kromek
detect image identify

D3S ID
User Manual

INDEX

Introduction

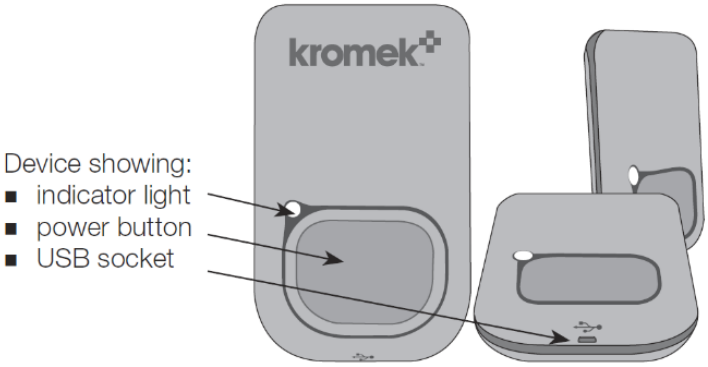
The D3S ID is a unique radiation detection solution which incorporates the Kromek D3S detector with an Android smartphone. The D3S integrated technology combines a CsI(Tl) gamma ray spectrometer and a non-He^3 compact thermal neutron scintillator detector.

The D3S hybrid gamma/neutron platform neatly combines high sensitivity, small form factor and a long battery life to produce an ideal portable instrument, that seamlessly connects via Bluetooth with the D3S ID smartphone application.

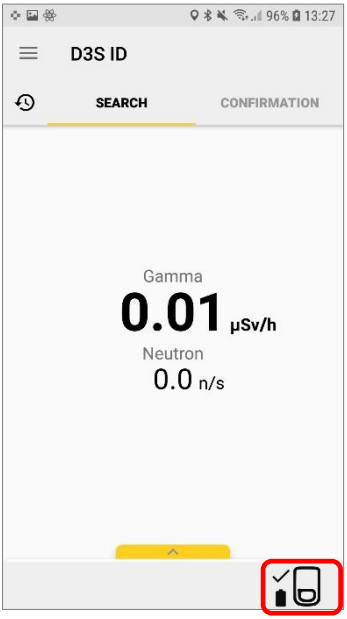
1 Power On / Off

The D3S is powered on by holding the power button for 1 second and the indicator light will start to flash.

The D3S is powered off by holding the button for 5 seconds and the indicator light will go out or turn white if it is still connected to a power source.



1.1 Warm-up Time



Warm-up time is the time required for the D3S ID to become fully functional from a dead start (off state).

This involves switching the already paired D3S detector and smartphone on, opening the D3S ID application and for the status to be connected and ready. This is indicated by the tick mark at the bottom right hand side and that gamma and neutron dose rate are displayed.

The warm-up time is ~40 seconds.

2 Charging the D3S

The D3S detector can be charged by connecting power via the USB cable or by placing the D3S into the Kromek induction charging station.

N.B. Only the Kromek branded USB cables provided should be used during charging as they contain surge protection to avoid damage to the D3S detector.

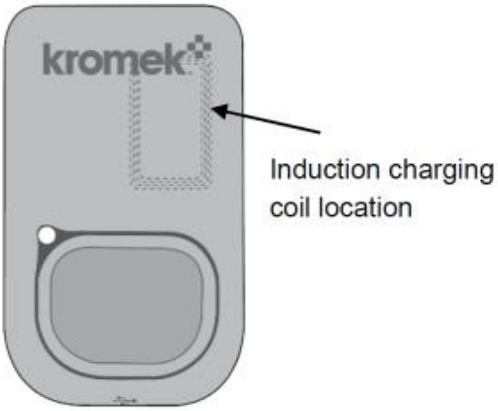
2.1 USB Charging

When power is connected via the USB cable, the D3S will start charging, indicated by the waving LED light. When the D3S is fully charged, the LED indication is solid light, instead of waving light. The battery percentage level can also be confirmed on the D3S ID app by disconnecting the USB charger and opening the status panel as shown in Section 5.1 D3S Status Panel.

If the D3S is powered off while charging, the indicator light will be white.

2.2 Kromek Inductive Charging

Place the D3S face up in the Kromek inductive charging station. Charging will automatically start, indicated by the pulsing indicator light.



3 D3S Indicator Light

The indicator light on the front of the D3S is used to convey the status of the D3S detector.

The light's colour indicates whether the device is switched on, charging and/or connected to the smart phone.

Indicator Light Colours						
Unlit	White	Orange	Yellow	Purple	Blue	Green
Off	Off / Charging	Fault	Waiting for Data Connection	Bluetooth Pairing Mode	Bluetooth Data Connection	USB Data Connection

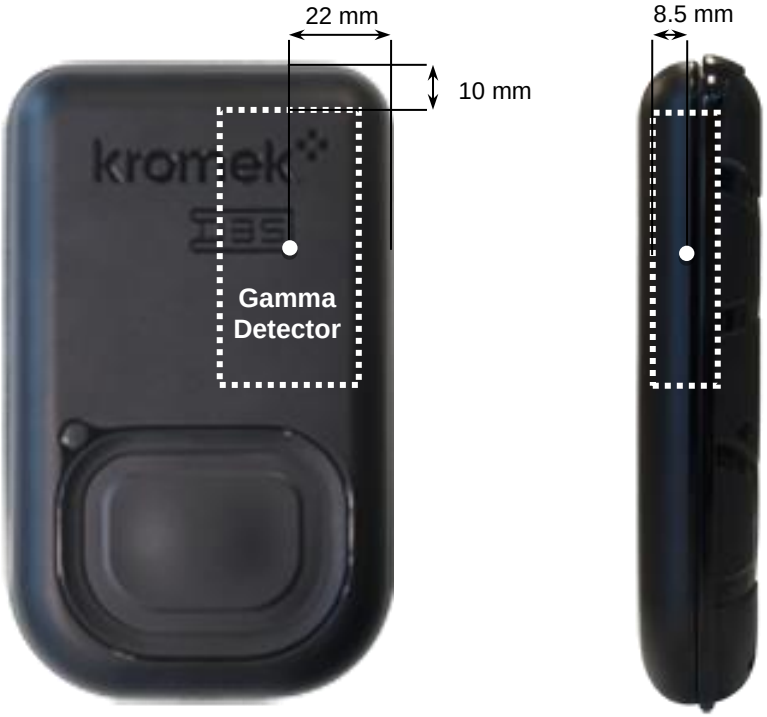
The light flash indicates the battery and charging status.

Indicator Light Operation				
Pulse Every 5 seconds	Continuous Fast Pulse	Wave	Solid	Triple Flash Every 1 Second
Normal Battery	Low Battery	Charging	Fully Charged	Fault

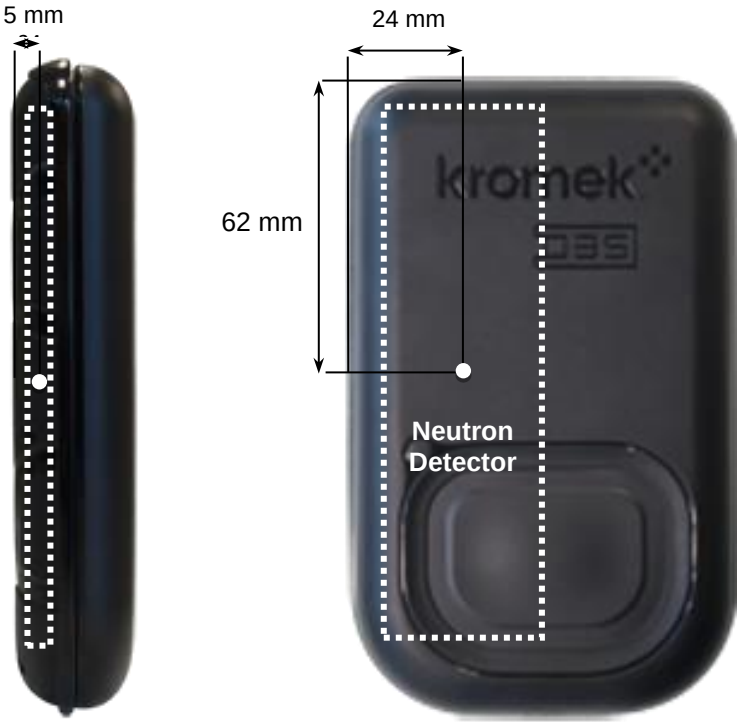
4 D3S Detector Reference Points

D3S contains 2 detectors, gamma and neutron. The following figures show the locations and the measurement reference points for each detector.

4.1 Gamma Detector Reference Point



4.2 Neutron Detector Reference Point

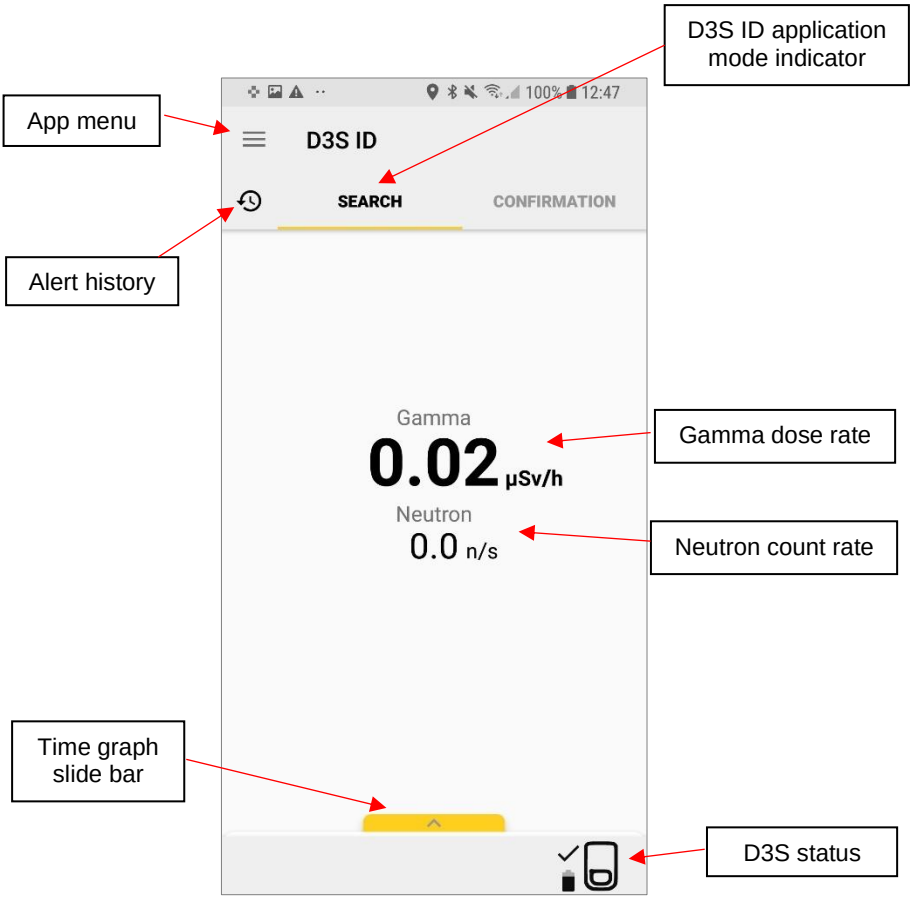


5 D3S ID Application Overview

The D3S ID application on the smartphone provides a user-friendly interface and visualisation of the acquired data from the D3S detector.

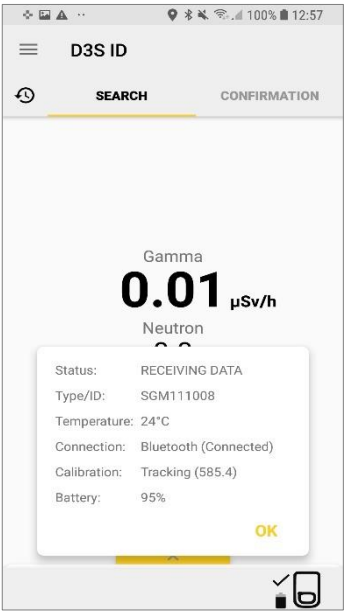
To use the D3S ID smartphone application, turn on the phone and press the D3S ID logo.

The smart phone application home screen display is shown below.



5.1 D3S Status Panel

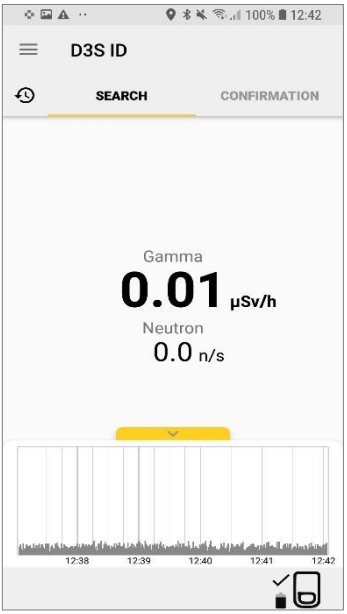
The D3S Status Panel gives details of the detector status when the D3S is connected with the smartphone.



- Status of “RECEIVING DATA” indicates continuous stream of data received from the D3S detector
- Type/ID shows the serial number of the connected D3S
- Temperature shows the temperature of the D3S
- Connection shows the type of connection between the D3S and smartphone (Bluetooth or USB)
- Calibration shows the K-40 tracking status; “Acquiring” shows when counts of natural K-40 are being acquired. When enough counts have been acquired to feed into the algorithm, “Tracking” status is shown
- Battery shows the battery level of the D3S. At 15% it will turn yellow, and at 5% it will turn red.

5.2 Search Mode

Search Mode is designed to be used to continuously scan and search for radiation whilst the user is going about their normal duties.



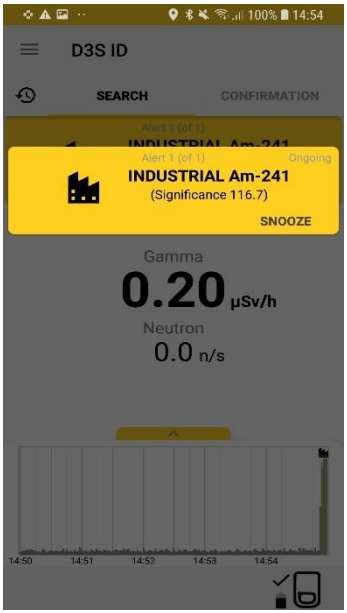
The scan is initiated automatically once a D3S is connected. It will continue to scan until the D3S is manually disconnected or the phone is turned off.

The scan will also pause when the user navigates to the Confirmation Mode (Section 5.3) and will resume once user navigates back to the Search Mode.

The time graph showing background reading in counts per second (CPS) in 10 minutes period can be displayed by dragging the slide card up.

The device uses a three second rolling average to detect and identify radioisotopes and the screen is updated every second.

When radiation is detected the smartphone will vibrate and an audible alarm will sound ‘Alert’ and name the detected isotope e.g. ‘Alert Americium-241 detected’ or ‘Alert high neutron count’.

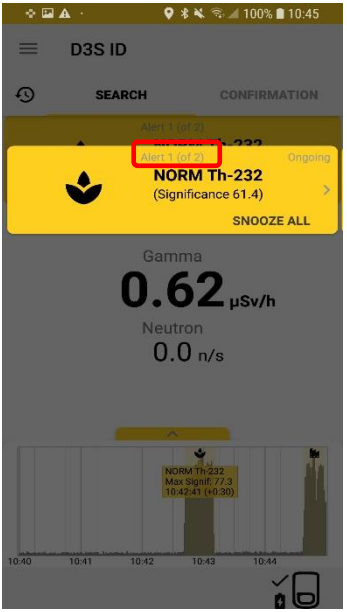


A pop-up window will be displayed, which contains information on the detected isotope and isotope classification (NORM, Medical, Industrial or Special Nuclear Material).

Click “SNOOZE” to acknowledge the alarm.

If more than one isotope is detected, an indication “Alert 1 (of 2)” will be displayed on the pop-up window. Swipe to the left to display the next alert.

Click “SNOOZE ALL” to acknowledge the alarm.



Visual notification panel of the alert will be displayed until the radioactive source is removed.

The icon on the time graph can be clicked to display the alarm information.

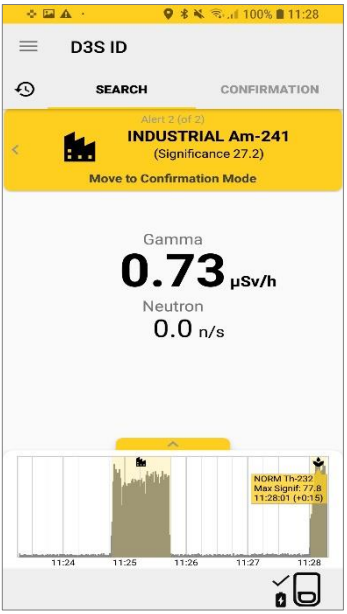
Below is the list of icons for each isotope classification.

Naturally Occurring Radioactive Material (NORM)

Medical

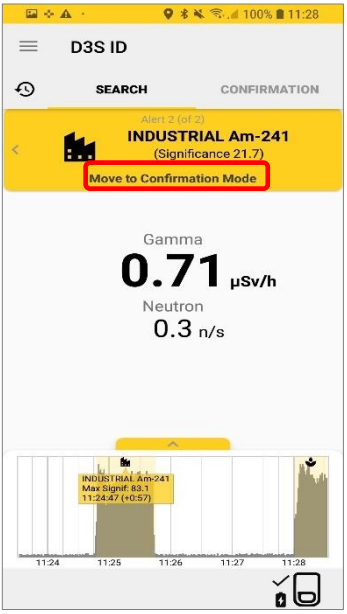
Industrial

Special Nuclear Material (SNM)



"Move to Confirmation Mode" displayed on the notification panel is a clickable link which takes user to the Confirmation Mode.

The acquired data is saved and updated in real time onto the phone. Refer to Section 8 Saved Data for more information.

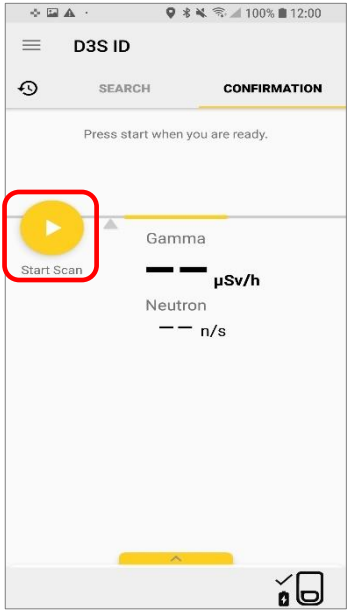


5.3 Confirmation Mode

After a radiation source has been detected during Search Mode, user can select the "CONFIRMATION" tab to go to Confirmation Mode to confirm the isotope identification.

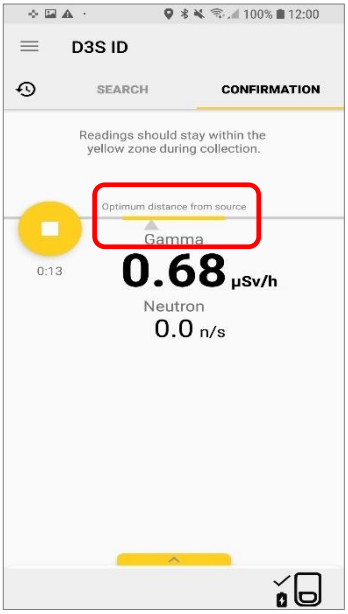
Click the "Start Scan" button to initiate the Confirmation Mode scan and confirm the isotope identification.

Note: The Search Mode scan will stop once switched to Confirmation Mode



The confirmation scan can be conducted from 30 seconds up to 5 minutes. During the scan gamma dose rate and neutron count rate are updated every second. Isotope identification is updated and displayed every 30 seconds.

The grey triangle moves depending on the number of gamma counts the device is detecting. The grey triangle should be kept within the yellow bar for optimum identification.



After 30 seconds, if a radioisotope is identified, the smartphone will vibrate, and an audible alarm will sound ‘Alert’ and name the detected isotope e.g. ‘Alert Americium-241 detected’ or ‘Alert high neutron count’.

A pop-up window will be displayed, which contains information on the detected isotope and isotope classification (NORM, Medical, Industrial or Special Nuclear Material).

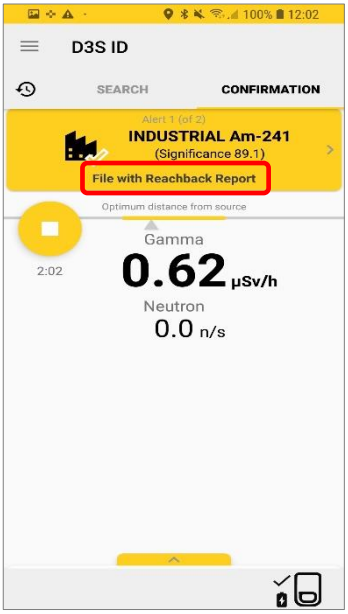
Similar to the Search Mode, if more than one isotope is detected, an indication “Alert 1 (of 2)” will be displayed on the pop-up window. Swipe to the left to display the next alert.

Click “Continue” to continue the scan for up to 5 minutes or “Stop ID” to stop.

Visual notification panel of the alert will remain displayed. If more than one isotope is detected, an indication “Alert 1 (of 2)” will be displayed on the pop-up window. Swipe to the left to display the next alert.

“File with Reachback Report” displayed on the notification panel is a clickable link which opens the Reachback Report panel.

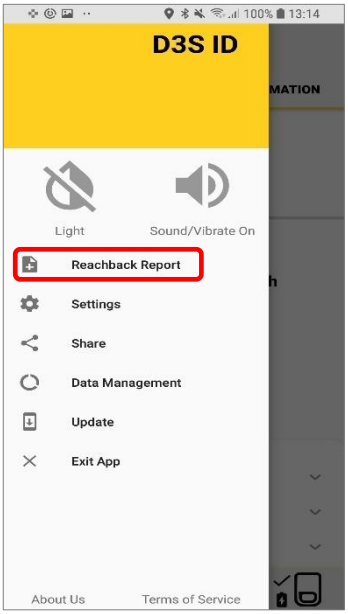
The acquired data is saved onto the phone. Refer to Section 8 Saved Data for more information.



5.4 Reachback Report

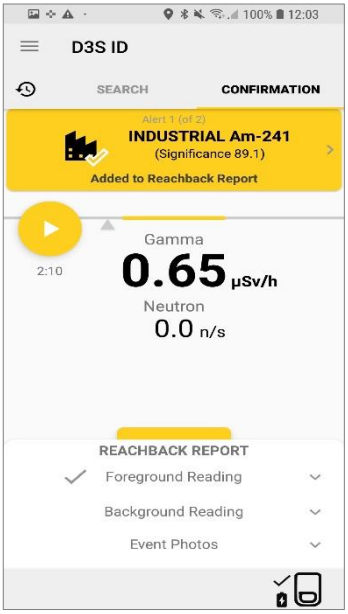
Reachback Report is a feature to share the acquired data, including the background reading. It can be accessed by:

- Pressing the clickable link on the notification panel after a confirmation scan as described in Section 5.3
- Going to Confirmation Mode and opening the slide card at the bottom
- Going to Menu > Reachback Report



Before data can be shared, it is mandatory to acquire foreground and background readings. Event photos and details sections are optional.

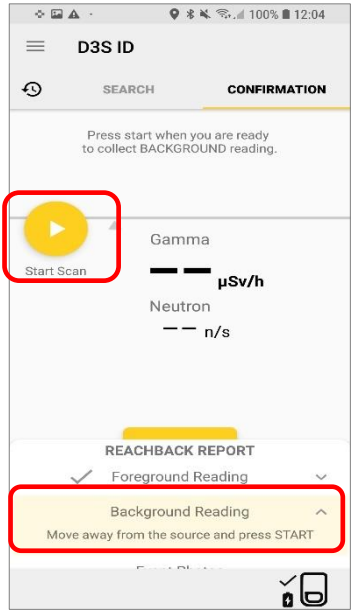
Once a reading has been completed, a tick is displayed next to it.



Select “Background Reading” and ensure the detector is away from any radioactive source. Press “Start Scan” to initiate the scan.

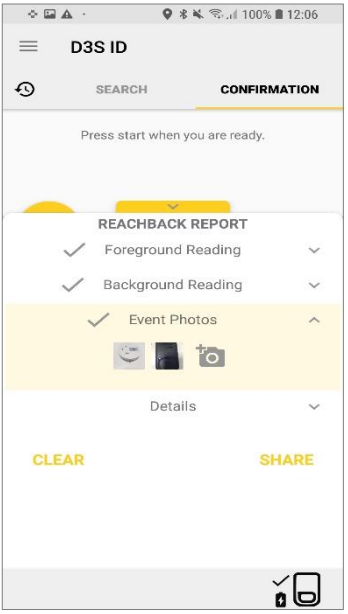
The background reading needs to be carried out for a minimum of 30 seconds to maximum of 5 minutes.

Stop the scan once the required scan time has been acquired.



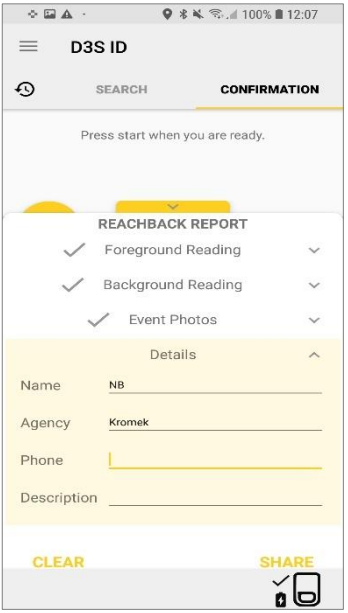
Further expand the Reachback Report panel by dragging up the slide card.

Up to 5 photos can be included within the Reachback Report.



The “Details” section can be filled in, to further aid adjudications.

Click “Share” to send the reachback report package.

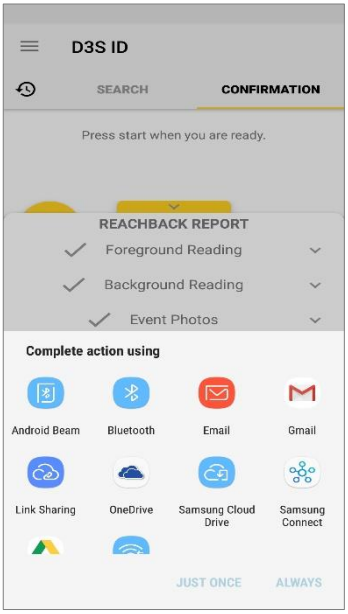


The reachback report package is sent in a zip folder via the selected and compatible app.

The zip folder contains:

- Foreground data in XML/N42 format
- Background data in XML/N42 format
- Event photos
- Details description in XML format

Note: Foreground and background data files are saved and shared in XML format. They can be changed to N42 file format by simply changing the file extension.

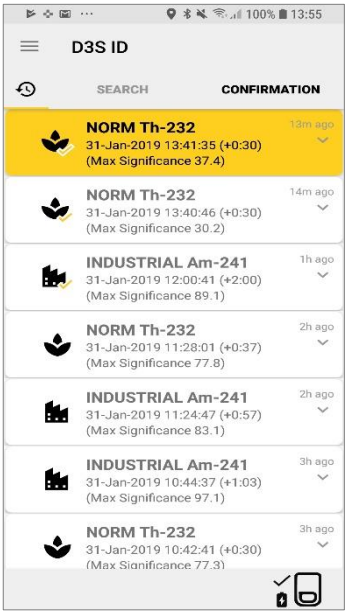


5.5 Alert History

The Alert History (clock icon) shows a list of previous alerts where each of the items are expandable. The Alerts History can store up to 100 most recent alerts, of which 50 can be from Confirmation Mode scan result.

The Confirmation Mode alerts are indicated by the yellow tick on the classification icon while Search Mode alerts have no tick.

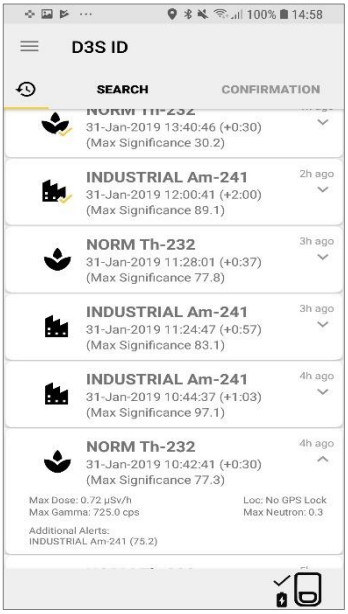
The alerts are sorted by time of alert with the most recent at the top of the list. A new and ongoing alert is shown with yellow background.



Expanding a Search Mode alert will display the following details associated with the alert:

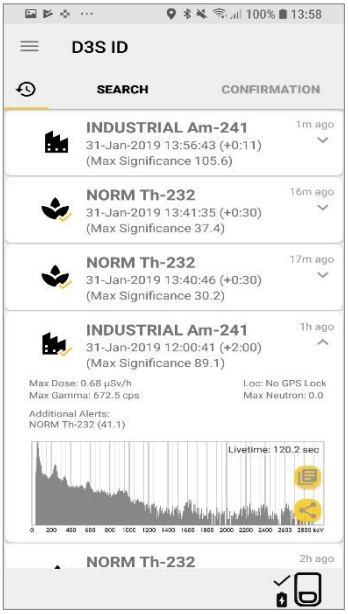
- Max dose rate
- Max gamma counts
- Max neutron counts
- Alert location in longitude and latitude
- If any, other isotopes detected simultaneously

Note: Location may display “No GPS Lock” in locations with no GPS signal, e.g. inside of a building

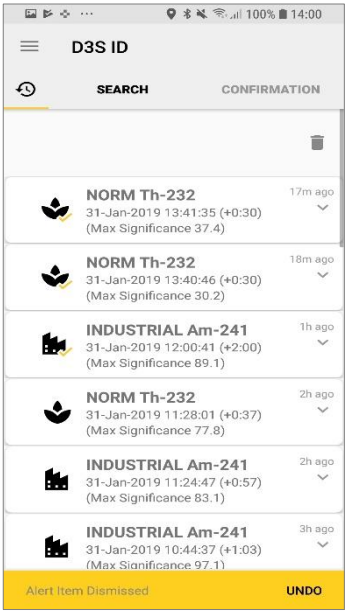


Similar to the Search Mode alert, expanding a Confirmation Mode alert will display the alert details. Additionally, a spectrum plot in exponential scale is also shown.

The yellow buttons indicate there is an N42 associated with the alert item, which can be viewed or shared. If the N42 had been deleted, then it will not show the buttons.



Deleting the alert is done by swiping left. There is an option to UNDO delete by pressing on the yellow snack bar for the next 5 seconds. The data itself will not be deleted.



6 D3S to Smartphone Connection

The D3S detector communicates and transmits data to the smartphone via Bluetooth or USB.

6.1 Bluetooth Connection

The D3S detector is delivered already paired to the smartphone via Bluetooth. Under normal circumstances there should be no need for the user to re-pair the detector to the phone.

Should the user need to use the phone with a different D3S device, it is recommended that the phone is un-paired from the original D3S before pairing it with the new D3S, as detailed in the Bluetooth Troubleshooting section below.

6.2 Bluetooth Troubleshooting

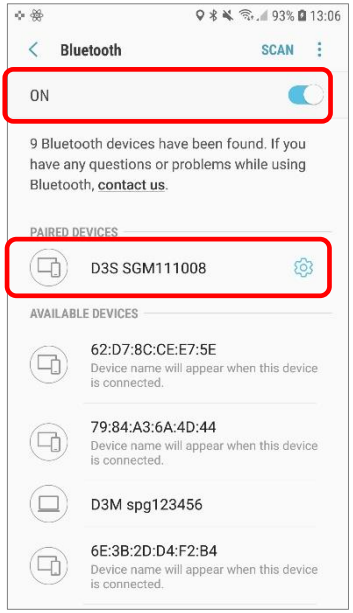
Should there be a problem with the Bluetooth connection between the D3S and the smartphone, the procedure outlined below should be followed in order, to identify and resolve the problem.

6.2.1 Bluetooth is on and paired

Ensure that the D3S is turned on and the smartphone Bluetooth is turned on.

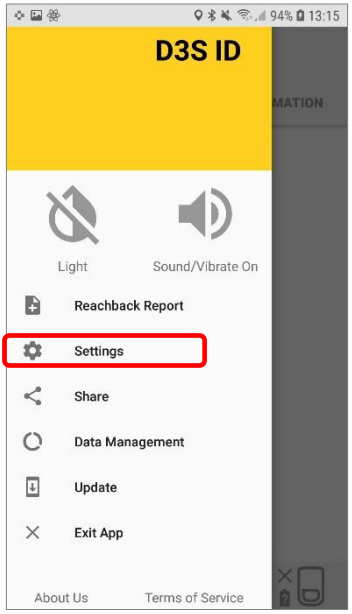
From the smartphone home screen, open the 'Settings' application, select 'Connections' and select 'Bluetooth' to access the Bluetooth Configuration menu.

Check the serial number of the paired D3S to ensure the correct device has been paired.

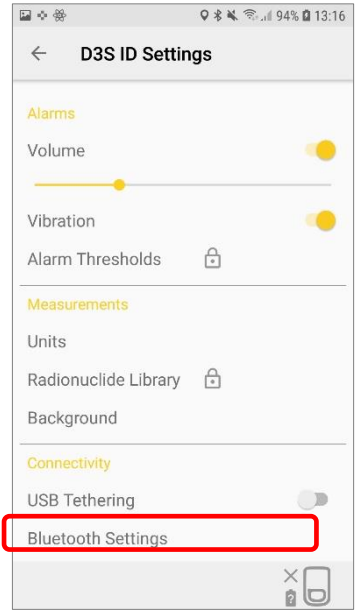


6.2.2 Bluetooth configuration

From the D3S ID application, go to:
Menu > Settings



Click “Bluetooth Settings”



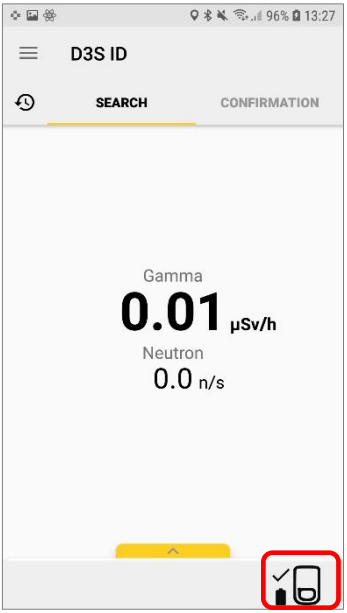
Under “Paired Devices”, ensure that the correct D3S serial number is displayed. Click the serial number to reset comms.

The D3S status at the bottom right hand side should now be connecting.

Go back to the app home screen.

The D3S status at the bottom right hand side should now be connected, indicated by the tick mark.

Gamma and neutron dose rate should now be displayed.



6.2.3 Power Cycling

Power off both the D3S and the smartphone and wait for at least 5 seconds before powering them back up.

Click the D3S ID app icon on the smartphone to open the D3S ID application.

The D3S detector indicator light should turn blue after ~10 seconds indicating Bluetooth connection has been established.

The D3S status at the bottom right hand side should now be connected, indicated by the tick mark. Gamma and neutron dose rate should now be displayed.

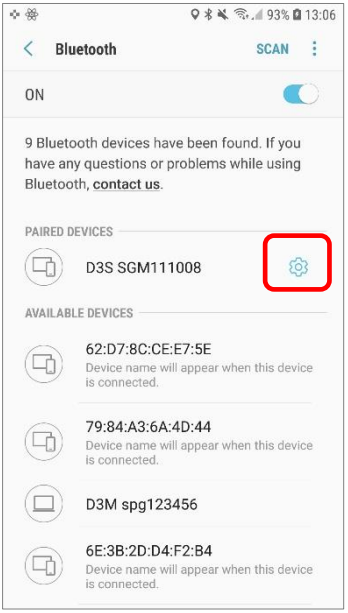
If not, repeat this process once more.

6.2.4 Un-Pairing

From the smartphone home screen, open the ‘Settings’ application, go to ‘Connections’ and select ‘Bluetooth’ to access the Bluetooth menu.

Under ‘Paired devices’ click the settings cog icon to the right of the corresponding D3S serial number then select ‘Unpair’.

The D3S indicator light should now be yellow, pulsing every 5 seconds.



6.2.5 Re-Pairing

To re-pair the smartphone and D3S, the detector needs to enter Bluetooth pairing Mode.

a) Turn the D3S off and wait for at least 5 seconds.

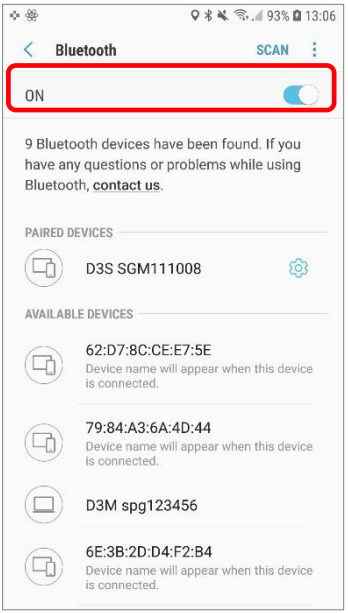
b) Hold the D3S button down for 6-8 seconds until the indicator light switched from yellow to purple.

c) Turn phone Bluetooth on and search for the D3S serial number. Under 'Available devices' select the corresponding D3S serial number to pair with the phone. If the D3S is not listed under the 'Available devices', select 'Scan' from the top right corner of the screen to initiate a scan to detect the D3S device.

d) If the D3S is still not listed under the 'Available devices' once the scan is complete, use the toggle switch below 'Scan' to turn Bluetooth off and on again, then repeat step c.

e) The D3S detector will stay pairable (purple indicator light) until a device successfully pairs or 60 seconds elapses.

Open the D3S ID app. Perform the steps in 6.2.2 Bluetooth configuration



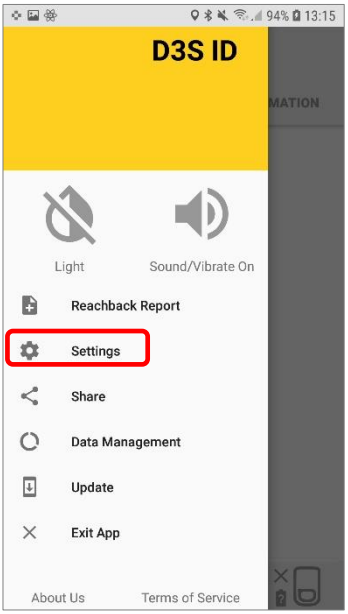
6.3 USB Connection

If required, the D3S can be connected to the smartphone via USB.

Ensure that the D3S has been turned on.

From the D3S ID application, go to:

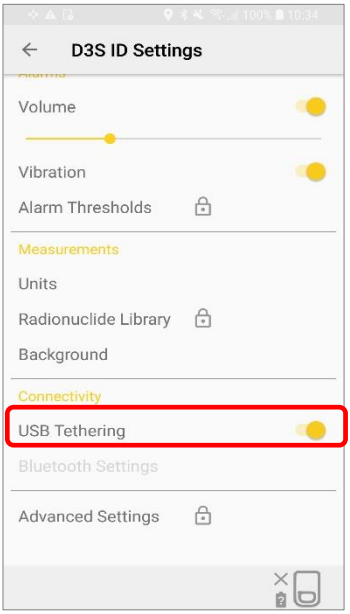
Menu > Settings



Within the Settings Menu, switch on “USB Tethering”.

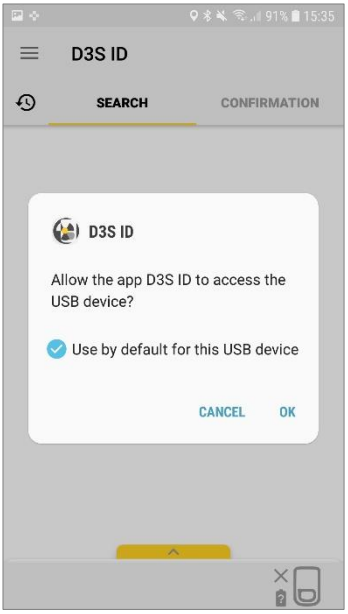
Go back to the app home screen.

Connect the D3S to smartphone via the male micro USB to male micro USB connector, ensuring that the ‘host’ end is plugged into the phone, and the other end is plugged into the D3S.



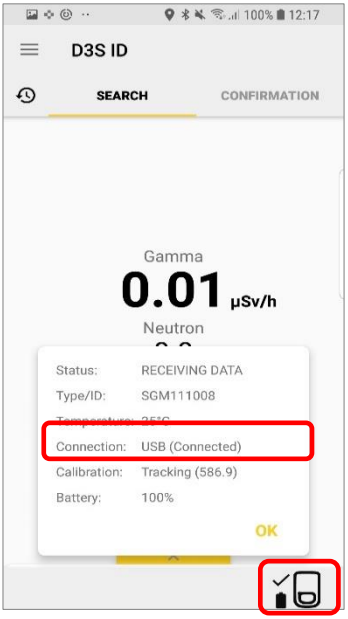
When the pop-up message ‘Allow the app D3S ID to access the USB device’ appears, tick “Use by default for this USB device” and click ‘Ok’.

If the pop-up message does not appear, swap the USB cable connections over in case the ‘host’ end has been plugged into the D3S by mistake.



After a few seconds the D3S should be connected to the phone via USB as indicated within the D3S status.

The D3S LED indicator light should turn green indicating that it is ready for use.



7 System Menu

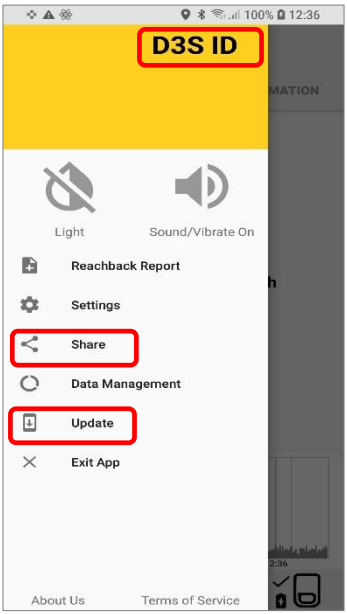
7.1 Pull-out Menu

The application pull-out menu can be accessed by clicking the app menu icon on the top left corner.

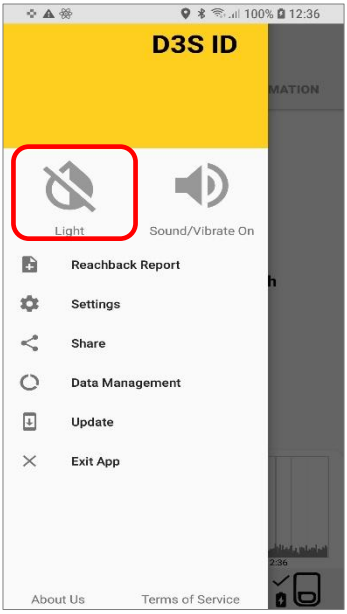
Clicking on "D3S ID" on the Pullout menu will show version history.

“Share” menu will share the latest N42 file from Confirmation Mode scan saved on the phone.

“Update” menu will check for any available update for the app. Ensure there is internet connection



Invert icon will invert color between light and dark.



Volume and vibration can be set either in the settings or the pullout menu.

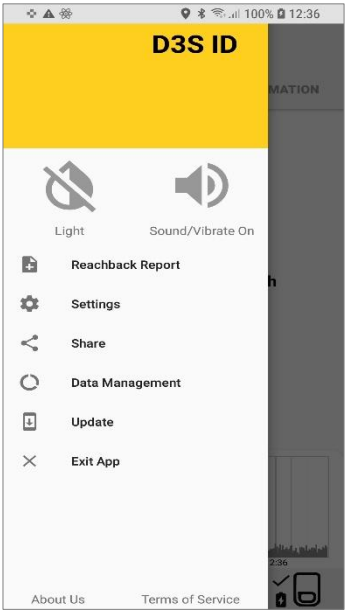
In the pullout menu, it will cycle through in the following order:

Sound On/Vibrate On -> Sound Only -> Vibrate Only.

BOTH sound and vibration can only be turned OFF by going to:

Settings > Alarm Thresholds

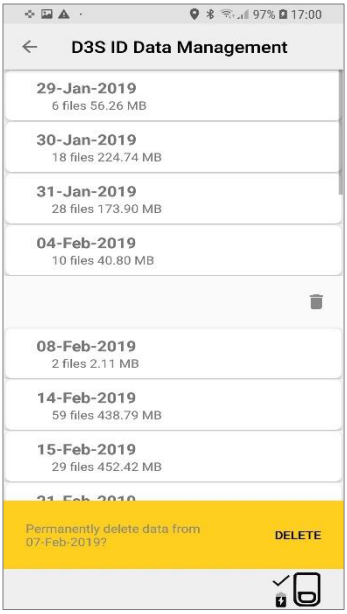
As shown in Section 7.2.1



Data Management Will show a list of days with data present.

Swiping to left will give a message to confirm delete. Data will only be deleted when it is confirmed to be deleted.

Deleting data is permanent.

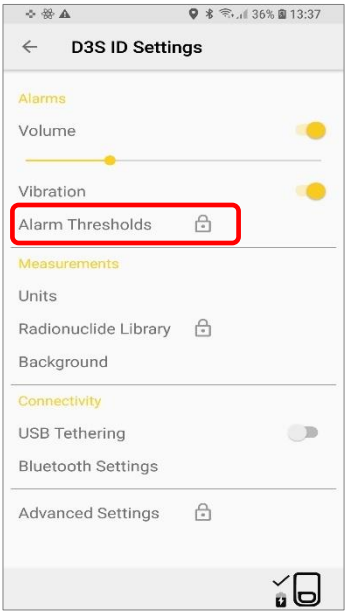


7.2 System Settings

7.2.1 Alarms Threshold

Alarm Threshold can be accessed using the Restricted Mode Access password.

The default password is: 123456

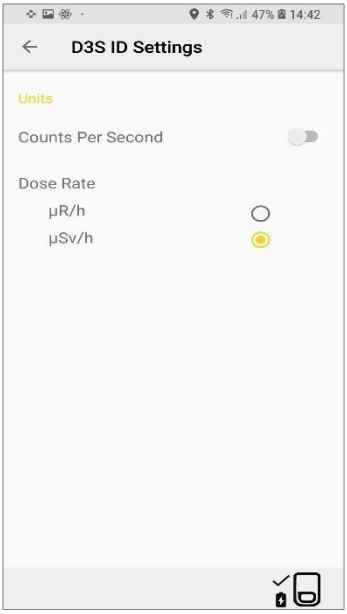


Alarm Thresholds contains:

- GAMMA Personal Protection) threshold for the Personal Gamma Alarm.
- Neutron (k-σ) is a multiplier of the n-sigma above threshold, set to 5 by default.
- Gamma (k-σ) is only enabled when identification capability is turned off in PRD MODE (refer to section 7.3).
- Allow Audio and Vibration Off allows complete silence of the alarms (i.e. both Sound and vibration are off). An alarm off indicator will be shown.

7.2.2 Units

UNITS can be set to display in terms of counts per second (cps) or dose rate (µR/hr or µSv/hr)



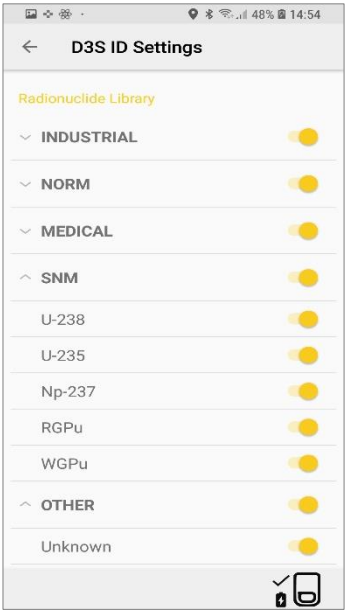
7.2.3 Radionuclide Library

Radionuclide library can be accessed using the Restricted Mode Access password.

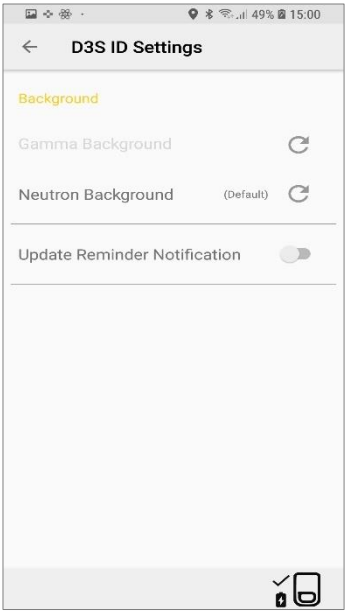
The default password is: 123456

Any isotope within this library can be muted. Once muted, the isotope will **not** be removed from the algorithm; the alarm will simply not be displayed.

“Unknown” isotope indicates any isotope that has been identified by the algorithm that is outside the isotope library.



7.2.4 Background



Background is used for k-sigma.

Gamma background is only enabled when identification capability is turned off in PRD MODE (refer to Section 7.3).

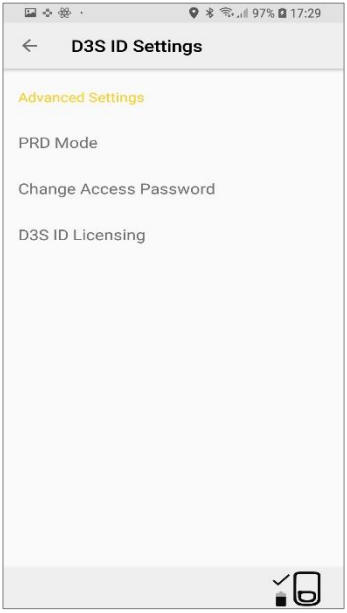
Neutron is used all the time.

Clicking on the refresh icon will start a background collection for 60 seconds for Gamma and 120 seconds for Neutron

Long click on the "Gamma Background" or "Neutron Background" will display the current rate and sigma.

Enabling Update Reminder Notification will alert user that background needs to be refreshed after 1 hour, every 5 minutes.

7.2.5 Advanced Settings



Advanced Settings can be accessed using the Restricted Mode Access password.

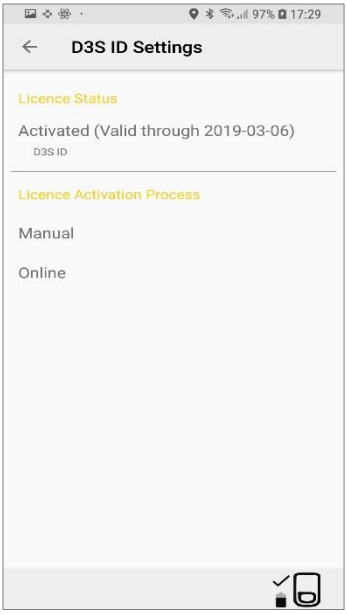
The default password is: 123456

The PRD Mode settings is outlined in Section 7.3.

The Restricted Mode access password can be changed within the Advanced Settings.

Note: forgotten password is unrecoverable

D3S ID Licencing shows your active licence validity. This utility can also be used to upgrade or activate a new licence**.**



7.3 PRD Mode

The device can be switched from ID mode to PRD mode and vice versa via the advanced settings, provided the appropriate licence key is employed.

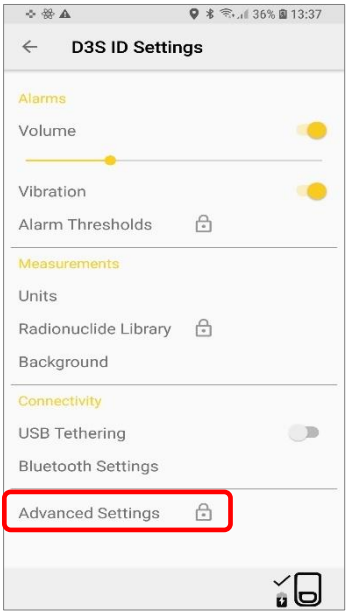
7.3.1 Switching from ID to PRD Mode

Advanced Settings can be accessed using the Restricted Mode Access password.

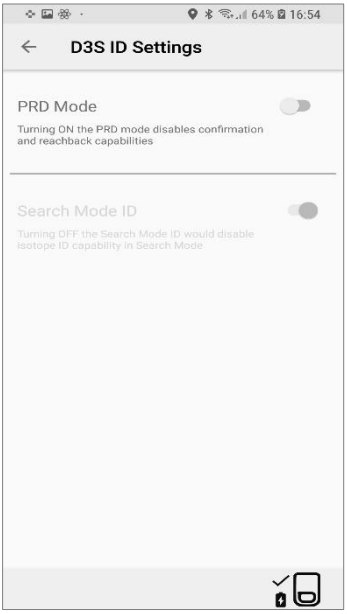
From the app screen go to:

Menu > Settings > Advanced Settings > enter password > PRD Mode

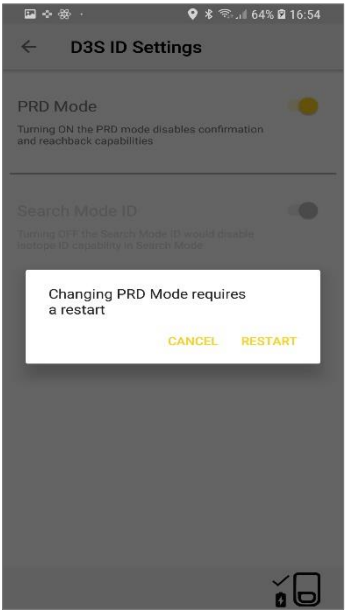
The default password is: 123456



Turning the PRD Mode on will disable the Confirmation Mode, Reachback Report and Alert History capabilities.

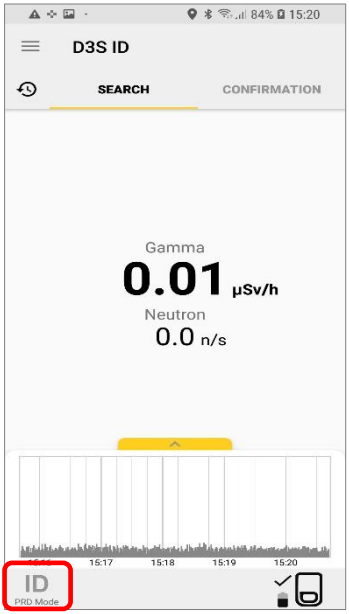


Clicking “Restart” will restart the app, not the phone.



Once restarted, the app should be in the PRD mode, as indicated by the mode status at the bottom left corner.

“ID” indicates that the identification capability is enabled.

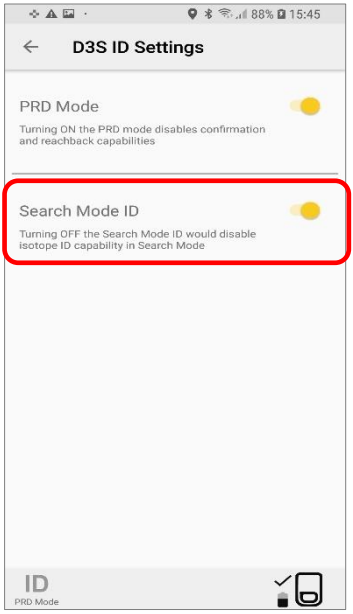


7.3.2 Disabling Search Mode ID Capability

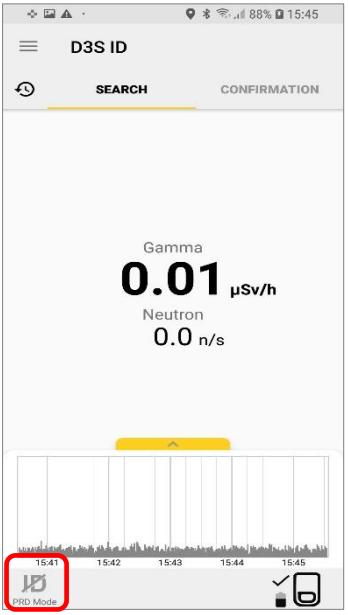
The identification capability can be disabled by going to:

Menu > Settings > Advanced Settings > enter password > PRD Mode > disable Search Mode ID

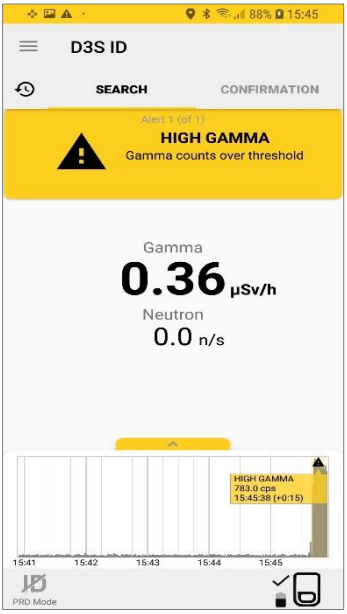
The default password is: 123456



The “ID” of the mode icon is stricken off indicating the identification capability is disabled.



Turning off the Search Mode ID disables the Search Mode identification capability. This means when a radioisotope is present, a high gamma alert will appear however, the isotope will not be identified.



8 Saved Data

The D3S ID smartphone application automatically saves data to the phone in .csv or the industry standard .N42 file format. The .csv file can be opened using Microsoft Excel and the .N42 file with radiation spectral viewing software.

Over time with regular use the data will build-up and can cause issues if the phone memory becomes full, therefore the data should be removed routinely to maintain optimal application performance.

The saved data can be accessed by connecting the phone to a computer via USB and the phone will appear in the file browser.

The path to the saved data files from the computer is as follows:

This PC\Phone\Android\data\com.kromek.android.D3S_ID\files

The files can also be accessed within the phones file management system, software capable of opening the specific file types are required to open them.

The path to the saved data files from the phone is as follows:

Files > Device Storage > Android > Data > com.Kromek.android.D3S_ID > files

8.1 Search Mode

'Search Mode' collects data from the detector in one second bunches and analyses the last three seconds' worth of data in a rolling average to detect and alarm the user of any radiation that may be present.

Whenever 'Search Mode' is stopped from within the D3S ID smartphone application, two files are saved to the location specified above, they are the 'Detections Log' file and the 'Spectra' file.

The 'Detections Log' file contains the search start and stop times plus information from when the alarm was alarming.
The naming convention for this file is:
'Date_Time_SerialNumber_DetectionsLog.csv'

The 'Spectra' file contains every second of data from the entire search.

The naming convention for this file is:
'Date_Time_SerialNumber_Spectra.csv'

At the top is the calibration of bin number or channel number, against the energy of that channel. There are columns titled like date, time, latitude and longitude. There are columns titled 'Output (0)' to 'Output (32)', these columns are for algorithm diagnostics and are not intended for customer interpretation. To the right of the output columns are the bin columns 'Bin(0)' to 'Bin(4095)'. Each bin represents one of the 4096 bins, and the number in the column below represents the number of counts.

8.2 Confirmation Mode

Whenever a Confirmation Mode scan is completed, two files are saved to the location specified above, they are the 'Confirmation Spectra' file and the 'Confirmation Result' file.

The 'Confirmation Spectra' file contains the data from the confirmation scan in csv file format.

The naming convention for this file is:
'Date_Time_SerialNumber_Confirmation_Spectra.csv'
For information on how the confirmation spectra file is laid out, see the search Mode spectra section above, as both files are in the same format.

The 'Confirmation Result' file contains the data from the confirmation scan in .N42 file format.

The naming convention for this file is:
'Date_Time_SerialNumber_ConfirmationResult.N42'

9 Technical Appendix

9.1 List of D3S ID Detectable Isotopes

The table below lists all the isotopes that can be identified by the D3S ID radiation detection solution.

If an unknown isotope is detected the audible alarm will sound “Alert, Unknown isotope detected”.

Americium-241*	Indium-111	Radium-226*
Antimony-124	Iodine-123	Scandium-46
Barium-133*	Iodine-131*	Selenium-75
Bromine-82	Iridium-192 in various shielding*	Sodium-22
Caesium-134	Lutetium-177	Strontium-90***
Caesium-137 in various shielding*	Lutetium-177m	Technetium-99m*
Californium-252****	Manganese-55	Thallium-201*
Chromium-51	Molybdenum-99	Thorium-232*
Cobalt-57*	Neptunium-237	Tin-113
Cobalt-60 in various shielding*	Palladium-109	Uranium-235*
Europium-152	Plutonium-239*	Uranium-238*
Fluorine-18**	Plutonium, reactor grade in various shielding*	Uranium, depleted in various shielding*
Gallium-67*	Plutonium, weapons grade in various shielding*	Uranium, highly enriched in various shielding*
Gold-198	Potassium-40*	Yttrium-88

Notes:
**Mandatory radionuclides as defined in ANSI N42.34*
***Beta+ emitting radionuclide*
****Beta- emitting radionuclide*
*****Neutron emitting radionuclide*

10 Specification

The D3S ID technical specification and regulations met are detailed below.

Detector Specification	
Detector type	Gamma and Neutron detection
Gamma detector material	CsI(Tl)
Gamma detector volume	1 in^3 (16 cm^3)
Gamma energy range	30 keV to 3 MeV
Gamma sensitivity for Cs137	5 cps/µR/h (500 cps/µSv/h) Photo peak 1.2 cps/µR/h (120 cps/µSv/h)
Maximum throughput for gamma channel	10,000 cps
Maximum dose rate	2.0 mR/h (20 µSv/h) at 662 keV (spectroscopic) 100 R/h (1 Sv/h) at 662 keV with high dose module
Neutron detector material	Non-^{3}He
Neutron detector	9 cps in a 1 neutron per cm^2 field
Neutron detector gamma rejection	Better than 10^{-7}, meets ANSI N42.34 section 6.7
Maximum throughput for neutron channel	5,000 cps
Communications	Micro USB, Bluetooth®
Operational battery life	12 hours, 24 hours with add-on battery pack
Operational temperature range	−20°C to 50°C, meets ANSI N42.32 section 7.1, section 7.2, section 7.5
Device size (excluding phone)	5.2" x 3.1" x 0.9" (132 mm x 80 mm x 23.5 mm)
Device volume (excluding phone)	248 cm^3
Humidity	Up to 93% RH ANSI N42.32 section 7.3
Moisture/dust protection	IP53 as per ANSI N42.32 section 7.4 IP65 with add-on enclosure
D3S weight (excluding phone)	0.52 lbs (237 g)
Battery	1450 mAh Lithium polymer
Charging	Charging via USB or inductive charging
External LEDs	Visual detector status
Device status indicator	External LED

Hardware Standard Compliance	
Vibration	ANSI N42.32 section 9.1
ESD immunity	ANSI N42.32 section 8.1
Radiated emissions	ANSI N42.32 section 8.4
Drop test	ANSI N42.32 section 9.2
Impact (microphonics)	ANSI N42.32 section 9.3
Software	
Graphic user interface	Android Smartphone
Spectra storage	ANSI N42.42 compliant
Spectra sharing	Reachback Report
Isotope Identification	
Confirmation mode complies with	ANSI 42.34 within 30 seconds
Search mode	Isotope ID within 3 seconds
Isotope ID	Special isotope(s) detected Classification of isotopes (industrial, medical, NORM, SNM)
False Alarm Rate	Superior false alarm rejection (ANSI N42.32) for the gamma and neutron channels independently

Note: The D3S detector and smartphone is not certified for use in explosive atmospheres.

11 Maintenance

The D3S ID requires minimal maintenance. However, since both D3S and smartphone contain Lithium-Ion rechargeable batteries, care still needs to be taken in their use and storage.

Rechargeable Lithium-Ion batteries have a limited life and will gradually lose their capacity to hold a charge. The typical estimated life of a Lithium-Ion battery is about two to three years or 300-500 charge cycles. One charge cycle is a period of use from fully charged, to fully discharged, and fully recharged again. This loss of capacity (aging) is irreversible. As the batteries lose capacity, the D3S ID run time decreases.

The Lithium-Ion batteries continue to slowly discharge (self-discharge) when not in use or while in storage. Therefore, when the D3S ID is kept in storage, the following need to be carried out to avoid over discharge.

- Charge the D3S and smartphone to >50% of battery capacity before storage.
- Charge the D3S and smartphone to >50% of battery capacity at least once every six months.
- Store the D3S and smartphone at temperatures between 5 °C and 20 °C (41 °F and 68 °F) as higher temperatures (above 20 °C or 68 °F) reduce the battery storage life.

12 End User License Agreement

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The information contained in this document shall be subject to change without notice.

13.1 FCC Warning

The D3S device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

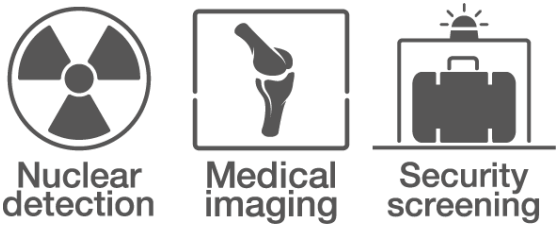
1. The device may not cause harmful interference

2. The device must accept any interference received, including interference that may cause undesired operation.

13.2 Versions Document

This document was correct at the time of publication and was written for the version numbers below:

D3S Hardware: 1.1
D3S Firmware: 3.75
D3S ID App Version: 2.2.5



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