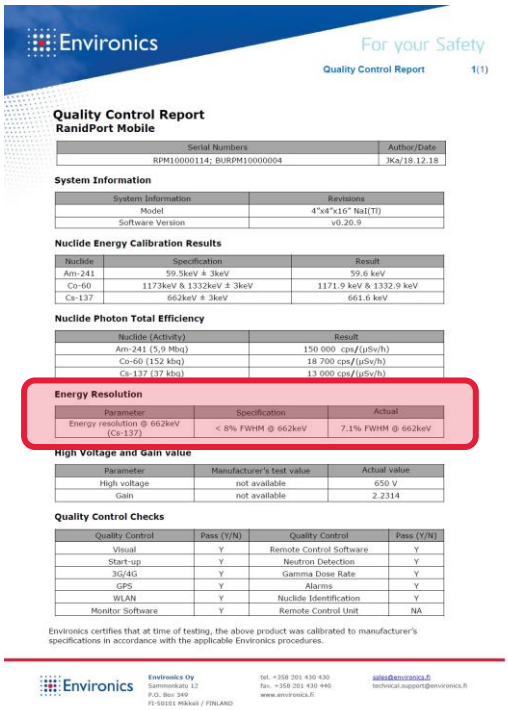
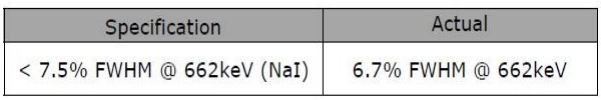
GAIN ADJUSTMENT	
Description	**Picture**
1. After initialization has been accepted: ▪ Data collection starts automatically ▪ Display switches to Main view **2.** Navigate to **Settings** tab	
3. Check the state of the energy peak on the stability window ▪ Right place for the highest energy peak is marked by a yellow line ▪ Highest peak should have the energy value of: ▪ NaI(Tl) peak: 1460.8keV ▪ $LaBr_3$ peak: 1468keV **4.** Depending on the result of energy peak: ▪ If the result is satisfactory continue to step 3 ▪ Otherwise continue to step 5	
5. If the highest point of the peak in not on the yellow line, **the gain adjustment must be done**: ▪ **Decreasing** the gain value moves the peak from left to right ▪ **Increasing** the gain value moves the peak from right to left ▪ Save the gain value by pressing the **Save** button	
6. If the energy calibration peak does not show up in the stability view: ▪ Repeat step 1	

5.1.1.3 Step 3 – Energy Calibration and Crystal Condition Check

Tab. 5-3 Step 3 – Energy calibration and crystal condition check

ENERGY CALIBRATION AND CRYSTAL CONDITION CHECK	
Description	**Picture**
1. Place Cs-137 source at a distance of 10cm from the detector	
2. Navigate to **Spectrogram** tab: ▪ Wait 5 minutes for test measurement data to be generated	
3. Press the **SUM** button ▪ Select an area of interest by dragging ▪ When the are interest has been selected, the sum spectra open in spectrum viewer	
4. Zoom in on the spectrum ▪ Press the **Zoom tool** button (magnifying glass) ▪ Select the peak of **Cs-137** nuclide by dragging	

ENERGY CALIBRATION AND CRYSTAL CONDITION CHECK

Description	Picture
5. Use the **Gaussian tool** ▪ Select the base of the peak by dragging	
6. Compare the value of the energy peak to acceptance limit values: ▪ Cs-137 peak: 662keV ± 3keV ▪ If the result is satisfactory **the calibration check is approved** and you can continue to action 7 ▪ Otherwise the calibration check is rejected and the energy calibration must be done	
7. Verify the condition of the crystal by using the Quality Control Report ▪ The report is supplied with the Spartan Portal **8.** Compare the energy resolution value made by the **Gaussian tool** to the energy resolution value of the Quality Control Report ▪ Difference must not exceed the tolerance of: **± 2% with NaI(TI) detector** ▪ If the result is inside the tolerance value, the crystal has a good resolution ▪ Otherwise continue to action 9	
9. If the energy resolution is outside the tolerance value, **energy resolution is low and replacement of the crystal is highly recommended**	

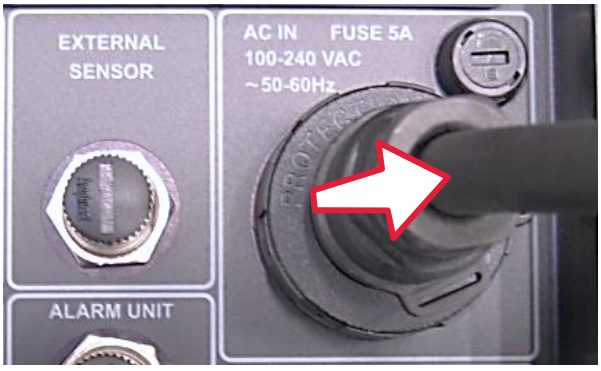
ENERGY CALIBRATION AND CRYSTAL CONDITION CHECK	
Description	**Picture**
Example: If NaI(Tl) energy resolution is more than 10%, the crystal's energy resolution is outside the tolerance	

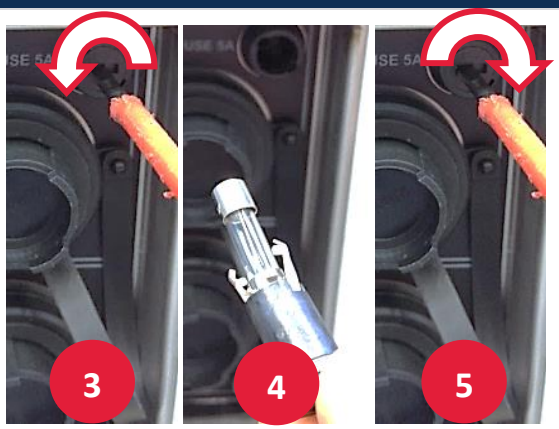
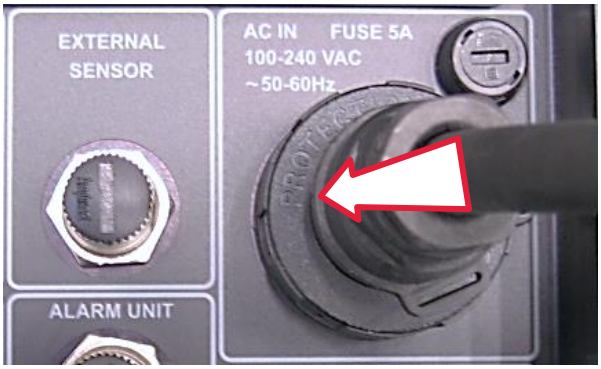
5.1.2 Replacing the Fuse

Spartan Portal connector panel contains two fuses:

- AC power supply fuse: 5 x 20mm, 250VAC, 5A
- DC power supply fuse: 5 x 20mm, 250VAC, 16A

Tab. 5-4 Replacing the fuse

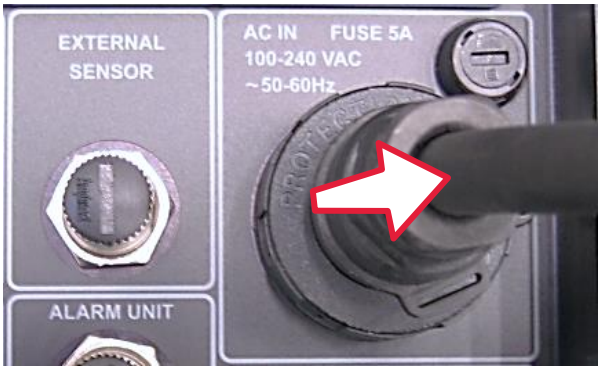
FUSE REPLACEMENT	
Description	**Picture**
1. Turn the detector **OFF**	
2. Disconnect all power cables	

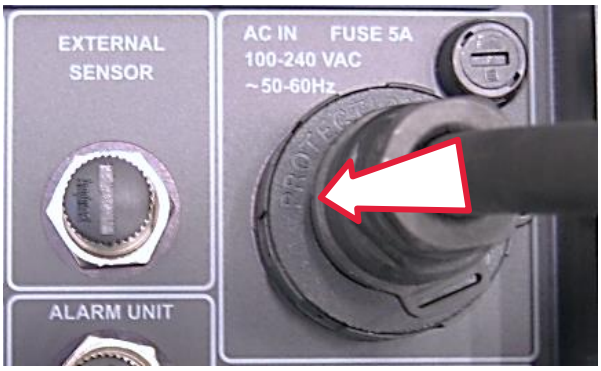
FUSE REPLACEMENT	
Description	**Picture**
3. Open the fuse holder with a screwdriver **4.** Pull the fuse holder out and replace the fuse **5.** Install the fuse holder with a screwdriver	
6. Connect all power cables	
7. Turn the detector **ON**	

5.1.3 Replacing the Battery Unit

Spartan Portal includes the battery unit that is located at the bottom of the detector.

Tab. 5-5 Replacing the battery unit

BATTERY UNIT REPLACEMENT	
Description	**Picture**
1. Turn the detector **OFF**	
2. Disconnect all power cables	
3. Open the latches on the sides of the detector **4.** Remove the battery unit **5.** Carefully insert a new battery unit in place. Make sure that the electrical connectors align: ▪ Connectors are aligned correctly when serial numbers of the parts are on the same side **6.** Close the latches on the sides of the detector ▪ **Note!** Do not touch the electrical parts located inside the case	

BATTERY UNIT REPLACEMENT	
Description	**Picture**
7. Connect all power cables	
8. Turn the detector **ON**	

5.1.4 Cleaning

The external surfaces of the Spartan Portal can be wiped off using a mild soap water solution.

WARNING
Do not spray liquid to the inlets, outlets, connectors or electrical components.
Do not submerge the device in the solution. Do not use other solvents or cleaning agents other than a mild soap water solution or other odorless cleaning agents.

NOTE
Ensure that the detector is powered off during cleaning.

5.2 Radiological Contamination

The best way to decontaminate radiation dust is mechanical decontamination. Remove radiological dust with e.g. vacuum cleaner, brush or wetted towel.

Perform a systematic decontamination to thoroughly clean all of the contaminated parts. Pay attention to places where radioactive dust may stick. If it is not possible to clean a contaminated part, it will need to be changed. The disposal of contaminated parts should be handled according to local regulations.

Follow the instructions given by your own organization. Basically, all radiation exceeding the normal background radiation should be taken into account and be decontaminated according to instructions below:

1. Remove radiological contamination from surface by either using brush, wetted towel or vacuum cleaner
    - Change the disposable gloves and towels to avoid cross-contamination
    - Do not use pressurized air for cleaning to avoid dust dispersion
2. Wipe the external surfaces of the device using a towel dampened with solution containing water and soap or unscented dish washing liquid
    - Change the disposable gloves and towels to avoid cross-contamination
3. Monitor the decontamination result using an appropriate monitoring tool
4. Repeat the decontamination steps 1… 3 as required

It's recommended to use identifying radiation detector for deeper inspection due to differences in the harmfulness of different isotopes.

WARNING
Contamination
Before working on the detector, always make sure that the device is not contaminated with dangerous substances. If you do not have reliable information about the safety of the device, the device needs to be decontaminated before the maintenance tasks.
Ensure that the device is powered off during cleaning and decontamination.
Decontamination procedures should be performed outdoors or in well-ventilated rooms.
Decontamination procedures should be performed while wearing an adequate level or protection.
Do not use high-pressure cleaning equipment, only hand operated sprayers.
Discard the gloves, paper towels and other contaminated items according to all national laws and regulations for hazardous waste.
Do not use pressurized air to avoid dispersing radiological dust.
Remember that radiological decontamination does not destroy the radiation, only removes it from the surface.

5.3 Troubleshooting

The Spartan Portal has been designed with a high level of integrated self-test. It will alert the user of any potential failures that could affect operational performance. If the detector senses a hardware or software failure it will stop and not enter the normal operating mode.

Due to the system's integrated design the user can perform only a very limited maintenance. If the following solutions do not resolve the problem, it is recommended that the detector is returned to the factory for maintenance.

Tab. 5-6 Troubleshooting

Troubleshooting
Spartan Portal will not enter normal operation
Possible causes include but are not limited to: ▪ Hardware or software failure   ▪ Spartan Portal built-in diagnostics will not allow the system to go into normal operation
1. Restart the device If this does not resolve the issue and the status message is shown again, contact authorized maintenance or manufacturer for further instructions.
Spartan Portal will not start
Possible causes include but are not limited to: ▪ Lack of power
1. Check the power connections and availability of power 2. Check the fuse If this does not resolve the issue and the status message is shown again, contact authorized maintenance or manufacturer for further instructions.
Battery will is not charging
Spartan Portal will not charge: ▪ Mains power is connected ▪ Battery status does not blink Possible causes include but are not limited to: ▪ Battery is fully charged ▪ Battery is broken
1. Run the Spartan Portal for a couple of hours without mains power before trying to charge the battery

Troubleshooting

If this does not resolve the issue and the status message is shown again, contact authorized maintenance or manufacturer for further instructions.

Spartan Portal gives false alarms

Spartan Portal gives false alarms:

- Detects wrong nuclides
- Alarms even when ambient radiation level is low

Possible causes include but are not limited to:

- The automatic energy stabilization has wrong adjustments
- Detector has been calibrated incorrectly

1. Restart the device

If this does not resolve the issue and the status message is shown again, contact authorized maintenance or manufacturer for further instructions.

Communication via Ethernet is not working

Possible causes include but are not limited to:

- Wrong IP address
- Wrong IP address space in PC
- Internal Ethernet port is broken

1. Check the Spartan Portal and PC network settings

If this does not resolve the issue and the status message is shown again, contact authorized maintenance or manufacturer for further instructions.

Communication via 4G is not working

Possible causes include but are not limited to:

- 4G network signal level is weak
- 4G modem settings are not correct
- SIM card has not been installed in the detector

1. Check the signal level of the 4G network

2. Check the 4G modem settings

3. Check that the SIM card has been installed

If this does not resolve the issue and the status message is shown again, contact authorized maintenance or manufacturer for further instructions.

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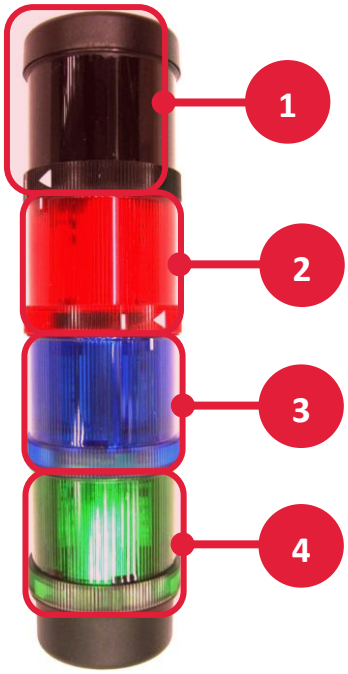
6 Optional Accessories

6.1 Alarm Unit

6.1.1 Key Elements

The Alarm Unit consists of the following elements:



1. Buzzer
2. LED -light for gamma radiation alarm
3. LED -light for neutron radiation alarm
4. LED -light for operational status

Fig. 6-1 Key elements of the Alarm Unit

6.1.2 Technical Information

Tab. 6-1 Alarm Unit technical data

Description	Value
Size (H x W x D):	305mm x 75mm x 120mm (12" x 3" x 4.7")
Approx. weight:	0.37kg (0.82 lbs)
Power:	24V DC/AC (Spartan Portal battery back-up not supported)
Build:	The lights are made of PC and the rest of the hull are made of PA
Rain and waterproofing:	IP65
Operational temperature:	-20… +50°C (-4… +131°F)
Storage temperature:	-20… +50°C (-4… +131°F)
Buzzer:	Piezo functioned, 85dB
Lights:	360° LED -lights

6.1.3 Normal Operation

The Alarm Unit is a light-weight device that displays the alarm information generated by the detector remotely. The Alarm Unit is usually located in a place where good audibility and visibility can be achieved. The Unit should be in the vicinity of the personnel who will take action when an alarm occurs so that the response will be immediate.

The Alarm Unit is equipped with bright, long lasting LED -lights that illuminate 360°. The buzzer volume can go up to 85dB and this audible alarm can be acknowledged with a separate “Reset alarm” button that does not affect visual alarms. Visual alarms will continue until the situation has been solved and the Spartan Portal returns to normal state.

Tab. 6-2 Alarm Unit status indications

Status	LED lights		Audible signals
	Color	Blinking rate	
Startup	All lights turn on briefly and turn off one by one	Continuous	One long sound
Normal status	Green	Continuous	No Sound
Gamma radiaiton alarm	Red	Continuous	One long sound
Neutron radiation alarm	Blue	Continuous	One long sound
Shutdown	Every light turns on one by one	Continuous	No sound

6.1.4 Maintenance

The Alarm Unit does not require any general maintenance to function properly. Since Alarm Unit is an audiovisual device, keeping the unit clean is the only issue that can be considered as a maintenance procedure. The unit is IP65 classified and can thus be washed safely with water and mild soaps without the possibility of malfunctioning afterwards.

7 Products Pre-Service Declaration Form

You can request the products pre-service declaration form from customer.services@environics.fi and fill it according to the instructions provided within. Alternatively, you can fill it at http://www.environics.fi/pre-service-declaration-form/.

Before sending products to WB Johnson Instruments for service, you must inform the company of the hazardous substances you have used or measured with our product. This information is fundamental for the safety of our service employees and will determine the procedures employed to service your equipment.

The pre-service declaration has to be completed and a copy must be sent via email, fax or post. You can declare multiple equipments with one form, if they have been in contact with the same substances.

After reception of the completed form, WB Johnson Instruments will contact you and give you an **RMA** number (Return Material Authorization) and instructions on delivering the device(s) to service. Attach one copy of the filled form including the **RMA** number with the device(s) to be sent to WB Johnson Instruments.

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