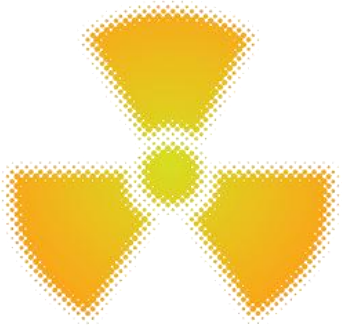


“A-GM Project”

Radioactivity level long term monitoring

ENGLISH:	The manual is only available in English.
FRANÇAIS :	Le manuel n’est disponible qu’en Anglais.
中國語文：	用戶手冊僅提供英文版本。
日本語：	このマニュアルは英語でのみ利用可能です
РУССКИЙ:	Данное руководство доступно только на английском языке.
Last update:	December 4, 2018

AD'novea

FOREWORD

The Radioactivity DIY Ethernet GM Counter device was initially called A-GM Counter and has been renamed to C-GM Counter (*Connected GM Counter*) for a better distinguish from the A-GM Manage web application in charge to manage the radioactivity level measures.

A completely independent Node-RED limited version of A-GM is available for QNAP IoT environment (*see Node-RED section*). It is a different and limited A-GM Manager application that can be used for monitoring only.

NOTES, REMARKS AND WARNING

ⓘ Note related to use.

➲ Important remark for avoiding failures or damages.

△ Critical note to avoid major injury or death.

RECYCLING

Please dispose electronics devices in an environmental friendly manner.

COPYRIGHTS

IMPORTANT

Lethal conditions might occur when human bodies are in contact with high voltage. Therefore, under no circumstances persons unskilled, not familiar or unaware of electrical risks must be involved and are discouraged to get involved.

Operating the device is under the entire, whole and sole responsibility of the user.

This project has been provided for educational purpose only and is not aimed for commercial applications neither it has been approved for any kind of uses.

TABLE OF CONTENTS

OVERVIEW

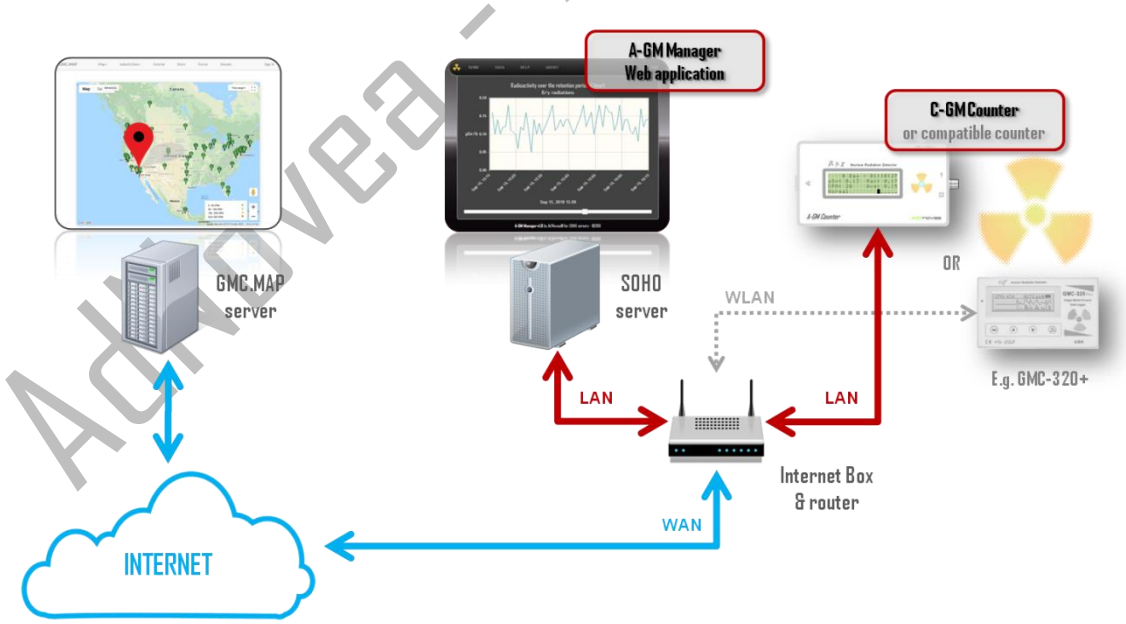
The **A-GM project** is aimed for providing a long-term **continuous measurement of the radioactivity level**. It includes an open-source Web application (*A-GM Manager*) running on a SOHO server (*e.g. NAS from QNAP for Small Office Home Office servers*) connected to a Geiger-Muller radioactivity counter device such as C-GM Counters or compatible counters from GQ Electronics LLC. Other compatible or DIY Geiger-Muller counters could also be used. This project has been developed and is provided AS IS by AdNovea®.

This document makes reference to:

- **A-GM Manager** — The **web application** that continuously monitors and stores the Beta/Gamma radiation levels acquired from Geiger-Muller Counters on a local server.
  Data can be redirected to the GMC.MAP website for worldwide data sharing using a user account.

- **C-GM Counter** — An open-source **hardware** and **firmware** for the Ethernet G.M. counter developed and provided by Ad'Novea® running with the A-GM Manager.

- **GMC-320 device** — GMC-320/5xx/6xx devices are sold by GQ Electronics LLC© and allow the redirection of measures to the GMC.MAP website directly from the device using a WiFi connection. A-GM Manager supports these devices for logging the radiation measures on your server and ensuring the redirection to the GMC.MAP website.



The A-GM project architecture

***IMPORTANT**: This project is provided for training or education and in no case for commercial or professional purposes. It has not been approved for any kind of applications.*

A-GM MANAGER

The **A-GM Manager** web application is aimed for providing a long term monitoring of radiation level using a homemade **C-GM Counter** or a GMC device sold by GQ Electronics LLC.

INSTALLATION

ⓘ **QPKG** packages are targeted for automatic installation on QNAP servers only. For other brand's server, the A-GM website can be manually installed from the **ZIP archive**.

Software files can be downloaded from https://sourceforge.net/u/adnovea website.

Checking Server configuration

In order to run correctly the A-GM Manager application on your server, the PHP and some additional features must be enabled on the server. To display the current configuration, you can click the "*server params*" link in the page footer of the A-GM Manager or run the following command:

```
http://<server IP addresse>/A-GM/test.php
```

This will display some parameters as well as the extensive list of PHP information.

Check your server for A-GM Manager

PHP Version 5.6.36

Current status:

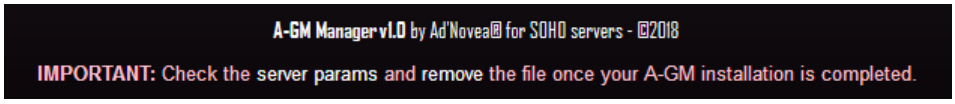
- allow_url_fopen: yes

…

If you don't see "**PHP Version xxxx**." in large green font above, then PHP is not enabled.

ⓘ *The **allow_url_fopen** parameters must be "yes" for enabling the C-GM Counter Remote control.*

➲ Once done, **DON'T FORGET TO DELETE the test.php** file. Use the "*remove*" link in the page footer:



Upgrading the application

Reinstall over the previous installation with the new version. The 'settings/agm.ini' file store the configuration and the' history' folder all the saved data.

Removing the application

Uninstall is managed through the “AppCenter” for QNAP QPKG applications interface.

On other’s server types, simply delete the A-GM folder from the Web server directories.

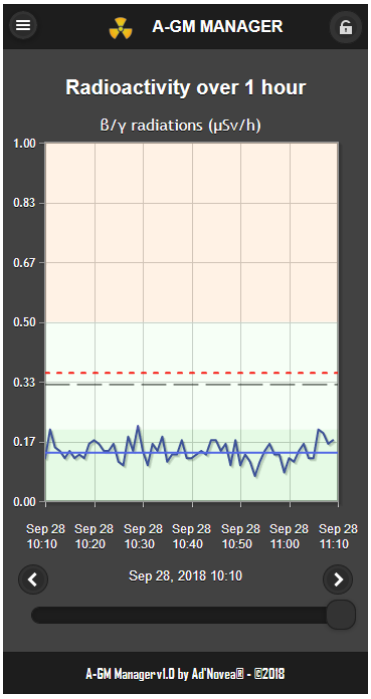
FEATURES

- Language support for English, French, Japanese, Russian and Chinese
- Support for C-GM Counters and GQ Electronics LLC Geiger-Muller counter or compatible devices
- Monitor radioactivity over a user-defined retention period (90 days max)
- Should the level exceed the user-defined threshold; emails are sent up to 5 email addresses.
- Display current radiation level in µSv/h and maximum level over the retention period (*recording*)
- Plot trace with zoom and pan functions (1 hour, 6 hours, 24 hours, 1 week and 4 weeks)
- Log over the retention period can be downloaded and monthly data when available
- Download and Configuration protected with login and password
- Detection of GM tube failure and send e-mail to the administrator
- Redirection to GMC.MAP website (*required a user account*)
- Support Desktop computers, Tablets and Smartphone screens.

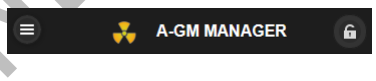
USAGE

The A-GM Manager web is accessible from your Internet browser at
http ://<your_server_ip>/A-GM/gmc.php.

Note: the gmc.php part of the URL can be omitted if your server supports the .htaccess file.



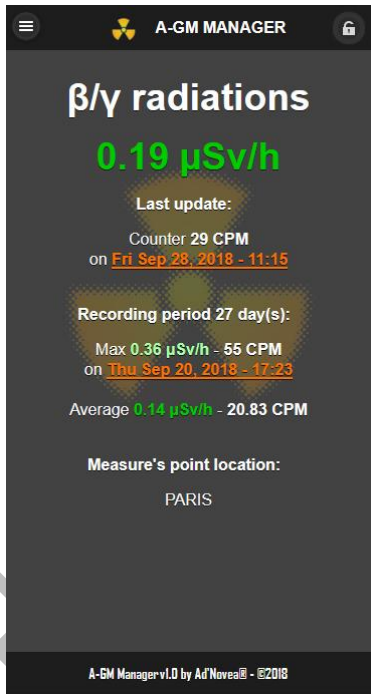
The left button on the header bar opens the menu whereas the left button enables to login and logout.



The A-GM Manager application has been designed for running on Desktop computers but also on Tablets or Mobile phones.

HOME page

The Radiation level displayed on the HOME page is shown in µSv/h and updated every X minutes (*X is set by the user*). The maximum level over the retention period is read from the measured received from the device every X minutes.



The measure's point location shown on the HOME page can be modified by the user from the GENERAL configuration page.

Actions:

CURRENT VALUE Click the "*Last update*" date to display the current radiation level chart

MAX VALUE Click the "*Recording period - Max value*" date to display the Maximum radiation level point on the chart.

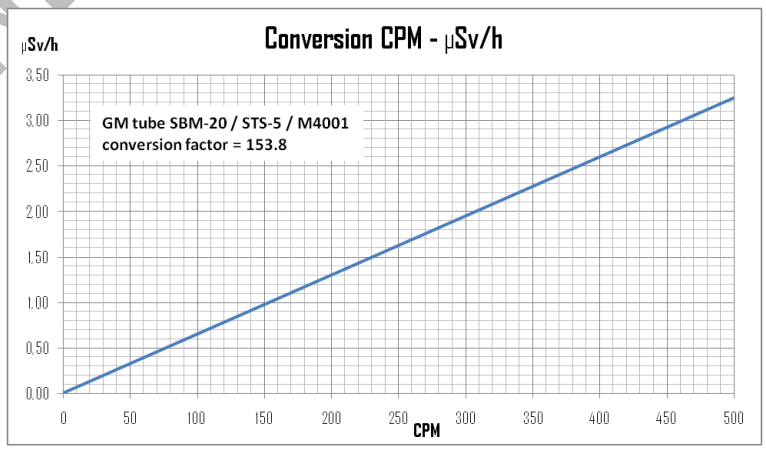
NOTE: When no data is available, radiation value displays '0'.

How data are managed between C-GM Counter and A-GM Manager

The radiation levels displayed by the C-GM Counter and the A-GM Manager can be slightly different because they are managed in different ways and sampled at different times.

	C-GM Counter	A-GM Manager
Current radiation level	Updated every second	Updated every minute or more
Maximum radiation level	Since device power-up	From data stored during the retention period
Average radiation level	Since device power-up	From data stored during the retention period

Data are expressed sometimes in CPM (*Count per Minute*) or in µSv/h (*micro-Sievert per hour*). The relation between the both units is linear and given below. It depends of the GM tube sensitivity (*conversion factor*).



Abacus to convert CPM into µSv/h

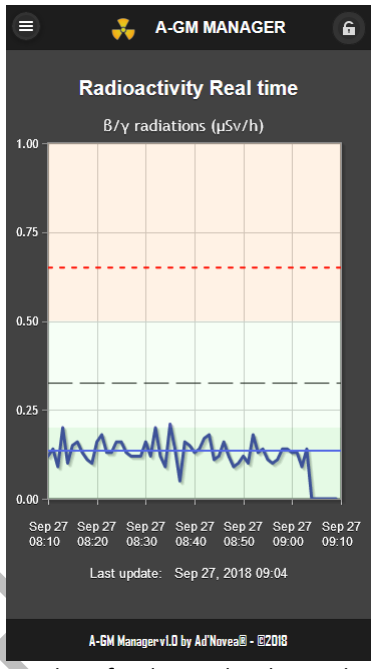
DATA page

The graphic pages are accessible from the DATA dropdown menu entry.

There are 5 zoom possibilities for displaying the data stored during the retention period (*recording period*). The scroll bar below the graphic allows browsing the overall retention period. The plot start time is displayed just above the scroll bar.

NOTE: *If the Monthly save mode is enabled, the retention period equals one month and data are reset on the 1st of the month.*

The plot minimum full scale is set to **1µSv/h** to cover all areas of radiation levels with limited health hazard.



Display of radiation level over the last hour (real time updated)

Real time	Last hour radiation updated every minute (*real time*)
1 hour[1]	Radiation evolution during one hour from the selected start time.
6 hours[1]	Radiation evolution during six hours from the selected start time.
24 hours[1]	Radiation evolution during one day from the selected start time.
1 week[1][2]	Radiation evolution during 7 days from the selected start time.
4 weeks[1][2]	Radiation evolution during 4 weeks from the selected start time.

[1] *You must be logged to access these plot graphs*

[2] *Each plot point is the averaging of several measures: 7 measures for the 1-week chart and 28 measures for the 4-week chart.*

NOTE: *When no data is available, le last radiation level is repeated. This avoid drops to '0' when no data was recorded for a specific time tick (real clocks de-synchronization)*

***IMPORTANT**: for accessing the all the graphics but the Real time you must be logged.*

Plot color

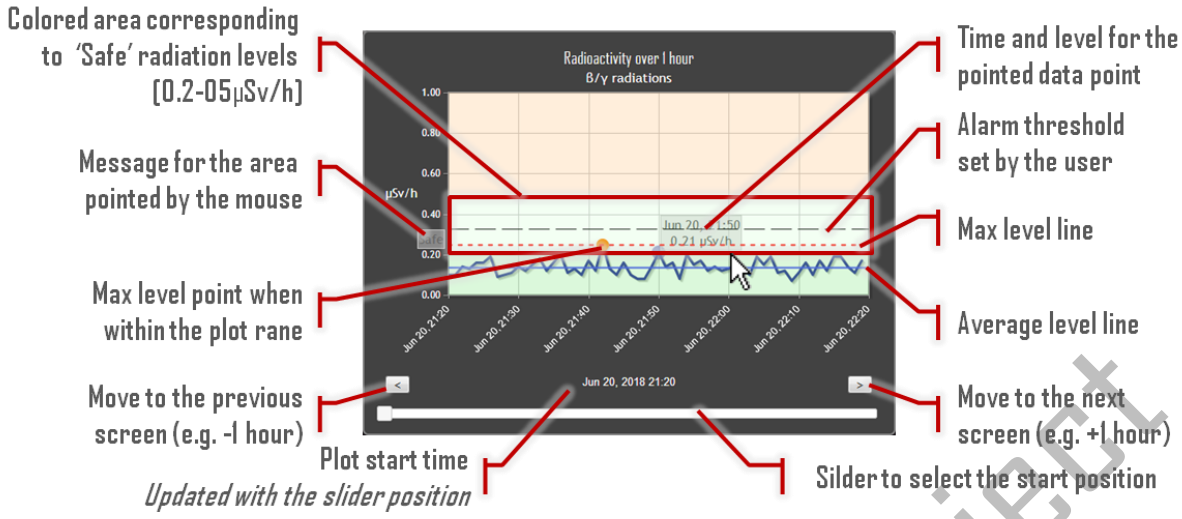
The plot background colors match the radiation level colors below in order to warn the user:

The Radiation *Thresholds* and *Colors* can be modified in the */A-GM/settings/ params.php* file if needed.

Plot data

By default, the plot graph display the current measures from the retention period or the current month (along with the Recording mode selection). When archive measures are available, the set of data to display can be selected from the HISTORY menu.

➲ *To come back to the current recording data, either select 'Current data' from the History page or display the 'Real time' graphic from the DATA menu entry.*



Radiation level plot chart

Actions possible on the plot chart

BUTTONS: Use the two buttons for shifting the plot reference by one unit time (*e.g. 1h, 6h, 1d, 1w, 4w*) and display the previous (<) or the next (>) data.

SLIDER: Use the slider for setting the start time (*plot origin*) within the range of the retention period. While the slider moves, the start time is show above. Fine tune the time position using the buttons

VALUES: Move the mouse cursor over the plotted curve to display the marker (*dot*) and read the time/level values of the highlighted point inside the tooltip box.

AREAS: Move the mouse over the different colored areas (*chart background*) to display the message corresponding to the radiation levels for the corresponding area.

LINES: Move the mouse over the lines to see their meanings: Average and Maximum levels over the recorded period or Alarm threshold level set by the user.

ZOOM: Click and drag the mouse cursor to select zoomed area. This operation can be performed again on the already zoomed area if needed. Double-click the chart to reset the zoom to default.

PRINT: The easiest way is to print the web page or to make a partial screen capture of the plot (*e.g. with Firefox contextual menu or Windows screen capture tool*).

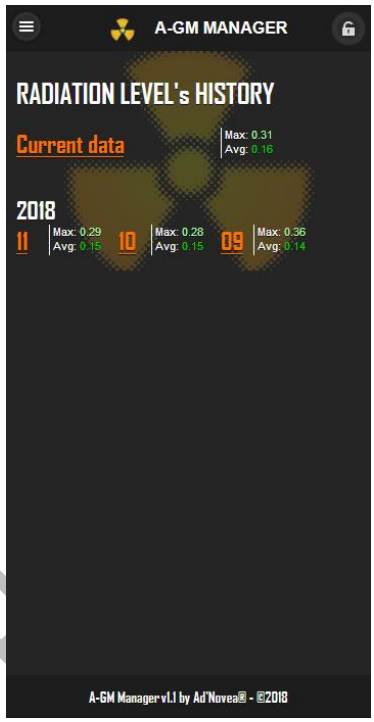
Restrictions on the plot chart

The sub-sampling data processing introduces some limitations for drawing chart plot larger than 24 hours. A minimum of data sample is needed to allow the display of at least one point on the plot:

- 1 week chart plot → >7 minutes of data recording minimum
- 4 weeks chart plot → >28 minutes of data recording minimum

HISTORY page

***IMPORTANT**: for accessing the configuration tabs you must be logged.*



The HISTORY page is under the DATA menu entry. When the "*Moving window*" mode is enabled, only the "*Current data*" link will be available. When the "*Monthly auto save*" mode is enabled, every month a new log file is saved containing the data records of the month.

Current data contents the recorded data currently used for the plot charts. It can be either the data corresponding to the retention period or the data of the current month depending of the *Recording mode* selected. For saving the "data.csv" log file, you should click the "*Current data*" link.

Click the **Month of the Year*** to select the corresponding data log file. Opposite to the month are given the Max and Average value in µSv/h for the month. Radiation levels are colored against the predefined level thresholds.

After selecting a dedicated month, all the graphical menu entries (*1-hour, 4-hour, 24-hour, 1-week and 4-week*) will plot the selected month measures.

➲ *To come back to the current recording data, either select 'Current data' from the History page or display the 'Real time' graphic from the DATA menu entry.*

* *When the mode "Monthly Auto Save" is enabled, every month a data file is created into the "**history**" folder located under the A-GM web server folder. The file is named after **AGM_<year><month.csv** and can be opened using the Excel application. The retention period is reset every month.*

EXCEL DATE-TIME CONVERSION

The date-time format used by Excel differs from the Unix timestamp format used by A-GM Manager. The conversion is given by the Excel formula **=(((A1/60)/60)/24)+DATE(1970,1,1)** where A1 is the date-time of the first data. For the French version of Excel, replace the comma (,) by a semi-colon (;).

*Inverse formula from Excel to Unix date is =(A1-DATE(1970,1,1))*86400 where A1 is the first data date.*

DOWNLOAD

This menu entry is only available for logged user. The file in use (*current or a selected month*) can be downloaded when clicking this menu entry. The file contains the CSV formatted data that can be handled in Excel or Open-Office for further processing.

ALARM E-MAILING

Should the radiation levels exceed the user set threshold; emails will be automatically sent to pre-defined e-mail addresses (*up to 5*).

The pre-defined alarm message looks like:

The radiation level exceed the setting: **0.33 uSv/h** [PARIS]
Please check your A-GM Manager server for details

RADIATION's LEVELS:

< 0.20 uSv/h - NORMAL: very low level
< 0.50 uSv/h - SAFE: check regularly
< 1.00 uSv/h - WARNING: potential danger, find out why
< 6.50 uSv/h - HIGH LEVEL: leave area (exclusion zone)
< 13.0 uSv/h - CRITICAL: leave area ASAP
> 13.0 uSv/h - EXTREME: Evacuate immediately and report to government

Moreover, if the device fails to work and the level gets below the user failure threshold; an email will be sent to the administrator (*1st email address in the configuration page*). The message will looks like:

The radiation level is abnormally low: **0.00 uSv/h** [PARIS]
Please check your A-GM Manager server for details

CONFIGURATION

***IMPORTANT**: for accessing the configuration tabs you must be logged.*

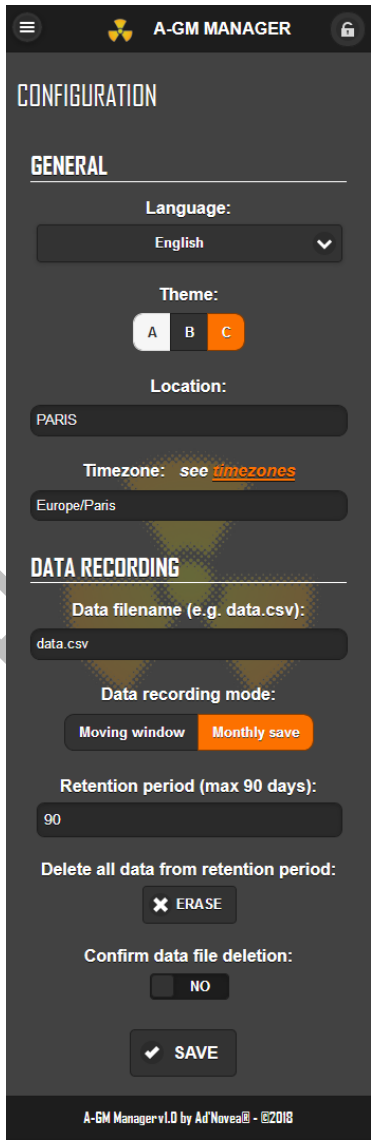
They are 6 tabs to configure the A-GM Manager application:

1. **GENERAL**
2. **REMOTE CTRL**
3. **PARAMETERS**
4. **GMC MAP UPDATE**
5. **MAIL**
6. **LOGIN**

➲ IMPORTANT: First, enter the GM Counter device IP address. Otherwise, if the IP address is wrong, you will be redirected to the home when saving the parameters.

GENERAL

This tab sets all parameters related to the A-GM Manager interface.



- There are 5 **languages** currently supported: English, French, Chinese, Japanese and Russian.
- There are **3 themes** available. The 'A' theme has a white background, the 'B' theme a black one and the 'C' a grey one.
- The **Location** is a free description of the position of the GM Counter.
- The **Timezone** must be set according to your GM counter location. Possible values are available from http://php.net/manual/en/timezones.php
- The **Data Filename** is the retention period log file name. By default the name is "*data.csv*" and does not need to be changed.
- The **Data recording mode** can be chosen between two modes. The "*Moving window*" mode where data are continuously recorded and discarded after the retention period set below and the "*Monthly Save*" mode where data are save into a file every month and the history cleared.

➲ Modification from one **Data recording mode** to another will impact the data already acquired:

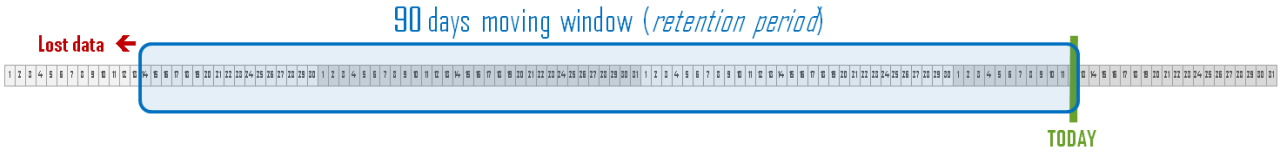
Changing from "*Moving window*" to "*Monthly auto-save*" removes from the current log all the data prior to the 1st of the current month. Moving back to "*Moving window*" will make the retention period to start on the 1st of the current month.

Changing from "*Monthly auto-save*" to "*Moving window*" has no impact until the end of the current month. Monthly data file will be no more created. The current data log will now expand to the maximum of the retention period and discard oldest data.

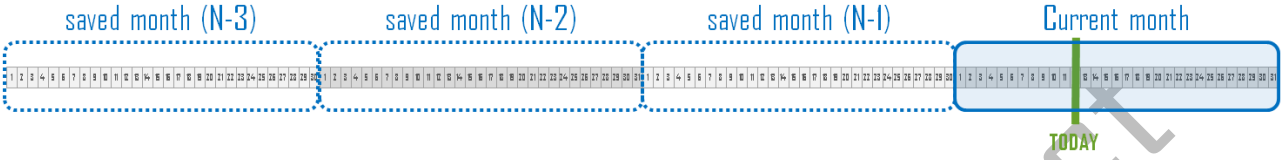
If you do not care storing data over a long period of time, choose the "*Moving window*" mode otherwise you should prefer the "*Monthly auto-save*" mode.

- The **Maximum Retention** Period sets the duration of the log. Data older than the retention period are removed from the log file.
- The History can be cleared using the "**ERASE**" button. To confirm the deletion, the flip switch below must also be set.

Moving window mode

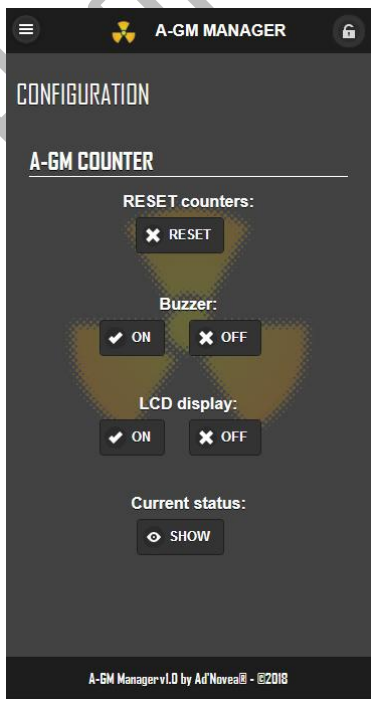


Monthly save mode



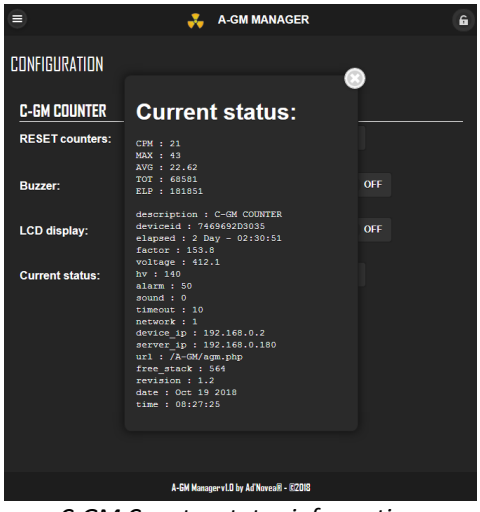
REMOTE CONTROL

This tab allows controlling remotely the C-GM Counter device.
This tab won't be accessible for none C-GM Counter devices.



- The **RESET** button clears all C-GM Counter device counters such as the elapsed time, Maximum level and Average values.
- The **BUZZER** buttons enables to switch ON or OFF the radiation discharges beeps. Audible alarms will not be disabled.
- The **LCD display** buttons enables to switch ON or OFF the display when not used. At anytime the LCD can be wake-up by depressing the C-GM Counter button.
- C-GM Counter **Current status** can be displayed in a dialog box by pressing the *SHOW* button. The radiation values, the elapsed time since start-up, the parameters values as well as the EEPROM status and the available free stack (*in Bytes*) are displayed.

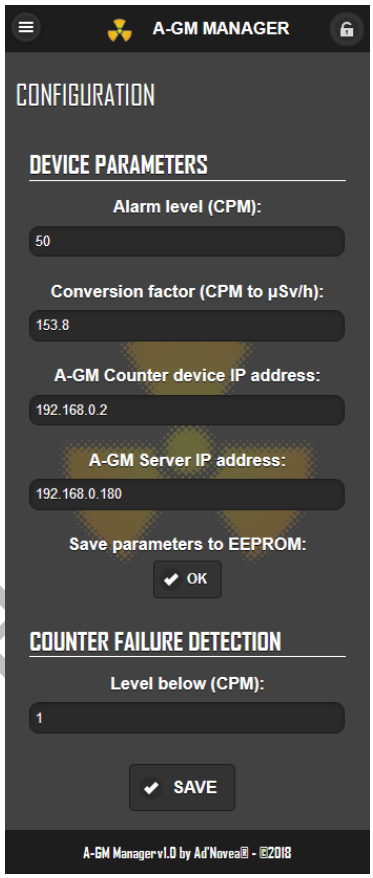
ⓘ *For saving the current state of the Buzzer, you should depress the "Save to EEPROM" button on the PARAMETERS tab.*



C-GM Counter status information

PARAMETERS

This tab is devoted to the parameters of the C-GM Counter device.



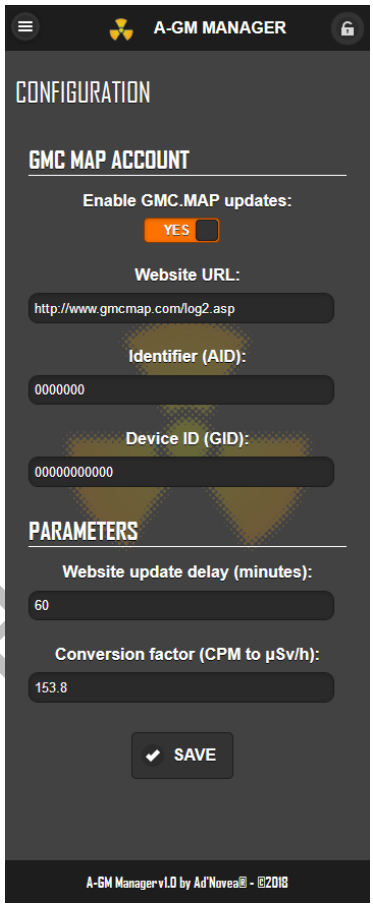
- The **Alarm level** sets the threshold above which the alarm is triggered. This value is set in **CPM** (*Count Per Minute*). Conversion into µSv/h involves the GM tube conversion factor (*see in" C-GM Counter", the "Conversion factors" section*). When the Alarm is triggered, the device beeps and the LCD backlight blinks, e-mails are sent to pre-recorded addresses (*see MAIL tab*).
  The radiation threshold in µSv/h is given by
  CPM threshold / Conversion factor
- The **Conversion factor** depends of the type of GM tube installed in the device (*see the GM TUBE'S CONVERSION FACTORS section*)
- The **C-GM Counter device IP Address** must be entered into this field to enable the C-GM Counter remote control. The device IP address can be found from the C-GM counter device INFO Screen. **WARNING**: Must be left EMPTY for none C-GM Counter devices.
- **The A-GM Server IP address** is the address of the server running the A-GM Manager web application. This address must be set into the C-GM Counter device and will be used for reporting the radiation level data.
- Any parameter modification MUST BE permanently **Save to EEPROM** in order to be restored at next device start-up.
- The **Counter Failure Detection Level** is the level under which the GM tube is detected as failure. This level must be set below the background noise. Default value is '1' CPM.

ⓘ

- The IP address of the C-GM Counter device can be found from the device info screen (Dev:).
- **Save to EEPROM** writes the parameters into the C-GM Counter device Flash memory.
- **SAVE** button writes the parameters into the A-GM Manager configuration file.

GMC MAP UPDATE

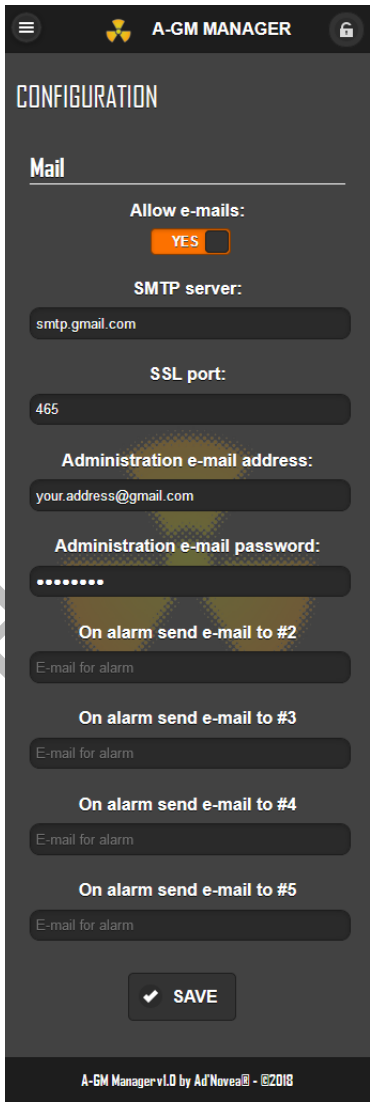
The A-GM Manager web application is able to redirect data to the GMC.MAP website that displays a worldwide map with registered GMC-320/5xx/6xx counter devices.



- **Enable or disable** the GMC.MAP update if needed.
- The default **web URL** for the GMC.MAP website is: http://www.gmcmap.com/log2.asp
- User must enter your **Identifier** (AID) and **Device ID** (GID) provided during your GMC.MAP website member registration.
- The **delay** for updating data on the GMC.MAP website is set to 60 minutes by default but can be lower such as once a day (60 x 24 = 1440 minutes).
- The **Conversion factor** to be used with the GMC.MAP website. The default value is **153.80** and does not need to be modified.

MAIL

The server used for sending the email and the SSL port are required. It works with the GMAIL smtp service.

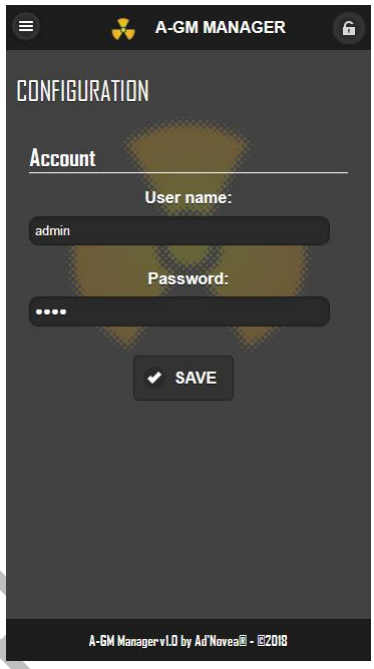


- **Enable or Disable** the e-mails.
- For GMAIL, these are respectively: **smtp.gmail.com** and **465**
- The Administration **email address to log the server** and requires the corresponding **password**.
- The **Administration email** address is used for both receiving the alarm message when threshold level is exceeded but also for the receiving the alerts when the GM tube is defect.
- Email **addresses #2-#5** are addresses for sending alarm messages to multiple recipients only when alarm threshold is exceeded.

ⓘ E-mails are sent only once every 24-hour. The first e-mail is sent when the alarm/failure is triggered and will be repeated 24 hours later if the default is still there.

LOGIN

This tab allows changing the login identifier and password required to access the A-GM Manager configuration page or to download the retention period log file.



- Default login is: **admin** / **admin**

Once logged, user can logout using either the top-right icon in the header bar or the Logout entry from the

ⓘ *Configuration and History menu entries are password protected*.

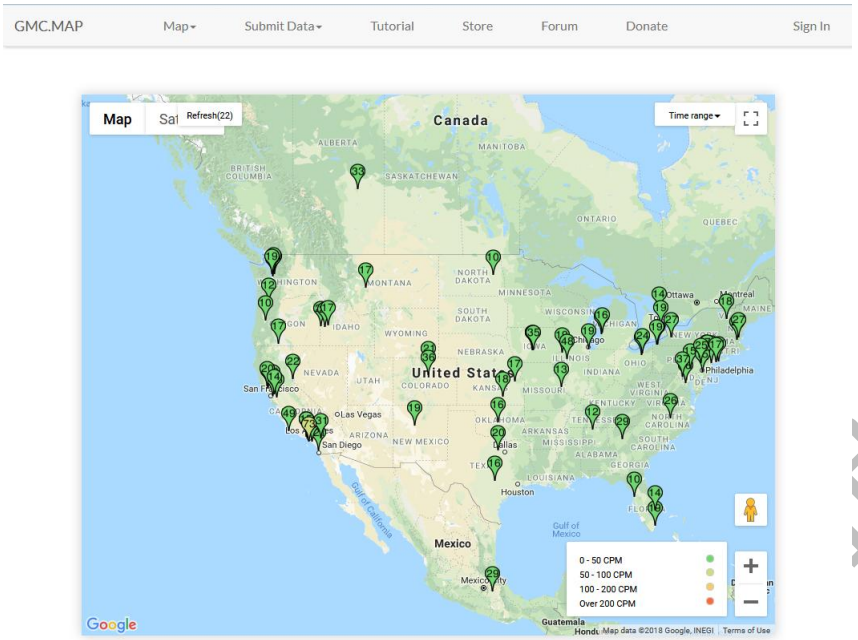
HELP & ABOUT

There is a short help accessible from the **ABOUT** entry in the menu bar. It also displays the Credits and a quick reminder about radiation levels.

A more comprehensive Help file in PDF format (*this document*) is accessible from the **HELP** entry in the menu bar.

GMC.MAP CONFIGURATION

In order for A-GM Manager to report the values on the GMC.MAP website, the parameters must be set along with the user GMC.MAP account. When the user registers, he/she receives an identifier (AID) and a Geiger counter identifier (GID). Both ID are needed for the sending data to GMC.MAP website.



GMC.MAP worldwide map with radioactivity levels in CPM

CPM values sent to GMC.MAP

GMC.MAP has been designed for GMC Counter sold by GQ Electronics LLC©. These counters report CPM values on the worldwide map of the GMC.MAP website. Unfortunately, the CPM values are directly related to the GM tube's sensitivity. For a shake of consistency between different GM tubes, the CPM values sent to GMC.MAP shall be recomputed from micro-Sievert values delivered by the counters.

For GM tubes having different sensitivities, an adjustment of the CPM value is required. The conversion factor for the default GQ Electronics LLC© counters (*equipped with M4001 GM tubes*) such as the GMC-320 counter, equals **153.8** ($GMC\ factor$). For a Counter which the GM tube has a sensitivity of $AGM\ factor$, CPM values to be sent to GMC.MAP shall be:

$$CPM\ sent = \frac{CPM\ counter}{AGM\ factor} \times GMC\ factor \quad or \quad \mu Sv\ counter * GMC\ factor$$

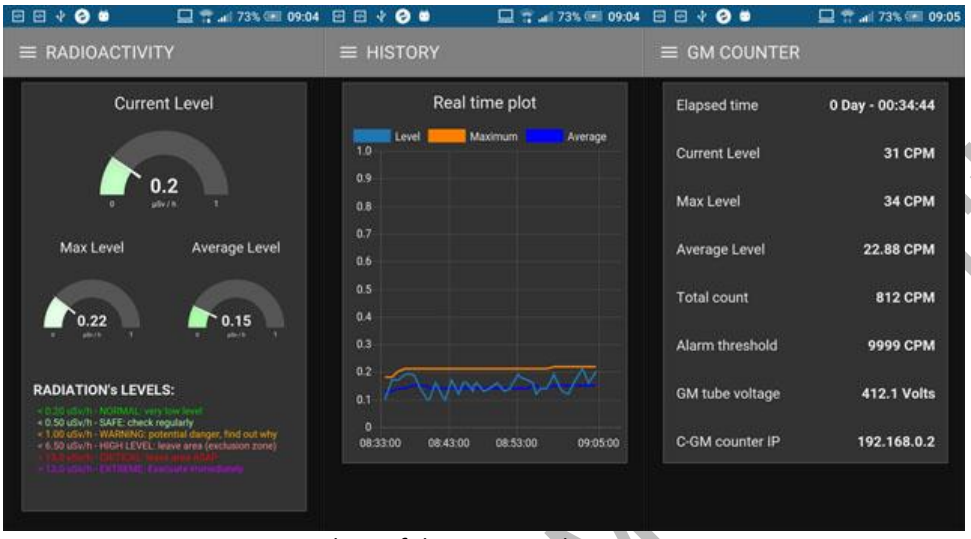
The C-GM Counter device is equipped with a CTC-5/STS-5 GM tube whereas the GMC-320/5xx/6xx devices are equipped with M4001 tubes. Hopefully, these two GM tubes have very similar sensitivities and the same 153.8 factor can be used.

A-GM MANAGER NODE-RED VERSION

This project derivative is aimed for providing real-time monitoring of the radioactivity level on Smartphones, Tablets or Desktops. It is made of an Open-source QNAP IoT application written in Node-RED running on QNAP servers connected to a DIY C-GM Counter device (*Open-source Hardware*). This project has been developed and is provided AS IS by AdNovea®.

There are only 3 screens available:

1. The Current, Maximum and Average radioactivity levels
2. The last hour radioactivity level plot
3. The Counter information.

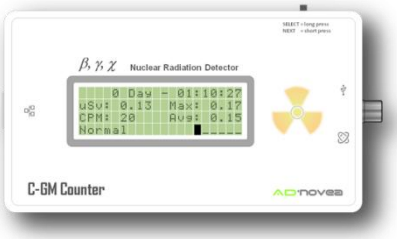


Screenshots of the A-GM Node-RED version

All pieces of information are provided by the counter itself and may differ from the A-GM Manager Web application. Whereas the A-GM Manager Web application processes current radiation levels and compute the Maximum and Average levels over the retention period, the Node-RED version uses the data computed by the C-GM Counter device that are reset at each startup or by the user.

ⓘ *The A-GM Manager Node-RED code can be downloaded from* https://github.com/adnovea/C-GM and runs in Node-RED such as QNAP IoT available on QNAP NAS.

C-GM COUNTER



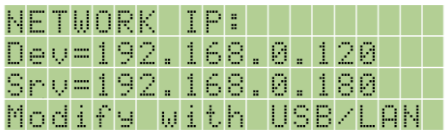
ⓘ *Information required for assembling the C-GM Counter device hardware and firmware can be found and downloaded from* https://sourceforge.net/u/adnovea

FEATURES

- Radiation detection : β, γ, χ-ray
- GM tube : STS-5 (*CTC-5*) / SBM-20 (*400 V operating voltage*)
- Language support : English only
- Maximum value 65 535 CPM / 425 µSv/h (*theoretical*)
- Display values :
  - Current CPM
  - Current µSv/h
  - Maximum µSv/h since startup
  - Average µSv/h since startup
  - Elapsed time since startup
  - Level on bar graph
- Alarm
  - User defined threshold
  - LCD backlight blinking
  - Alarm messages on LCD
- LED flash for each beta/gamma radiation pulse
  - LED blink every second if GM tube is detective
  - LED still on when Network connection fail
- Audio sound
  - Beep for each beta/gamma radiation pulse
  - Audible sound alarm
- Device control from :
  - Device internal menu
  - USB (*require a serial console such as Termite*) or Ethernet (*using a web browser*)
- Network connection using DHCP
- Support for A-GM Manager web interface
- User defined parameters (*from Menu or through web interface*)
- GM tube conversion factor (*CPM to µSv/h*)
  - Alarm threshold in CPM
  - Buzzer On or Off
  - Display timeout
  - Enable Network for communication to A-GM Manager
  - A-GM server IP definition (*through USB or A-GM Manager*)
  - Internal H.V. voltmeter calibration (*through USB or A-GM Manager*)
  - Parameters can be saved permanently into the EEPROM

CONFIGURATION

The C-GM Counter send radioactivity measures to **the <server_ip>/A-GM/agm.php** URL. The only configuration is to program the IP address of the A-GM Manager server. This can be done using the USB connection and a Serial console or the A-GM Manager. To get the C-GM Counter IP Address, toggle the C-GM Counter information screens to the NETWORK screen (*refer to C-GM documentation*).



NETWORK SCREEN *

Display the device (Dev) IP address (*allocated by the DHCP service*) and the A-GM remote server (Svr) IP address.

Data Output

The C-GM Counter sends every second over the Serial communication ports and every minute over the Ethernet port the radiation data values as:

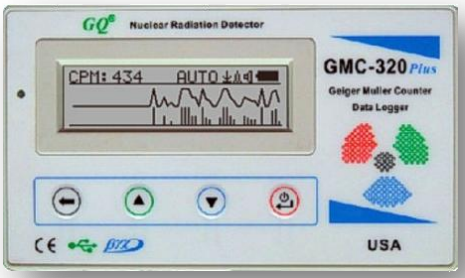
&CPM=0&MAX=0&TOT=0&AVG=0&ELP=0

Where respectively are the Current count in CPM, the Maximum count in CPM, the Total number of counts since power-up, the Average count in CPM since power-up and the Elapsed time since power-up.

If the High Voltage is out of range, the CPM value is set to '0'.

ⓘ *CPM values equal to '0' are managed by the A-GM Manager web application as GM tube failure and will sent an e-mail to the administrator address. CPM=0 is not possible in normal condition because the background radiation which is about 0.041-0.081 µSv/h and will continuously generate 6 – 13 CPM.*

GMC-320/5XX/6XX DEVICES



GMC-320 SPECIFICATIONS

- Radiation detected — Beta, Gamma, X-Ray
- Maximum CPM — 65535
- Maximum µSv/h — 328
- Maximum mR/h — 32.8
- Geiger-Muller tube type — M4001 (400V / factor=153.8)
- Timed Count
- LED Indicator
- LCD Display Size — 128x32
- LCD Contrast Control
- Back Light Level Control
- Onboard Speaker
- Audio Data Port
- Speaker On/Off control
- USB Data Port
- Internal Flash Memory — 1MB
- Real-Time Clock
- Electronic Gyroscope
- Temperature Sensor
- WiFi Module
- Threshold Data Logging
- History Data Save
- Total count user reset
- Battery Included — 3.7V Li-Ion AA(14500)
- GMC.MAP logging server

GMC WORLD MAP DATA FORMAT

GMC.MAP is a free worldwide map for gathering radioactivity levels from worldwide compatible devices. GMC-320/5xx/6xx devices are able to connect to GMC World Map using their internal WiFi module over an Internet.

Auto Submit Data and Protocol

In order to automatically submit data, user has to be registered from GMCmap.com, so that to get a valid user **account ID** (AID) and **Geiger counter ID** (GID). Each user can have multiple Geiger Counters at the different locations.

The submission URL formal looks like:

```
http://www.GMCmap.com/log2.asp?AID=UserAccountID&GID=GeigerCounterID&CPM=nCPM&ACPM=nACPM&uSV=nuSV
```

At least one reading data has to be submitted.

Where:

1. **UserAccountID**: user account ID. This ID is assigned once a user registration is completed.
2. **GeigerCounterID**: a global unique ID for each registered Geiger counter.
3. **nCPM**: Count Per Minute reading from this Geiger counter.

4. **nACPM**: Average Count Per Minute reading from this Geiger counter (*optional*).
5. **nuSv**: µSv/h reading from this Geiger Counter (*optional*).

E.g.: http://www.GMCmap.com/log2.asp?AID=0230111&GID=0034021&CPM=15&ACPM=13.2&uSV=0.075

The µSv/h value is given from dividing the CPM values by the M4011 Geiger-Muller tube conversion factor that equals 153.8.

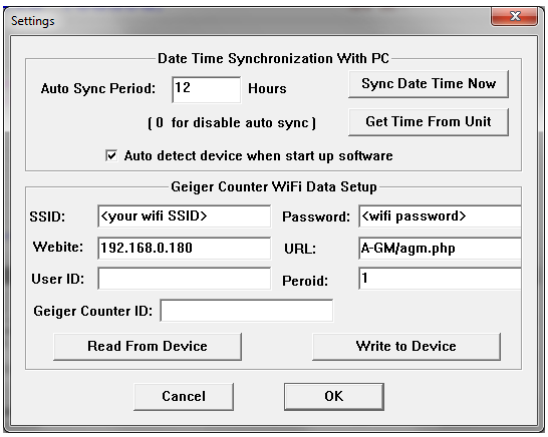
A-GM MANAGER CONFIGURATION

In order to connect to the A-GM Manager web application, the GMC devices must be configured using the following parameters:

WiFi:	
WiFi On/Off	**On**
SSID	Enter your **WiFi network name** (max 16 characters)
Password	Enter your **WiFi network password** (max 20 characters)
WiFi Signal	*Show the received WiFi strength*
IP Address	*Show the allocated IP address*
Mac Address	*Show the device MAC address*
Server:	
Website	Enter your **server IP address** (e.g. 192.168.0.180)
URL	Enter: **A-GM/agm.php**
User ID	Can be left empty
Counter ID	Can be left empty
Period	Set to "**1**" minute
Test connection	*Check if the server is responding*

➲ **IMPORTANT:** *Due to limitation of string's length, WiFi network SSID with name exceeding 16 characters cannot be used. This may also apply to the WiFi password. To overcome the limitation, rename your WiFi network or create a new WiFi network.*

Configuration can also be done using '*GQ GMC Data Viewer*', a free application from *GQ Electronics LLC*.



ⓘ *Lack of data sending can occur when battery goes low. To avoid drops in the plot, for missing time ticks, the previous radiation value is repeated on the plot graphs.*

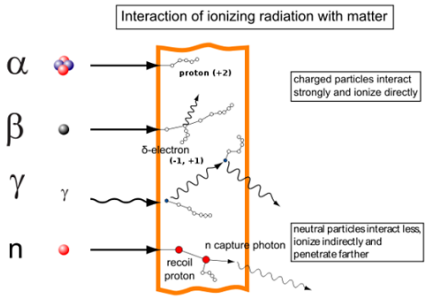
ANNEXES

GLOSSARY

The list below contents abbreviations and acronyms.

µRem	The roentgen equivalent man (Rem) is an older CGS unit. **1 Rem = 100 Sv**
µSv/h	Micro-Sievert per hour – The Sievert (Sv) is a derived unit of ionizing radiation dose in the International System of Units (SI) and is a measure of the health effect of low levels of ionizing radiation on the human body.
Alpha particles (α)	Alpha particles have a typical kinetic energy of 5 MeV and a speed of about 15,000,000 m/s, or 5% of the speed of light. They can be stopped by few centimeter of air, a piece of paper or the epidermis
Beta particles (β)	Beta particles have medium energy and most can be stopped by a few millimeters of aluminum. Beta radiations are in the range of 0.25 to 3.5.
CPM	Count Per Minute.
Gamma particles (γ)	Gamma particles have very high energy and require shielding by dense material such as lead or concrete to be stopped. Gamma radiations are in the range of 0.1 to 1.25 MeV.
GM	Short for Geiger and Muller who are the inventors of the vacuum tube with low pressure gas able to detect ionizing radiations from X-Ray, alpha, beta and gamma particles.
GM Counter	Device able to count the number of radiation impulses per minute (CPM).
GM Factor	Each GM tube manufactured type has its own sensitivity to radiation and a specific factor to convert the number of impulse (CPM) into micro-Sievert per hour (µSv/h).
GUI	Graphic User Interface includes the display and keyboard systems.
Ionizing radiations	Radiation carrying enough energy to liberate electrons from atoms or molecules, thereby ionizing them (Alpha, Beta, Gamma or X-Ray radiations)
LAN	Local Area Network: private network installation
LCD	Liquid Crystal Display is a dot-matrix display for text and semi-graphic characters.
QPKG	Packaged application module compatible with QNAP servers
Sv (Sievert)	Unit of ionizing radiation dose in the International System of Units (SI) measuring the health effect of low levels of radiation on the human body.
Tack switch	Push button made of micro-switch system.
X-Ray	X-ray radiations are in the range of 30 keV to 3.0 MeV.

TYPES OF RADIATIONS



Alpha:

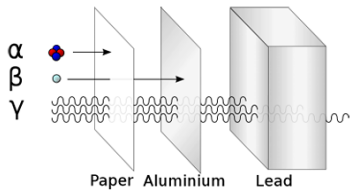
Alpha radiation are positively (+2) charged particles emitted from atom nucleus in the process of decay. These particles are also very dense and their strong positive charge precludes them from penetrating more than an inch of air or a sheet of paper. Alpha particles are not a serious health hazard, except when they are emitted from within the body as a result of ingestion, for instance, when their high energy poses an extreme hazard to sensitive living tissue. This weak form of ionizing radiation is only detectable by some models of Geiger counters equipped with Geiger-Muller tubes having a thin mica window at one end.

Beta:

Beta radiation are negatively charged (-1) particles emitted from an atom in the process of decay. These relatively light particles can penetrate deeper than Alpha particles, though still only through a few millimeters of aluminum at best. If ingested, Beta radiation can be hazardous to living tissue. This relatively weak form of ionizing radiation is detectable by many Geiger counters.

Gamma:

Gamma radiations are one extreme of the electromagnetic spectrum, particularly that radiation with the highest frequency and shortest wavelength. (*That same spectrum also includes the more familiar X-rays, ultraviolet light, visible light, infrared rays, microwaves, and radio waves, listed in order of decreasing frequency and increasing wavelength from Gamma rays*.) Gamma rays can pass through virtually anything, and are effectively shielded or absorbed only by materials of high atomic weight such as lead. Gamma rays are produced naturally by the sun and other bodies in outer space, their transmission to earth being known as "*cosmic radiation*". A very powerful and potentially very dangerous type of ionizing radiation detectable on virtually all Geiger counters.



Background radiation:

Certain earth's minerals contain the radioactive elements such as Uranium and/or Thorium which also emit Gamma rays. This radiation along with the cosmic radiation (*Gamma rays which come from the sun and other stars*) combine to produce the "*background count*" of a Geiger counter. This might typically be in the range of 15 to 60 counts per minute, but will vary depending upon your location on the earth, your altitude, and also

the efficiency (*sensitivity*) of the Geiger counter tube. The background count should always be factored in or "subtracted" from the overall reading derived from a specific radioactive source.

Common background radiation goes from 0.041µSv/h to 0.081µSv/h (3650 - 7200µSv/year).

DOSE RATE EXAMPLES

All conversions between hours and years have assumed continuous presence in a steady field, disregarding known fluctuations, intermittent exposure and radioactive decay. Converted values are shown in parentheses.

Source Wikipedia

<1 mSv/a	< 0.1 µSv/h	Steady dose rates below 100 nSv/h are difficult to measure
1 mSv/a	0.11 µSv/h avg*	ICRP recommended maximum for external irradiation of the human body, excluding medical and occupational exposures.
2.4 mSv/a	0.27 µSv/h avg	Human exposure to natural background radiation, global average
3.7 mSv/a	0.42 µSv/h avg	.Average radioactivity level at the entrance of the Chernobyl exclusion zone.
24 mSv/a	2.7 µSv/h avg	Natural background radiation at airline cruise altitude
41 mSv/a	4.6 µSv/h avg	Radioactivity level at the Chernobyl memorial near the nuclear plant before the new sarcophagus.
130 mSv/a	15 µSv/h avg	Ambient field inside most radioactive house in Ramsar, Iran. Radioactivity level in sewer drain in Pryp'yat', Ukraine.
(800 mSv/a)	92 µSv/h	Natural radiation on a monazite beach near Guarapari, Brazil
(9 Sv/a)	1 mSv/h	NRC definition of a high radiation area in a nuclear power plant, warranting a chain-link fence
	2–20 mSv/h	Typical dose rate for activated reactor wall in possible future fusion reactors after 100 years. After approximately 300 years of decay the fusion waste would produce the same dose rate as exposure to coal ash, with the volume of fusion waste naturally being orders of magnitude less than from coal ash. Immediate predicted activation is 90 MGy/a
(1.7 kSv/a)	193 mSv/h	Highest reading from fallout of the Trinity bomb, 32 km away, 3 hours after detonation
(2.3 MSv/a)	262 Sv/h	typical PWR spent fuel bundle, after 10-year cool down, no shielding
(4.6–5.6 MSv/a)	530–650 Sv/h	The radiation level inside the primary containment vessel of the second BWR-reactor of the Fukushima power station, as of February 2017, six years after a suspected meltdown

**avg The equivalent average dose over one year (1y = 8766h).*

TROUBLESHOOTING

Problems	Solutions
A-GM MANAGER	
Download and Configuration menu entries are grayed	• You must first login to enable these menu entries. Once logged these menu entries become available.
A-GM Count Remote Control not working	• Check using the "test.php' link your server configuration. The *allow_url_fopen* parameters must be active. • Open a console on your sever and try to ping the C-GM Counter device. If it fails, there is a server configuration issue. • Check if any ad blocker is enabled in your browser (e.g. NoScript) and give it permission for the device IP address.
Some chart plot (e.g. 4-week, 1-week, etc…) are empty	• See the "*Restrictions on the plot drawing*" section for explanations.
Empty chart plot is displayed when switching from one duration to another	• The start time of the plot may be located into a not empty period of data recording to show data. Ensure your start time is within a valid recoded period.
Time to display plot chart is very long. It is even longer for 1 or 4 weeks.	• Because of the sub-sampling data processing, the number of data drastically increases for the 1 and 4 weeks plot chart.
Maximum values seen on the 1-hour plot chart are no longer noticeable on the 6-hour plot chart or above. The plot curves tend to match the average line.	• This is absolutely normal because the plot data point interpolation processing is based on an averaging function. It smoothes the curve and minimizes the picks.
There are some misalignments or bugs in web pages	• We have tested AGM-Manager against Firefox 60.2.0ESR, Internet Explorer 10.0.9200 and Chrome 65.0.3325. There was no test done on Opera neither on Mobile or Tablet devices.

LICENSES

We are proud to release our A-GM project under free licenses. Feel free to use it the way you like in accordance with the licenses below.

A-GM Manager Web application	 *License : GPL v3 (open-source)* https://www.gnu.org/licenses/gpl-3.0.en.html
C-GM Counter Firmware	 *License: Free to use for personal application only* No source code released, only binary files
A-GM Manager Node-RED application	 *License : GPL v3 (open-source)* https://github.com/adnovea/C-GM

SUPPORT

This project is provided “AS IS” and is not committed to provide support of any type.

Nevertheless you may find some helpful pieces of information and exchanges from the SourceForge repository.

https://sourceforge.net/u/adnovea