

alphaMETER 611 OPERATING MANUAL

Version 3

alphaNUCLEAR  
2100 Dudley Street  
Saskatoon, Saskatchewan  
S7M 5W3

Tel: (306) 956-6660 Fax: (306) 956-6661

## TABLE OF CONTENTS

	Page
Model 611 alphaMETER Description .....	1
Mode 611 alphaMETER Power Requirements.....	2
Model 611 alphaMETER RS-232 Communications .....	3
Computer Software .....	3
Computer Software Operation .....	5
Dumb Terminal Operation.....	7
Model 611 alphaMETER Specifications .....	8
IMPORTANT NOTES .....	8

(prnt.HS COUR 12 FMT)

## **Model 611 alphaMETER Description**

### **General**

The model 611 alphaMETER is intended for the detection, counting, and recording of alpha particle radiation from radon gas present in the near surface soil gas.

The unit is a tubular 'O'ring sealed device, 51mm in diameter, by approximately 350mm (2" dia x 14") long. It is constructed from stainless steel and weighs 1.2kg. One end is open to provide the sensitive volume for counting. At the top of this open-ended chamber, at approximately 65mm in from that end is located the alpha particle sensitive detector. The detector is a silicon-diffused junction (DJ) with a sensitive surface area of 400 square mm. As this detector requires a dry, dark environment to operate, it is sealed behind a thin opaque film or membrane. This film is 0.25 mil aluminized mylar, and thus is of sufficiently low density to efficiently pass alpha particles while excluding water vapour and light. This fragile sealing/alpha particle window is protected from mechanical damage behind a plastic grill located approximately 12mm from the open end of the sensitive volume.

The other end of the alphaMETER is fitted with a 4 conductor sealed military type electrical connector. This connector and its mate provide power to, and communications with the internal electronic systems. When deployed, this connector-pair are protected from the environment by a plastic boot that supports the cable, and forms a seal between the top of the alphaMETER and the connecting cable.

The internal electronics include a pulse amplifier/conditioner and the power regulator circuits as one of the printed circuit boards, while the other circuit board contains a real-time clock and calendar, a non-volatile data memory, and a micro-processor. The micro-processor performs all necessary house-keeping functions, as well as the pulse counting and communications. Each micro-processor has a unique serial number installed in it's permanent memory (ROM); it is this unique number that allows each alphaMETER to be addressed individually, even though numerous units may be connected to a central computer's (IBM PC or compatible) RS-232 (COM1) serial communications port.

### **Deployment**

Each unit is supplied with a one metre long interconnect cable, it is therefore necessary for the user to determine the most practical field deployment configuration for the application and conditions imposed by the local environment. The most simple deployment is to treat each unit as a stand-alone monitoring station, that is, simply connect the 615 battery pack with the supplied cable. Or in the case of a user-supplied battery, attach an appropriate battery to the power conductors of the supplied special cable at each site.

Then at some future time (within 40 days) return to each site with a portable battery operated computer, connect to the communications connector of the battery pack, or the appropriate

conductors of the special supplied cable, read each unit with the data stored to a disk file for later processing.

The other more permanent deployment method involves installing either separate cables from a central reading site to each alphaMETER (up to half km long), or have one cable pass by each monitor site, such that each unit's short cable may be spliced on to it. In both these installations the power can be supplied over the cable(s) from the central reading (computer) site.

## **The Data**

The alpha particle count data (5 digits) is stored in the non-volatile memory in 15 minute increments (15 minute integration periods). The first reading data of each day is stored along with the day's date, and followed by the 95 subsequent reading's data for that day. Likewise the data is retrieved by date. This data retrieval process may be performed with the aid of an IBM PC or compatible computer and the program supplied by alphaNUCLEAR, or with a dumb terminal, by manually entering the appropriate commands.

In some applications of the alphaMETER, the alpha particle count rate is quite low, thus the counting statistics for the 15 minute intervals is often poor. The software supplied with the system provides the facilities to sum any number of the 15-minute count periods.

The software also provides facilities for adjusting the time and date of the alphaMETER's real time clock and calendar. Also, to aid in acquiring data from the alphaMETER, the PC software allows the user to read any one-day's data, specified by a date. Or, numerous day's data may be acquired automatically by specifying a range of dates. The data may be acquired for display on the computer monitor, or written to a disk file. All 41 days original 15-minute data is retained in the alphaMETER's non-volatile memory, and may therefore be recorded and/or displayed any number of times with or without any summing interval. The data first recorded (day 1), is written over and lost on the 42<sup>nd</sup> day.

## **Power Requirements**

As the model 611 alphaMETER is intended for remote field deployment, it is designed to operate with low power demands on an external battery, or if so deployed, on power supplied by cable from a central data acquisition site.

The ideal power source for either mode of operation should be ripple free and low impedance, the inherent characteristics of lead acid or alkaline batteries. The voltage tolerance of the electronics systems is from 12 volts minimum to 20 volts. The flat discharge characteristics of a lead acid battery pack (gel type) being a good choice. The alphaNUCLEAR supplied 615 Battery pack contains two 8 volt 3.0 Ah gel batteries connected in series to provide 16 volts nominal. However, if long cables are involved between power source and alphaMETER, then line voltage losses must be taken into account.

The current draw of the alphaMETER during normal field operation is typically 3 to 4 mA (0.0040 Amps). During acquisition of data from the alphaMETER, the current draw increases to 20 mA (0.02 Amps). In the case of numerous units connected onto a common long cable, the only situation where more than one unit will draw the 20 mA simultaneously, is for 1 or 2 seconds immediately following connection of the power source.

**\*\*\*\*\* WARNING \*\*\*\*\***

In the case of user supplied battery power sources.

Before attaching the alphaMETER to your power source, make careful note of the power source's voltage polarities (+ and -). The RED wire of the short alphaMETER cable must be connected to the positive (+) terminal of the power source, and the BLACK wire to negative (-). Failure to observe this requirement could cause major damage to the internal electronics systems, and void the product warranty.

A 0.25 or 0.5 amp fuse connection at the battery is recommended.

## **RS-232 Communications**

Data retrieval and presetting functions of the alphaMETER is achieved with the standard serial RS-232 (COM1) communications port of a PC. Unless otherwise user specified, the communications baud rate is preset at 1200. As only 3 wires are used to provide the communications (transmit, receive, and ground), the various hand-shaking functions of a standard RS-232 PC port are inhibited/ignored by the software. The cable supplied with an alphaMETER(s) is wired to be compatible with an IBM type PC. If a terminal is to be used for communications, then a connector adapter will be required to achieve compatibility.

## **Computer Software**

### Hardware Requirement

The minimum hardware required for the alphaMETER program to function is an IBM PC/XT/AT or true compatible, equipped with all of the following:

- A minimum of 128K bytes of memory.
- One 5 1/4 or 3 1/2 inch floppy disk drive.
- An MDA, CGA, or EGA card.
- One RS-232 adaptor card.
- A display monitor.

Operating under MS-DOS version 3.30 or later.

The 611 Operating Program supplied when the computer is also supplied by alphaNUCLEAR, is bootable and ready to use. To operate, install the diskette in drive A, and switch ON the computer. The program will run automatically. With such complete turn-key systems, a special MASTER Operating diskette is also supplied. This disk will automatically produce Operating diskettes. Install this diskette in drive A, turn on the computer, and follow the instructions as they appear on screen.

### Software Installation

User supplied, single floppy disk drive system.

A back-up copy of the original diskette should be made before proceeding further. Boot up the system from drive A using your DOS system disk. Copy the original alphaMETER diskette by using the DOS utility DISKCOPY.

A>DISKCOPY A: A: <Enter>

When DOS asks for SOURCE diskette, replace the DOS system diskette with the original alphaMETER diskette and press <Enter>.

When DOS asks for TARGET diskette, replace the alphaMETER diskette with a new diskette, and press <Enter>.

Store the original diskette in a safe place.

The newly produced diskette will include the following file/s:

- standard: AM.EXE The alphaMETER executable software module.
- optional: AM.BAS The alphaMETER software source code.
- optional: LBIS.OBJ Run time object module. Required only in the linking phase if AM.BAS has been modified.  
Detailed description of how to use LBIS.OBJ is documented within AM.BAS.

The diskette prepared this way is not a bootable diskette. However disk space has been allocated for the DOS system files. To make this a bootable diskette, use the SYS utility provided in your operating system. Refer to your DOS manual for detailed instructions.

### **Hard disk drive system**

To install the alphaMETER software onto your hard disk drive, proceed as follows:

Boot the system as usual, if boot from drive A then replace the DOS diskette in drive A with the alphaMETER diskette, if boot is from the hard disk, then simply install the alphaMETER diskette in drive A.

At the system prompt, type the following lines:

```
C:<Enter>  
C>CD\<Enter>  
C>MD alphaMETER<Enter>  
C>CD\alphaMETER<Enter>  
C>COPY A:*.*/V<Enter>
```

Installation complete. Store the original diskette in a safe place.

## Software Operation

Remove any floppy disks from the drive(s), switch OFF the computer, install a bootable alphaMETER diskette in drive A, (floppy drive systems only) switch ON (hard boot) your system.

To invoke the alphaMETER program simply type in AM. Assuming the AM program (AM.EXE) is on your current drive and current directory. The sign-on screen will appear for a few seconds, followed by the Main Menu screen.

This screen lists 3 user options for either presetting the alphaMETER, acquiring it's data, or printing previously recorded data from a disk file. A 4th option <ESC> exits the alphaMETER program. These choices are invoked by pressing the appropriate <F> (function) key, <ESC> key, or by using the up - down arrow keys to highlight the desired option, which is then invoked by pressing the <Enter> key.

## Setting Clock and Calendar

Connect the alphaMETER to the power source, and plug in the RS-232 cable to the COM1 serial port of the computer.

If this is the first use of the alphaMETER, start by selecting option F1 to set the alphaMETER's clock and calendar. After pressing the F1 key the lower portion of the screen show a highlighted box containing a request for the alphaMETERs Serial Number. Assume the serial number of the/one of the alphaMETERs is AC 1, enter 1 <Enter> (ignore the AC prefix of the serial number). The screen will now revert to the Set Working Parameters screen with the alphaMETERs serial number showing. This screen has 4 options available, plus exit, again, the options are selected with the Function keys, or the up - down arrow keys.

Select F1, an overlay will appear on the screen for a few seconds, this overlay will be flashing Working\*\*Please Wait; at this time the computer is establishing communications with the alphaMETER.

If the attempt to establish communications is successful, the screen will change and show the alphaMETER's current time and date. Press any key to Exit back to the Set Working Parameters

screen. Next press the F2 key (Set Date), the lower portion of the screen will now show the computer date and the alphaMETER date, the cursor will be flashing under the month of a highlighted alphaMETER date. Enter the current month (11), the balance of the date will disappear, enter the dash sign (-) then the day's date (05), another dash, and finally the year (87), followed by <Enter>, the computer will rewrite the year as 1987.

The Working\*\*Please Wait overlay will appear momentarily as the date is down-loaded into the alphaMETER.

Now use the F3 key to set the alphaMETER's clock to current time, note that colons (:) are used between the hours, minutes and seconds instead of the dash used for date setting. It is not necessary to enter seconds, simply press <Enter> following the minutes.

The final option is F4 Set Summing Interval, this setting defaults to 1 when the program is invoked. Also this parameter is for the computer only, and has no effect on the alphaMETER, the default value 1 means that all the data, in it's original 15 minute intervals as acquired from the alphaMETER, is displayed, and/or recorded. A setting of 04 here would mean that the data would be displayed/recorded in hourly intervals. If the specified summing factor results in the number being greater than 99999, that interval's data becomes \*99999. To recover this data, reduce the summing factor and acquire again.

## Acquiring Data

Press the <ESC> key to exit back to the Main Menu, select the F2, Read Data from alphaMETER option. The serial number of the alphaMETER that was previously used for parameter setting will be showing at the bottom of the screen, press <Enter>. However, if this is a new session the serial number must be entered at this time. The Read alphaMETER screen will now appear, there are 3 options from this screen, first press F1, Send output to Screen. The highlighted area in the lower portion of the screen is now requesting the date range of the data to acquire from the alphaMETER, enter a valid From Date (using the displayed date format) <Enter>, then a valid To Date <Enter>. For this example make both dates the same, (10-05-87) this will result in one, one day's data being acquired. The screen will show the communications overlay for several seconds while the data is being acquired, next, the 96 count interval data will appear on the screen. Next press <ESC>, then F1 and try the foregoing using a range of dates (10-05-87 to 10-10-87). After reviewing the first date's data, follow the instructions on the bottom of the screen and press any key, the next day's data will appear shortly there after, and so on, finally the menu screen will reappear.

If there is no data in the alphaMETER memory for date(s) specified, a message so stating is displayed.

The F2 option, Send output to Printer, has an identical procedure to the foregoing, but with an additional message being displayed following acquisition of data to remind the user to prepare the printer.

Likewise the F3 option, Send output to Disk File, here a request for a file name is shown on the screen, with the previous file name used (if any) highlighted. Type in a name (OCTOBER.DAT) and press <Enter>.

Exit back to Main Menu, there is one other option here, F3, Print Data from Disk File. This is self explanatory, with a request being issued to enter the name of the disk file to be printed, and a reminder to prepare the printer.

### **Dumb Terminal Operation**

The data acquisition and setting functions of the alphaMETER can also be performed with a terminal equipped with a standard RS-232 serial port.

Set the terminal's baud rate to 1200, connect the alphaMETER to the serial port (pin 2 and pin 3 of the supplied cable may need to be interchanged). Plug in the model 615 battery pack, or attach your power source to the alphaMETER's cable RED and BLACK wires, carefully observing the voltage polarity.

Press the Enter (RETURN) key of the terminal, then enter the alphaMETER's serial number, (AC1) <Enter>. If the communications connections, baud rate, and serial number are correct, the alphaMETER will come on line, then echo back it's serial number, (AC 0001).

Now that communications have been established, the following commands can be used to set-up and acquire data from the alphaMETER.

RT .....<Enter> ..... Read Time .....The alphaMETER will transmit its current time.  
RD .....<Enter> ..... Read Date .....The alphaMETER will transmit its current date.  
RI .....<Enter> ..... Read Interval ...The alphaMETER will transmit its current summing factor.  
RA .....<Enter> ..... Read Alpha .....The alphaMETER will transmit the current days data (if it has been ON for >15 minutes).  
RA 87-10-25 .....<Enter> ..... The alphaMETER will transmit (YY-MM-DD) the data of the date entered.  
MV <Enter> ..... Nondestructively tests memory a good memory will return 0000.  
MD <Enter> ..... Lists all dates and times of stored data.  
ST 16:55 <Enter> ..... Set Time to 16:55 (4.55pm).  
SD 87-10-25 <Enter> ..... Set Date to October 25, 1987.  
SI 04 <Enter> ..... Set Interval to 4, alphaMETER will dump data summed in one-hour intervals.

The alphaMETER automatically reverts to its low power off line state if there has been a period of about 2 minutes without communications. To wake-up the unit (place on line) again, simply transmit its serial number from the terminal (AC1).

On power up (connection of power source) the summing interval defaults to 1. If the summing interval is changed and no further power interruptions occur, the next data dump will be with the data summed by that value. However, the data is stored in the alphaMETER in the 15-minute intervals, and can be recovered as such after an SI01 command.

### **Half Duplex operation**

All the foregoing commands can be performed in the half duplex mode, this mode is automatically invoked when the command follows the AC serial call command. eg. AC1 RA 90 12 25 <Enter> will return the data of December 25/90, the 611 immediately goes off line after execution of the command.

### **alphaMETER Specifications**

Detector..... Silicon Diffused Junction  
Detector Area.....400 square mm  
Energy Response.....> 1.5Mev alpha only  
Counting Capacity .....65535 (16 bit) per 15 minute interval (overflow not indicated)  
Temperature Range.....-10 to +40 degrees C  
RS-232 Baud Rate.....1200 standard  
Power Requirements .....12 to 20 VDC, 3 - 4 mA (off line)  
Weight.....1.2 kg (2.6 lbs)  
Dimensions .....51 mm dia. x 351 mm (2" x 14")  
(specifications subject to change without notice)

### **IMPORTANT NOTES**

Prior to deployment of the alphaMETER in the ground, it is recommended that a low-density plastic film ("Glad Wrap" food wrapping film) be used to seal off the detector chamber. This film will help exclude corrosive ground water and soil from the detector.

Corrosion and pitting of the fragile detector sealing membrane will void the alphaMETER warranty.

The plastic film has virtually no barrier effect to radon gas, but thoron gas will be effectively excluded.

The alphaNUCLEAR supplied 615 Battery pack is not waterproof. It is recommended that the

battery pack be contained in a plastic bag if wet conditions are anticipated.

The Model 611 alphaMETER includes a pressure release screw located on the top of the unit beside the data/power connector. This feature is to allow internal/external pressure equalization to take place, thus eliminating any pressure stress on the detector sealing membrane during airfreight shipments.

It is therefore VERY IMPORTANT to close (seal) this pressure-port prior any field use of the alphaMETER. Use a small screw driver (slot type) turn the screw clockwise until it becomes firm only, do not try to make the screw tight. Use of a screwdriver with a small diameter handle (1 cm) will reduce the possibility of over tightening this screw.

Operation of the alphaMETER with the battery charger attached to the battery power source and plugged into the AC line power IS NOT RECOMMENDED (can cause power line noise induced counts).

Operation of the alphaMETER with a computer or terminal connected and operating IS NOT RECOMMENDED (can cause power line/computer noise induced counts).

In very wet conditions the plastic boot should be clamped at the top of the alphaMETER with a hose clamp or similar. Also, the cable entry to the boot should be sealed with a silicon based sealant compound.

The sensitive volume chamber may be unscrewed from the alphaMETER to facilitate cleaning its inside surfaces. At this time, the very fragile detector sealing membrane is exposed and vulnerable to physical damage, protect it accordingly.