

RaySafe i3

– with stand-alone display

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CONTENTS

ABOUT THE RAYSAFE i3 SYSTEM.....	4
PREPARATIONS	5
Package contents	5
Learn more.....	6
System requirements for Dose Viewer	6
System requirements for Dose Manager.....	6
Tools required for mounting the Real-time Display	6
INSTALLATION.....	7
Dose Viewer.....	7
Initiate a Real-time Dosimeter.....	7
Real-time Dosimeter Rack	9
Real-Time Display	10
CONFIGURATION	12
User settings	13
Admin settings	13
SYSTEM FUNCTION TESTS	17
Real-time Display test	17
Dose Viewer test	17
MEASUREMENT PERFORMANCE VERIFICATION.....	19
Instruction	19
MAINTENANCE AND SOFTWARE UPDATE.....	20
Dosimeter battery replacement	20
Dose Viewer software upgrade	20
Cleaning.....	21
TROUBLESHOOTING.....	22
TECHNICAL DATA	23
Real-time Dosimeter	23
Real-time Display	23
Real-time Dosimeter Rack	24
Climatic conditions	24

ABOUT THE RAYSAFE i3 SYSTEM

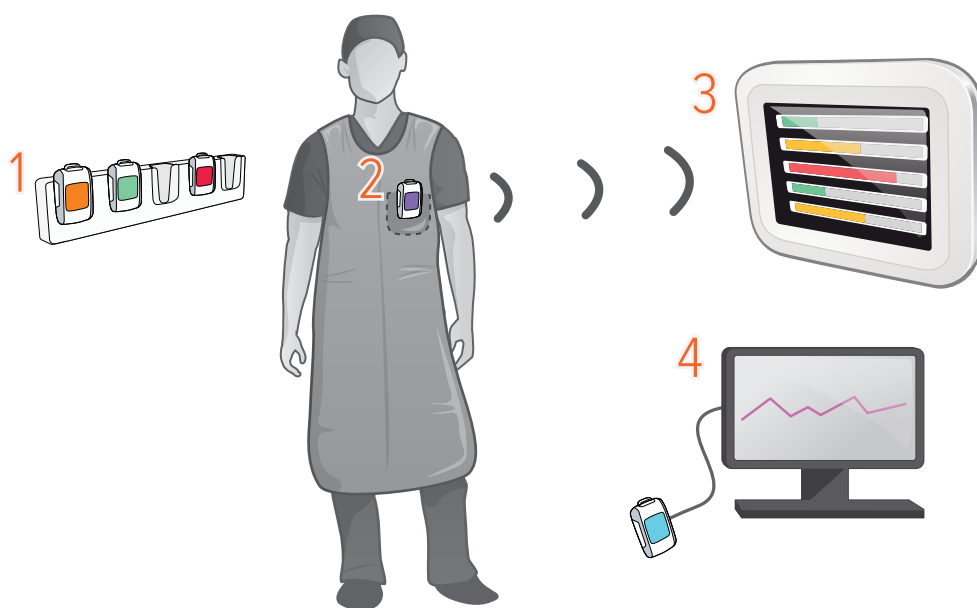


Figure 1. 1: Dosimeter Rack, 2: Real-time Dosimeter, 3: Real-time Display, 4: Dose Viewer software.

The dosimeters measure radiation and store measurements. When a dosimeter is in range of a Real-time Display, measurements are transferred once per second via radio and are displayed as dose rate bars low to high dose rate: green, yellow or red. You can also have the accumulated dose displayed next to the dose rate bar.

All measurements recorded while connected to a Real-time Display are saved in the display. Tap a dosimeter user name on the display to access the measurements.

To view the measurements stored in the dosimeter, connect the dosimeter to a computer running Dose Viewer. Dose Viewer can also be used for changing dosimeter settings, such as displayed name and annual dose limit.

PREPARATIONS

PACKAGE CONTENTS

NOTE: *The content depends on purchased configuration.*



Figure 2. Instructions for Use, Service manual, Quick Guide.



Figure 3. Real-time Display with power adapter.



Figure 4. Cables and screws, Windows software, wall mount, tie wraps, Dosimeter Rack, Real-time Dosimeters.

LEARN MORE

- Real-time Dosimeter quick guide under the lid of the dosimeter packaging
- Dose Viewer manual via the Help button in Dose Viewer
- Dose Manager manual via the Help button in Dose Manager

SYSTEM REQUIREMENTS FOR DOSE VIEWER

Dose Viewer is required during the installation to initiate dosimeters.

- Operating system: 32 bit or 64 bit version of Windows 7, 8.1, 10 or 11
- .NET 4.6.2 or higher (.NET 4.6.2 included in installation, needs 6 GB extra disk space)
- At least one USB port available
- At least 2 GB RAM available
- At least 2 GB free disk space
- Recommended screen resolution at least 1024 × 768

SYSTEM REQUIREMENTS FOR DOSE MANAGER

Dose Manager is optional.

- Operating system: 64 bit version of Windows 7, 8.1, 10 or 11
- .NET 4.6.2 or higher (.NET 4.6.2 included in installation, needs 6 GB extra disk space)
- At least one USB port available
- At least 2 GB RAM available
- At least 15 GB free disk space
- Recommended screen resolution at least 1280 × 1024

TOOLS REQUIRED FOR MOUNTING THE REAL-TIME DISPLAY

The following tools are required for mounting the Real-time Display with VESA 75 on a wall:

- 8 mm masonry drill or one 3 mm wood drill
- cross headed screwdriver, Phillips PH2
- medium sized slotted screwdriver

INSTALLATION

DOSE VIEWER

1. Check that the system requirements (on page 6) is met.
2. Log on as local administrator on the computer.
3. Insert the Dose Viewer USB memory.
4. Double click on *InstallDoseViewer.exe*.
5. Follow the instructions on the screen to finish the installation.

NOTE: Press *Help* in Dose Viewer to access the Dose Viewer manual.

TROUBLESHOOTING

If the installation procedure fails, verify that:

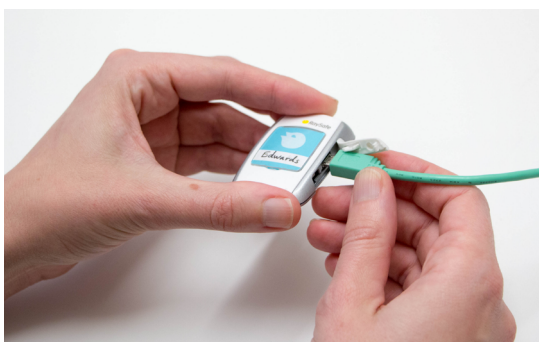
- the system requirements are met (on page 6).
- you are logged on as local administrator.

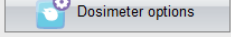
If there is an older version of Dose Viewer already installed, you can try uninstalling that before installing the new one.

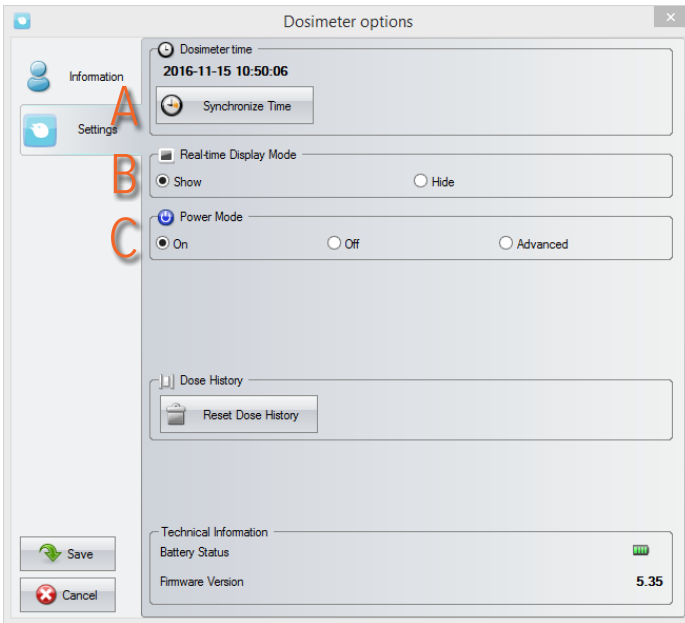
INITIATE A REAL-TIME DOSIMETER

Each dosimeter needs to be initiated using Dose Viewer before use.

1. Start Dose Viewer.
2. Connect the dosimeter via USB cable to the computer running Dose Viewer.

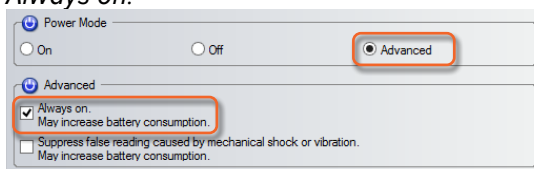


3. Open the dosimeter options window by pressing *Dosimeter options*  and then the *Settings* tab:



- A. Verify that the computer time is correct and then synchronize the dosimeter time. Be sure to do this with all dosimeters in a lab.
- B. Set the *Real-time Display Mode* to *Show*, to make the dosimeter appear on a display.
- C. Set *Power Mode* to *On* to start radio communication and dose logging.

NOTE: *Power Mode On includes an automatic power saving function controlled by accelerometers. When the dosimeter is stationary for 9 minutes, it enters power save (no dose logging, no radio communication). The dosimeter wakes up when moved again. If the dosimeter is stationary positioned, not worn by a person, turn off the automatic power saving by selecting **Advanced: Always on**.*



4. Press *Information*:

The screenshot shows a software window titled "Dosimeter options" with a close button (X) in the top right corner. On the left, there are two tabs: "Information" (selected) and "Settings". The "Information" tab contains the following fields:

- Full Name:** Jane Edwards
- Display Name:** Edwards
- Dosimeter position:** Torso (dropdown menu)
- Clinical Role:** Doctor (dropdown menu)
- Color:** Ocean (dropdown menu)
- Annual Dose Limit (mSv):** 20.00 (spin box)

At the bottom left of the dialog, there are two buttons: "Save" (with a green checkmark icon) and "Cancel" (with a red X icon).

- Set **Full Name** and **Display Name**. The Display Name appears in the online view on the Real-time Display. The Full Name is visible in the dose history views on the Real-time Display and in Dose Viewer.
- Change **Dosimeter Position**, **Clinical Role** and **Annual Dose Limit** if desired. These settings do not affect the dose registration.
- Select **Color** and insert a corresponding inlay under the plastic shield on the front of the dosimeter. Tip: Write on the inlay.



- Press Save and disconnect the dosimeter.

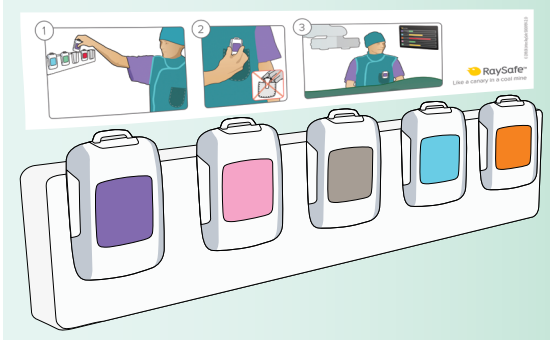
NOTE: Always power *OFF* the dosimeter before air transport, to make sure that the radio communication is completely turned off.

REAL-TIME DOSIMETER RACK

A Real-time Dosimeter rack provides room for 5 dosimeters. Mount it on a wall with easy access, for example near storage of radiation protection garment.

- Mount the rack with 2 screws to the wall.
- Attach the dosimeters.

3. Mount the supplied quick guide sticker above the rack.



REAL-TIME DISPLAY



Figure 5. Interfaces (back side of the Real-time Display): 1: 12 V DC, 2: Ethernet, 3: USB, 4: VESA 75

MOUNT THE REAL-TIME DISPLAY

NOTE: *In a setup with multiple Real-time Displays, there should only be one per room.*

NOTE: *For other mounting options than VESA mount on wall, contact your RaySafe representative.*

The wall mounting parts for the Real-time Display:

- one Vogel's VESA wall mounting kit
- separate screws and washers for mounting the Vogel's VESA adapter to the Real-time Display

Mount the Real-time Display on a wall:

1. Attach the VESA adapter to the Real-time Display using the screws and washers provided separately (not in the Vogel's VESA wall mounting kit). Use 8 washers, one on each side of the VESA adapter for each screw.
2. Follow the instructions included in the Vogel's VESA wall mounting kit for attaching the wall mount to the wall. Use screws and plugs suitable for the wall material.
3. Attach the Real-time Display to the wall mount.
4. Connect the power adapter to the Real-time Display and to an electrical outlet. The Real-time Display will turn on and your dosimeters will show up on the screen. The first time a dosimeter connects to a certain Real-time Display, the detection process can take up to three minutes.

5. As soon as the dosimeters show up on the display, the system is ready to use!

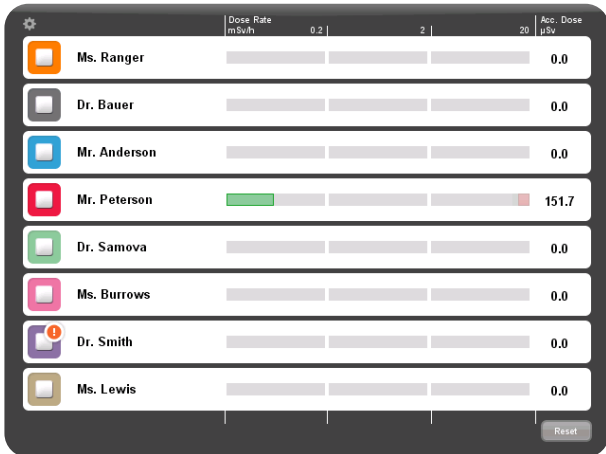


Figure 6. Online view on Real-time Display

The following chapters describe optional configurations and tests.

CAUTION: *The electrical outlet socket shall be easily accessible, for security reasons.*

ETHERNET CONNECTION (OPTIONAL)

Dose Manager can be purchased separately to be used with RaySafe i3. The Ethernet interface is used together with the Dose Manager application only.

Connect the Real-time Display to the hospital network:

1. Connect an Ethernet cable (not included in the package) to the hospital's network.
2. Connect the Ethernet cable to the Ethernet connector at the back of the Real-time Display.
3. Configure the network connection, see "Admin settings 3/4: Network." on page 14.

CONFIGURATION

The Real-time Display is delivered with the required software installed. The default settings are usually suitable. This chapter will guide you through the settings screens.

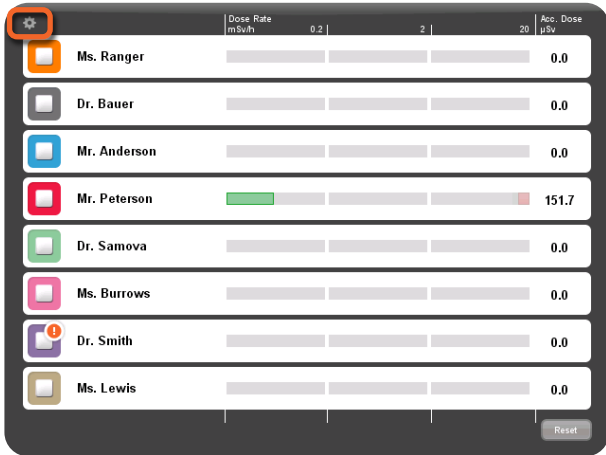


Figure 7. Online view with settings button highlighted.

Tap the cogwheel in the upper left corner of the online view to access the settings.

NOTE: *Some changes require a restart to take effect. Disconnect and reconnect the power cord to restart the Real-time Display.*

USER SETTINGS

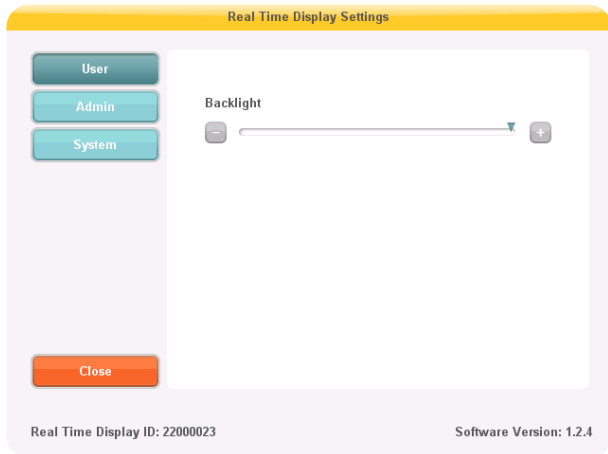


Figure 8. User settings 1/1: Backlight.

Tap the + or - buttons (Figure 8) to adjust the backlight level.

ADMIN SETTINGS

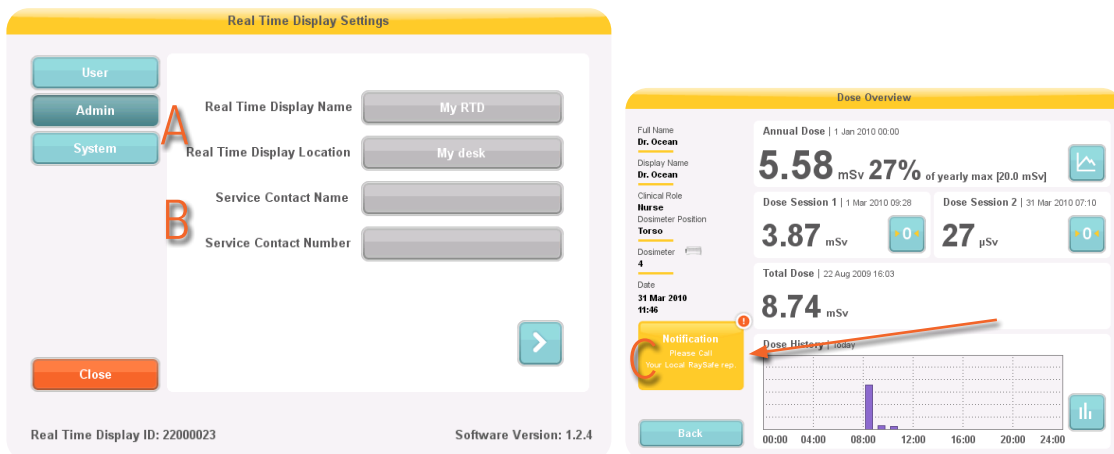


Figure 9. Admin settings 1/4: Identity and contact, and notification area in personal dose overview.

The *Real-time Display Name* and *Location* (A in Figure 9) is only applicable in use together with Dose Manager (optional Windows software), to be able to download dose data from the Real-time Display to Dose Manager.

The *Service Contact Name* and *Number* (B in Figure 9) appears in the notification area (C in Figure 9), on the left side of the personal dose overview (accessed by tapping a dosimeter name), only when service is required.

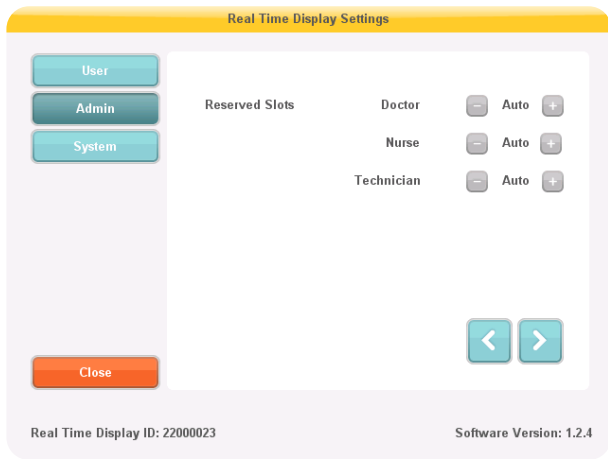


Figure 10. Admin settings 2/4: Reserved slots.

The admin and system settings menu consists of several screens. Tap the arrows in the lower right corner to access the other screens.

You can *Reserve slots* (rows) (Figure 10) in the online view for dosimeters with a certain clinical role set. For example, if you have reserved three slots for doctors and there is only one doctor within range, there will be two empty rows before the first nurse is displayed. Auto is default. The dosimeters will appear in the order they are detected by the Real-time Display, sorted by clinical role: doctor, nurse, technician, other.

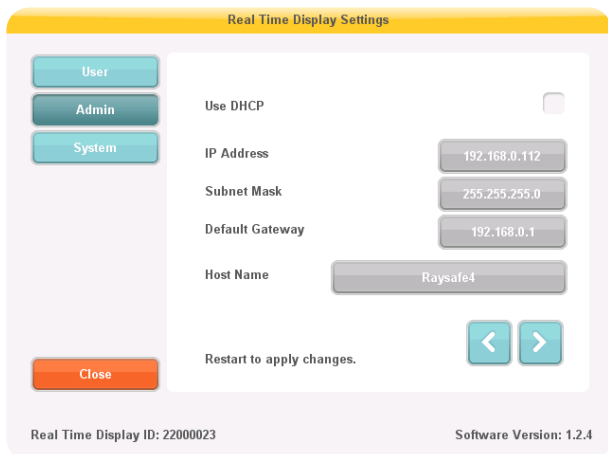


Figure 11. Admin settings 3/4: Network.

Network setup (Figure 11) is only useful if your Real-time Display is connected to Ethernet and you have Dose Manager installed in your system. Contact your local IT department for help with these settings.

Changes of the network settings requires a restart to take effect.

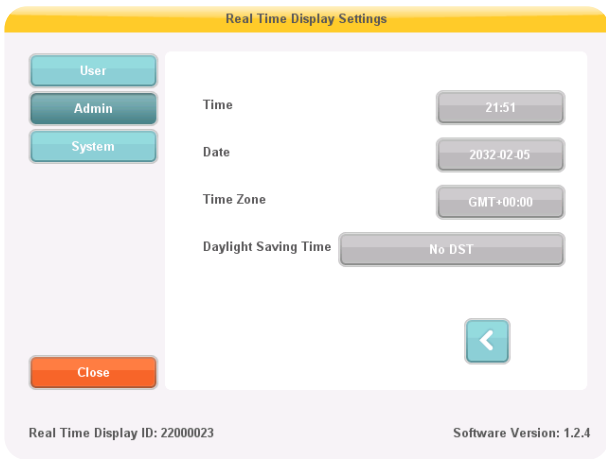


Figure 12. Admin settings 4/4: Time and date.

You can manage *Daylight Saving Time* manually, or by selecting a region for your *Time Zone* (Figure 12). The list of regions is updated according to the selected time zone.

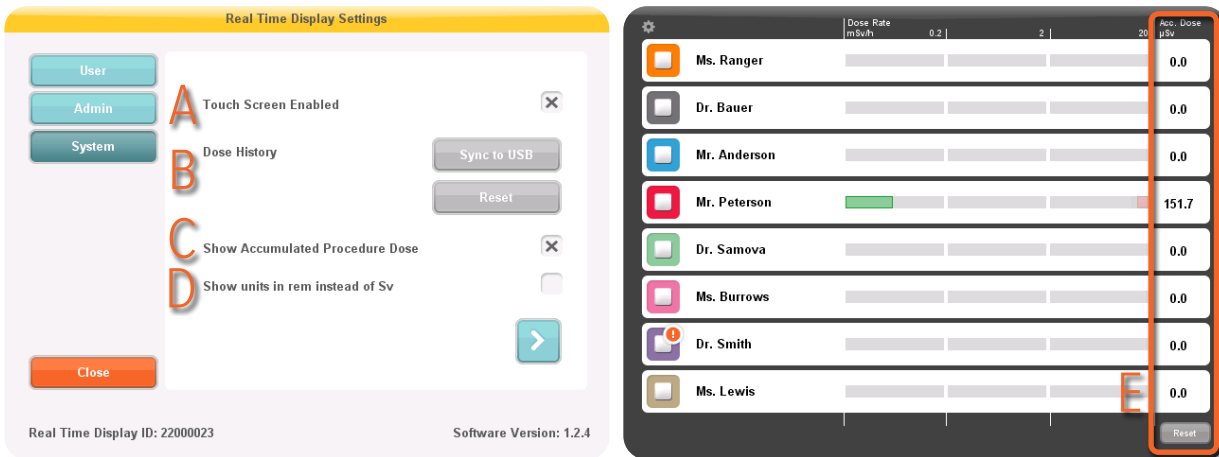


Figure 13. System settings 1/3: Touch screen and dose settings.

Uncheck the box *Touch Screen Enabled* (A in Figure 13) to turn off the possibility to tap on a dosimeter row to access dose history on the Real-time Display. The settings menu is however always accessible.

You can copy dose history from the Real-time Display to a USB memory. Insert the memory at the back of the Real-time Display (see Figure 5 on page 10). Press the button *Sync to USB* (B in Figure 13) to start writing to the memory.

If you want to delete all *Dose History* from the Real-time Display, press the *Reset* button (B in Figure 13). This reset will **not** affect the dose history stored in the dosimeters.

The *Accumulated Procedure Dose* (C in Figure 13) is shown to the right of each dose rate bar in the online view, when activated. Reset the dose value with a tap on the *Reset* button in the lower right corner of the online view (E in Figure 13).

Conversion factor for the *units* (D in Figure 13) is $1 \text{ Sv} = 100 \text{ rem}$.

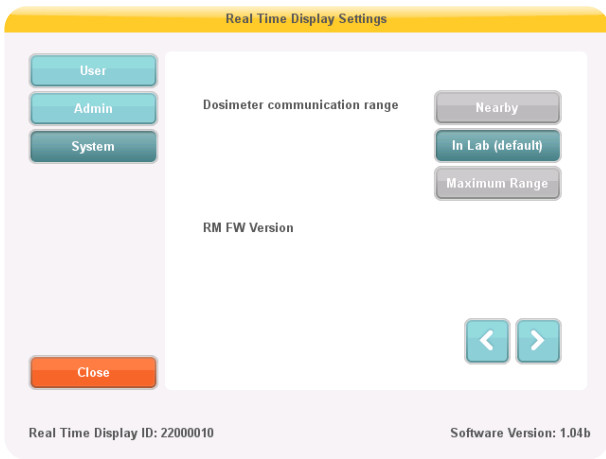


Figure 14. System settings 2/3: Communication range.

If you experience problems with the communication between dosimeter and display, try changing the *range* setting (Figure 14):

- If other dosimeters than the desired show up on the display, select *Nearby*.
- If dosimeters do **not** show up on any display, select *Maximum Range*.

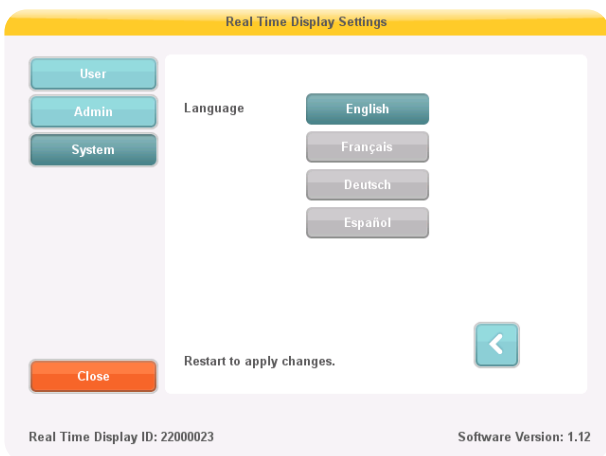


Figure 15. System settings 3/3: Language.

Select language (Figure 15) for the Real-time Display user interface. This setting requires a restart to take effect.

SYSTEM FUNCTION TESTS

We recommend these tests in order to verify the correct installation and configuration of the RaySafe i3 system.

REAL-TIME DISPLAY TEST

ONLINE VIEW TEST

Follow the instructions below to verify that the dosimeter appears in the Real-time Display:

1. Check that the dosimeter appears in the display's online view.
2. Expose the dosimeter to scattered radiation by placing the dosimeter outside the primary beam, close to a phantom which is placed in the X-ray field. Verify that the Real-time Display shows a dose rate bar instantaneously, updating once per second (Figure 16).

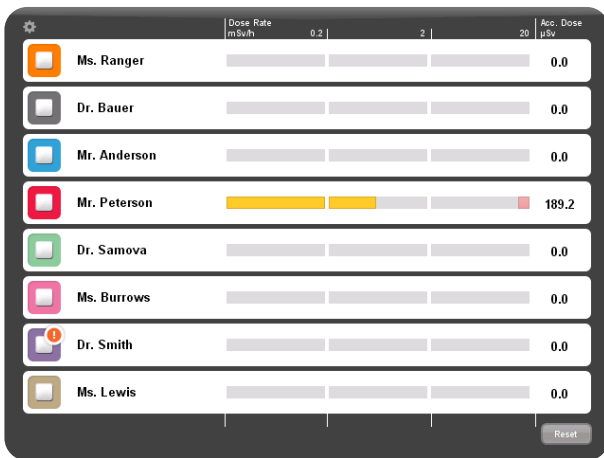


Figure 16. The Real-time Display online view.

DOSE VIEWER TEST

Follow the instructions below to verify that Dose Viewer detects the dosimeter:

1. Connect the dosimeter to a computer running Dose Viewer.
2. Dose Viewer will detect the dosimeter within a few seconds. Ensure that dosimeter information and dose history is presented in the main window (Figure 17).

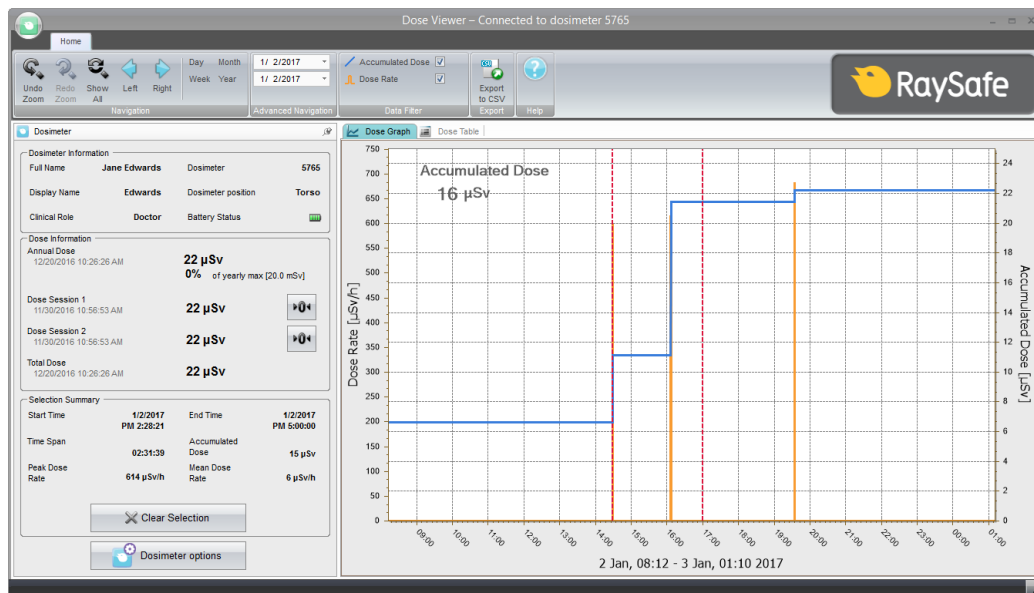


Figure 17. Dose Viewer with a dosimeter connected.

COMMUNICATION RANGE TEST

Follow the instructions below to verify the function of an environment with several Real-time Displays installed.

Check that the dosimeter communication range configuration is correctly tuned, that is, dosimeters currently not in use shall not appear on the Real-time Display's online view, but will appear when they approach the display.

1. Position a dosimeter near Real-time Display **A**.
2. Visually check that the dosimeter is shown on Real-time Display **A**.
3. Move the dosimeter within range of Real-time Display **B**.
4. Visually check that the dosimeter appears on Real-time Display **B** within 30 seconds within range.
5. Put the dosimeter in a rack and verify that it disappears from all displays within 3 minutes.

See also "System settings 2/3: Communication range." on page 16. If anything fails in this test, see "Troubleshooting" on page 22.§

MEASUREMENT PERFORMANCE VERIFICATION

The dosimeter is delivered calibrated, with no need for re-calibration during its lifetime. See the radiological specification in the accompanying *Instructions for Use*. If you want to check the measurement accuracy, we recommend the following arrangement.

The purpose of this test is to verify the measurement performance of dosimeters using scattered radiation from diagnostic X-ray units.

CAUTION: *Do not expose yourself to X-ray radiation.*

Required equipment:

- Two PMMA phantoms or other scattering material.
- Dosimeters for test
- Real-time Display, for dosimeter readings

INSTRUCTION

1. Place one of the phantoms (simulating the patient) on the patient support. Use a large phantom or a bucket filled with water.
2. Place the other phantom (simulating the staff) at the same height, but 1.5 m away from the first one.
3. Place the dosimeter at the staff phantom, centered on the side facing the patient phantom. Test one dosimeter at a time.
4. Expose with a field fully covering the patient phantom, at 80 kVp set, 4 mA, for 60 s. Adjust the mA to get a dose rate of above 1 mSv/h. The dose rate can also be increased by placing a larger (or several) phantom(s) to simulate the patient.
5. Note the dose rate from the Real-time Display. Repeat steps 1 – 4 with the dosimeters you want to compare.



Figure 18. Performance verification arrangement. 1. Patient phantom. 2. Staff phantom. 3. Dosimeter. 4. X-ray field.

NOTE: *Radiologic specification in Instructions for Use (separate document).*

MAINTENANCE AND SOFTWARE UPDATE

DOSIMETER BATTERY REPLACEMENT

When a red LED flashes on the side of the dosimeter, the battery needs to be replaced. You need a Phillips screwdriver (PH1) and a battery (CR2450) for this.

NOTE: *Make sure that the dosimeter is not connected to a computer with a USB cable while replacing the battery.*

1. Remove the screws on both sides of the dosimeter clip.
2. Remove the battery cover.
3. Take out the battery by carefully bending with for example the plastic clip under the battery at the top side of the dosimeter.



4. Wait at least 5 seconds before inserting the new battery, to make sure that the dosimeter registers that a new battery is inserted.
5. Put on the cover and the clip (optional) and insert the screws carefully (max 0.15 Nm torque), to avoid damage on the screw threads.
6. Connect the dosimeter to a computer with Dose View and synchronize the time. The internal clock is the only thing that is affected by a battery change. Other information in the dosimeter such as name, dose history and calibration are unaffected.

Check that the dosimeter appears on a Real-time Display again.

DOSE VIEWER SOFTWARE UPGRADE

Follow the installation instructions in section “Dose Viewer” on page 7 to upgrade Dose Viewer.

NOTE: *Configuration from a previous version of the Dose Viewer software will remain unaffected by the software update.*

REAL-TIME DISPLAY TOUCH SCREEN CALIBRATION

If the touch screen does not respond correctly to user interaction, a touch screen calibration may be needed.

1. Tap on the welcome screen that appears during Real-time Display startup. (Restart by disconnecting and reconnecting the power cord.)
2. Follow the instructions on the screen to perform the calibration.

CLEANING

For cleaning of dosimeter and display, use a damp cloth and mild detergent.

TROUBLESHOOTING

PROBLEM	POSSIBLE REASON	ACTION
Some dosimeters do not show up on screen.	Dosimeter problems.	Verify dosimeter functionality with another system, if available. Check dosimeter configuration with Dose Viewer: (Power: On, Real-time Display Mode: Show)
	Radio configuration problems.	Increase radio range in Real-time Display settings. See “Figure 14. System settings 2/3: Communication range.” on page 16.
	Frequencies of dosimeters and Real-time Display do not match.	Check labels on the back of the dosimeter and the Real-time Display to verify that they communicate on the same frequency.
Dosimeter does not keep a stable connection.	Real-time Display gives blind spot for radio at some places in the room.	Increase the radio range in the Real-time Display configuration.
Dosimeter does not disappear from screen.	Dosimeter power mode settings not suitable.	Check that the dosimeter power mode is not set to <i>Always on</i> .
	Dosimeter storage is located too close to the Real-time Display.	Move the storage further away from the Real-time Display.
	Radio range configuration not suitable.	Decrease the radio range in the Real-time Display configuration.
Dosimeter visible on the Real-time Display but does not seem to record dose.	Defective dosimeter or bad radio connection.	Test the dosimeter with another system (if available).
Dosimeter turns off (disappears from the screen) in unwanted situations.	The auto power save is not suitable for the application.	Change the Power Mode setting to <i>Advanced: Always on</i> . This may decrease the battery life.
There is a blinking red light on the side of the dosimeter.	The battery needs to be replaced.	Follow the instructions in “Dosimeter battery replacement” on page 20.
There is no Accumulated dose at the right edge of the screen.	The Accumulated Procedure dose is turned off.	Turn the Accumulated Procedure dose on, see “System settings 1/3: Touch screen and dose settings.” on page 15.
The Real-time Display does not react properly on touch.	The touch screen may need to be recalibrated.	Follow the instructions in “Real-time display touch screen calibration” on page 20.

TECHNICAL DATA

REAL-TIME DOSIMETER

CHARACTERISTIC	MEASURE
Weight	34 g (1.2 oz)
Dimensions (WxHxD)	40x58x17 mm (1.6x2.3x0.7 in)
Mounting	Clip and lanyard holder
Communication interface	USB, radio
Battery type	CR2450
Battery life	Approximately 1 year of normal use
Radio frequency	866.0 MHz, 868.3 MHz, 918.3 MHz or 927.9 MHz (depending on purchased configuration)

REAL-TIME DISPLAY

CHARACTERISTIC	MEASURE
Weight	1.2 kg (2.6 lbs)
Dimensions (WxHxD)	297x243x51 mm (11.7x9.6x2.0 in)
Display	10.4" touch screen, 640x480 pixels, 65 000 colors
Power supply	External supply (included): GTM96600-6012-T3
Mounting	VESA 75
Backlight life time	Approximately 50000 hours
Communication interfaces	Ethernet 10/100 Mbps, 1.1 host for USB Mass Storage Device
Radio frequency	866.0 MHz, 868.3 MHz, 918.3 MHz or 927.9 MHz (depending on purchased configuration)
Exposed network interfaces	8060, UDP: service discovery for Dose Manager sync 8070, TCP: Dose Manager sync

REAL-TIME DOSIMETER RACK

CHARACTERISTIC	MEASURE
Dimensions (WxHxD)	300x63x20 mm (11.8x2.5x0.8 in)

CLIMATIC CONDITIONS

PARAMETER	MEASURE
Temperature	+15 °C – +35 °C (for operation), -25 °C – +70 °C (for storage)
Temperature rate of change	< 0.5 °C/minute
Relative humidity	20 – 80 % (for operation), 5 – 95 % (for storage)