



# ***RnView 2 SOFTWARE***

## ***User's manual***

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Ind	Date	Designation	Author	Approved

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## 1- GETTING STARTED

**RnView2** is the software for using Radon measurement instruments developed by ALGADE.

**RnView2** controls, reads, displays and converts the data recorded by the radon probes.

**RnView2** is configured in the workshop to adapt it to the instrument it has to manage.

**RnView2** is delivered on CD with an installation manual



This software functions under:

- Microsoft Windows 98, NT, 2000
- Microsoft Windows XP, Vista, Seven

### Installation of the software

The installation procedure is as follows:

Switch on the computer.

Insert the CDROM **RnView2** and without loading it, execute the *Installe.exe* installation program.

Follow the instructions presented on the screen to choose the installation language and the installation directory, and install the files on your hard disk. (It is not necessary to copy the loading program onto the disk).

When the installation is complete, create a shortcut and place it on the computer office.

### IMPORTANT

**RnView2** software must be used only with BMC2 type probes, manufactured after October 2003.

In the same way BMC2 probes must only be driven by **RnView2** software.

Applications using the same serial port using by **RnView2** must be closed.

The historical file with the CD installation lists the software developments since version 1.0 of October 2003.

## 2- USE

Set the computer with:

- dot “.” as decimal separator
- date format dd/MM/yyyy separator” / “
- time format HH :mm separator “ : ”

Start >> Control Panel >> Regional and language options

Start-up

Launch the **RnView2** application

using the **ALGADE** icon

or via the menu bar **Start >> Program >> RnView2**

**RnView2** functions intuitively.

In particular:

**The accessible functions are designated by texts in bold.**

The paths will be given in the form **command1 >> command2 >> Command3**

**example: file>>convert>>untreated values**

The functions are accessible by clicking with the mouse or by the sequence alt+ underlined letter then underlined letter.

At launch a screen appears with 6 buttons. **File – Probe** - Display – Volumic Activity Parameters – **Maintenance** - ?

By clicking on one of the authorized buttons, the corresponding screen will be called up.

The command tree structure is indicated:

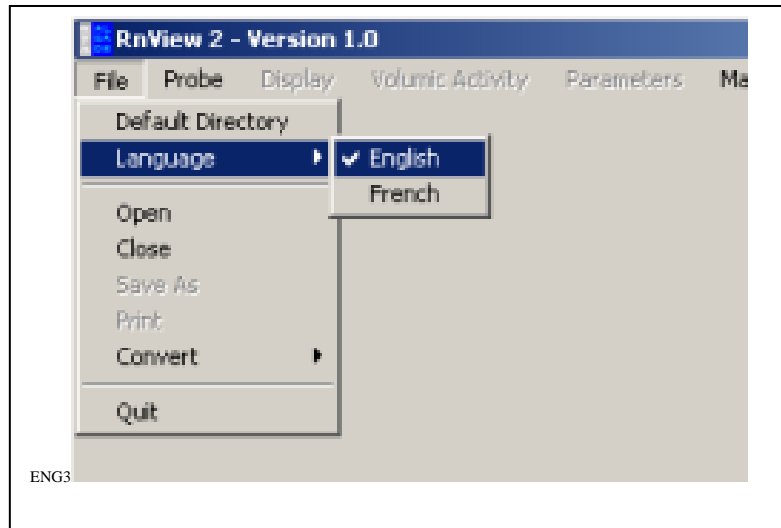
File			Probe	Display	Volumic activity	Parameters	Maintenance	?
>> Directory By default			>> Connection					
Language >> French			Read >>			Partial		
Open English			Initialisation			Complete		
Close			Parameter set					
Save as			Stop probe					
Print			Port					
Conversion								
Exit								

You can avoid using the mouse. Press the ***Alt*** key and the function code letter is underlined. Press the underlined letter to activate the corresponding command.

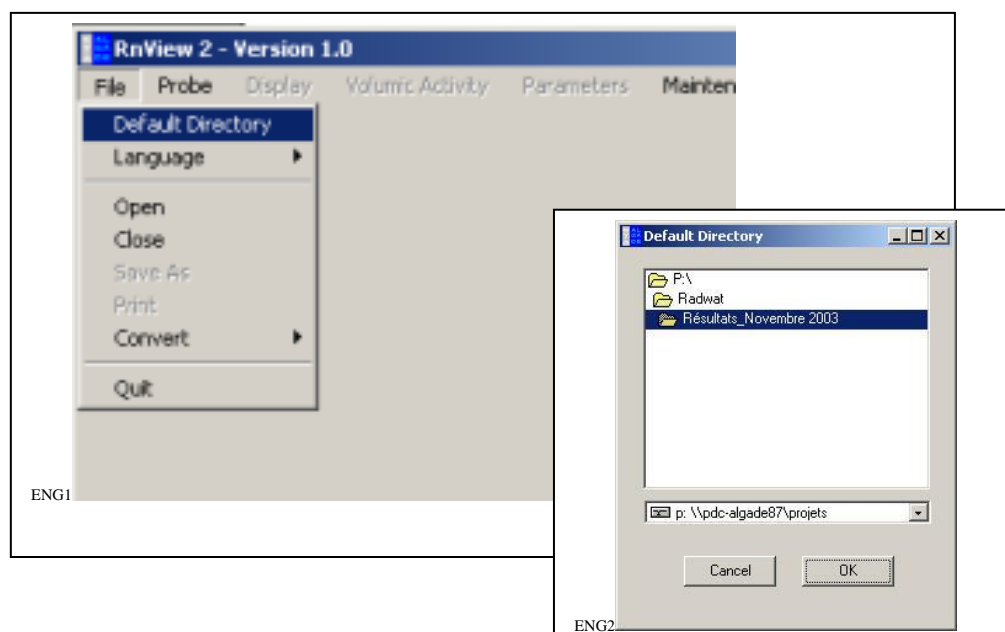
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## Preparation

Choose your preferred language: English or French.



Select the button **File >> Default Directory** where the data files will be stored



## Communications

The communications panel selects the transmission method and configures the installation.

- Local : Reading the probe by physical connection, by cable, between a PC and the probe
- Remote: Hertzian reading between a PC equipped with a local RTC modem (modem 56K) and the probe connected to a GSM modem.

A directory of devices that can be remote read is accessible with the « Device List » tab

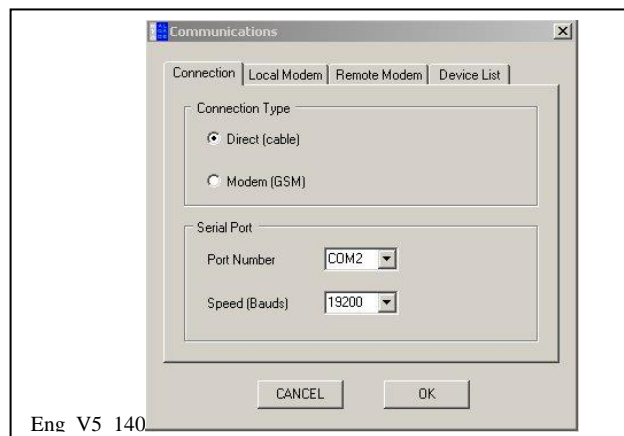
### Connection

Access by **Probe >> Communications**

*a) Case of standard probes not connected to a GSM modem*

Select the type of Direct connection (**Cable**)

Adjust the speed of the serial port to 19200 bauds.

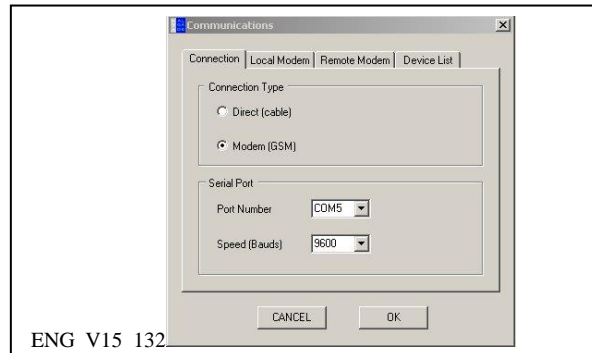


*b) Case of probes connected to a GSM modem:*

Adjust the speed of the serial port to 9600 bauds.

To consult the probe by cable, select the type of **Direct** connection ( **Cable** ) as above and select the COM port to which the probe is connected.

To consult the probe by GSM modem, select the choice: **By GSM Modem** and select the COM port to which the local modem is connected.



*NB: If you don't know which COM port is used by your local modem:*

*Launch the Windows device manager ( right click on My Computer > Properties Hardware tab > Hardware Manager Button )*

*Double-click on the « Modems » heading*

*Right click > Properties on your modem*

*On the panel obtained, the number of the COM port is usually indicated on the « Modem » tab.*

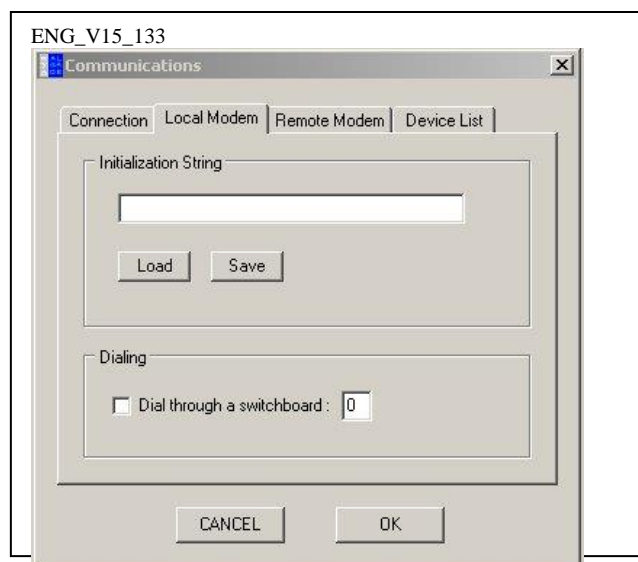
*NB If you use a PC equipped with an integral modem, the COM port used is generally the 3*

The mode **by GSM Modem** makes it necessary to set the parameters of the modems placed at each end of the link

### Local modem

Enter the modem initialisation string if necessary.

*The modems supplied or recommended by ALGADE do not require any specific initialisation*





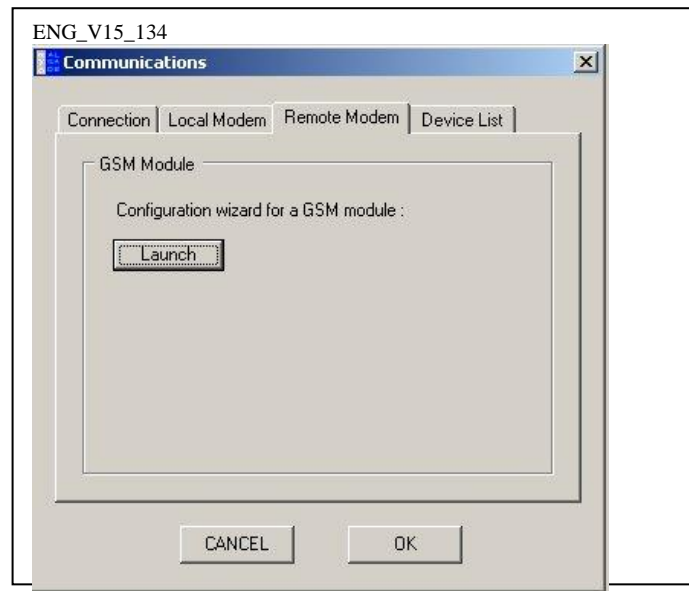
- **Remote modem**

The user's manual (NU-XFA542-244) in English, describes the operations to be carried out at the remote modem end.

Take the SIM card and its pin code. The configuration wizard guides you.

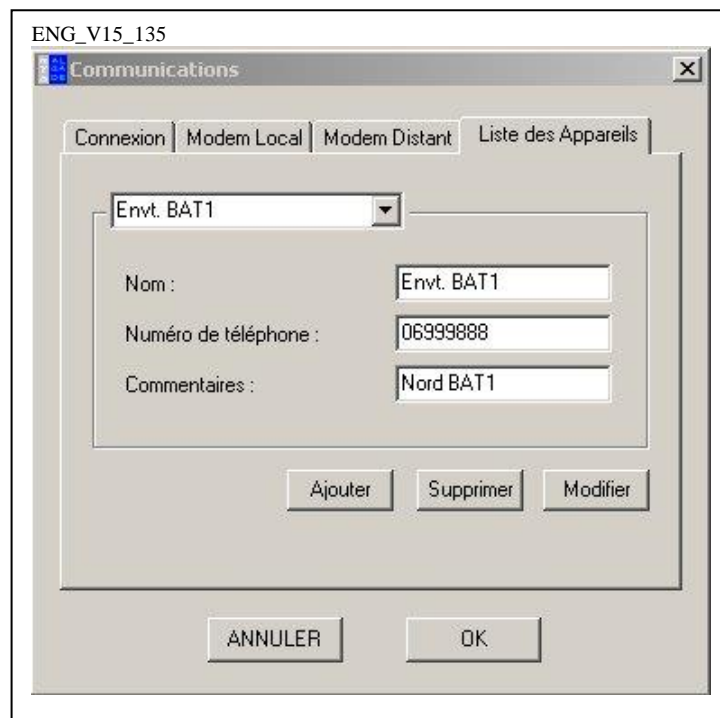
*Important: for the configuration, the GSM modem must be connected to the host PC by the modem configuration cable supplied with the probe. The configuration is only made once after the insertion of the SIM card in the GSM modem.*

*The GSM configuration file is supplied in the installation directory of RnView2 ( file type xxx.gsm )*



#### Device list

This is a directory containing the devices that can be consulted by GSM.  
You must have the call number.



### **Adjustment particular to Windows:**

Specify the dot as decimal separator.

For Windows 98 and 2000: **Start>>Parameters>>Control panel>> Regional options>>Button Number>>Decimal symbol**

For Windows XP: **Start>>parameters>>control panel>>regional options, date, hour and language>>Modify the format of numbers, dates and time>>Button Number>>Personalize>>Decimal symbol**

# PROBE

Select the **Probe** button

Depending on the context, access will be given to



Connection → prior stage to access the probe functions when the link is by GSM.

Retrieval → transfer of data from the probe to the computer

Initialization → Initialize the probe taking into account the parameters defined by the user

Parameter set → accessible after a code is entered

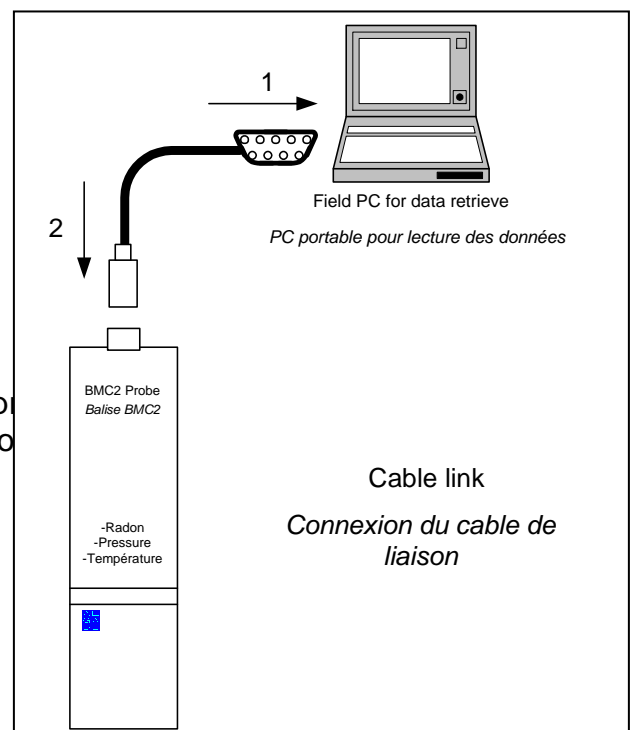
Stop Probe → places the probe in sleep mode. Consumption is reduced.

Port → defines the output port used as well as the transmission speed.

The cycle of use of the Radon probes is:

- Initialization
- Acquisition for the time necessary
- Intermediate retrieval
- Acquisition for the time necessary
- Final retrieval
- Stop

The link between the computer and the radon probe is made by a dedicated cable. Always connect the plug of the cable to the computer by GSM

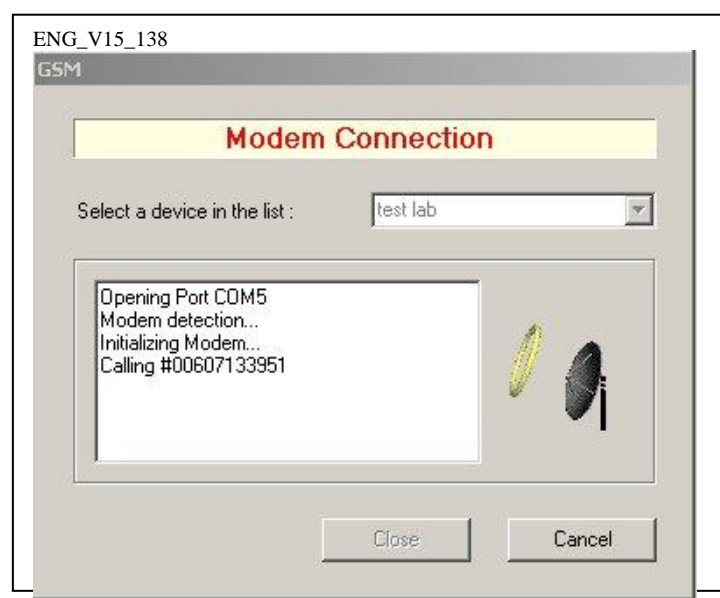


In all cases, if the probe is not connected to the computer an error message will appear.



## Connection (GSM)

Access by **Probe** >> **Connection**



The scrolling menu selects the call number from among the numbers previously entered in the directory.  
The access phases to the GSM number selected scroll down the window.

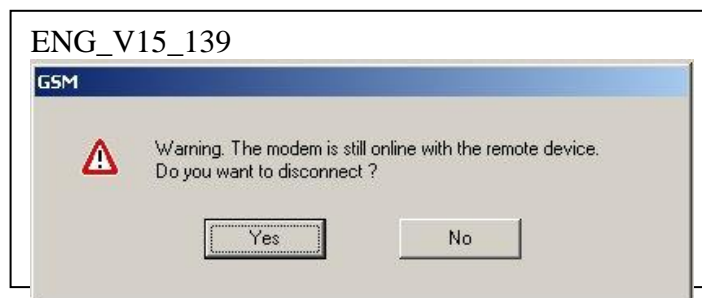
When the connection is established, the following message is displayed in the bottom left corner of the screen.



The link features are displayed in the lower line of the RnView2 application



At this moment the probe is accessible with the same functionalities as a direct connection by cable.  
After 30 seconds of inactivity a message appears.

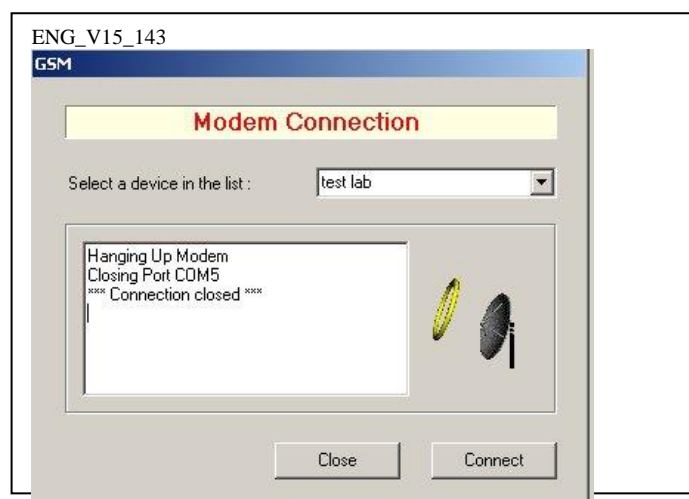


*The connection is automatically cut off after 60 seconds of inactivity.*

In all cases, if the probe is not connected to the computer an error message will appear.

- Local Modem not found (GSM )
- No response( GSM )
- Busy (GSM)
- No response (local)

To end the connection **Probe >> Disconnection**



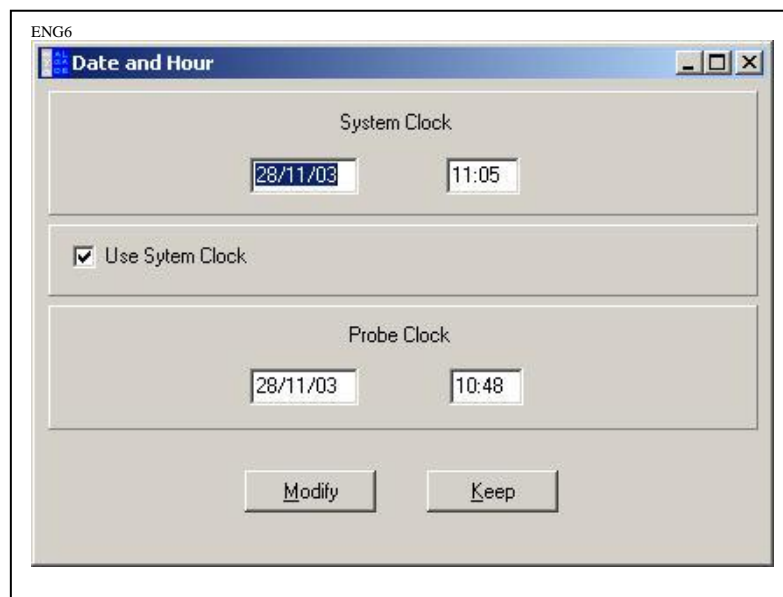
## To initialize a probe

This command initializes the probe using the following procedure:

1. set the correct time and date of the probe,
2. enter the integration time and a comment,
3. clear the probe flash memory completely,
4. write the parameters entered in the probe memory,
5. launch the first acquisition.

For access, **Probe >> Initialization** (local) or **Probe>> Connection >> Initialization** (GSM).  
The time setting window appears :

the time setting window appears:



The display gives the present setting of the probe clock as well as the time of your PC.

You can choose to keep or replace the probe setting by selecting the box ***Use the system time***:

- if this box is selected, the probe will be reinitialized with the date and time of your computer.
- if this box is not selected, you can enter a new date and transmit it to the probe.

Click on **Modify** to take your modifications into account, if not click on **Keep** to keep the probe setting.

The window which then appears displays the parameters extracted from the probe during initialization by means of the 7 tabs:

General – Radon – Pressure –Temperature – Humidity – GSM Option – Comments.

*The tabs: Radon, Pressure, Temperature, Humidity, GSM Option, Comments cannot be modified in GSM link.*

The screenshot shows a software window titled 'Initialization' with a tabbed interface. The 'General' tab is selected. The window contains several input fields for probe configuration. At the top, there is a 'Probe #' field with the value '157'. Below this, the parameters are organized into four groups: 'Model' (Software Version: 1.6, Probe Type: 12), 'Battery' (Reference (Volts): 3.3, Minimum Voltage (Volts): 2.0, Battery Coefficient: 1.0), 'Maintenance' (Last maintenance: 11/2006, Gap (years): 2, Next maintenance: 11/2008), and 'Measurements' (Number of measurements: 467, Start Date: 15/11/06 at 09:04, Period (minutes): 15). At the bottom of the window are two buttons: 'CANCEL' and 'INITIALIZATION'.

Parameter	Value
Probe #	157
Software Version	1.6
Probe Type	12
Reference (Volts)	3.3
Minimum Voltage (Volts)	2.0
Battery Coefficient	1.0
Last maintenance	11/2006
Gap (years)	2
Next maintenance	11/2008
Number of measurements	467
Start Date	15/11/06 at 09:04
Period (minutes)	15

In the General button the user can modify the active areas, that is, the period. The accepted periods go from 1 to 240 minutes by increments of 1 minute.

The acquisitions will take place at each whole minute. Moreover, to make it easier to interpret the measurements, rules have been adopted for the following periods:

*5 minutes start-up at  $T=0 \text{ modulo } 5$*

*10 minutes start-up at  $T= 0 \text{ modulo } 10$*

*15 minutes start-up at  $T= 0 \text{ modulo } 15$*

*30 minutes start-up at  $T= 0 \text{ modulo } 30$*

*60,120,180 and 240 minutes start-up at  $T= 0 \text{ modulo } 60$ .*

The first measurement will be registered P minutes after starting time

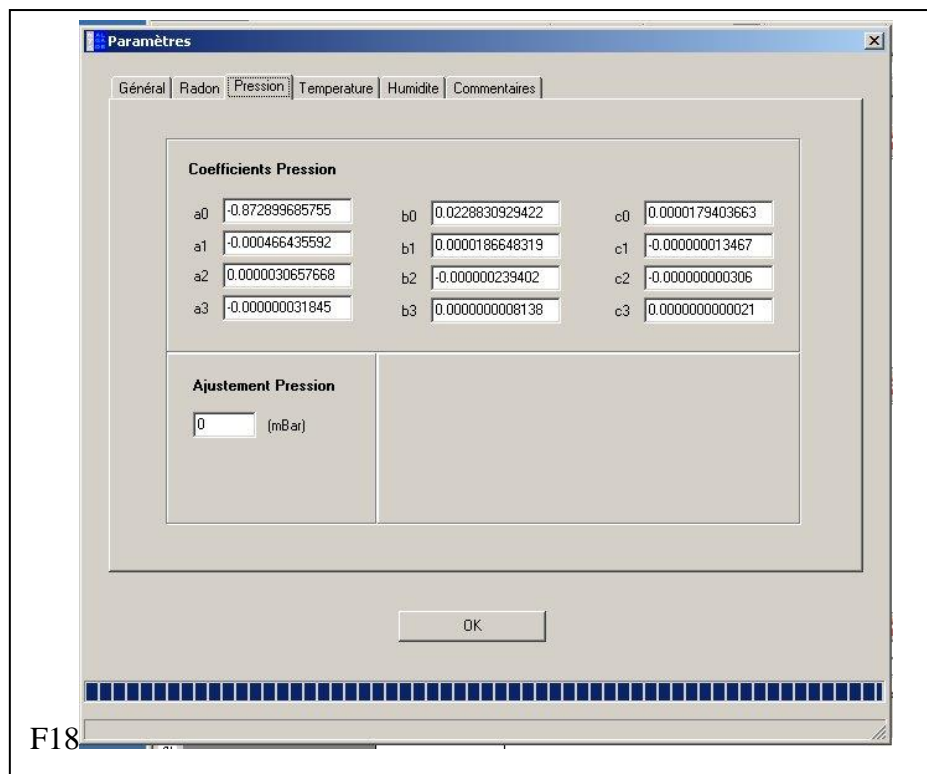
The type of probe defines the measurement methods used. The type of probe is defined at the time of ordering and cannot be modified.

The soft version is that of the software internal to the probe.

### Radon Tab

In the **Radon** tab, the user can set the alarm values that will activate the controls Alarm 1 or Alarm 2 on the display.

In some models, exceeding the alarm can cause a warning light, a fan... to come on.



F18



## Pressure Tab

The *Pressure adjustment* box in the **pressure** tab serves to adjust the pressure value measured by the probe to the atmospheric pressure value measured locally by a reference method.

The value of divergence is obtained by subtracting the result of a probe acquisition from the local atmospheric pressure measurement.

By default the pressure adjustment is at 0 mbar

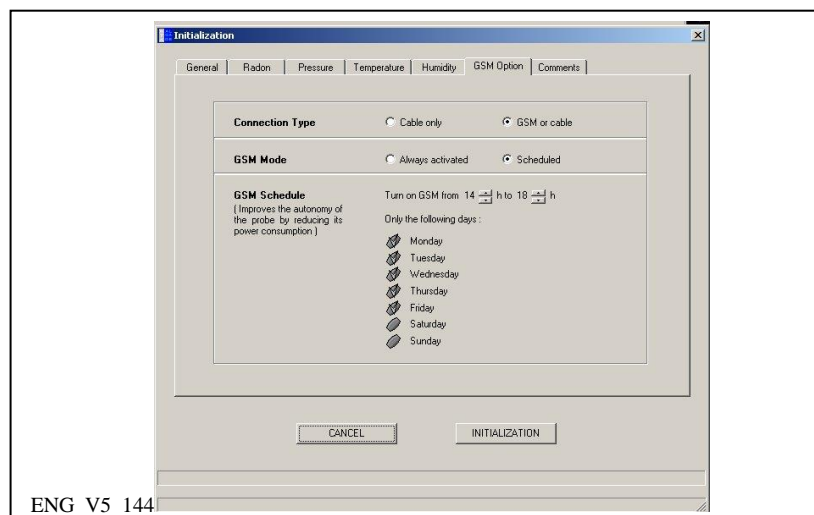
## GSM Option Tab

**Important: This tab is only accessible in the direct connection mode (by cable)**

In the GSM Option tab (probes equipped with a GSM modem only) the user can configure the accessibility of the probe by GSM.

In the case of independent power supply, by batteries, in order to retain sufficient independent use for the probe, the GSM modem can be activated by the probe for just a given period of time, on certain days of the week.

The activation of the programmed mode gives access to the functioning periods, with the choice of the day and the period.



Only the « GSM schedule » part is accessible: Select the period of time during which the probe will be used. The maximum interval authorized is 4 hours a day. Then select the days when the probe will be used.

NB: It is essential for these parameters to be defined before the first use of the probe by GSM modem. For this, the probe must be connected to the PC by cable.

Important: Given that the GSM modem will only be activated at the fixed hours and days, it is essential for the probe time setting to be correct.

The **Comment** button is reserved for entering any comments ( location, test conditions etc...).

By clicking on **Initialization**, you will launch the probe initialization procedure. The stages of the initialization appear at the bottom of the screen (the complete clearing of the flash memory lasts between 10 and 30 seconds depending on the number of measurements previously stored).

At the end of the initialization, disconnect the cable from the probe, at the probe end first and then at the computer.

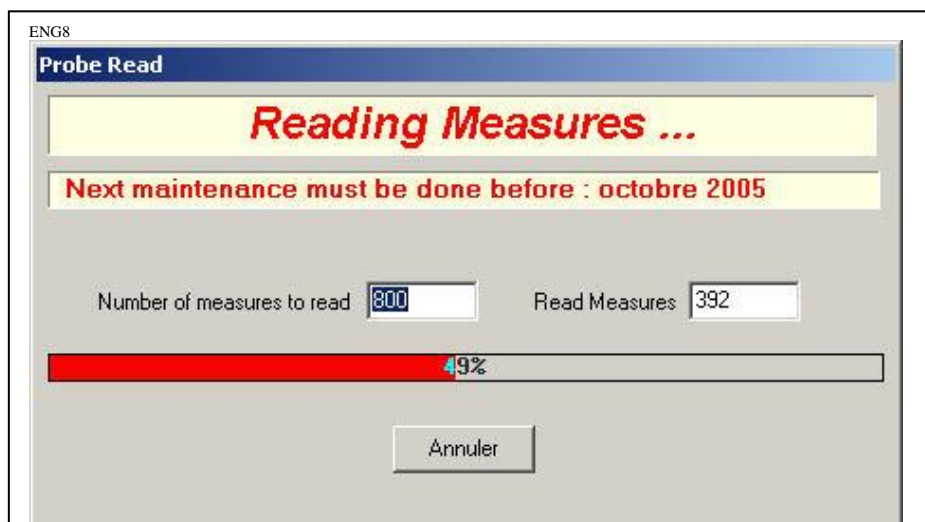
After this stage the probe can be installed on the measurement site.

## Data retrieval

To retrieve all the data recorded in the probe memory,

And after making sure that the probe is correctly connected to the PC:

**Probe >> Read >> Complete (local) or Probe >> Connection>>Read >> Complete (GSM)**



progress of the  
measurements

A screen indicates the end of retrieval and suggests you disconnect the cable if you have no other command to send to the probe.

When the retrieval is complete and finished, the software automatically goes into **Display** mode.

## **PARTIAL**

The instrument only transmits the data between 2 dates. This function is useful to limit the connection times by GSM.

***Probe >> Read >> Partial (local) or Probe >> Read >> Partial (GSM)***

The function seeks the starting date. This operation may require a few moments, depending on the volume of measurements recorded. (20 seconds for 3 months of measurement).

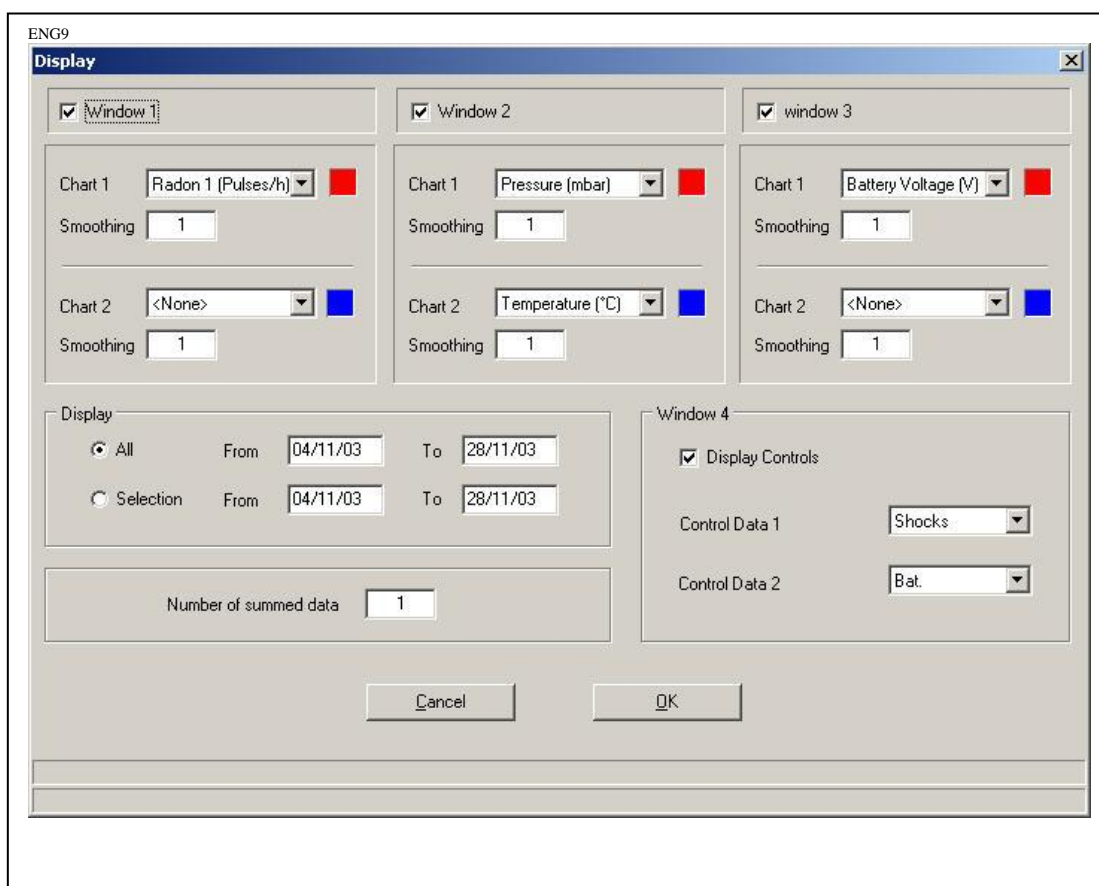
The transfer rate is slower than in Read >> Complete mode

## **Stop Probe ( local only )**

The command chain ***Probe >> Stop Probe*** stops the acquisitions and places the probe in a low consumption functioning mode.

**It is essential for the probe to be disconnected before any new operation.**

# Display



The display window opens in a default state.

You can change the display parameters by clicking on Display in the menu.

The **Display** screen manages the representation of the values recorded by the probe.

The representation will be divided into 1 to 4 windows, each window able to contain 1 or 2 curves.

On windows 1 to 3 it is possible to carry out processing and play on the representation.

Window 4 displays the state of the different controls, with no action possible

All of the windows displayed simultaneously are temporally interdependent both for modifications of the time scale and for cursor movement.

It makes it possible to reset completely the number of windows desired, the curves present in each window (Curve 1 or Curve 2), and the time field displayed ( All or Selection ) .

And the desired level of smoothing.

The display of a window is selected by validating the box next to its name.

Display of a parameter is selected using the drop list associated with **Curve 1** or **Curve 2**. You can choose from among all the parameters displayed. To display nothing, choose **<None>**.

The smoothness coefficient associated with each curve is set in the area named **Smoothness**. A coefficient of 1 corresponds to the untreated curve. The smoothing is carried out by a sliding mean on the number of measurement points displayed in this area ( from 1 to 10 ).

If you double click on the color field associated with the curve, you can change the color of the curve.

The display of the control parameters ( impacts and battery defect ) is obtained by selecting the box **Display the controls**.

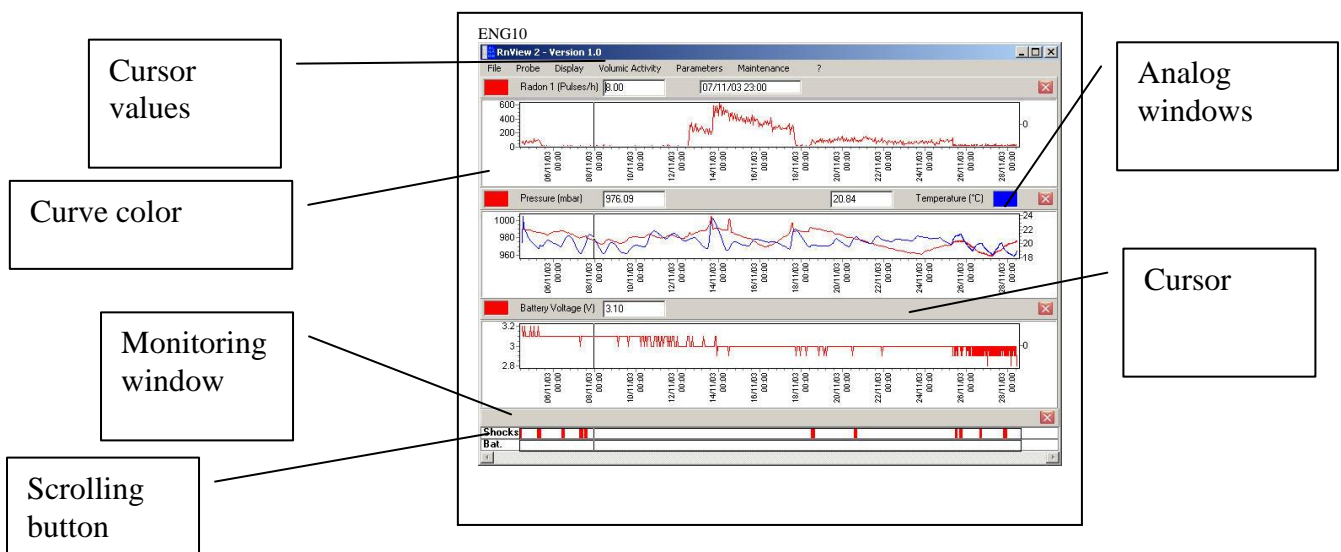
The parameter **Number of added acquisitions** ( from 1 to 20 ) enables you to generate a display and file outputs at multiples of the integration time. For example, a display and a file output on a step of 1 hour can be obtained from an acquisition made on an integration step of 15 minutes by entering 4 as number of added acquisitions.

The last field of this window concerns the selection of the temporal period to be displayed. This period can be total by choosing **All**. It can also be restricted by choosing **selection** and entering the start and end dates in the boxes **From** and **To**.

Once all your choices have been made, click on **OK**.

## Display windows

As stated earlier, there are two types of windows presented on the following figure:

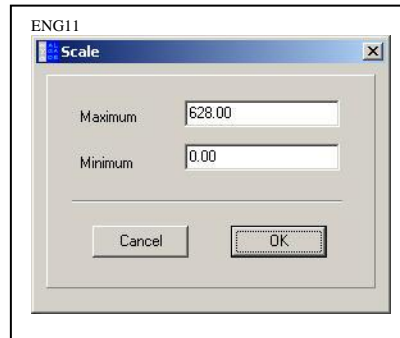


Once the display window is on the screen there are several actions you can make.

You can close a window by clicking on its close box in its top right hand corner. The display window is then redrawn so that the curves are as large as there is space available.

The cursor movement and any temporal modification are passed on to all the windows present so that you can always compare your curves temporally.

By positioning the cursor on the temporal or ordinate axes and clicking in a window with the right button of your mouse, you will bring up the setting window corresponding to this window.



It modifies the display parameters by entering the minimal and maximal values desired for the axis considered.

The curves are displayed by default between their minimum and their maximum, so that the variations are the most often directly visible. For the curves relative to radon, the default display is between 0 and the maximal value.

You can zoom onto any area of the recording period by positioning the cursor on the curve then holding down a left click – movement to the right – release the left click. The area surrounded by the frame will be zoomed.

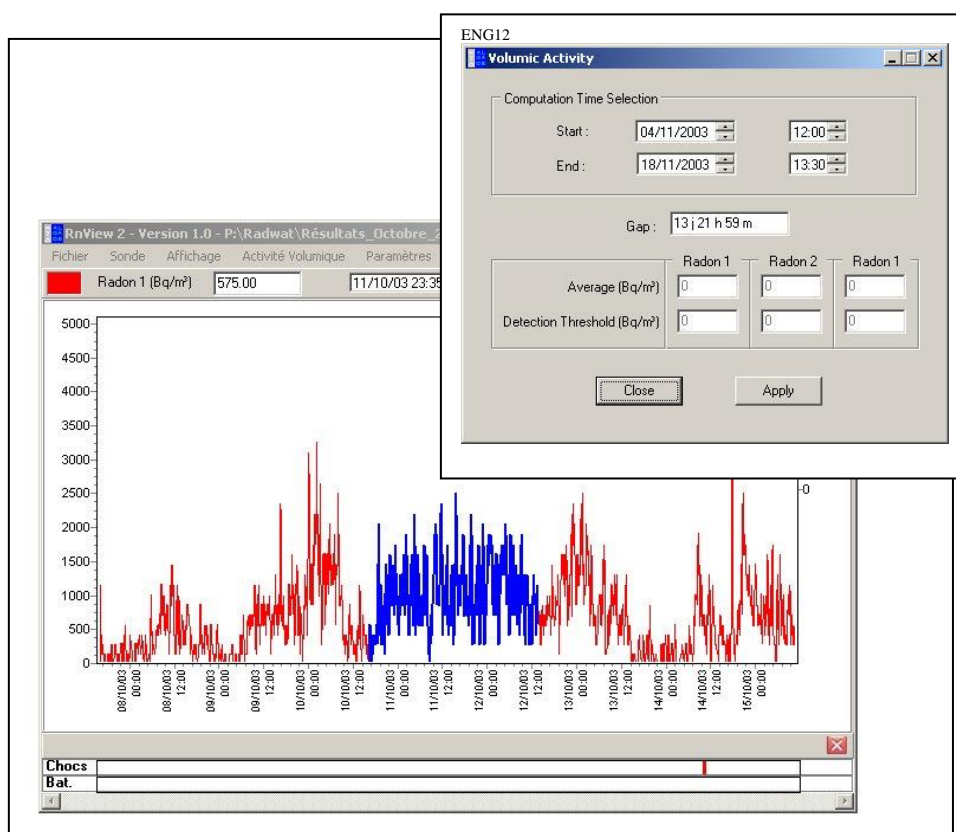
The zoom affects the two axes of the curve on which the zoom has been drawn and only the time axis on the other curves. The scrolling button at the bottom of the screen authorizes the movement of the curve according to the time axis.

To return to the original curve: left click held down – movement to the left – release the left click.

As soon as it is positioned on one of the displayed curves, the cursor follows the movements of the mouse. The corresponding values are displayed.

## Volumic activity

To calculate a volumic activity, choose the button **Volumic activity**. A window opens which enables you to choose a temporal field for this calculation (by default the whole of the curve is selected). Click on **Apply** to calculate the value and display in blue the selected data.

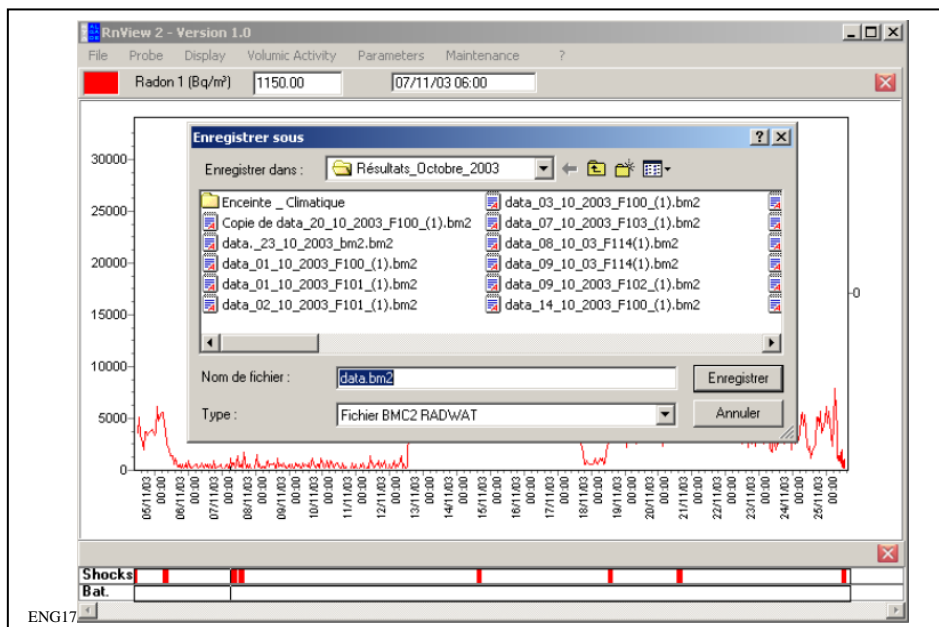


The calculated decision threshold indicates the value above which the instrument gives a correct result at statistical level. See the chapter indicating the equations used for processing.

# File management

## Recording data

The commands **File >> Save as** will be used to save the data during processing.  
All the data are saved in the format **.bm2**.





## Opening an existing .bm2 file

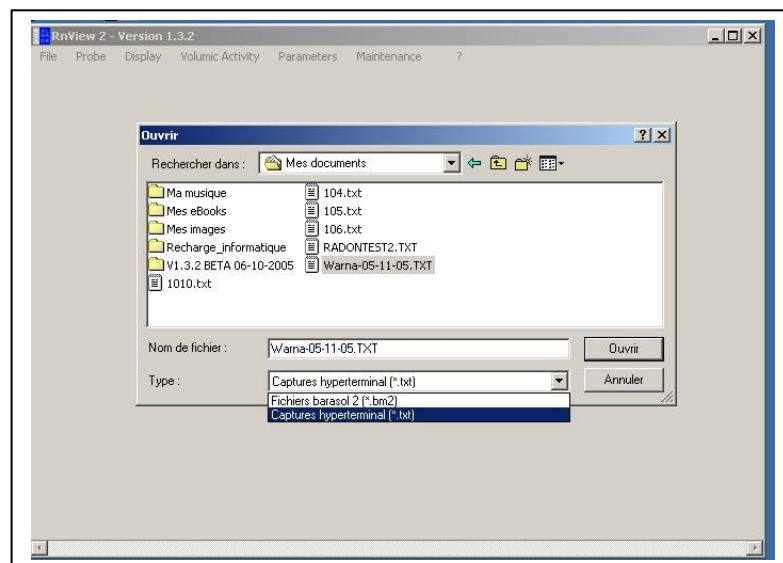
The display of a previously saved file is obtained by **File >> Open**.

The content of the **Default directory** is displayed. The commands of the Windows explorer implanted in this function enable movement in the computer file system.

Two files extension are acceptable

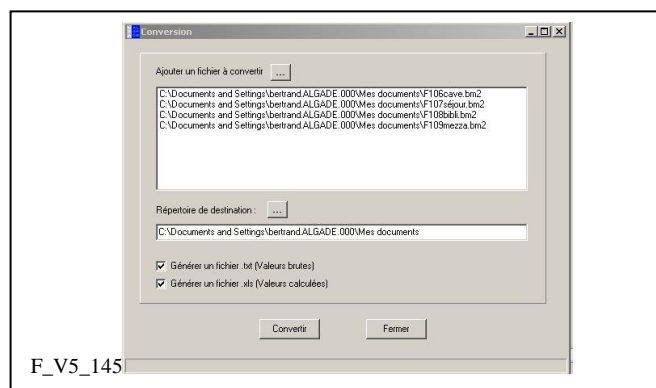
- Barasol 2 Files (\*.bm2). Files with .bm2 extension. Such files are created during BMC2 probe data reading.
- Captures Hyperterminal (\*.txt). Files with .txt extension are created with hyperterminal using ID RH RM SL or ID RH RI SL protocol. See Hyperterminal chapter in BMC2 user's manual

File extension is input with Type selection in the following display.

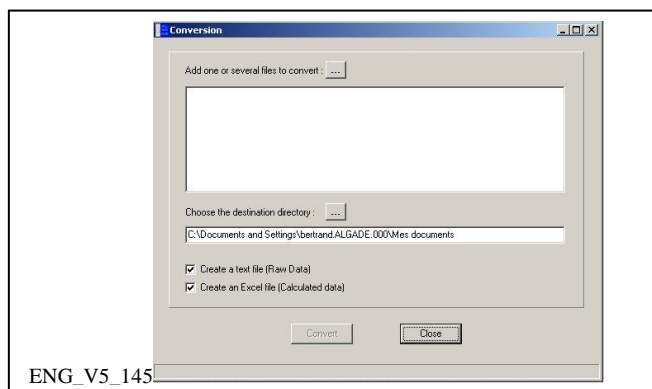


## Outputs on files

From the file .bm2 transferred from the probe, the software proposes two types of back-up on file. The command **File >> Conversion** is used



F\_V5\_145



One or several files can be selected. They appear in the central window of the screen above.

The first type of back-up corresponds to the untreated file. It is in tabulated text format that can be used in any mathematical software or spread sheet. It contains all the data generated by the probe: content of counters, results of the analogue-digital conversions... Its extension is **.txt**.

The conversion is activated if the box: Generate a .txt file (Gross values) is activated.

The second type of back-up proposed is also in the tabulated text format. It contains the calculated data corresponding exactly to the display that you can obtain in the visualisation window. Its extension is **.xls**.

### Example of untreated file:

#### HEADER

Version of PIC program 10  
Probe number 104  
Radon Counter 1 coefficient 50  
Radon Counter 1 background noise 1  
Background noise determination time 72  
Radon Counter 2 coefficient 0  
Radon Counter 2 background noise 0  
Radon Counter 3 coefficient 0  
Radon Counter 3 background noise 0  
Bunsen Degree 4 coefficient 0  
Bunsen Degree 3 coefficient 0  
Bunsen Degree 2 coefficient 0  
Bunsen Degree 1 coefficient 0  
Bunsen Degree 0 coefficient 0  
Coefficient 1 Linked to Membranes 0  
Coefficient 2 Linked to Membranes 0  
Coefficient 3 Linked to Membranes 0  
Rain gauge coefficient 0  
Pressure A Degree 0 Coefficient -0.902209676996  
Pressure A Degree1 Coefficient -0.000558815794  
Pressure A Degree 2 Coefficient -0.000004026755  
Pressure A Degree 3 Coefficient -0.000000032579  
Pressure B Degree 0 Coefficient 0.0241925889859  
Pressure B Degree 1 Coefficient 0.0000212661759  
Pressure B Degree 2 Coefficient -0.000000328742  
Pressure B Degree 3 Coefficient 0.0000000013743  
Pressure C Degree 0 Coefficient 0.0000134327997  
Pressure C Degree 1 Coefficient -0.000000035811  
Pressure C Degree 2Coefficient 0.0000000008816  
Pressure C Degree 3Coefficient -0.000000000007  
Temperature Coefficient 1  
Humidity Coefficient A  $RH=f(CRH)$  1  
Humidity Coefficient B  $RH=f(CRH)$  1  
Humidity Coefficient A  $FT=f(RH)$  0  
Humidity Coefficient B  $FT=f(RH)$  0  
Humidity Coefficient C  $FT=f(RH)$  0  
Humidity Coefficient A  $K=f(AH)$  0  
Humidity Coefficient B  $K=f(AH)$  1  
Date of last Maintenance 3/2010  
Time interval between two maintenances ( Years) 2  
Alarm 1 Radon Threshold 400  
Alarm 2 Radon Threshold 1000  
Heating startup temperature 21  
Comments sensor DI256  
Number of measurements 3648  
Period of measurement (Minutes) 5  
Minimum power supply voltage 2.5  
Reference voltage measurement power supply voltage 3.3  
Starting date 7/10/3  
Starting time 16:2  
Type of probe 10

#### MEASUREMENTS

Date / Time	Temp	Pressure	Battery Voltage	Humidity	Radon 1	Radon 2	Radon 3	Rain gauge	Status byte
07/10/2003 16:10:00	50216	47809	32	0	25	0	0	0	24
07/10/2003 16:15:00	49739	47804	32	0	27	0	0	0	24
07/10/2003 16:20:00	49443	47810	32	0	29	0	0	0	24
07/10/2003 16:25:00	49248	47805	32	0	24	0	0	0	24
07/10/2003 16:30:00	49043	47804	32	0	29	0	0	0	24
07/10/2003 16:35:00	48952	47801	31	0	27	0	0	0	24
07/10/2003 16:40:00	48718	47798	32	0	25	0	0	0	24
07/10/2003 16:45:00	48680	47799	32	0	26	0	0	0	24
07/10/2003 16:50:00	48633	47794	31	0	27	0	0	0	24

The first part, « HEADER. « contains the whole of the probe parameters.

The second part displays the values obtained for each measurement with in order:

Date of measurement, Time of measurement, Temperature, Pressure, Battery voltage, Humidity Counter, radon 1 counter, radon2 counter, radon 3 counter, Rain gauge, Byte of state.

For the temperature and pressure sensors the displayed value is the converter output voltage expressed in micro-volts.

For the counters the displayed value is the number of events counted during the functioning period.

The state byte is broken down as follows:

- Bit 0 - Impacts
- Bit 1 - Pump ON OFF
- Bit 2 - Heating ON OFF
- Bit 3 - Alarm 1 ON OFF
- Bit 4 - Alarm 2 ON OFF
- Bit 5 – Battery voltage 0=OK 1=< Vlimit

### Example of calculated file:

```

HEADER
PIC program Version      10
Probe number      100
Radon Counter 1Coefficient      50
Radon Counter 1 Background noise      1
Background noise determination time      72
Radon Counter 2Coefficient      0
Radon Counter 2 Background noise 0
Radon Counter 3Coefficient      0
Radon Counter 3 Background noise      0
Bunsen Degree 4Coefficient      0
Bunsen Degree 3Coefficient      0
Bunsen Degree 2Coefficient      0
Bunsen Degree 1Coefficient      0
Bunsen Degree 0Coefficient      0

```

Coefficient 1 Linked to Membranes 0  
 Coefficient 2 Linked to Membranes 0  
 Coefficient 3 Linked to Membranes 0  
 Rain Gauge Coefficient 0  
 Pressure A Degree 0Coefficient -0.866264520677  
 Pressure A Degree 1Coefficient -0.000370368970  
 Pressure A Degree 2Coefficient -0.000001068638  
 Pressure A Degree 3Coefficient -0.000000025584  
 Pressure B Degree 0Coefficient 0.0383124529702  
 Pressure B Degree 1Coefficient 0.0000184064346  
 Pressure B Degree 2Coefficient -0.000000333953  
 Pressure B Degree 3Coefficient 0.0000000011478  
 Pressure C Degree 0Coefficient 0.0000073478684  
 Pressure C Degree 1Coefficient 0.0000000214597  
 Pressure C Degree 2Coefficient -0.000000001661  
 Pressure C Degree 3Coefficient 0.0000000000107  
 Temperature Coefficient 1  
 Humidity A Coefficient RH=f(CRH) 1  
 Humidity B Coefficient RH=f(CRH) 1  
 Humidity A Coefficient FT=f(RH)0  
 Humidity B Coefficient FT=f(RH)0  
 Humidity C Coefficient FT=f(RH)0  
 Humidity A Coefficient K=f(AH) 0  
 Humidity B Coefficient K=f(AH) 1  
 Date of Last Maintenance 3/2009  
 Time Interval between two Maintenances (Years) 2  
 Alarm 1 Radon Threshold 400  
 Alarm 2 Radon Threshold 1000  
 Heating Startup Temperature 21  
 Comments cýpteu gi548  
 Number of Measurements 4808  
 Measurement Period (Minutes) 5  
 Minimal Power Supply Voltage 2.5  
 Measurement Reference Voltage Power Supply Voltage 3.3  
 Starting date 3/10/3  
 Starting time 15:25  
 Type of Probe 10

#### MEASUREMENTS

Date / Time	Radon1 (Impacts/h)	Radon1 (Bq.m3)	Radon2 (Impacts/h)	Radon2 (Bq.m3)	Radon3 (Impacts/h)	Radon3 (Bq.m3)	Temperature (°C)	Pressure (Bar)	Humidity	Battery Voltage (V)	Impacts	Battery	Pump	Heating	Alarm 1	Alarm 2
03/10/2003 15:35:00	12	550	0	0	0	0	0	21.4005496331422								
965.879427111256	0	0	2.9	0	0	0	0	0	0	0	0	0	0	0	0	0

The first part « HEADER. « « contains the whole of the probe parameters. This part is identical to the result obtained with the untreated values conversion.

The second part displays the values obtained after application of the calculation formulae for each measurement with in order:

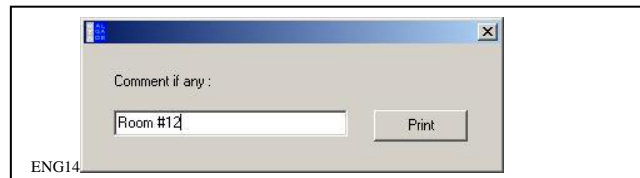
Date of measurement, Time of measurement, radon 1 counter, Volumic activity, radon2 counter, radon 3 counter, Temperature, Pressure, Humidity, Battery voltage, Rain gauge, Impacts, Low battery, pump, heating, radon level 1alarm, radon level 2 alarm.

## Printing

Printing the display window is possible via the menu command **File >> Print**.

A window opens enabling you to enter a comment.

The configuration of the printer is possible using the following standard Windows panel.



## Stopping the probe (sleep mode)

You can stop your probe to store it for a short while or during transport.

Storage must be in a place with low radon concentration to avoid any pollution of the detector.

To stop the probe, select **File >> Stop probe**.

***Stopping the probe places it in low consumption mode, sleep mode. The probe can be activated at any moment by connecting it up to the computer again.***



For long periods when not in operation, it is preferable to remove the batteries from their compartment after placing the probe in sleep mode. When replacing the batteries in the compartment, it is essential to replace the probe in a stable mode, either by stopping it or by initializing it.

---

# Parameters

The screenshot shows a software window titled "Parameters" with a tabbed interface. The "General" tab is selected, showing fields for "Probe n°" (106), "Model" (Soft Version: 1.0, Probe Type: 10), "Battery" (Reference (Volts): 3.3, Minimum Voltage (Volts): 1.5), "Maintenance" (Latest maintenance: 10/2003, Gap (years): 2, Next maintenance: 10/2005), and "Measures" (Number of measures: 335, Start Time: 04/11/03 at 11:00, Period in minutes: 60). An "OK" button is at the bottom. The text "ENG15" is visible in the bottom left corner of the window frame.

This screen consists of several buttons enabling the internal probe parameters to be consulted.

It must not be modified by anyone other than authorized personnel

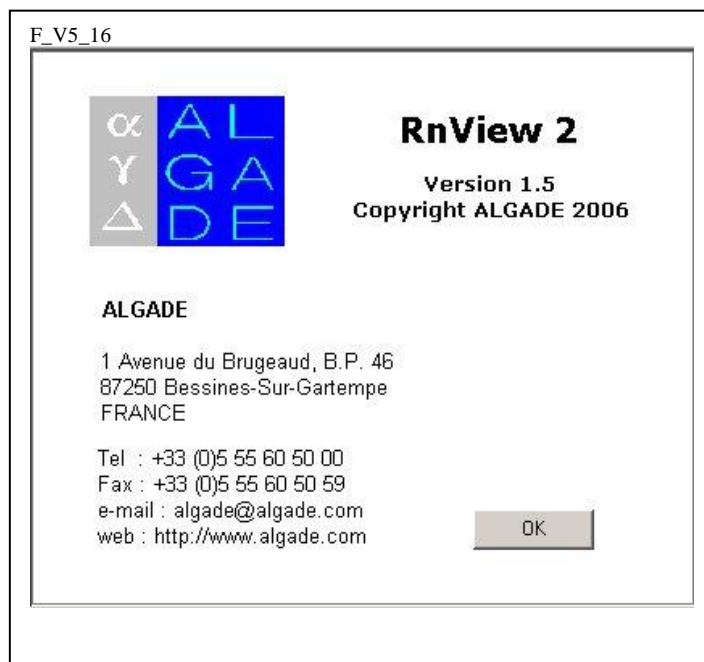
---

# Maintenance

After introduction of an identification code, the maintenance button gives the possibility of modifying the internal probe parameters.

---

## Information ?





---

## Equations used in the processing

These are the equations used for the display of data on the screen and for the calculation of the values displayed in the conversion file in text file if the option **calculated values** is chosen.

### Radon and radon options

#### *PIC side*

Memorized capacity of counters limited to 3 bytes =  $2^4 = 16 \times 10^6$  impacts

The corresponding maximal activity if  $P=240$  minutes and  $C=1$ , ( Radim = 1.5 for memory) =  $4 \times 10^6 \text{ Bq.m}^{-3}$  if  $C=50$  ( case of BMC)  $200 \times 10^6 \text{ Bq.m}^{-3}$

These values are very much higher than those met in nature.

#### *PC side*

let.:

$t$  be the acquisition interval in minutes (typically 15 min),

$C$  the Radon calibration coefficient in  $\text{Bq/m}^3/\text{impulse/h}$ ,

$B$  the instrument background noise expressed in impulse/h,

$x$  the number of impulses measured in the acquisition interval.

$x = (\text{value of counter at instant } t) - (\text{value of counter at instant } t-1)$

The volumic activity in the air expressed in  $\text{Bq/m}^3$  will be:

$$R_n = \left( x \cdot \frac{60}{t} - B \right) \cdot C \quad \text{Bq/m}^3$$

Important (1): When the calculation of  $R_n$  leads to a negative result,  $R_n$  is made equal to zero

Important(2): it concerns here the volumic activity of the radon in the air of the measurement chamber.

### Decision threshold

The decision threshold indicates the value in  $\text{Bq/m}^3$  below which the calculation of the volumic activity cannot be considered as significant in relation to the instrument's background noise.

let.:

$t_b$  be the measurement time of the instrument's background noise in hours,

$t$  the number of hours selected for the calculation of the volumic activity,

$B$  the background noise of the probe in number of impulses/h,

$C$  the Radon calibration coefficient in Bq/m<sup>3</sup>/impulse/h,

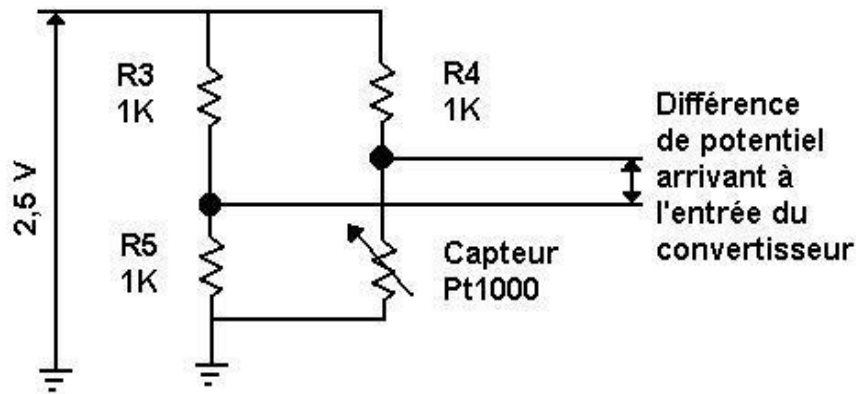
The value displayed on the screen is:

$$Sd = 2C\left(\frac{1}{t} + \sqrt{\frac{1}{t^2} + B\left(\frac{1}{t} + \frac{1}{tb}\right)}\right) \text{ Bq/m}^3$$

## Temperature

The result of the digital analog conversion in the converted untreated file is expressed in microvolts.

The temperature sensor is a probe Pt1000 (1000 Ohms at 0°C) mounted in a Wheatstone bridge. To simulate the presence of this sensor we will replace it with a variable resistance inside the Wheatstone bridge as can be seen on the diagram below:



depending on the value of the resistance applied, in obtained a difference of potential on the input of the analog digital converter which enables us to calculate the temperature with the following formulae:

$$(1) \quad R_{pt}(T) = (R_0 + 3,90802 \times 10^{-3} \times R_0 \times T - 5,80195200854 \times 10^{-7} \times R_0 \times T^2)$$

With  $T$  : Degree Celsius

$R$  : Ohms

N.B. : This equation established for positive temperature can be used without any risk in the temperature range 0°C to -20°C.

There is an equation of second degree of the form:

$$R_{pt}(T) = R_0 \times (A \times T^2 + B \times T + 1)$$

Inside the Wheatstone bridge there is:

$$V_d = V_{e^+} - V_{e^-}$$

$$V_{e^+} = V \times \frac{R_{pt}}{R_{pt} + R_4}$$

$$V_{e^-} = V \times \frac{R_5}{R_5 + R_3}$$

$$V_d = V \left( \frac{R_{pt}}{R_{pt} + R_4} - \frac{R_5}{R_5 + R_3} \right)$$

$$R_3 = R_5 = R_4 = 1K \text{ Ohms}$$

$$V_d = V \left( \frac{R_{pt}}{R_{pt} + R_4} - \frac{1}{2} \right)$$

$$V_d = V \left( \frac{2 \times R_{pt} - R_{pt} - R_4}{2 \times (R_{pt} + R_4)} \right)$$

Whence

$$(2) \quad R_{pt}(T) = R_4 \times \frac{V + 2 \times V_d}{V - 2 \times V_d}$$

With R : Ohms

V<sub>d</sub> : volts

V = 2.5 Volts

By replacement in the equation of R<sub>pt</sub>(T) the following equation is obtained:

$$R_3 \times \frac{V + 2 \times Vd}{V - 2 \times Vd} = R_0 \times (A \times T^2 + B \times T + 1)$$

As  $R_4 = R_0 = 1000 \, \Omega$ , an equation of second degree is obtained of the form:

$$A \times T^2 + B \times T + 1 - \frac{V + 2 \times Vd}{V - 2 \times Vd} = 0$$

This equation admits roots of the form:

$$T = \frac{-B \pm \sqrt{B^2 - 4 \times A \times C}}{2 \times A}$$

With  $A = -5,80195200854.10^{-7}$

$B = 3,90802.10^{-3}$

$C = 1 - ((2,5 + 2 \times Vd)/(2,5 - 2 \times Vd))$

The coefficients are replaced in the resulting equation to obtain:

$$T = \left[ -3.90802 + \sqrt{15.272 + 2.320781 \times \left(1 - \frac{2.5 + 2 \times Vd}{2.5 - 2 \times Vd}\right)} \right] \times \frac{10^3}{-1.16039}$$

With  $Vd$  : volts and  $T$  in  $^{\circ}\text{C}$

## Pressure

The result of the analog digital conversion,  $S$ , present in the converted untreated file is expressed in micro-volts.

The sensors used are sealed at  $1000 \text{ mbar} \pm 500$ .

In the conditions of use they give a response,  $Sig$ , expressed in mv and linked to  $S$  by:

$$Sig = \frac{(S - 32768) \times 1.25 \times 1000}{32768 \times 16}$$

The sensors are provided with a compensation in temperature governed by a polynomial law. The coefficients  $a_i$ ,  $b_i$ ,  $b_i$  are determined by the manufacturer.

The calculation of P is as follows:

$$P(Sig, T) = (1 + A(T) \times Sig^0 + B(T) \times Sig^1 + C(T) \times Sig^2) * 1000$$

$$A(T) = a_0 \times T^0 + a_1 \times T^1 + a_2 \times T^2 + a_3 \times T^3$$

$$B(T) = b_0 \times T^0 + b_1 \times T^1 + b_2 \times T^2 + b_3 \times T^3$$

$$C(T) = c_0 \times T^0 + c_1 \times T^1 + c_2 \times T^2 + c_3 \times T^3$$

with Sig in millivolts, response of the pressure sensor, T in degrees Celsius and P in mbar.

## Rain gauge

let:

*P* be the calibration coefficient in mm H2O/impulse,

*x* the number of impulses measured in the acquisition interval,

*x* = (value of the counter at instant *t*) - (value of the counter at instant *t-1*)

The value displayed on the screen is:

$$Pluvio = x \cdot P \text{ mm H2O}$$

## Battery

The result of the analog digital conversion, *V*, present in the untreated converted file is linked to the battery voltage by:

$$V_{bat} = V / 10$$

## Humidity

Humidity sensor is of a capacitive type, associated with an oscillator. The oscillator output is proportional to relative humidity.

Relative humidity output (*RH<sub>f</sub>*) is expressed in Hertz.

Calibration of the sensor gives  $\beta$  and  $\gamma$  coefficients.  $\beta$  and  $\gamma$  coefficients allow calculation of relative humidity expressed in percentage.

$$RH_{\%} = \beta RH_f + \gamma$$

## Humidity compensation

Ions collection on the detector surface by the mean of an electric field is absolute humidity dependant.

Let :

$AH$  be the absolute humidity in  $g.m^{-3}$ ,

$T$  the temperature in  $^{\circ}C$ ,

$RH$  be the absolute humidity in %,

The value displayed of absolute humidity is:

$$AH = (RH / 100) * F(T)$$

With

$$F(T) = a_0 + b_0 * T + c_0 * T^2.$$

$a_0, b_0, c_0$  coefficients are given by Dupré formula. Then :

$$F(T) = 5.355 + 0.1489 * T + 0.0227 * T^2.$$

For instruments of the Radhome HR family,  $K$ , radon compensation coefficient is used.

$K$  has no unit.  $K$  is given by :

$$K = a_1 * AH + b_1.$$

$a_1$  and  $b_1$  are determined by experiences.

$a_1 = -0.026796$  and  $b_1 = 1.276$ .

In practice  $0.85 < K < 1.12$

After compensation, the volumic activity in the air expressed in  $Bq/m^3$  will be:

$$Rn = \left( x \cdot \frac{60}{t} - B \right) \cdot C / K \quad Bq/m^3$$