CAEN SyS
Systems & Spectroscopy Division

RIID HandHeld Training, Hands-on and Report

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Doha Qatar - 2025

1. INTRODUCTION

Use Cases and Operative Scenarios

Why you bought a DiscoveRAD?

- Where you use it?
- What kind of measurement you do?
- What are the minimum requirements you have?

Use Cases and Operative Scenarios

The DiscoveRAD is a Radionuclide Identifying Device (RID)

- Large volume items: trash, scrap metals, hospitals
- CBRNE: investigation or inspection of goods, item control etc.
- looking for SNM with neutrons detection (optional)
- Single items checks logistics, post offices, NPP for single waste drum

Detection capabilities

The DiscoveRAD is a Radionuclide Identifying Device (RID)

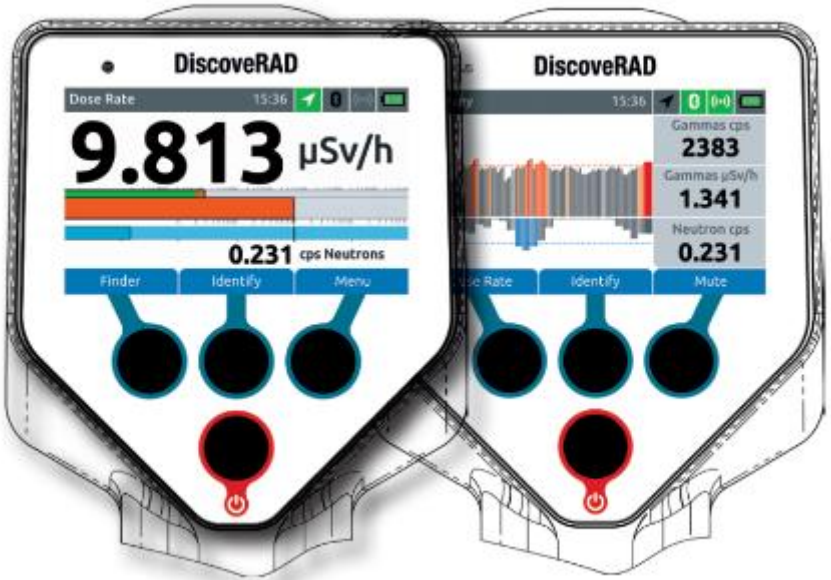
- Extended Dose-rate (Sv/h, Sv/h*, rem/h)
- High efficiency detector with 2’’x1’’ BGO
- High dose rate capability (ID up to 1 milion cps or 500 mSv/h)
- Detects and identifies nuclides in mixed, shielded and heavily masked configurations including Special Nuclear Material
- Gamma Isotope Identification (NaI, LaBr, BGO, etc.)
  - More than 4 radionuclides simultaneously
- Neutron Counting (optional, depending on the crystal)
- Cumulative dose and count rate
- Spectrometry at up to 1 million cps between 10 KeV to 10 MeV
- Radiation directionality (Compass – Rapidfinder)

Key Features

The DiscoveRAD is a Radionuclide Identifying Device (RID)

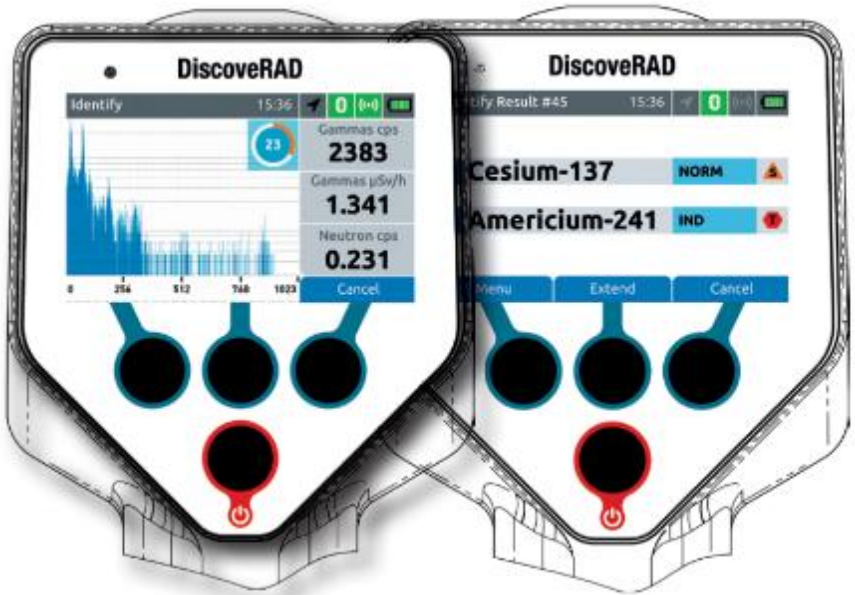
- Novel quantum source-less gain stabilization (pat. US 9,864,076)
- Non-hygroscopic and watertight up to 10 m (IP 68)
- Small, lightweight (< 1,25 Kg/<2,7 lbs, *235 x 88 x 92 mm*)
- Wi-Fi access point (*2,4 GHz 802.11 g, encryption WPA-PSK AES*)
- Bluetooth LE for connection to the Mobile App
- Spectra view and analysis with data storage for Reachback
- User Interface with day and night view
- Replaceable batteries (optional adapter for AAA batteries)
- Three buttons operation
- Multiple modes of configuration
- Operation from remote PC with full view of the screens
- N42.42 data format

Multiple Mode of Operation



Dose rate mode

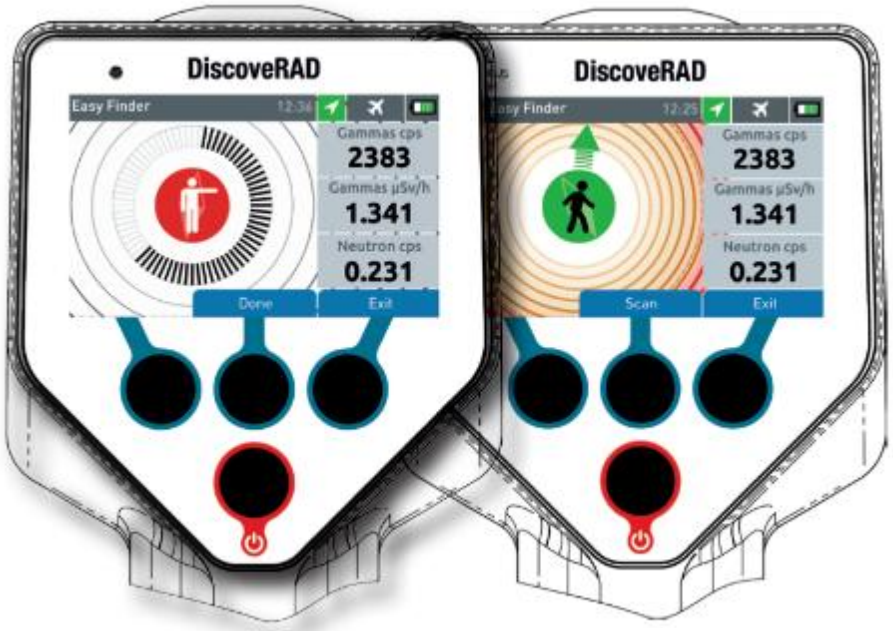
Finder mode



Identification mode

Identification results

Multiple Mode of Operation

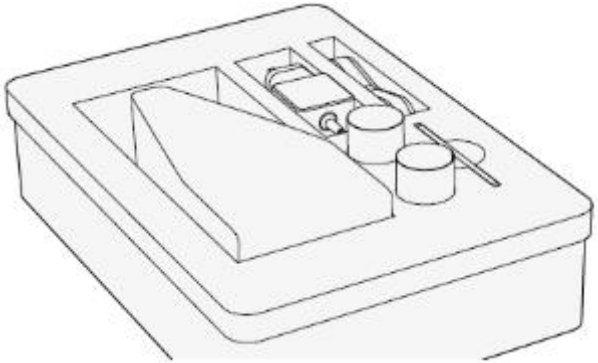


Rapid-Finder scanning

Rapid-Finder with direction

2. HARDWARE and PRELIMINARY OPERATIONS

Kit composition and Spare Parts



The CAEN F501 comes in a custom fit transport case with a set of the following accessories:

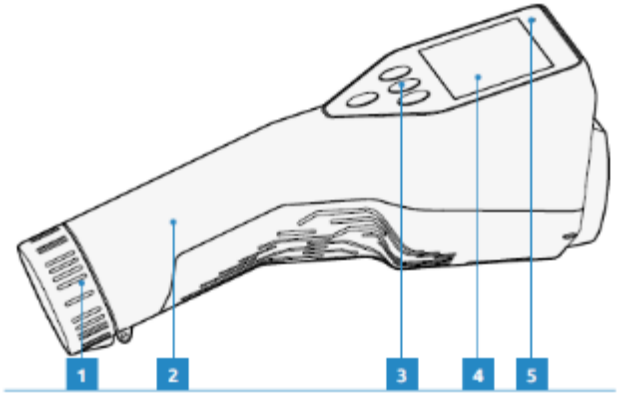
- 1x Lanyard
- 1x Belt Holster
- 1x USB Cable
- 1x AC-DC Wall Adapter
- 1x PM1 Cargo AA Battery Holder
- 2x Power Module PM1 Li-Ion 240

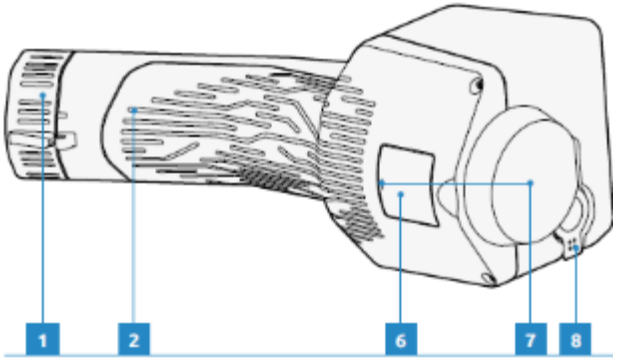
Spare Parts

Battery Pack Li-Ion CAEN F501	4210014
Battery Pack NiMH CAEN F501	4212835
Battery Holder CAEN F501	4212836
Case and Foam	4213734
Case Label	4213732
Holster	4209891
Micro USB Cable 1m	4202304
Mini USB Cable 2m	103429

O-Ring 40x1.5 NBR 70A	4213725
Power Supply USB 5.0V/2.0A includes adaptors US, UK, EU, AUS	4213398
Synthetic O-Ring Grease 1cc	4214141
Wrist Strap	100034
1GB USB Memory Stick includes User Manual and Quick Reference Guide	4204014
4mm Ring	103787

DiscoveRAD hardware





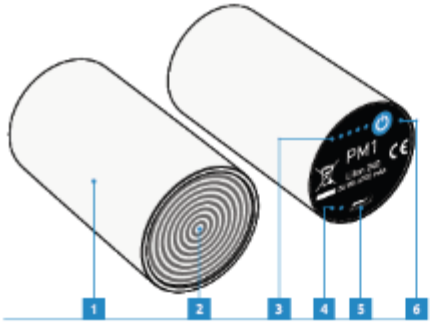
1. Battery cover
2. Battery compartment
3. Operating keys
4. Display
5. Power On / Loading Indicator
6. Serial number
7. Detector positioning marks
8. USB-socket

Handle the instrument with care and never drop it.

Never expose the instrument to a sudden jump in temperature of more than 30 °C(54 °F). This should be considered if the instrument is being transported in a vehicle with a climate control system in regions where extremely high or low temperatures may occur.

Batteries

PM1 Li-Ion 240



The **PM1 Li-Ion 240** is a rechargeable lithium-ion power module.

1. Power module housing
2. Contact plate
3. Capacity LEDs (4)
4. Status LED
5. USB power socket
6. Test button

To check for the remaining capacity of the power module press the test button. The four capacity LEDs will indicate the remaining battery capacity.

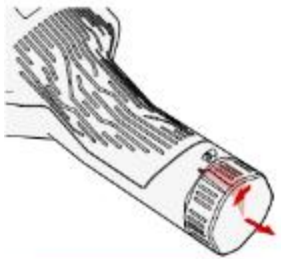
- ●●●● ○ 90 - 100 % remaining capacity
- ●●●○ ○ 65 - 90 % remaining capacity
- ●●○○ ○ 40 - 65 % remaining capacity
- ●○○○ ○ 15 - 40 % remaining capacity
- ○○○○ ◉ A fast flashing status LED means, that the capacity of this power module is too low to be used in a CAEN F501. To avoid damage through deep discharge recharge the power module within a month.

⚠ The power module **PM1 Li-Ion 240** has no serviceable or removable parts inside. Under no circumstances should the housing be tampered with, penetrated, or otherwise removed.

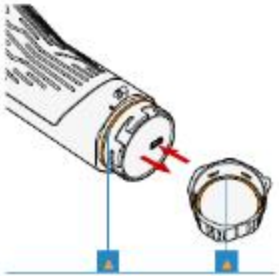
⚠ Do not short-circuit the battery contacts and always use the provided covers outside of the instrument. Be careful when placing the power modules somewhere with the contact plate pointing downwards. Batteries may be damaged by a short-circuit.

Exchange Power Modules

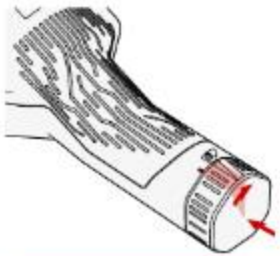
In order to exchange the power module shut down the CAEN F501 first.



Open the battery compartment



Change the power module



Close the battery compartment

Ship batteries in the same transport case with the Discoverad. If you ship them alone, they are considered Dangerous Goods

Recharge and Powering

Recharging of the PM1 Li-Ion 240

To charge **PM1 Li-Ion 240** connect the included USB charger with a power line and the USB plug of the charger with the USB socket of the power module. The status LED is flashing slowly while charging, the four capacity LEDs indicate the battery capacity.

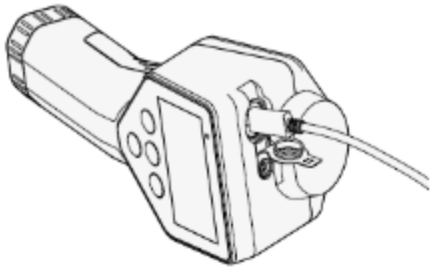
- ●○○○ ⊙ the power module has between 15 % and 40 % capacity and is still charging
- ●●●● ● the power module has between 90 % and 100 % capacity, charging has stopped
- ○○○○ ⊙ fast flashing status LED, the ambient temperature is too low or too high for charging

The power modules can be charged over the built-in micro USB connector with any USB device. Charging may be slower when the provided power is low

Storage of the power modules

Power modules have to be charged before storing. Empty power modules should not be stored longer than a month, after this time the batteries may be damaged by self-discharge. Full power modules have to be recharged after one year of storage.

Recharge the PM1 Li-Ion 240 inside of the CAEN F501



You can charge a power module inside the CAEN F501 without opening the battery compartment.

Open the lid of the USB socket on top of the CAEN F501. Connect the included USB charger with a power line and the USB plug of the charger with the USB socket of the CAEN F501.

A slowly flashing power indicator above the display of the CAEN F501 indicates the active charging process.
The power indicator glows continuously after the charging has stopped.
A fast flashing power indicator indicates that the ambient temperature is too low or too high for charging

The power module inside of the CAEN F501 does not charge, when the CAEN F501 is connected to a PC. This connection can only be used for communication, not for charging.

3. GETTING STARTED

The User Interface

When we talk about the "**User Interface**", we always mean **the interface of the CAEN F501 itself**, with the four hardware buttons and the 800 x 480 pixel color display

in contrast to the "**Web Interface**", which is **displayed in a browser on a connected computer**.

The user interface has no restricted areas, every screen and menu on the instrument is accessible for every operator and represents as such the **routine mode** of the CAEN F501.

If you need to make further changes to the instrument, want to access the nuclide library or download N42.42 files from the CAEN F501, you must connect a computer and go to the web interface, which represents the **expert mode** of the CAEN F501.

Starting the DiscoveRAD

1. Check the battery

(see the battery chapter for details)

2. Press the power button ●

A fast flashing power-on-indicator means that the battery is too low and the CAEN F501 will not start.

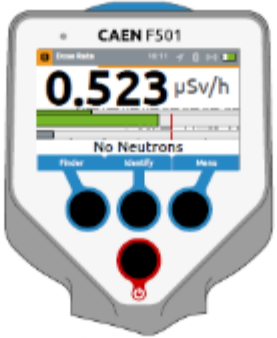
3. Wait. This may take up to 60 seconds.

While displaying the CAEN SyS logo the CAEN F501 loads its software and does some startup quality checks. After that the dose rate screen appears and the CAEN F501 displays dose rate and neutron presence.

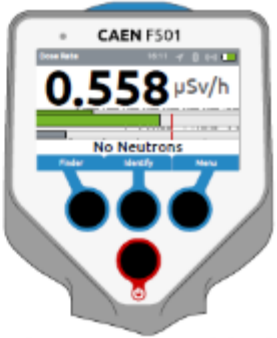
4. The CAEN F501 is stabilizing

In the first seconds after the start the CAEN F501 does its stabilization routine in background. The progress of the stabilization is displayed in the upper right corner of the status bar. The CAEN F501 is fully functional during stabilization.

Press the ● power button...



... the CAEN F501 is stabilizing and fully functional.



The CAEN F501 is stabilized and fully functional.

The CAEN F501 is usually operated with the hardware buttons ● ● ● and the on-board user interface, but it can also be operated via the web interface. Please refer to the appropriate chapters for more information.

Shutdown and Standby

When the CAEN F501 is switched on, the power button has two different functions:

1. Standby

A short press of the power button will instantly put the CAEN F501 in sleep/standby mode.
There are some situations, in which it is not possible to switch to the standby mode, i.e. active alarms, running identifications. In such cases, an additional icon to the right of the battery icon will be displayed indicating that the standby mode is currently not available.
In standby mode, the display and other power consuming hardware are switched off to save as much power as possible, without switching the instrument off completely. When the gamma value approaches the set threshold for a gamma alarm, the standby mode is automatically terminated.

Press the power button again and the CAEN F501 wakes up instantly showing the most recent screen.

2. Shutdown

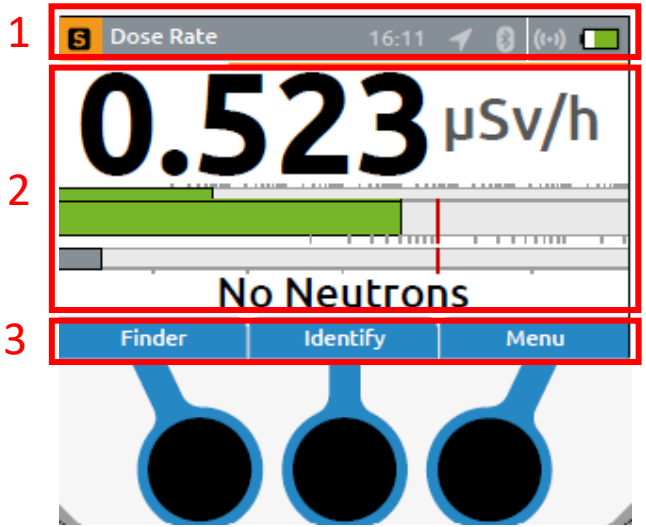
To shut the CAEN F501 down press the power button until the shutdown screen appears. Press **Yes** to switch off the CAEN F501 or **No** to cancel the shutdown process.

The User Interface

We talk about **screens**, when we describe the different modes of the user interface, compared to **pages** of the web interface.

Every screen of the user interface is vertically divided into three main parts:

1. On top: the status bar
2. In the middle: the main content of the different screens
3. At the bottom: the button bar



The CAEN F501 is usually operated with the hardware buttons ● ● ● and the on-board user interface, but it can also be operated via the web interface. Please refer to the appropriate chapters for more information.

The Status Bar

The status bar contains all information regarding the current status of the CAEN F501.

1. The **title** of the current screen.
2. The **time** of the instrument.
3. A set of icons, that indicate the status of:

- **GPS**
  - GPS is switched off
  - GPS is switched on, but has no fix
  - GPS is switched on and has a fix
- **Bluetooth**
  - Bluetooth is switched off
  - Bluetooth is switched on, but is not paired
  - Bluetooth is switched on and is paired
- **Wi-Fi Access-Point**
  - Wi-Fi access-point is switched off
  - Wi-Fi access-point is switched on
  - Wi-Fi access-point is switched on and a device is connected
- **Flight-Mode**
  - Flight-mode is switched off
  - Flight-mode is switched on, Bluetooth and Wi-Fi antennas are switched off
- **Power Supply**
  - The battery is empty; the instrument will shut down very soon
  - The battery is under 10 % capacity
  - The battery is full
  - The battery is connected to a battery charger and loading
  - The battery is connected to a battery charger and completely charged
  - The CAEN F501 is powered from an external power supply
- **Muted Alarms**
  - Alarms are muted
- **Stabilization Progress**

The CAEN F501 is perfectly stabilized

The stabilization is invalid or not present.

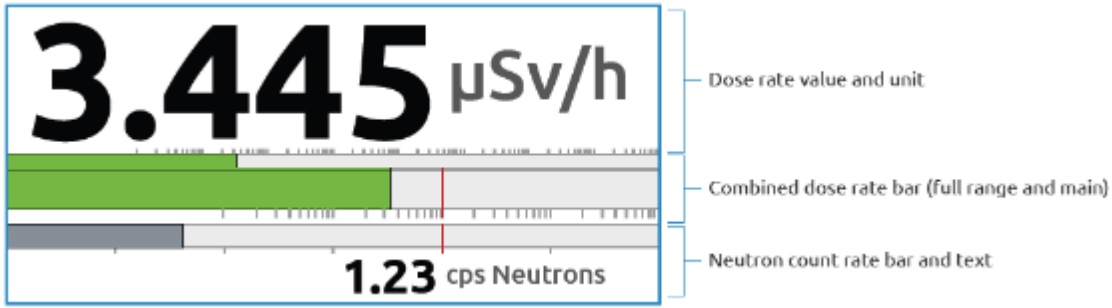
The initial stabilization progress is at 75 %.

(During the initial stabilization only dose rate measurements ar

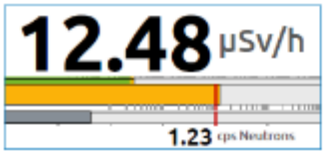
- **Gamma and Neutron Alarms**
  - Active Gamma Alarm
  - Active Neutron Alarm
  - Active Gamma and Neutron Alarm

4. FUNCTIONALITIES DESCRIPTION

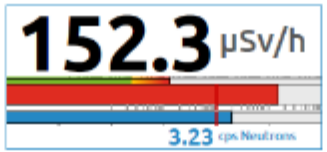
Dose Rate Screen



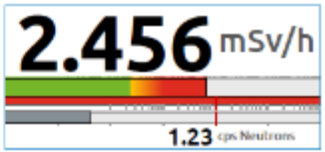
Exemplary states of the dose rate screens.



Dose rate screen with a dose rate above the threshold.



Dose rate screen with a high dose rate and a neutron alarm.



Dose rate screen with a dose rate that exceeds the main dose rate bar.

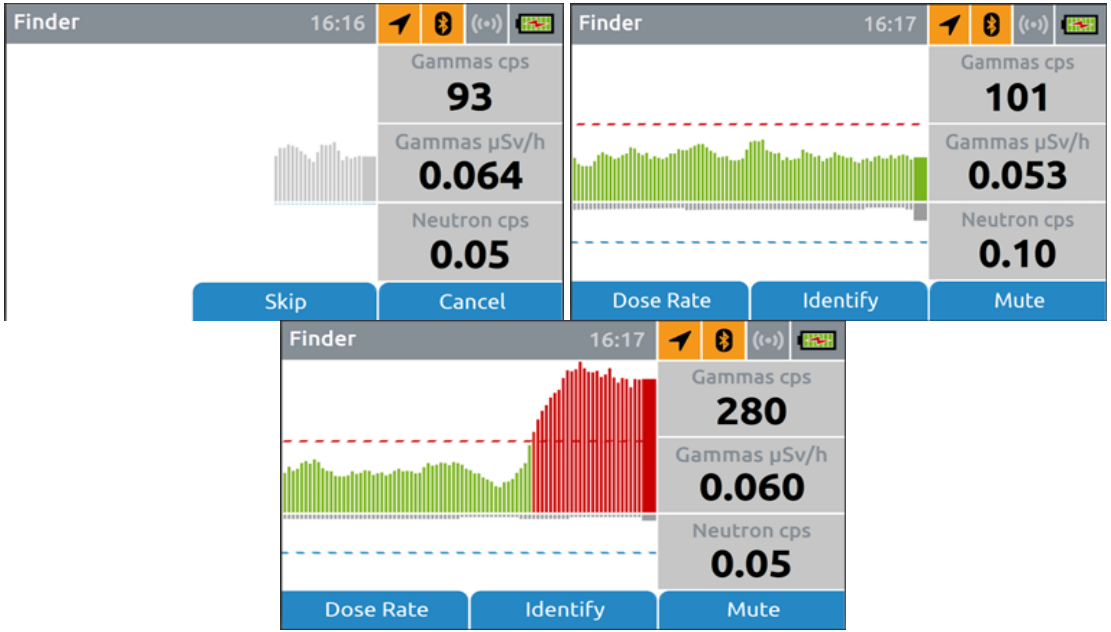
full range bar
small one, display the full dose rate range of theCAEN F501

Beneath the **main bar**
wider one, shows the preset dose rate alarm threshold at 2/3 of the display width.

- Both bars are scaled logarithmically, thin light grid lines indicate the decades.
- The color of the bars change according to the dose rate and dose rate alarm threshold.

neutron count rate bar rises with neutron counts and changes color if the countrate exceeds the threshold.

Finder Screen

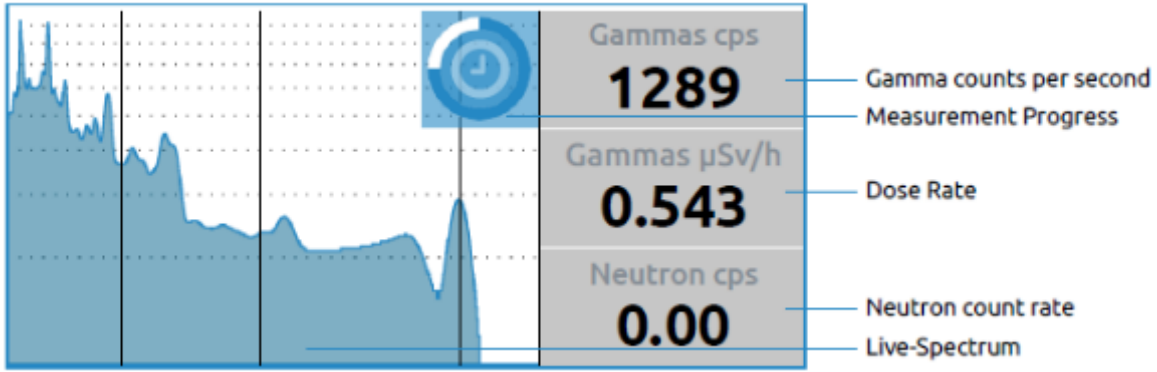


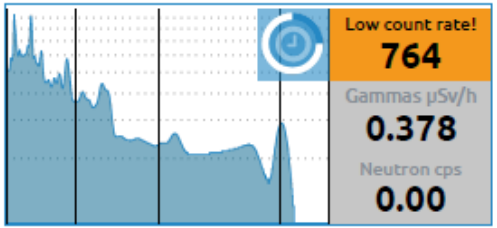
Start to **search for Rad sources** when the **background measurement is completed-**

- Move (sweep) the CAEN F501 **slowly** around and observe the display
- **If bars exceed the threshold,** verify the measurement
- **follow the direction** the CAEN F501 points to at the highest dose rate**.**

If the bars tend to always exceed the threshold, repeat the background measurement (exit to the dose rate screen then go to the finder screen again).

Identify Screen



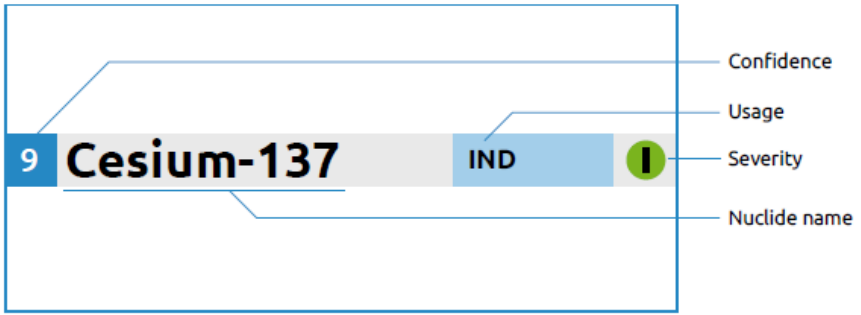


Too low count rate - move closer to source

The **identify running** screen shows up during an identification with the most important information on the progress of the identification.

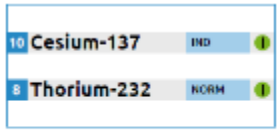
- CAEN F501 needs a minimum count rate to do a reliable identification
- Count rate “too low” indication
- During an ID, only cancel command is available. It bring you back to the Dose Rate screen.

Identify Results Screen

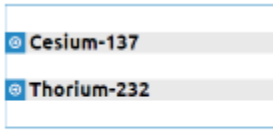


The identification result screen with a single identification.

Result screen with one identification



Result screen with two identifications



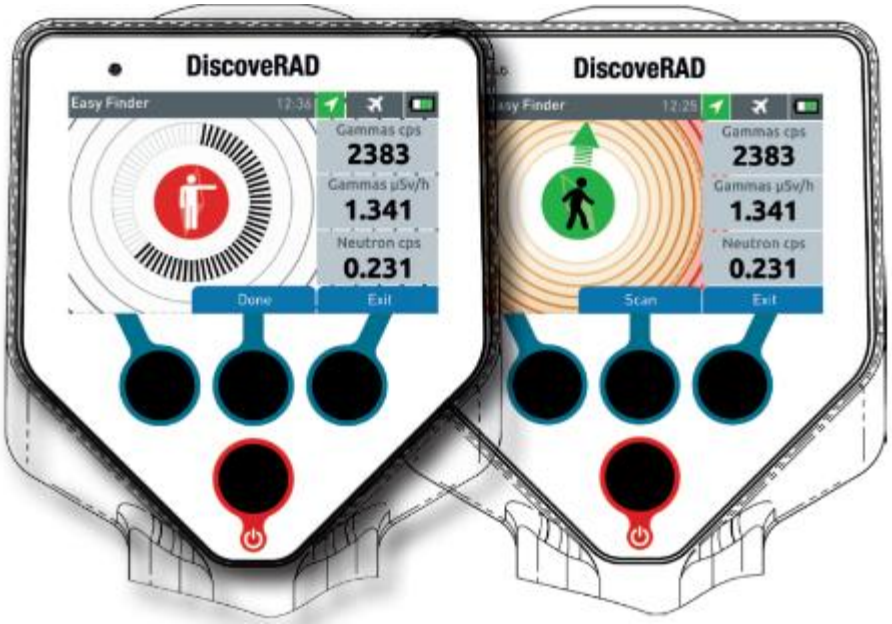
The same result without classification and confidence indicators

The identify result screen displays the results of an identification

- Up to 4 radionuclides displayed, sorted by confidence and nuclide name
- "**No identification**" display is possible
- Every ID automatically saved in the internal Database
  - DB with all IDs can be browsed by web interface
- **Confidence of ID** of the nuclide (1 min – 10 max)
- **Nuclide name** with mass number
- **Usage** (IND, MED, NORM, SNM, SNMR, NUC)
- **Severity**

- **Extend** ID time add another ID run with 1x *Id Statistics* time. Analysis is done on both spectra. Can be repeated as long as you want.

Easy Finder Screen



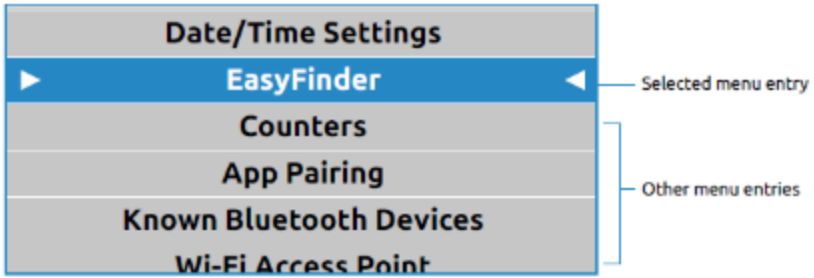
The EasyFinder screen is an innovative way to locate radioactive sources.If the bottom end of all menu entries is reached, the selection starts on the top again.

- actively scan the surroundings for radioactive sources.
- Move slowly through the area you want to survey in stripes of ~3m distance.

Radial scan

- Hold CAEN F501 horizontally with your outstretched arm and turn around your axis.
- turn slowly and to move the CAEN F501 on a circle around your body.
- Scanned angles are marked on the display
- If the result is unambiguous an arrow pointing in the direction of the suspected source appears
- Keep standing still and turn around your axis until the arrow turns green and points to the top of the screen.

Main Menu Screen



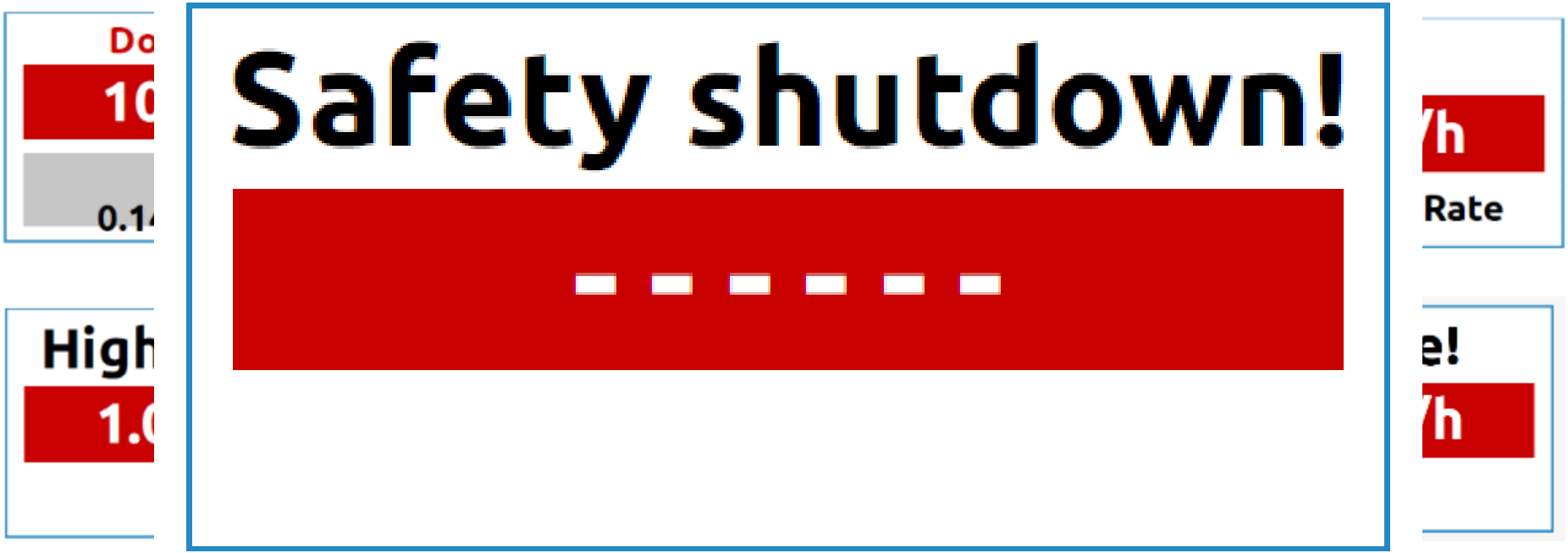
The menu screen with all entries

- The **Next** button activates the next menu entry.
  - If the bottom end of all menu entries is reached, the selection starts on the top again.
- The center button is to **Navigate or Activate** the menu entry
- The **Back** button takes you back to the former screen.

Navigate all the main menu entries with a trainer

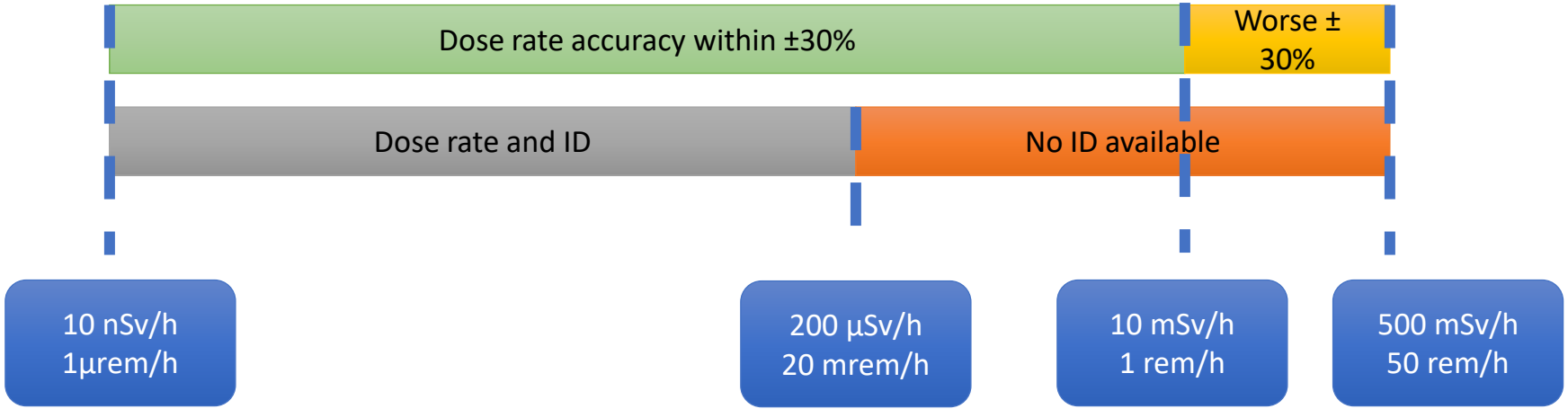
Alarm Screens

Every alarm will **automatically be saved to the internal data base** of the CAEN F501 with a unique id in the moment the alarm is stopped. You will not lose any data if you swap batteries or run out of battery power after the alarm has stopped. You can browse the database with all alarms via the **web interface**.



Extended Dose Rate Range

- In a 2x1 BGO the same efficiency of a 2x2 NaI(Tl) but lighter and smaller
- Gamma dose rate and H*(10) (ambient dose equivalent rate)
- Superior efficiency with rugged non-hygroscopic BGO detector: not yellowing or aging
- Less resolution vs a NaI(Tl) → Patented ID algorithm based on template match



5. WEB INTERFACE

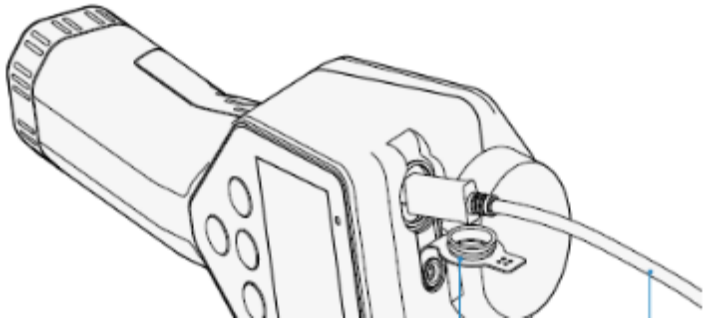
Expert Settings

After you have connected the computer to the CAEN F501, you can access the web interface.

With the web interface you can change the setup of the instrument, alarm thresholds and display settings or access the radionuclide library.

With the web interface, settings can be changed, that may affect the results of measurements.
Use it carefully and change things only, if you know, what you are doing.

For this reason, some pages of the web interface are password protected. You can identify them by the 🔒 icon in the menus or to these pages.



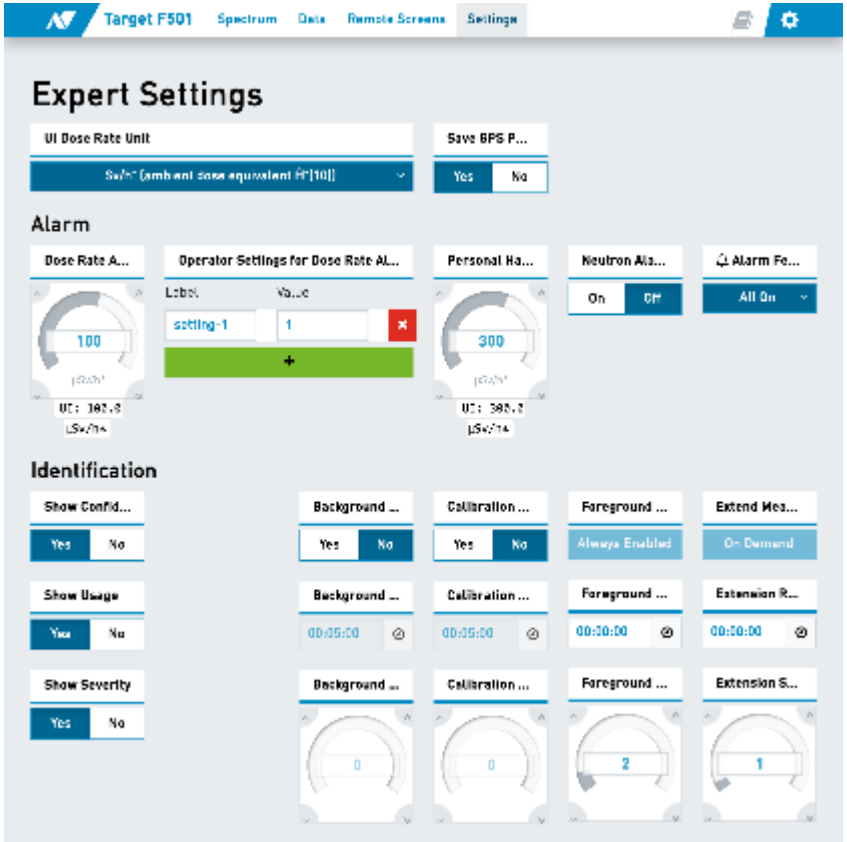
- Spectrum: you can record a spectrum and download the recorded data to your computer
- Data management
  - Identifications
  - Dose rate alarms
  - Neutron alarms
  - Personal hazard alarms
  - Sessions

Secon screen: support the operator with some special views andcontrols for the CAEN F501 user interface.

  - If the bottom end of all menu entries is reached, the selection starts on the top again.
- The center button is to **Navigate or Activate** the menu entry
- The **Back** button takes you back to the former screen.

Expert Settings

Expert settings accessible by webinterface



Video and hands-on

- kit composition
- Start and play
- Smartphone pairing and webinterface navigation
- Webinterface advanced
- Quick troubleshooting

DiscoveRAD main references

CUSTOMER	SCOPE
SORIM S.R.L.	Company in charge of measurements for quality check in hospitals
ZATCA هيئة الزكاة والضريبة والجمارك Zakat, Tax and Customs Authority	More than 20 units purchased to be deployed at different Custom border and Ports in Saudi Arabia
LARSA scientific LARSA scientific	UAE agents buy a unit for demo and training purposes
Beijing Phyclover PhyClover 中 检 电 子	Cina agents buy a unit for demo and training purposes
CAEN India IN CAEN	India agents buy a unit for demo and training purposes

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