uRADMonitor-D

PRODUCT MANUAL

DEVICE ID: _____

QC ENGINEER: _____   DATE: _____

Congratulations on purchasing this excellent environmental monitor! You are now part of an ambitious global effort named uRADMonitor. Some information to help you get started is provided in this manual and more is available online, on http://www.uradmonitor.com , both on the Blog and the Forums.

Summary

The uRADMonitor network

The uRADMonitor project is a global array of network connected monitoring stations, focused on continuous Environmental Surveillance. Its purpose is to generate fully transparent open data, used to assert the quality of our environment and the impact of various pollutants on human health.

uRADMonitor D

This is so far our most complex hardware product. It is a handheld mobile unit designed to measure a total of six important parameters related to pollution and air quality. It comes in a rugged aluminum enclosure that comfortably fits the palm of your hand thanks to the side grips machined in the enclosure metal.

Connectivity

Model D is equipped with Wireless LAN connectivity, with an internal ceramic antenna and a carefully designed window in the aluminium enclosure to allow RF signal to escape.

Picture 1: front lid enclosure openings for antenna, card and USB

Connect the uRADMonitor-D to your Wifi Internet router so data is synchronized with the central server automatically. This allows you to access interactive charts and stats, and do various comparisons from one target location to another, on the uRADMonitor global map.

There is also an API that can be used to access the readings, or import them to other systems (alarms, automated response systems, etc.).

Sensors

uRADMonitor model D uses the BME680 from Bosch to measure air temperature, barometric pressure, humidity and volatile organic compounds, or VOC. A Sharp photoelectric sensor is used to detect the Particulate Matter PM2.5 concentration in air. A high quality LND712 Geiger Tube Made in the USA allows this dosimeter to detect alpha, beta, gamma and x-ray ionising radiation.

Sensor	Parameter	Min value	Max value
BME680	Temperature	-40 °C	+85 °C
	Pressure	300 hPa	1100 hPa
	Humidity	0% RH	100% RH
	VOC	0 mg/m³	100 mg/m³ reducers 10 mg/m³ oxidizers
Sharp GP2Y1010AU 0F	PM2.5	0 µg/m³	800 µg/m³
LND LND712	α, β, γ,x-rays	0.005µSv/h	5000.00µSv/h

Picture 2: uRADMonitor units on the test bench

Each Model D unit is subjected to a final test: the tested device must be in a confidence interval of 5% in comparison to a master.
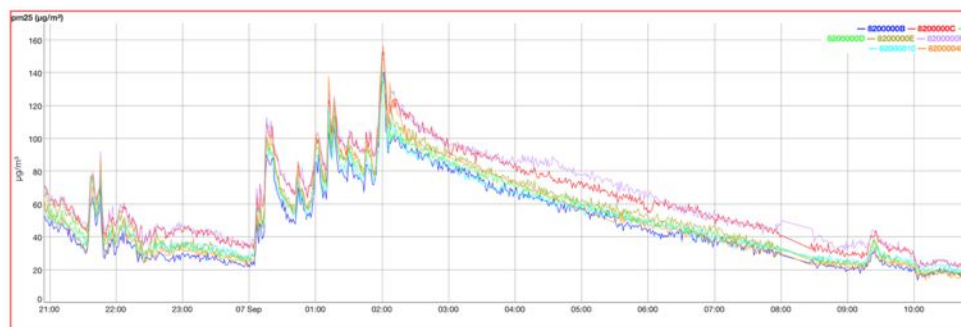
Dosimeter and Monitor

Your model can do both. Monitoring brings certain advantages over simply using a handheld unit occasionally. First it's the capability of identifying the trend, due to long-term measurements, and taking action in regards to the evolution of numbers rather than not knowing how to interpret short time readings. Then with long term continuous monitoring we get a clue even on low-level changes that often evade portable localized readings (unless the levels are higher). Finally having an automated system monitoring the values 24/7 results in keeping you informed all the time, not only on occasional situations like when using a handheld for an isolated check.

Health impact

Picture 3: Air pollution can shorten our lifespan

The purpose of the model D detector and of the entire uRADMonitor network is to monitor chemical and physical factors that can have a negative impact on our health or on the environment. Using its advanced sensors, the model D monitors against the following potentially hazardous parameters:

VOC or volatile organic compounds are a class of substances that evaporate at room temperature. Being different substances may be responsible for a broad category of disorders, including respiratory problems, allergic or weakening immunity in children. Some VOC 's are responsible for the formation of smog, irritation of eyes, nose and throat, headaches and concentration problems. In extreme circumstances, more severe complications can occur, such as damage to liver, kidney and central nervous system or cancer [1].

Ionizing radiation is harmful to living organisms because it can cause damage to cells that can result in multiple disorders, the most common of which is cancer. Ionizing radiation is naturally occurring from cosmic and terrestrial sources, but there are also artificial generators related to nuclear activities or x-ray devices . Worldwide global average dose is 3.01mSv [2].

Particulate matter PM2.5 refers to small particles with a diameter of up to 2.5 microns. These particles can penetrate deep into the lungs , causing allergies, respiratory and cardiovascular diseases .[3]

 [1] Volatile Organic Compounds' Impact on Indoor Air Quality, US Environmental Protection Agency
[2] Radiation Health Effects, US Environmental Protection Agency
[3] Health and Environmental Effects of Particulate Matter (PM), US Environmental Protection Agency

Product features

These are mobile units powered by a high capacity Lithium Ion rechargeable battery, with a GPS receiver for location mapping and Wifi connectivity, but also with a SDCard slot to store all readings when WLAN is not available. This not only addresses radioactivity in a similar way to existing top-notch dosimeters, but it also measures the air pollution, contributing with valuable data to the uRADMonitor network. The model D also features an Alarm built in and has a touchscreen to provide visual and audible indications, keeping you informed all the time. Using the uRADMonitor backend infrastructure and model D's wireless data sharing capabilities, the global readings provide useful data on pollution, its geographical distribution, and evolution in time.
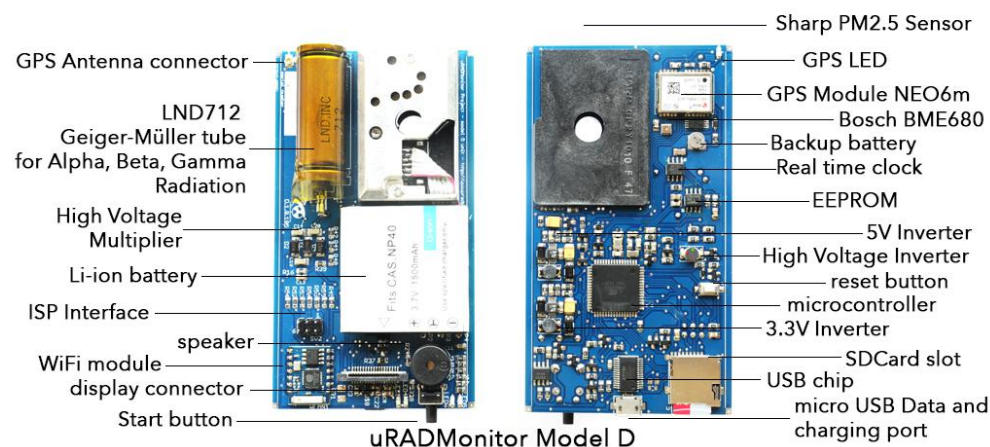
Picture 4: uRADMonitor D motherboard front and bottom view

Item	Parameter	Ratings
Battery	Lithium Ion	1500mAh
Connectivity	WLAN	802.11b/g/n
Microcontroller	Atmega 2561	8 bit
Enclosure	Rugged / Al	110x70x24 mm

Starting and configuring your uRADMonitor D

Turn on your Model D using the start button, labeled "ON". To configure the Internet connection, follow the guide below:

1.Click Settings

2.Click CFG WIFI

3.Enter SSID & KEY


4.See confirmation

Picture 5: Wifi settings

Now your Model D will connect to the given SSID for Internet access.

Webpage based configuration

The model D has an internal webserver that can be used for data access and configuration. First, turn on your Model D unit using the start button. On your computer search for nearby wireless networks. Connect to the Wifi hotspot spawned by your Model D:
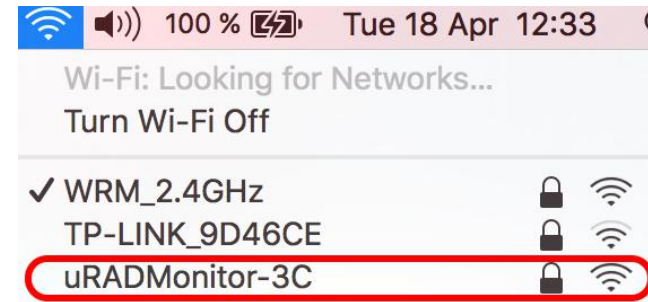
Picture 6: uRADMonitor local Wifi Hotspot

The SSID is uRADMonitor-XX, where XX are the last two digits of your Model D ID (eg. 64000001) that is printed on the back of your unit, under "serial number". uRADMonitor Wifi Hotspot password: the Device ID (eg. 64000001)
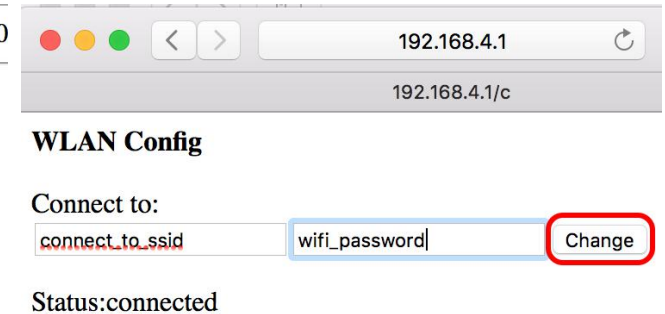
Once connected, open 192.168.4.1 in your browser. You'll see the internal webpage of your model D. Click the WIFI link at the bottom to configure the AP where your model D should connect to.

Picture 7: uRADMonitor D internal webpage

When done press "Change". Check the Status message to confirm the model D is connected.

The user interface

You will interact with your model D unit using the touchscreen. This is a resistive touchscreen, so clicks must be performed in a focused manner, unlike capacitive screens where you use the finger. Use your nails, or a stylus.

As the unit performs multiple tasks at once, the device might sometimes be non responsive for just a few moments. If this happens, do not express excess pressure on the screen, better do long clicks, just until your desired action is being recorded. Remember the LCD is sensitive, and should be treated as such.

The user interface has a titlebar, buttons, and various values displayed.

Picture 8: UI titlebar

The title bar shows the current UTC time. This is being synced automatically every time the GPS connects, and time is kept locally by a real time clock separate circuit, that functions even when the device is turned off, using tiny amounts of power just to keep the time.

The first icon shows the GPS status, then there's the SDCARD symbol, the WIFI and the speaker icon showing if the sound is enabled or muted. You can toggle these modules in the Settings. Finally there's the date and the battery level indicator.

Offline data

All data is being recorded to the SDCARD. While using the model D offline, either with WLAN turned off or out of your WLAN coverage area, the measurements will be marked accordingly, and when the Internet connection becomes available, you can use the SYNC option in the SETTINGS menu to synchronize your offline data with the server.

The watchdog

When used as a monitoring station, most likely the unit will run unattended. There is a watchdog mechanism that automatically reboots the unit in case of any lockdown. This approach is a proven technique that allowed uRADMonitor units to operated unattended for long periods of time, while providing valuable measurements. When connected to the uRADMonitor server (network on), the uRADMonitor D will automatically reboot if during a certain interval, it receives no acknowledgement from the server.

The alarm

In the event of a high Radiation dose being measured or a high air pollution level, the alarm will sound. The alarm will stop when the dose has decreased back to normal levels.

The dashboard

The purpose of the Dashboard is to offer an interface to the uRADMonitor system, the global data and the uRADMonitor detectors.

Using the Dashboard, you can see your connected units, add them to your account and manage them further. This includes changing the coordinates of your uRADMonitor unit on the map, either for better privacy or for better accuracy.

The dashboard is can also be used to access your units data.

Finally, you can use the dashboard to set automated notifications for when certain thresholds are met.

More information is available on http://www.uradmonitor.com/dashboard

Accessing the data

You can access the data collected by your unit in multiple ways. First, you can see the readings online, on the uRADMonitor webpage, by opening http://www.uradmonitor.com/?open=ID (where ID is your unit's ID, just replace accordingly)
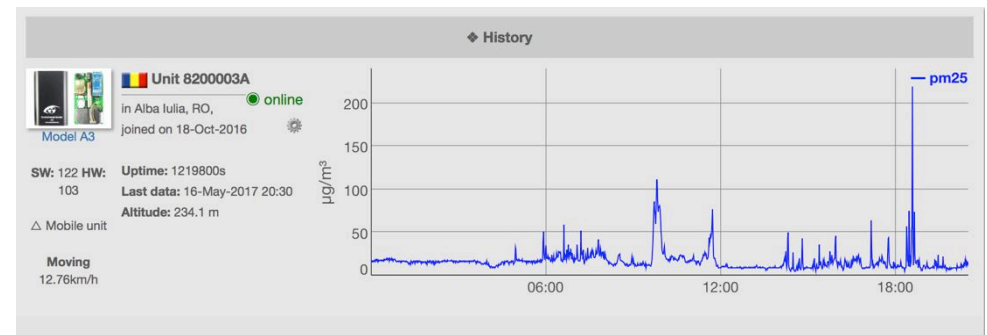
Picture 9: data chart example

With the embedded webserver, you can also access the data directly via your LAN, by opening its DHCP assigned IP in your Internet browser:

Picture 10: direct access to D data via LAN

The JSON link can be used to read the data via various scripts or automation programs. There is an online community developing such tools, here are a few useful resources that you should checkout:

http://www.uradmonitor.com/weather-vs-radiation-readings/
http://www.uradmonitor.com/howto-upgrade-uradmonitor-graph-local-statistics/
http://www.uradmonitor.com/topic/new-firmware-enables-rrdtool-graphing/
http://www.uradmonitor.com/topic/include-uradmonitor-in-monitoring-software/
http://www.uradmonitor.com/topic/setup-local-graphs-for-your-uradmonitor/
http://www.uradmonitor.com/topic/uradmonitorx/

uRADMonitor API

The uRADMonitor data is released as public source, open domain. Complete instructions on how to use the uRADMonitor API are presented in the Dashboard, on http://www.uradmonitor.com .

Data from all units in the network is available via a RESTful API. To access the uRADMonitor data, the following APIs have been implemented (more to be added in the close future). Calling the following via HTTP GET:

http://data.uradmonitor.com/api/v1/devices/

will return a JSON array with all available devices, their IDs and some basic parameters such as location, status or model type.
For a given ID, you can call:

http://data.uradmonitor.com/api/v1/devices/1200000A/

To get a list of the available sensors. Finally, knowing the ID and the sensor, call the following to get the wanted data:

http://data.uradmonitor.com/api/v1/devices/1200000A/temperature

Here, 1200000A was just an example of a network unit.

The mobile application

At the time of writing this article, there is a mobile application for Android OS, that can be used to access environmental data worldwide. Go on Google play and search for uRADMonitor to download your copy.
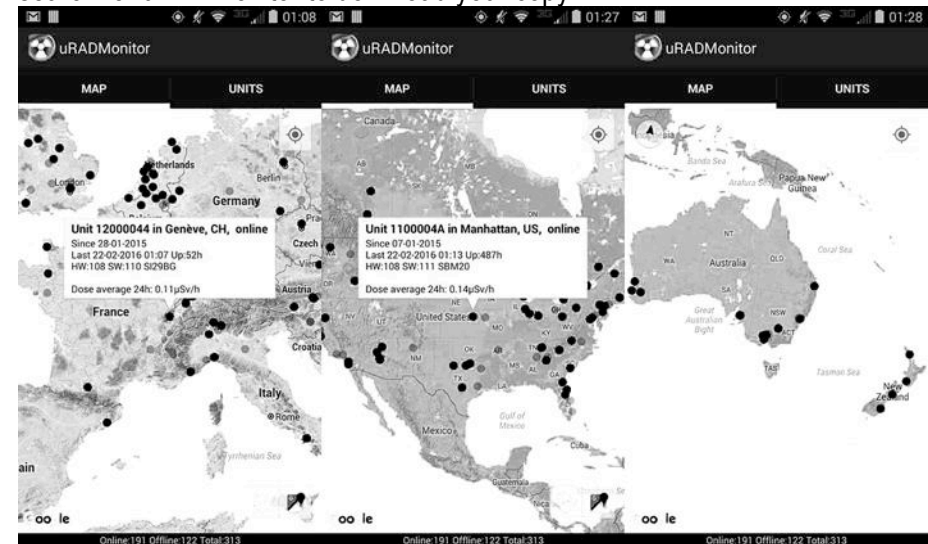
Picture 11: the mobile application

Troubleshooting

Here are a few hints on fixing various issues when using your Model D dosimeter. For additional help resources use the uRADMonitor forum on www.uradmonitor.com/forum or contact us.

1.My unit doesn't start

If the battery is depleted, your unit won't start. Connect a standard USB charger, via the USB port, and check the RED battery LED turning on. When charging is complete, the GREEN led will turn on.

2.The unit is not visible online, nor can I access it via LAN

Make sure you've successfully configured the WIFI settings for your unit. Open your router's admin page and check that a valid IP was allocated via DHCP. Try pinging the IP to make sure the connection is properly setup. Check the network and your router.

Frequently asked questions

Is my model D being calibrated?

Each uRADMonitor-D meter is subjected to a final test. The tested device must be in a confidence interval of 5% in comparison to a master.

Can I use it outdoors?

Yes, but only taking precautions not to expose it to rain or sun. The device, like other electronics, is sensitive to the elements, and reasonable care must be taken to protect it.

Can I remove the SDCARD?

Yes, you can remove the card, read it on your computer, or replace it with a different card, as long as it is formatted as FAT32, it will be recognized by the Model D.

What is the privacy policy if the unit sends data online?

We retain no personal information associated with your unit's data online, and the location on the map can be customized for better accuracy or better privacy, according to your requirements. You have access to these coordinates yourself, by using the Dashboard, on http://www.uradmonitor.com/dashboard . Additionally you can opt to mark your unit as private.

What is a microsievert?

In physics, three types of radioactive radiation are known: alpha, beta and gamma radiation. They differ, not only in their physical characteristics, but also in their effects on humans. To make these three radiation types comparable in their effects on humans, a value has been created which defines the biological effects of radiation: it is referred to as dose equivalent whose unit is the sievert (called equivalent dose). Based on the counted radiation pulses, the different components of a radiation mix are converted into a common measure for the biological effect.

Air quality index worldwide thresholds

You can read more on international pollutants legal limits by visiting https://en.wikipedia.org/wiki/Air_quality_index

Disclaimer

Magnasci SRL deems the data generated by the uRADMonitor detectors as factual, and the opinions expressed above are those of qualified experts based on the results of tests conducted. The uRADMonitor data can not be used as a warranty provision or representation for which Magnasci SRL assumes legal responsibility. The data are offered solely for consideration, investigation and verification. Any use of this information is subject to federal, state and local laws and regulations.

Warranty and support

Your model D comes with a warranty that covers any defects in material or workmanship under normal use during the warranty period. During the Warranty period, your unit will be repaired or replaced, at no charge if it proves defective because of improper material or workmanship under normal use and maintenance. The warranty period is one year (12 months) from the date of purchase.

The warranty does not cover any problem caused by conditions, malfunctions or damage not resulting from defects in material or workmanship.

To obtain the warranty service, you must first contact us to determine the problem and the most appropriate solution for you.

Contact

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"Thank you for participating in World's first global open source environmental surveillance program and for helping the uRADMonitor project move forward! This work has a direct impact on the quality of our environment and implicitly, on the quality of our lives."

Radu Motisan
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