Radon Monitor User's Guide

Accurate, Reliable, Economical

Models 1028, 1029

User's Guide, Radon Monitor

This guide is written for:

PC software:	version 2.2.0
Embedded firmware:	version 1.0.9

SUN NUCLEAR
corporation

Preface

Description

The Continuous Radon Monitor is a detection device used to measure the concentration of radon gas. The unit is designed for professional inspectors to use in homes and buildings. The device is EPA verified and radon proficiency programs approved.

CAUTION: The Continuous Radon Monitor Model 1028 is intended to be used only for indoor applications of radon gas sampling. Using in an outdoor environment may cause errors due to humidity and extreme temperatures.

Health and Safety Instructions

WARNING: To avoid risk of electric shock, this device must only be connected to a supply mains with protective earth (ground).

WARNING: Never use the device in an area that could contain explosive gases. A spark from inside the device could ignite an explosion.

To protect Radon Monitor performance and cable insulation, never pull on a cable to disconnect it. Always grasp the plug or connector.

Do not permit water or any other liquids to spill onto the device.

For instructions to report health or safety related concerns, see *Reporting Health or Safety Related Issues or Concerns* on page 56.

Finding Additional Information

The U.S. Environmental Protection Agency (EPA) maintains a comprehensive radon website at http://www.epa.gov/radon/index.html where you can find EPA documents, brochures, and publications relating to radon, including:

- *A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon*. This guidance offers strategies for testing your home for radon and discussions of what steps to take after you have tested, as well as discussions about the risk of radon and radon myths.

- *Consumer's Guide to Radon Reduction: How to Fix Your Home*. This booklet is for people who have tested their home for radon and confirmed that they have elevated radon levels. This booklet can help with selecting a qualified contractor to reduce the radon levels in the home, determining an appropriate radon reduction method, and maintaining a radon reduction system.

- *Home Buyer's and Seller's Guide to Radon*. This booklet is intended for anyone who is buying or selling a home, real estate and relocation professionals, home inspectors and others.

Contents

Introduction

Parts

Unpack the radon monitor and identify the parts described below.

Note: *Save the packing material so it can be used when sending the radon monitor to Sun Nuclear Corporation for annual re-calibration.*
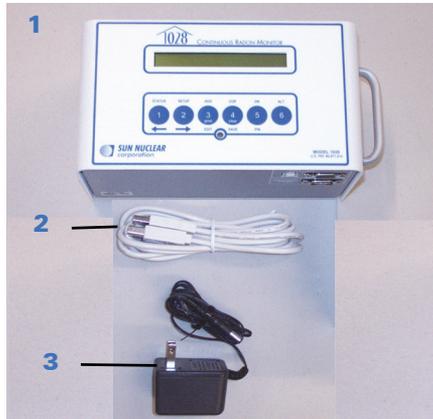
No.	Part Number	Description
1	1028300 or 1028300-RM	Model 1028 Radon Monitor* or Model 1028 Radon Monitor (Refurbished)
2	801041Z	Cable, USB A-B M, 2 m
3	741011**	Power supply, 18 VDC, 100-240 VAC, 0.3A
—	0200014	Radon Customer Support Site letter (not shown)
—	1028012	Getting Started Guide (not shown)

* Model 1029 Radon Monitor is obsolete.
**Power supply P/N 741011 is only included with Model 1028 Radon Monitors shipped within the United States.

Figure 1. Parts Furnished with Model 1028 Radon Monitor

Options and Accessories

Contact Sun Nuclear Corporation to order any of the following accessories:

Table 1. Radon Monitor Accessories

Part Number	Description
1028050	Printer, thermal, 80 column, Seiko DPU-414.
022005Z	Power supply for printer, 6 VDC. Used with P/N 801008Z.
750052	Rechargeable battery pack for printer (furnished with P/N 1028050 or can be ordered separately).
801008Z	Line power cord for printer. Detachable, IEC Plug to USA style, 1.8 m.
801032Z	Serial cable for printer, 9-pin, D-connector, M/F (furnished with P/N 1028050 or can be ordered separately).
850043Z	Thermal paper for printer (furnished with P/N 1028050 or can be ordered separately).
750004	Battery, alkaline, 9V, for radon monitor.
741011	Power converter for Radon Monitors shipped within the United States, 120 VAC to 12 VDC, 200 MA, 60 Hz.
801041Z	USB cable for Radon Monitor, 2 m.
1028012	Radon Monitor Getting Started Guide.
1028000-SC	Carrying case, single radon monitor.
1028000-SPC	Carrying case, single radon monitor plus printer.
1028000-DC	Carrying case, dual (holds two radon monitors, printer, cables).
102378	Sign, self-adhesive, "Warning, Closed Building Procedure".
102379	Sign, plastic, hanging, "Caution, Radon Test in Progress".
1028130	Sign, vinyl static cling, "Warning, Closed Building Procedure".

Connections
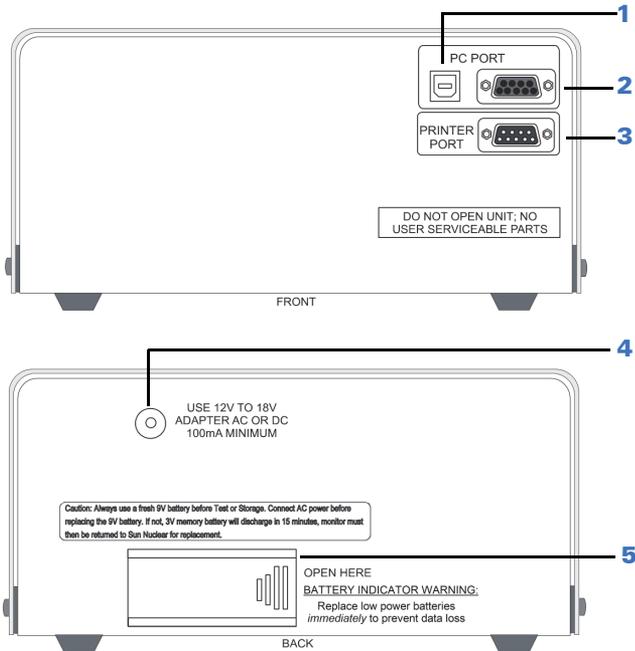
No	Description	Function
1	USB PC PORT (front)	USB port (USB 1.1 or 2.0); for connection to a computer
2	Serial PC PORT (front)	Serial port (RS-232); for connection to a computer
3	PRINTER PORT (front)	Serial port (RS-232); for connection to the optional printer.
4	Power connection (back)	Power connector; connects to the power supply when using AC power.
5	Battery compartment (back)	Insert and connect a fresh 9V battery for either backup or primary power. A fresh alkaline battery will operate the radon monitor for approximately 100 hours while a fresh lithium battery will provide about 300 hours of operation. See *Replacing the 9V Battery* on page 6.

Figure 2. Connections

⚠ **WARNING: Always install a fresh 9V battery before test or storage to prevent the internal 3V battery (required for operation) from discharging.**

3

Controls
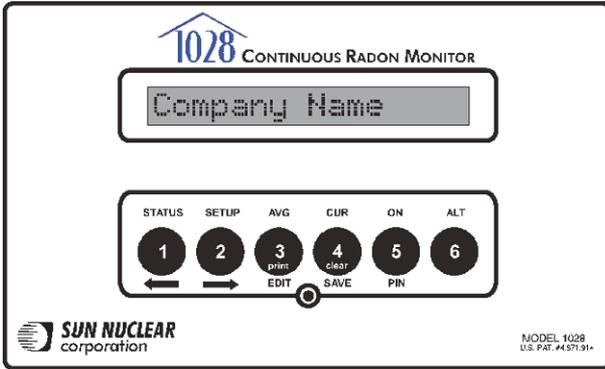
Description	Function
Display	16-digit LCD display shows messages to guide the operation.
Buttons	Six push buttons with different functions depending on mode. Press keys to operate. Top row of labels lists main functions. Bottom row of labels are for Setup. Print and Clear functions are used after measurement. Numbers are for PIN entry and Setup.
STATUS	Selects the Status mode, which scrolls through the Status settings.
SETUP	Selects the Setup mode, which is used to enter setup values from the keypad.
AVG	Displays the measured cumulative average radon gas concentration in pCi/l or Bq/m^3 since the memory was last cleared.
CUR	Displays the measured short-term radon gas concentration, a rolling average of the most recent 12 hours.
ON	Press to turn on the display. There is no OFF switch. To save power, the display turns off automatically after a few minutes of inactivity.
ALT	For future use.
PIN	Press to enter PIN (personal identification number), if used.
SAVE	Saves the Setup mode values that were entered.
EDIT	Allows editing of the Setup mode entries.
Right arrow	Scrolls ahead during Setup or Status.
Left arrow	Scrolls backward during Setup or Status.
Clear	Clears the test memory in Print/Clear mode. Memory must be cleared before starting a new test.
Print	Sends report data to optional printer in Print/Clear mode.
Mode light	The green light between EDIT and SAVE has the following meaning: • Blinks once during power up, indicating that the startup test is in progress. • Blinks when radon is detected.

Figure 3. Controls

4

Standalone Operation

Position the Monitor

1   Place the radon monitor in the desired position in the area to be monitored for radon gas. The radon monitor does not need to be level.

2   To use a tripod, thread the standard tripod screw (1/4-20UNC) into the threaded fitting on the bottom of the case (Figure 4).

Figure 4. Using a Tripod

Install a Fresh Battery

The radon monitor can be operated on battery power or AC power. When connected to AC power, the battery provides back-up power. However, even when operating on AC power, a battery must be installed to provide backup power.

> ⚠️ **WARNING: Always install a fresh 9V battery before test or storage, even when the unit is connected to AC power, to prevent the internal 3V battery from discharging. The 3V battery will discharge in 15 minutes; the battery is not user-serviceable and if discharged, the unit must be returned to Sun Nuclear for replacement.**

With the radon monitor disconnected from AC power, a fresh alkaline battery will operate the device for about 100 hours, or a fresh lithium-ion battery for about 300 hours.

⚠ **CAUTION: High humidity may shorten battery life. Connect the AC power adapter when using the radon monitor in areas with high humidity.**

The battery is located in a small compartment on the back of the radon monitor (Figure 5). To install a new battery, *Replacing the 9V Battery*, below. A replacement 9V battery can be purchased from Sun Nuclear or any retail source.

Figure 5. Inserting a Battery

Replacing the 9V Battery

⚠ **WARNING: Always connect to AC power before replacing the 9V battery, to prevent the internal 3V battery (required for operation) from discharging.**

The internal 3V battery will discharge in 15 minutes and if discharged, the unit must be returned to Sun Nuclear for replacement. Additionally, if the 3V internal battery is discharged, the time and date may be reset and the "Current" values may be permanently erased.

⚠ **CAUTION: Never replace the battery during a test.**

1   If a test is in progress, wait for the test to complete.

2   Connect the radon monitor to AC power using the AC adapter. See *Connecting the AC Adapter* on page 7.

3   Open the battery compartment door (Figure 5) on the rear panel of the unit.

4   Remove the old battery and unsnap the connector.

5 Connect a fresh 9V battery to the connector, insert the battery into the battery compartment, and close the battery compartment door.

Connecting the AC Adapter

1 After verifying a battery is installed (see Figure 5 on page 6), connect the power cable to the power connector on the rear panel of the radon monitor.

Figure 6. Connecting Power to the Radon Monitor

2 Plug one end of the power cord into the adapter and the other end into a 100 to 240 VAC, 1-phase, 50-60 Hz mains power source.

Turn on the Display

To conserve power, the 16-digit display is always off until the ON button is pressed. If no buttons are pressed for 2 – 3 minutes, the display turns off automatically.

To turn the display on:

1 Press the **ON** button (**5**). After a few seconds, the display turns on and shows the message "*Battery OK*" (Figure 7).

2 If a Personal Identification Number (PIN) is set up, the display prompts the user to enter it. The company name is displayed momentarily (if set up) followed by the message "*Checking Memory.*" If there is data in memory, the message "*Data in Memory!*" appears. The data can be printed before clearing the memory.

Figure 7. Turning on the Display

3 When the display shows "Start Test = 5," the user may start a new test, check AVG, check CUR, check STATUS, or change SETUP. The table below summarizes the steps to turn on the display.

Press…*	Display Shows…	Comment
5	Battery OK	Display is always off until ON key (5) is pressed. "Battery OK" means there is enough power for 60 hours of operation (delay plus test). "Low/No Battery!" means that the battery has less than 60 hours operating life, or there is no battery installed.
–	Enter PIN	Only appears if a Personal Identification Number has been set up.
nnnn	NNNN	Enter PIN using digits 1 – 4 (5 and 6 not supported; there are no buttons for 7 – 9). Numbers entered are displayed. Enter "5' after entering PIN.
5	Company Name	Press PIN button (5). If correct PIN was entered, company name (if set up) displays. If wrong PIN was entered, message *"Shutting down..."* appears briefly and then display turns off.
–	Checking Memory	If data is in memory, the messages *"Data in Memory!"* and *"Print and Clear"* are displayed. Print and Clear the memory before starting a new test. See *Clearing Memory* on page 11.
–	Start Test = 5	With the display reading "Start Test = 5," the user can press a button to: • Start a test. See *Starting a Test* on page 9. • Check AVG or CUR. See *Displaying Average and Current* on page 10. • Check STATUS. See *Checking Unit Status* on page 11. • SETUP the unit. See *Setting Up Parameters* on page 12. After a few minutes of inactivity, the display turns off automatically to save power.

Starting a Test

When the "Start Test = 5" prompt appears, press the 5 button to start a new test.

Press…	Display Shows…	Comment
–	`Start Test = 5`	A new test can be started.
❺	`Checking Memory`	Memory is rechecked. If data is found, memory must be cleared before starting a new test. See *Clearing Memory* on page 11.
–	`Delay      0 hr`	Displays the time delay defined in Setup.
–	`Interval   1 hr`	Displays the measurement interval defined in Setup.
–	`Duration   12 hr`	Displays the test duration defined in Setup.
–	`Test in Progress`	The test has started and will be finished after the duration defined in Setup (plus delay). The display turns off after a few minutes and remains off until the test is interrupted or the display is turned on.

Interrupting a Test

A test in progress can be interrupted to view the average or current readings. After the interruption, the test can be terminated or continued.

Press…	Display Shows…	Comment
❺	`Battery OK`	Display turns on and battery is checked.
–	`Enter PIN`	This prompt only appears if a Personal Identification Number was set up.
nnnn	`NNNN`	Enter the PIN using only digits 1 through 4.
❺	`NNNN`	PIN number is displayed. Press PIN button (5) to check PIN. If the wrong PIN is entered, the message "*Shutting down…*" is displayed.
–	`End Test Y=5 N=2`	Press 5 to end a test prematurely or 2 to continue. Pressing 2 will turn off the display and continue the test. Note, when this message is displayed, the user also has the option to press AVG (3) or CUR (4) to display the average or current readings. See *AVG or CUR During a Test*, below.
❺	`Confirm  Y=5 N=2`	Press 5 to confirm or 2 to cancel.
❺	`Test Complete`	The test is terminated.
–	`Start Test = 5`	A new test may be started. If there is partial test data in memory, it must be cleared before starting a new test. See *Clearing Memory* on page 11.

9

Note: A completed test cannot be interrupted. After a test is completed, pressing ON displays the normal start sequence.

Displaying Average and Current

Note: AVG is the average radon concentration over the total monitoring period; CUR is the average radon concentration over the last 12-hour period.

AVG or CUR During a Test

The average (AVG) or current (CUR) radon values can be displayed during a test. Turn ON the display (see *Interrupting a Test* on page 9), and note the button press options in the table below.

Press…	Display Shows…	Comment
–	End Test Y=5 N=2	When the display shows this message, press AVG (3) or CUR (4) to access those functions.
❸ or ❹	Hold 3&4 Prt/Clr	This message only appears for a moment after pressing 3 or 4. If the test was just started, the message "Not Enough Data" is displayed.
–	Average 1.2	If AVG (3) was pressed, radon monitor displays the average radon concentration over the total monitoring period.
–	Current 1.2	If CUR (4) was pressed, radon monitor displays the radon concentration in the current 12-hour period.
–	Shutting down...	After displaying AVG or CUR, monitor shuts down to resume test.

AVG or CUR After Test

The average (AVG) and current (CUR) radon values can also be displayed after a test is completed. Turn ON the display (see *Turn on the Display* on page 7), and note the button press options in the table below.

Press…	Display Shows…	Comment
	Start Test = 5	Press AVG (3) or CUR (4).
❸	Hold 3&4 Prt/Clr	This message only appears for a moment after pressing AVG (3).
–	Average 1.2	Displays the average radon concentration over the total monitoring period.
❹	Hold 3&4 Prt/Clr	This message only appears for a moment after pressing CUR (4).

Press…	Display Shows…	Comment
–	`Current      1.2`	Displays the radon concentration in the current 12-hour period.
–	`Start Test = 5`	AVG or CUR reading is complete. The data for the test remains in memory and must be cleared before starting a new test. See *Starting a Test* on page 9.

Clearing Memory

After printing the report, clear the memory using the key press options in the table below.

Press…	Display Shows…	Comment
–	`Start Test = 5`	It is recommended to print a report before clearing data.
❸+❹	`Prt=3 Cl=4 Ex=5`	When the "*Start Test = 5*" message appears, press and hold 3 and 4. Keep holding until the "*Prt=3 Cl=4 Ex=5*" message appears. Press 4 to clear (or 5 to exit).
❹	`Confirm  Y=5 N=2`	Press 5 to confirm the clear memory command.
❺	`Clearing Memory`	The memory is cleared in a few seconds.

Checking Unit Status

Before starting a new test, it is recommended to scroll through the status items to confirm they are correct.

Press…	Display Shows…	Comment
–	`Start Test = 5`	The status menu can be selected when the display shows "Start Test = 5."
❶	`Status Menu`	Press the (1) button to select the status menu. The status of each item will scroll through automatically. Each item displays for about 2 seconds.
–	`DELAY      nn hr`	The delay time selected.
–	`INTERVAL   nn hr`	The measurement interval selected.
–	`DURATION  nnn hr`	The duration of the test.
–	`BATTERY    Ok`	Battery status.
–	`TIME    nn:nn PM`	Current time.
–	`DATE    MM DD YY`	Current date
–	`CAL    MM/DD/YYYY`	Date of last calibration.
–	`SNC MODEL   1028`	Model number.

Press…	Display Shows…	Comment
–	CODE VER nnnn	Embedded code (firmware) version number.
–	S/N nnnnnnnnnnn	Serial number.
–	Status Menu Done	End of the menu. Display returns to "Start Test = 5".

Status items can also be displayed *during* a test by pressing the (1) button while the display shows "End Test Y=5 N=2."

Setting Up Parameters

Note: *If there is any test data in the radon monitor, parameters cannot be entered. Clear test data before changing parameters.*

Parameter data can be entered using a computer or by entering the characters with the front panel keys on the radon monitor. Using a computer is the faster of the two methods. For instructions to enter parameter data using a computer, see *Monitor Settings Preferences* on page 38. The table below shows the parameter key press options.

Press…	Display Shows…	Comment
–	Start Test = 5	Parameters can be changed at any time before starting a test.
❷	Setup Menu	Entering setup menu.
–	Checking Memory	Checking memory for data.
–	Delay 0.0 hr	Shows current delay settings.
⇦ or ⇨	Delay 12 hr	Press arrow buttons to change value. • If the monitor firmware version is 106 or higher, the delay options are 0.0 hours, 12 hours, 24 hours, or 48 hours. • If the monitor firmware version is 105 or lower, the delay options are 0.0 hours or 12 hours. For the steps to check firmware version on a standalone monitor (not connected to a computer), see *Checking Unit Status* on page 11. For the steps to check the firmware version from the computer, see *Monitor Settings Preferences* on page 38. The serial number and firmware version of the unit are displayed on the right side of the Monitor Settings screen.
❹	Interval 1.0 hr	Press SAVE; saves the Delay setting and advances to Interval.
⇦ or ⇨	Interval 4.0 hr	Press arrow keys to scroll through selection of intervals, 0.5 (model 1029 only), 11.0, 2.0, 4.0, 8.0, 12, 16, 20, or 24 hours.

Press…	Display Shows…	Comment
④	Duration 1.0 hr	Press SAVE; saves the setting and advances to the next item.
⇦ or ⇨	Duration 48 hr	Press arrow keys to scroll through test duration times: 1.0, 12, 24, 36, 48, 60, 72, 84, 96, 100, or 999 hours. If 999 is selected, measures until memory is full or to 720 data points, whichever occurs first.
④	COMPANY Company	Press SAVE; saves the setting and advances to the next.
❸	COMPANY Company	The EDIT key (3) lets you begin to edit the first character.
⇦ or ⇨	COMPANY Mompany	Press the arrow keys to scroll through the available characters. See *Character Set* on page 14 for a list of characters. Press and hold for rapid scroll.
❸	COMPANY My Comp	Press EDIT key (3) and scroll to the next and subsequent characters. Press EDIT (3) again to enter the next character. Continue character by character until the company name is entered (up to 30 characters).
④	ADDRESS1 none	Press SAVE (4); saves the setting and advances to the next item.
❸	ADDRESS1 9one	The EDIT key (3) allows editing beginning with the first character. Enter up to 30 characters for the first address line using the same procedure as for Company name.
④	ADDRESS2 none	Press SAVE (4); saves the setting and advances to the next item.
❸	ADDRESS2 none	If a second address line is not needed, leave it blank. The EDIT key (3) will allow editing beginning with the first character. Enter up to 30 characters for the second address line using the same procedure as for Company name.
④	City none	Press SAVE (4); saves the setting and advances to the next item.
❸ and ④	City none	Enter city (20 characters) and SAVE (4) (same as above).
❸ and ④	STATE none	Enter state (10 characters) and SAVE (4) (same as above).
❸ and ④	ZIPCODE	Enter zip code (10 characters) and SAVE (4) (same as above).
❸ and ④	PHONE	Enter phone number (20 characters) and SAVE (4) (same as above).
❸ and ④	LICENSE	Enter license number (10 characters) and SAVE (4) (same as above).
❸ and ④	TIME	Enter current time (4 numbers plus AM or PM) and SAVE (4) (same as above).
❸ and ④	DATE	Enter current date in the format MMDDYY (6 numbers) and SAVE (4) (same as above).

13

Press…	Display Shows…	Comment
❸ and ❹	UNITS pC/l	Select units, pCi/l or Bq/m³ (edit, select with arrows, and SAVE (4)).
❸ and ❹	PIN NUM 1111	Enter a PIN number if desired in the range of 1111 to 4444 and SAVE. The number 1111 is equivalent to no PIN. To clear a PIN, enter 1111.
	Setup Menu Done	End of setup menu.

To enter parameter data using the front panel keys on the radon monitor:

1 Turn on unit.

2 Press "Setup" (button 2).

3 Advance through the list by pressing "Save" (4).

4 Stop on an item to change it.

5 Press "Edit" (3) to edit the item.

6 Press the arrow keys to scroll through a list of available characters and stop when the desired character appears. Press and hold arrow key for fast scroll.

7 When a desired character to change appears, press "Edit" (3) again to change it.

8 When all the characters are changed, press "Edit" to complete the item.

9 Press "Save" and advance to the next item.

Character Set

The available character set includes the following in the sequence shown:

(space) ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ^ _ ' a b c d e f g h i j k l m n o p q r s t u b w x y z

Display Turns Off Automatically

The display turns off automatically after a period of inactivity of about 2-3 minutes. There is no OFF switch or key sequence.

Clearing a Reset

1 Turn on the radon monitor to check the battery. If the system is accidentally reset, clear the reset as shown in the table below.

Press…	Display Shows…	Comment
❺	Battery OK	Battery is checked.
–	System has reset	System has been reset.
–	Check Date/Time	An alert to check the date and time and re-enter them.
❺	Clear Reset? Y=5	Sets the system back to operational mode.
–	Shutting down...	System shuts down.

2 Start the radon monitor again. See *Turn on the Display* on page 7.

3 In Setup, change the date and time. See *Setting Up Parameters* on page 12.

> **Note:** *A reset does not clear or change any test data stored in memory.*

Low Battery Messages

A 9V battery must always be installed, even when using an AC power supply, to prevent discharge of the internal 3V battery. When the battery is low or needs to be replaced, a message is displayed on the radon monitor. The following sections describe the messages that may be displayed.

Low Battery with AC Power Connected

If the battery is low and the AC power adapter is connected, a message appears when key 5 is pressed.

Press…	Display Shows…	Comment
❺	Low/No Battery!	Battery is checked. Does not have enough power for a 60-hour test.
–	Replace Battery!	Replace the 9V alkaline battery as soon as convenient. Current test can continue until complete if AC power is reliable.
–	Shutting down...	The system shuts down to save power.

Replace the 9V battery as soon as the test is complete. See *Replacing the 9V Battery* on page 6.

Low Battery Without AC Power Connected

If the battery is low and the AC power adapter is not connected, a message appears when attempting to power on.

Press…	Display Shows…	Comment
❺	`Low Battery!`	Battery is checked. Does not have enough power for a 60-hour test.
–	`No Extern. Power`	Indicates AC power should be connected to continue the test in progress. At the conclusion of the test, replace the battery.
–	`Shutting down...`	The display shuts down to save power.

Connect the AC adapter to continue the test or perform any other operation. Replace the 9V battery as soon as possible. See *Replacing the 9V Battery* on page 6.

Storage Under Power

WARNING: For long term storage, always connect to AC power or install a fresh 9V battery to prevent the internal 3V battery (required for operation) from discharging. The 3V battery is not user-serviceable and if discharged, the device must be returned to Sun Nuclear for replacement.

The radon monitor must always be stored with a 9V battery installed or connected to AC power. This additional power is required to prevent discharge of the 3V lithium battery located inside the unit. The 3V battery will discharge in 15 minutes, and if the internal battery is discharged, it must be replaced at the factory. See *Contacting Sun Nuclear Support* on page 54.

Portable Printer (Optional)

Printer - Parts

The following parts are included with the optional portable printer, P/N 1028050.

Part Number	Description
022005Z	Power supply, 6 VDC out, 2.1 mm plug
750052	Rechargeable battery pack, 4.8 V Ni-MH
801008Z	Line power cord for printer, detachable, IEC Plug to USA style, 125 V, 10 A, 2.3 m.
801032Z	Cable, RS-232 (serial), DB9M to DB9F, 6 ft.
850040Z	Thermal printer
850043Z	Thermal printer paper (roll)

Printer - Description

The optional portable printer prints reports directly from the radon monitor. It can be connected to AC power or used as a portable printer by switching to battery power. See *Printer Battery Pack* on page 22.

Figure 8. Optional Portable Printer

The printer is not used to print reports from the computer. For computer reports, see *Printing Reports* on page 44.

Printer Connection and Controls

1   Connect the printer cable to the PRINTER PORT on the radon monitor and the serial port on the printer's rear panel (Figure 9).

Figure 9. Connecting the Printer Cable

2   To operate the printer on AC power, plug the power supply (P/N 022005Z) into the power connector at the back of the printer. Then, plug the detachable power cord (P/N 801008Z) into the power supply and into a power source that matches the ratings on the power supply.

Alternately, the printer can be operated from the rechargeable battery.
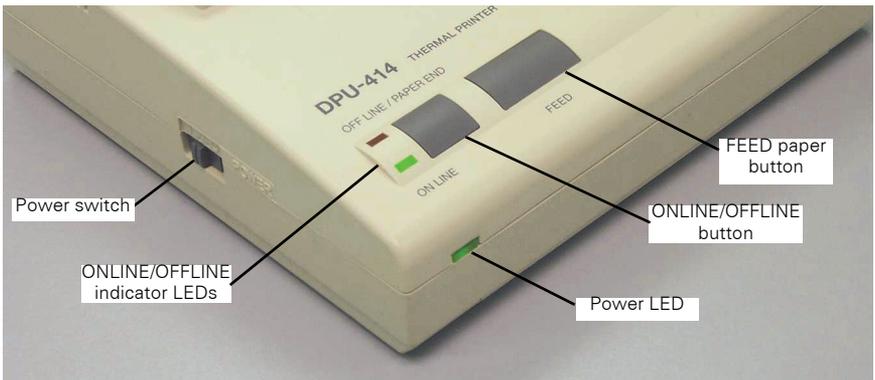
Figure 10. Printer Controls

3   Slide the Power switch (on the side of the printer) to the On (I) position.

The Power LED (green) will illuminate and blink once every second. If the rechargeable battery pack is low, the Power LED will blink once every 1/2 second.

18

4 To feed paper, press the **ONLINE/OFFLINE** button to select off line mode (red LED illuminated), then press the **FEED** button. It is only possible to feed paper when the printer is OFFLINE.

5 When complete, press the **ONLINE/OFFLINE** button to select on line mode (green LED illuminated).

- The green ONLINE LED will blink if there is data in the buffer memory when you toggle the switch to off line mode.

- The red OFFLINE light indicates the printer is off line.

- The red OFFLINE light flashes if the paper is not set or has run out.

- Both the ONLINE and OFFLINE lights flash if there is an error.

> **CAUTION: Do not press and hold the ONLINE/OFFLINE button and the FEED button simultaneously for 30 seconds or more. This resets the printer's internal switches and prevents use of the printer.**

Loading the Paper

> **Note:** *Load the paper in an area protected from direct sunlight.*

1 Unwrap the roll of thermal paper (P/N 850043Z) and, if necessary, cut the leading edge straight across.

2 Open the paper cover on the printer and place the roll of thermal paper, edge down, in the cover (Figure 11). (Printing surface is on the inside of the roll.)

Figure 11. Loading the Paper

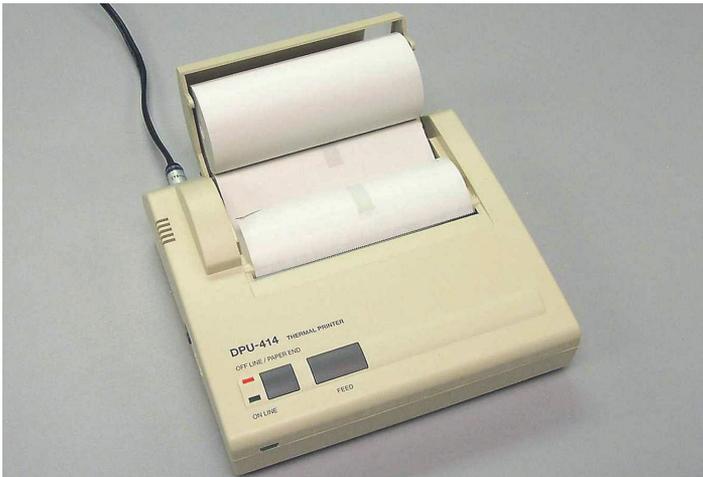**3** Press the **ONLINE/OFFLINE** button to select off line mode (red LED illuminated).

4 Push the edge of the paper into the inlet slot at the bottom of the paper holder until the auto-loader catches and feeds about 10 cm of paper through the paper cutter.

> **Note:** *If the paper is set correctly, the OFFLINE (red) LED will stop flashing and stay on to indicate the printer is still in off line mode.*

5 If necessary, keep pressing the paper FEED button until the paper feeds straight and smoothly.

Printing a Report

After a test has been performed, it is recommended to print a report before clearing the data from memory. If there is data in memory when the display is powered on, the "*Data in Memory!*" and "*Print and Clear*" messages appear. Print a report using the key press options in the table below.

Press…	Display Shows…	Comment
–	Start Test = 5	Printing can be initiated when the display shows "Start Test = 5."
❸+❹	Prt=3 Cl=4 Ex=5	Press and hold 3 and 4. Keep holding until the "*Prt=3 Cl=4 Ex=5*" message appears.
❸	Compact? Y=5 N=2	Press 3 to print (or 5 to exit without printing) (1029 only).
❷ or ❺	Graph? Y=5 N=2	Press 5 for compact printout; press 2 for standard printout.
❷ or ❺	Printing...	Press 5 to print the bar graph; press 2 to exclude it. Data is sent to the portable printer.
–	Start Test = 5	Printing is complete. A new test can be started. The data for the test remains in memory and must be cleared before starting a new test. See *Clearing Memory* on page 11.

Typical Printer Report

```
Radon Inspections, Inc.
1234 County Road
Anywhere
OH
12345
123-456-7890
License# or RPP ID #:4445738

Sun Nuclear Model:   1029 CRM
Serial Number:       3337219
Calibration Date:    01/10/2006
Correction Fact1:    2.80
Correction Fact2:    2.75

Start Date/Time:     01/28/2006   08:54
End Date/Time:       01/28/2006   18:54
Time Delay:          0.0
Start Temp: Humid: Pressure : 75.1 : 49.5 : 29.3
--------------01/28/2005-----------

TIME    CNT    TEMP   HUM    PRE    M
hh:mm   pC/l    F      %     inHG

08:54   0.9    75.2   49.5   29.2
10:54   1.8    75.3   49.6   29.2
12:54   3.1    75.2   49.5   29.2    M
14:54   2.1    75.3   49.6   29.2
16:54   2.0    75.2   49.5   29.2
18:54   2.1    75.3   49.6   29.2


--------------END--------------

Elapsed Time:    000 days 12 hrs 00 mins
Overall Avg:     2.0
EPA Avg:         2.0

Test Performed For:
_____

_____

_____

|''''|''''|'01/28/2005'''|''''|''''|'''|''''|''''|
0      1.0     2.0     3.0     4.0     5.0
|....|....|....|....|....|....|....|....|....|....|
08:54  #########
10:54  #################
12:54  ################################
14:54  #####################
16:54  ####################
18:54  #####################
```

HEADER DATA: Prints information about the inspector and the device.

TABULAR DATA: Average radon gas concentration during each measurement interval is printed in sequential order; reading in rows from one to a maximum of 720 measurement intervals.

TIME: Shows the time of each measurement.

CNT: Shows radon measurement count in either picocuries per liter (English units) or becquerels per cubic meter (metric units) depending on which units are selected.

"M" (movement): Indicates that movement occurred during the measurement. The unit may have been moved during the test.

TEMPERATURE, HUMIDITY, & PRESSURE (model 1029 only): Show the effect of changing weather conditions, ventilation, or detector interference that may alter test results. Temperature and pressure units are English or metric (F or C, inHG or kPa) corresponding to the type of radon units.

OVERALL AVERAGE: Long term average since last memory CLEAR.

EPA AVERAGE: Long term average less the first 4 hours of data.

Information to be filled in by the inspector.

MEASUREMENT GRAPH: Each radon concentration value is graphically represented in the same order as the tabular printout. Scale is automatically adjusted to show maximum value.

Figure 12. Typical Printer Report

21

Movement

The movement indicator (M) indicates if the unit was moved during the displayed time period. The movement indicator is sensitive and can be triggered by bumping or minor shifting. It could also mean that the unit was moved to a different location during the test, invalidating the test.

Temperature, Humidity, Pressure

Model 1029 contains additional temperature, humidity, and pressure sensors. Changes recorded by these sensors may help to determine if the unit was moved or the area ventilated during the test period.

Printer Battery Pack

The rechargeable battery pack (P/N 750052) allows the user to print reports without connecting the printer to AC power. The battery pack is automatically re-charged when AC power is connected to the printer.

Inserting the Battery Pack

1   Move the power switch to the OFF (0) position.

2   Turn the printer over and slide the battery cover away from the battery pack enclosure (Figure 13).

Figure 13. Inserting and Removing the Battery Pack

3   Connect the battery pack wires to the connector.

4   Turn the battery pack so the label is visible, insert it in the printer, and close the battery cover.

Removing the Battery Pack

1   Move the power switch to the OFF (0) position.

2   Turn the printer over and slide the battery cover away from the battery pack enclosure.

3 Pull out the battery pack, grasp the connector between your thumb and index finger, and then pull gently to remove.

4 Close the battery cover.

Charging the Battery Pack

1 Turn the power switch to the OFF (0) position.

2 Connect the AC adapter to the printer. The Power LED will blink once every second while the battery is charging. It takes about 10 hours to completely recharge the battery. When the battery is fully charged, the Power LED stops blinking and turns off.

3 Disconnect the AC adapter.

> **Note:** *Always charge the battery in a location that is 5 to 40 °C (41 to 104 °F) to avoid degradation of the battery pack.*

Low Printer Battery Indication

When the Power LED blinks once every 1/2 second and the printer goes into off line mode, connect the AC adapter. If there is data left in the memory buffer when this happens, to preserve the data, connect the AC adapter as quickly as possible and push the ONLINE button.

Efficient Use of Printer Battery

Battery efficiency decreases if the battery is recharged more than necessary. Confirm whether the Power LED is blinking and battery charge is low before recharging the battery.

When using the rechargeable battery, turn off the power switch after use. Leaving the power switch on will consume battery power and eventually run the battery down.

When the AC adapter is connected, please note that the battery gradually recharges whether or not the printer is on or off. It takes about 15 hours to charge the battery with the power on. Battery charging is temporarily disrupted while the printer is printing and resumes automatically when printing is completed. If the printer is not in use, move the power switch to the OFF position and then unplug the AC adapter.

Printer Switch Settings

The thermal printer (P/N 1028050) has internal DIP switches that are set at the factory. For proper operation, these switches must be set as shown in Figure 14 on page 25.

To check and set the switches, perform the following steps:

1   Slide the power switch to the OFF (0) position.

2   Slide the power switch to the ON (I) position while pressing and holding the **ONLINE/OFFLINE** button.

3   Release the **ONLINE/OFFLINE** button after a list of the current settings (Figure 14 on page 25) begins to print. When the list of settings is complete, the following prompt appears at the bottom of the printout:
> *"Continue? : Push On-line SW"*
> *"Write? : Push Paper feed SW"*

4   To leave the switch setting the same, push the **FEED** button.

5   To change any switch settings, push the **ONLINE/OFFLINE** button. The prompt "*Dip SW-1*" appears on the printout below the current settings.

> ⚠️ **CAUTION: Never turn the printer off while writing the switch set-tings to memory. When "*Dip SW setting complete*" is printed, power may be turned off.**

> 📌 ***Note:*** *All eight switches in SW-1 must bet set to 'on' or 'off' before exiting.*

6   Set each of the eight switches in Dip SW-1 by pressing the **ONLINE/OFFLINE** button="on" or **FEED** button="off". As ON or OFF is selected for each switch, the printer prints the selection. When switch 8 is set, the printer once again prompts to *"Continue?"* or *"Write."* Press the **ONLINE/OFFLINE** button to continue to SW-2.

7   In the same manner, set the switches for SW-2 and SW-3.

8   When SW-3 is finished, press the **FEED** button to select *"Write."* The changes are written to printer memory, and then the printer returns to on line mode.

```
[ DIP SW Setting mode ]

Dip SW-1
1 (OFF) : Input = Serial
2 (ON ) : Printing Speed = High
3 (ON ) : Auto Loading = On
4 (ON ) : Auto LF = On
5 (ON ) : Setting Command = Enable
6 (OFF) : Printing
7 (ON ) :   Density
8 (ON ) :   = 100 %
Dip SW-2
1 (OFF) : Printing Columns = 80
2 (ON ) : User Font Back-up = ON
3 (ON ) : Character Select = Normal
4 (ON ) : Zero = Normal
5 (ON ) : International
6 (ON ) :   Character
7 (ON ) :   Set
8 (OFF) :   = USA
Dip SW-3
1 (ON ) : Data Length = 8 bits
2 (ON ) : Parity Setting = No
3 (ON ) : Parity Condition = Odd
4 (OFF) : Busy Control = XON/XOFF
5 (OFF) : Baud
6 (ON ) :   Rate
7 (ON ) :   Select
8 (ON ) :   = 9600 bps


Continue? : Push 'On-line SW'
Write?    : Push 'Paper feed SW'

DIP SW setting complete!!
```

Figure 14. DIP Switch Settings for Printer

25

Computer Operation

About the Software

The Radon Monitor uses a Windows program called "1028/1029 Radon Monitor." The software can be used to:

- Enter and download setup parameters into the radon monitor
- Upload report data from the radon monitor into the computer
- Add customer information and test conditions to the report
- Print reports on any available printer

Set Up Software

Prerequisites

- Ensure the computer meets the system requirements in *Recommended System Requirements* on page 46.
- Administrative rights may be required to install and use the software, and to set up communication between the computer and the Radon Monitor.

Install Software

Note: USB drivers are installed automatically during this procedure.

1 Download the 1028/1029 Radon Monitor software from the Radon Support website, https://support.sunnuclear.com/radon/ and save it to your computer or laptop.

2 Right-click the software executable file ***Setup.exe*** and select ***Run as Administrator***, then follow the on-screen instructions to install the software. Accept all default folders and file locations.

3 When the 'Device Driver Installation Wizard' is displayed, click **Next**. The device drivers are installed and then the driver status ('Ready to use') is displayed.

4 Click **Finish** to close the window. The 'Installation Completed' window is displayed.

5 Click **Finish** to close the 'Installation Completed' window. The Radon Monitor icon appears on the desktop.

Connecting to Computer

The radon monitor can be connected to a computer using the USB cable provided with the radon monitor.

If the computer does not have a USB port, a serial cable can be used to connect the radon monitor to the computer. See *Optional Serial Connection* on page 50.

1 Ensure that the radon monitor software has been installed on the computer.

2 Connect the USB cable to the computer and the radon monitor (Figure 15).

Figure 15. USB Connection to a Computer

3 If desired, plug the power supply cord into a 100 to 240 VAC, 1-phase, 50-60 Hz mains power source.

Launch Software

1 Ensure that the radon monitor is connected to the computer via a USB or serial cable.

2 Launch the software application by double-clicking the **Radon Monitor** desktop shortcut [icon] or by selecting *Start > Programs > SNC Group > Radon Monitor*.

3 If the 'Select Port' window is displayed, select the port and then save it. See *Port Selection* on page 51.

> *Note: If the software does not detect the port, select it manually by selecting **Setup > Select Serial Port** from the on-screen menu. See Serial Port Setup on page 50.*

27

Using Software to Retrieve Data

1   After launching the software, turn on the radon monitor by pressing the **ON** key (5).

2   If prompted, enter the PIN and press 5.

3   When the display shows "Start Test = 5", click the **Retrieve Data from Monitor** button at the bottom of the Inspection tab on the main screen. The connection is maintained until software is closed.

USB Cable Connection/Disconnection

If the USB cable is connected after software is already launched, the computer will detect the port and display a message (Figure 16). Click **Yes** to connect. A similar message appears if the cable is disconnected while software is running.

Confirm	☒
❓ Com4 is connected would you like to connect to this port?	
Yes No	

Information	☒
ℹ Com4 is disconnected. Port is no longer available.	
OK	

Figure 16. Port Detection Message

Closing Software

To close the radon monitor software, click the **Close** button in the Inspection tab or select *File > Exit* from the menu.

About the Main Screen

The main screen has a menu bar, toolbar buttons, a status bar, and four tabs (Inspection, Chart, Pictures, and Checklist). The toolbar and status bar can be displayed, as shown below, or hidden.

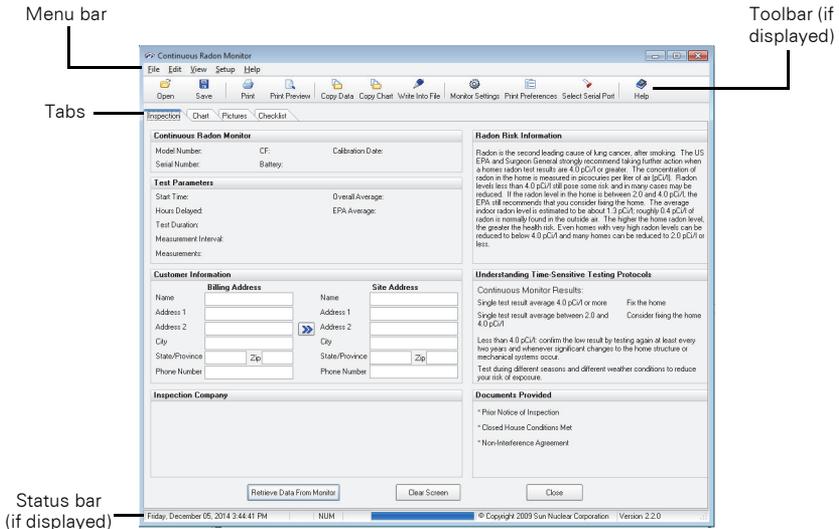The appearance of the main screen will change depending on the tab that is selected.

Figure 17. Main Screen, Inspection Tab Shown

Main Screen - Inspection Tab

The Inspection tab (Figure 18 on page 30) shows:

- Information about the Radon Monitor.
- Test parameters
- Customer information
- Inspection company information
- Radon risk information (EPA information about Radon)
- Testing protocols (information to help interpret test results)
- A list of documents that the inspector can provide to the homeowner

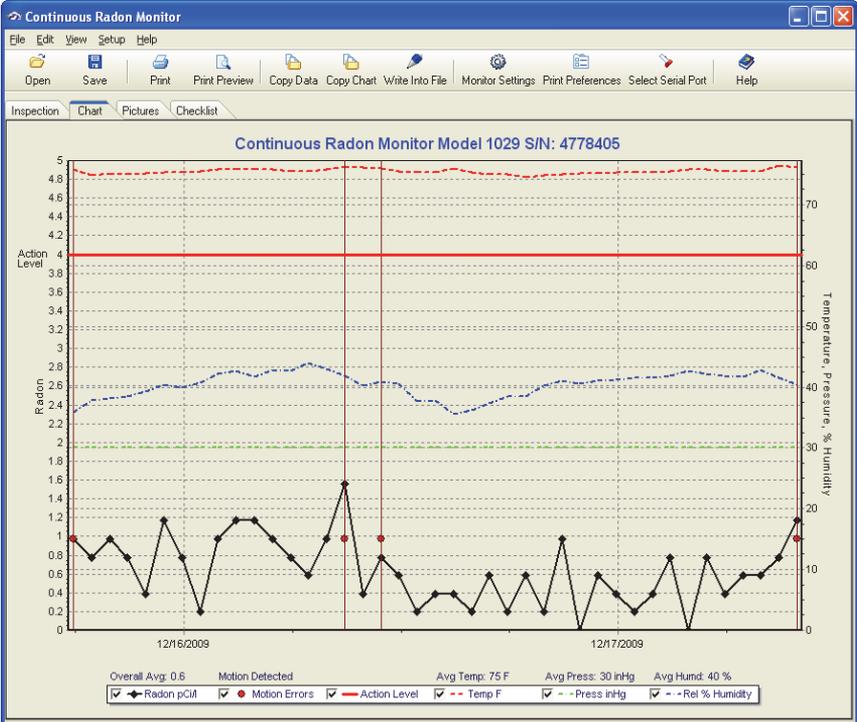| Group	Item	Description
Continuous Radon Monitor (from factory)	Model Number	Model number, 1028 or 1029.
	Serial Number	Serial number of this unit.
	CF	Calibration factor—determined during calibration.
	Battery	Battery voltage.
	Calibration Date	Date the unit was last calibrated.
Test Parameters (from monitor)	Start Time	Time the test started.
	Hours Delayed	Time delay before starting test.
	Test Duration	Length of the test in hours.
	Measurement Interval	Hourly interval between measurements.
	Number of Measurements	Total number of measurements in this test.
	Overall Average	Average radon level detected during the entire test.
	EPA Average	The average radon level detected during the duration of the test minus the first 4 hours. Removing the first 4 hours permits the test environment to stabilize.

Figure 18. Inspection Tab Details

30

Group	Item	Description
Customer Information (usually entered after retrieving test data from the monitor)	Name	Enter customer name to appear on printed report.
	Address 1	Enter address line 1.
	Address 2	Enter address line 2 (if applicable).
	City	Enter city.
	State/Province	Enter state or province.
	Zip	Enter zip or postal code.
	Phone Number	Enter phone number.
	Double arrow button ≫	If Site Address and Billing Address are the same, click the double arrow to copy the information.
Inspection Company	N/A	The "Inspection Company" information is entered in the Monitor Settings tab in the Preferences screen. See *Monitor Settings Preferences* on page 38.
Radon Risk Information		Radon risk information (EPA information about Radon). This information can also be included in the printed report. See *Report Printing Preferences* on page 40.
Understand-ing Time Sensitive Testing Protocols		Testing protocols (information to help the inspector interpret test results). This information can also be included in the printed report. See *Report Printing Preferences* on page 40.
Documents Provided		A list of documents that the inspector can provide to the homeowner. These documents are copied to the computer during the Radon software installation, and are saved in the ***C:\Program Files\SNC\Radon10281029\Radon-Documents*** directory.
Retrieve Data From Moni-tor button		Retrieves data from the connected radon monitor. This function can also be performed from the Moni-tor Settings tab.
Clear Screen button		Clears all data from the left side of the Inspection tab (monitor information, test parameters, customer information, inspection company information). This provides a visual cue that all data has been cleared from the software and that new data is downloaded when the user clicks the 'Retrieve Data from Moni-tor' button.
Close button		Closes the Radon Monitor software program.

Figure 18. Inspection Tab Details (Continued)

Main Screen - Chart Tab

The Chart tab shows a chart (graph) of the test results (Figure 19). The graph is included in the printed report.

Group	Item	Description
Chart	Chart Title	The chart title includes the model number and serial number of the radon monitor.
	Left vertical scale	The left vertical scale of the chart shows the Radon concentration in the units selected, pCi/l or Bq/m³.
	Right vertical scale	(Model 1029 only; for Model 1028 the right vertical scale is blank). The right vertical scale is for temperature, pressure, and % humidity. The units for temperature and pressure are the units selected.
	Horizontal scale	The horizontal scale shows the date in one-day increments.
	Radon (units) graph	If checked in the Legend Panel, the Radon graph line connects the values of the periodic measurements during the test. The overall average (or EPA average) is displayed above the Legend panel.

Figure 19. Chart (Graph) Details

Group	Item	Description
Chart (Continued)	Motion Errors	If checked in the Legend Panel, and if motion was detected during the test, a vertical line with a red circle indicates each motion event. Also, the text 'Motion Detected' is displayed above the Legend Panel.
	Action Level	If checked in the Legend Panel, the Action Level horizontal, red line is displayed. The line will be drawn on the graph at the selected radon concentration above which mitigation action is necessary. Normally the level is 4 pCi/l or 148 Bq/m³.
		When the radon level line does not exceed the action level, the action level line is always visible on the chart for easy comparison.
	Temp (units)	(Model 1029 only) If checked in the Legend Panel, temperature recorded during the test is shown as a red dotted line. The average temperature is displayed above the Legend Panel.
	Pressure (units)	(Model 1029 only) If checked in the Legend Panel, the pressure recorded during the test is shown as a dotted green line. The average pressure is displayed above the Legend Panel.
	Rel % Humidity	(Model 1029 only) If checked in the Legend Panel, the percent relative humidity recorded during the test is shown as a blue dotted line. The average relative humidity is displayed above the Legend Panel.
Legend Panel	Radon (units)	Select this checkbox to display the Radon graph line.
	Motion Errors	Select this checkbox to display vertical Motion Error line(s).
	Action Level	Select this checkbox to display the horizontal, red Action Level graph line.
	Temp (units)	(Model 1029 only) Select this checkbox to display the Temperature graph line.
	Pressure (units)	(Model 1029 only) Select this checkbox to display the Pressure graph line.
	Rel % Humidity	(Model 1029 only) Select this checkbox to display the Relative Humidity graph line.

Figure 19. Chart (Graph) Details (Continued)

Zooming In and Out

- To zoom in on the chart, drag a bounding box down and to the right around the area to be examined more closely. When the mouse button is released the view will zoom in to the selected area.

- To zoom out, drag the cursor up and to the left. The original view is restored.

Moving the Chart

- To move the chart on the page, position the cursor over the chart, press and hold the *right* mouse button, and then move the mouse.

- To restore the original view, position the cursor over the chart, click the *left* mouse button, and then drag the cursor up and to the left.

33

Main Screen - Pictures Tab

The Pictures tab is used to select up to six pictures that can be printed in the report. The pictures may consist of setup photos, before and after, etc.

The **Print Picture** checkbox above each picture allows the user to select which images will be displayed in the report. The selected images are displayed on the last page of the report, except for the top, left image (labeled 'Cover Page Picture'), which can be displayed on the cover page as well as the last page of the report. Note that the report will only contain a cover page if the 'Create Cover Page' checkbox is selected in the Preferences 'Print Tab' screen.

A title or comment may be entered in the Comments box below each picture (up to 50 characters). If the 'Print Picture' checkbox is selected, both the picture and comment are printed in the report. If the Comments box is blank, no comment will be included with this picture in the report.

The **Select Picture** button below each picture is used to browse to the directory where pictures are stored and select a picture.
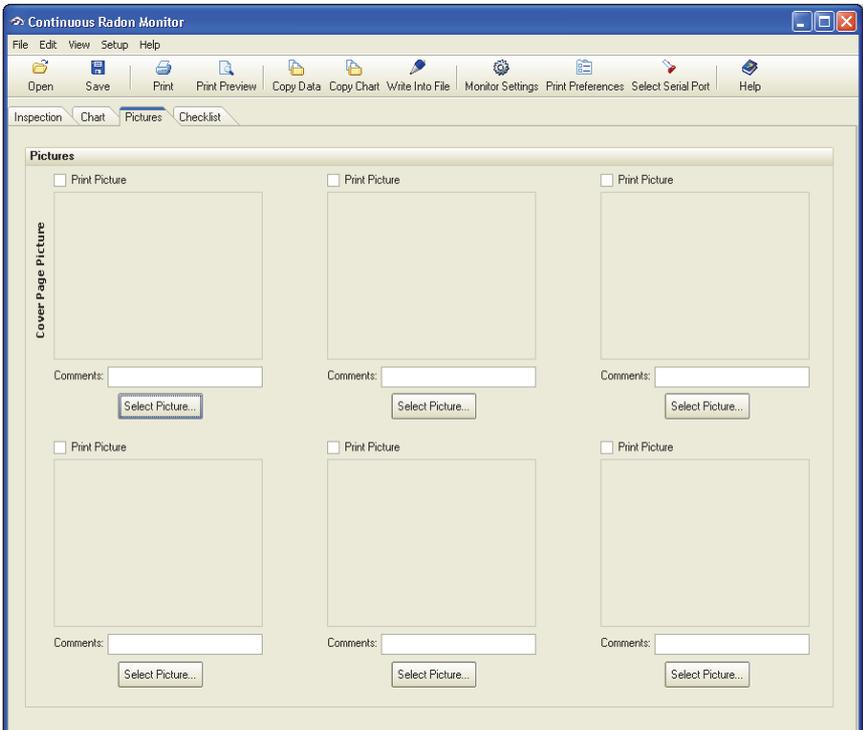

Figure 20. Main Screen - Pictures Tab

Main Screen - Checklist Tab

The Checklist tab provides a checklist that the inspector can use to verify that best practice actions were completed prior to starting the test (such as locating the radon monitor where it will not be disturbed, not locating it near drafts, etc.).
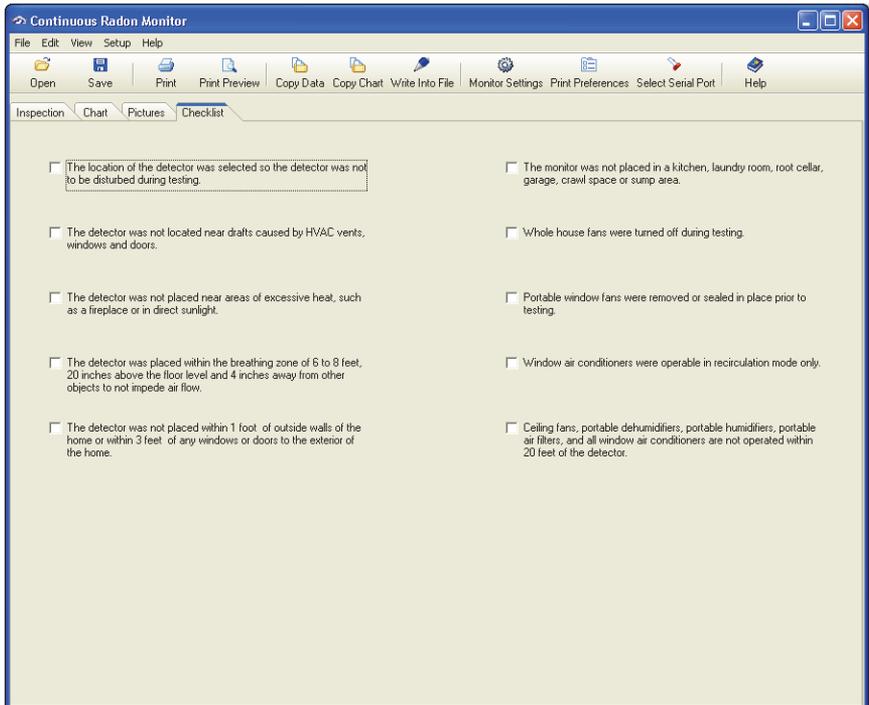

Figure 21. Main Screen, Checklist Tab

Menu Bar and Toolbar Functions

The menu bar contains commands for operating the program. The toolbar (if displayed) is just beneath it. All of the toolbar commands can also be selected from the menu.

Group	Item	Description
File	Retrieve Data	Retrieves data from the connected radon monitor.
	Save Measured Data	Allows measured data to be saved in text (.txt) format. This menu command has the same function as the **Save** toolbar button.
	Open Measured Data	Opens a previously saved text file with measured data. This menu command has the same function as the **Open** toolbar button.
	Print > Test Results	Prints the selected test results to the default system printer. This menu command has the same function as the **Print** toolbar button.
	Print Preview	Opens a preview window to view the report to be printed. From the preview window, the user can scroll through a multi-page report, print it, or print the report to a PDF file.This menu command has the same function as the **Print Preview** toolbar button.
	Print Setup	Opens the Windows printer setup dialog box to change printers or printer characteristics.
	Exit	Exits the radon monitor program.
Edit	Copy Raw Data	Copies raw test data to the Windows clipboard. Then the data can be pasted into another application, such as a word processor or spreadsheet.This menu command has the same function as the **Copy Data** toolbar button.
	Copy Chart	Copies the chart for the test to the Windows clipboard. Then the chart can be pasted into another application, such as a word processor or spreadsheet. This menu command has the same function as the **Copy Chart** toolbar button.
	Write Raw Data	Writes raw test data to a text (.txt) file that can be opened with a text editor, spreadsheet, or word processor. Raw data does not contain file header information, such as customer name, etc. This menu command has the same function as the **Write Into File** toolbar button.

Figure 22. Menu Bar Commands

36

Group	Item	Description
View	Toolbar	When checked, displays the toolbar below the menu.
	Toolbar Label	When checked, displays labels beneath the tools on the toolbar.
	Status Bar	When checked, displays the status bar at the bottom of the main screen.
	View Notices	Displays a screen that can be used to show all notices from the monitor, clear notices, or save notices to a log.
Setup	Monitor Settings	Displays the 'Preferences' screen with the Monitor Settings tab selected. This tab is used to update information about the Inspection Company or the radon monitor. Note that monitor data must be cleared before updating monitor information. For details, see *Preferences Screen - Monitor Settings Tab Details* on page 39. This menu command has the same function as the **Monitor Settings** toolbar button.
	Print Preferences	Displays the 'Print Preferences' screen with the Print tab selected so the user can update print preferences. For details, see *Report Printing Preferences* on page 40. This menu command has the same function as the **Print Preferences** toolbar button.
	Select Serial Port	Opens a 'Select Port' dialog box to select the COM port number for connection to the radon monitor. This menu command has the same function as the **Select Serial Port** toolbar button.
Help	Contents	Opens the on-line help viewer.
	About	Displays information about the program including version number.

Figure 22. Menu Bar Commands (Continued)

Data to/from Text File

Save Data to File

1 Retrieve data from the monitor.

2 Click the **Save** toolbar button or select *File > Save Measured Data* from the menu.

3 When the 'Save As' window is displayed, browse to the directory where the file will be saved, enter a file name, and then click **Save**.

Open Data from File

1 Launch the monitor software and then click the **Open** toolbar button or select *File > Open Measured Data* from the menu.

2 When the 'Load Measured Data' window is displayed, navigate to the directory where the text files are stored, select the desired file, and then click **Open**. The data is populated on the screen.

Monitor Settings Preferences

The software can be used to send basic parameters to the radon monitor. Although this can also be done using the keypad on the radon monitor, it may be quicker and easier to perform from the software, especially when several radon monitors are being updated.

> *Note: Some test parameters, such as Delay, Test Duration, and Measurement Interval, can only be changed on the radon monitor.*

1   Connect the radon monitor to the computer and launch the software.

2   Turn on the radon monitor display by pressing the ON button (5).

3   When the display shows "Start Test = 5," click the **Monitor Settings** button in the toolbar or select *Setup > Monitor Settings* from the menu. The 'Preferences' screen opens with the **Monitor Settings** tab options displayed.

> *Note: A pop-up window warns if there is data in memory. The Monitor Settings options cannot be edited if there is data in memory.*

Figure 23. Monitor Settings

4   In the Monitor Settings tab, click the **Retrieve Data From Radon Monitor** button to retrieve the data stored in the radon monitor.

38

5 Edit the Inspection Company and Radon Monitor information, as needed. For details about the screen options, see *Preferences Screen - Monitor Settings Tab Details* on page 39.

6 Set the date, time, pin number and Radon units. If the **Set Monitor Time** checkbox is selected, the software automatically updates the time and date to the computer's system clock.

7 Click the **Send Data to Monitor** button. The changed parameters are stored in the radon monitor's internal memory.

Preferences Screen - Monitor Settings Tab Details

The Monitor Settings tab is used to enter details that will be transferred to the radon monitor's memory.

Group	Item	Description
Retrieve Data from Monitor button	N/A	When Start Test = 5 is displayed on the monitor, click this button to retrieve the parameters and test results stored in the radon monitor.
		Note that radon monitor data cannot be updated if there is test data in memory.

Figure 24. Monitor Settings Tab Details

Group	Item	Description
Inspection Company	Name	Enter inspector name for the report.
	Company Name	Enter the name of the inspection company.
	Address 1	Enter the inspection company's address line 1.
	Address 2	Enter the inspection company's address line 2.
	City	Enter the city.
	State/Province	Enter the state or province.
	Postal	Enter the zip.
	Phone Number	Enter the inspection company's telephone number.
	License Number	Enter the inspection company's radon inspection license number. The field allows up to 100 characters. The separator character (between license numbers), can be a comma, dash, period, or any other character.
Radon Monitor	Date/Time	Date and time of the radon monitor's clock when retrieve button is pressed. Time is not continuously updated.
	Set Monitor Time	Click checkbox to set monitor time to be the same as the computer's system time.
	PIN	Enter a PIN number if desired. Pin numbers are 4 digits ranging from 1112 to 4444. PIN 1111 is the same as "no PIN." PIN entry must be followed by entering "5."
	Radon Units	Select radon units from the drop-down list. Units are: • picocuries per liter (pCi/l) (English units), or • becquerels per cubic meter (Bq/m^3) (metric units).
	Pressure units	(Model 1029 only) Units of pressure selected automatically depending on whether metric or English radon units are selected. • metric = kilo Pascals (kPa) • English = inches of mercury (inHg)
	Temperature units	(Model 1029 only) Units of temperature selected automatically depending on whether metric or English radon units are selected. • metric = degrees Celsius (centigrade) • English = degrees Fahrenheit
	Serial number	Factory set unit serial number.
	Firmware version	Version number of the firmware.
Send Data to Monitor button		Sends updated parameters to the Radon Monitor.

Figure 24. Monitor Settings Tab Details (Continued)

Report Printing Preferences

1 Connect the radon monitor to the computer and launch the software.

2 Turn on the radon monitor by pressing the ON button (5).

3 When the display shows "Start Test = 5," click the **Print Preferences** button in the toolbar or select **Setup > Print Preferences** from the menu. The 'Preferences' screen opens with the Print tab displayed.

4 Select or enter the desired information. For details about the Print Tab options, see *Preferences Screen – Print Tab Details*

40

5 If the report will be printed on company letterhead, select the amount of space that should be left at the top of the paper so the report does not overprint the letterhead.

6 Select whether the report displays EPA Average, Overall Average, or both.

7 If a signature image file is available, select it. The signature image is displayed on the last page of the printed report, above the 'Signature' line.

   a. Click the file folder button ; the file selection window appears.

   b. Browse to the directory where the pictures are stored.

   c. Click on a picture (.gif, .bmp, or .jpg.) to highlight it.

      • The image is displayed on the right side of the screen and the image size is displayed in the upper right of the screen.

      • The preferred image size for the signature file is 200 x 60 or smaller (width=200 pixels, height=60 pixels). The preferred image size for the header image is 250 x 60 or smaller (width=250 pixels, height=60 pixels). Any size can be used and the image will be scaled; however some distortion may occur if the image does not have the same aspect ratio.

   d. Click the **Open** button.

8 If a header image file is available, select it (see the signature image substeps above). The header image will be displayed on the first page of the report (not the cover page or other report pages).

9 The Chart Action Level setting draws a line on the graph to show where the radon level exceeds the local standard and requires the owner to take remediation action.

   • If the units are picocuries/liter (pCi/l), set the action level required in your region. For example, USA action level for pCi/l is 4.

   • If the units are Bq/m^3, set the action level required in your region. For example, USA action level for Bq/m^3 is 148.

   • Units can be converted by multiplying pCi/l x 37 = Bq/m^3; for example, 4pCi/l x 37 = 148 Bq/m^3.

Preferences Screen – Print Tab Details

The 'Print Preferences' screen **Print** tab is used to select options for the printed report. If a checkbox is selected, the information is included in the report.
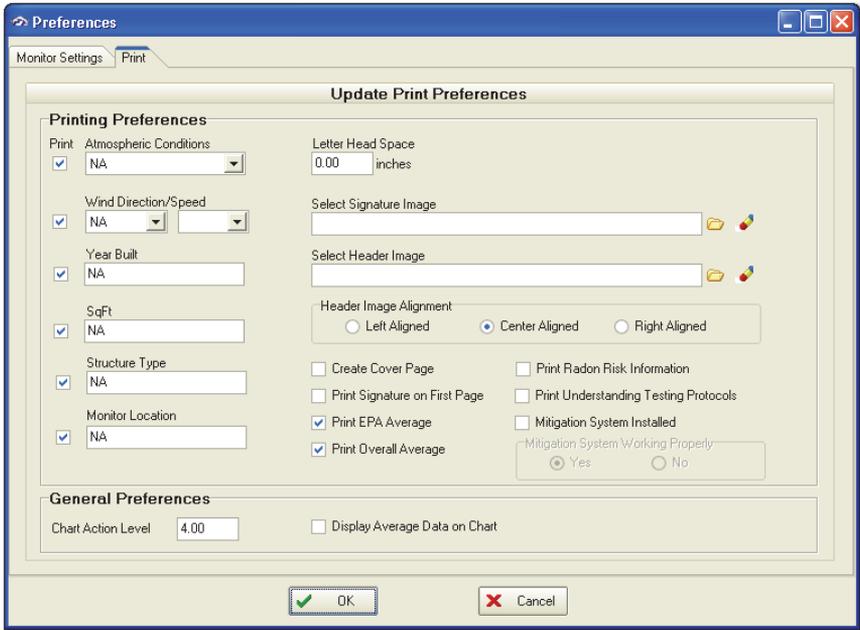
Group	Item	Default Value	Description
Printing Preferences	Atmospheric Conditions	Selected (checked)	Select atmospheric conditions at test site from drop-down list.
	Wind Direction/Speed	Selected (checked)	Select wind direction and speed at test site from drop-down list.
	Year Built	Selected (checked)	Year construction was completed.
	Sq. Ft.	Selected (checked)	Approximate area of the room that was monitored.
	Structure Type	Selected (checked)	Type of construction or other descriptive information.
	Monitor Location	Selected (checked)	Location of the radon monitor in the house, building, or mine.
	Letter Head Space	0.00 inches	Extra space in inches to be added at the top of a report to provide room for inspector's preprinted letterhead.

Figure 25. Print Tab Details

42

Group	Item	Default Value	Description
Printing Preferences (Continued)	Select Signature Image	Blank	If selected, the signature image will appear on the last page of the report above the 'Inspector Signature' line. The header image will appear at the top of the first page of the report (not the cover page or other report pages). Use the Print Preview function to see the image and verify alignment.
	Select Header Image	Blank	
	File Folder button 📁	N/A	Opens a file selection window so the user can browse to and select the file. The right panel of the file selection window displays the selected image and the image size.
	Clear Image button 🖌	N/A	Clears the image selection.
	Header Image Alignment	Center Aligned	Select if the header image will be left-aligned, center-aligned, or right-aligned.
	Create Cover Page	Not Selected (unchecked)	Selecting this checkbox adds a cover page to the printed report and prints the image selected in the 'Cover Page Picture' box in the Pictures tab. See *Main Screen - Pictures Tab* on page 34. The cover page will also display the site address, inspection date, inspection company information, and inspector license number.
	Print Signature on First Page	Not Selected (unchecked)	Certain US states, such as Ohio, require the inspector's signature to appear on the first page of the report. If this is requirement in the local inspection area, select this checkbox. An Inspector Signature is added to the first page of the report (not the cover page).
	Print EPA Average	Selected (checked)	Print the EPA Average radon concentration on the printed report.
	Print Overall Average	Selected (checked)	Print the Overall Average radon concentration average on the printed report.
	Print Radon Risk Information	Not Selected (unchecked)	If selected, the Radon Risk Information (from the Inspection tab) is printed in the report.
	Print Understanding Testing Protocols	Not Selected (unchecked)	If selected, the Understanding Testing Protocols information (from the Inspection tab) is printed in the report.
	Mitigation System Installed	Not Selected (unchecked)	Select this checkbox if a Radon mitigation system was installed at the site. If checked, the report will show that a Radon mitigation system was installed.
	Mitigation System Working Properly	N/A	If the Mitigation System Installed checkbox is selected, choose the appropriate radio button to note whether the mitigation system was "Installed and working properly" or "Installed but not working properly."

Figure 25. Print Tab Details (Continued)

Group	Item	Default Value	Description
General Preferences	Chart Action Level	4.00 pCi/l	Enter the action level required by the country or state for the maximum allowable level of Radon concentration before mitigation action is required. See Step 9 in *Report Printing Preferences* on page 40. The Action Level appears as a red, horizontal line on the graph.
	Display Average Data on Chart	Not Selected (unchecked)	If this checkbox is selected, the Overall Average (or EPA Average) is displayed in the Chart tab above the Legend panel.

Figure 25. Print Tab Details (Continued)

Printing Reports

1 To print a standard, formatted report, open the Radon Monitor software, retrieve data from the monitor, and then click **File > Print > Test Results**. A formatted report is printed on the default printer (Figure 26). The first page of the report will display the same graph as the Chart tab.
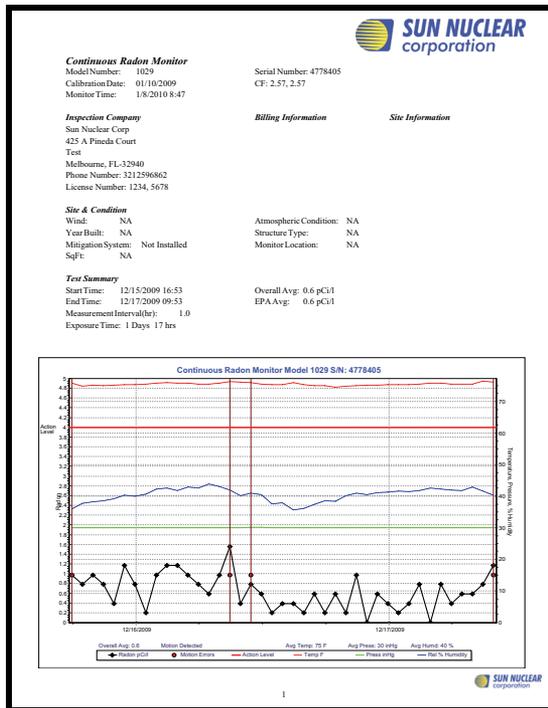

Figure 26. Printed Report (First Page)

2 To see a preview of the report before printing, click the **Print Preview** toolbar button or select **File > Print Preview** from the menu. From the 'Print

Preview' window, the user can print the report, save it to a PDF file, or view it page-by-page by clicking the buttons at the top of the screen (Figure 27).
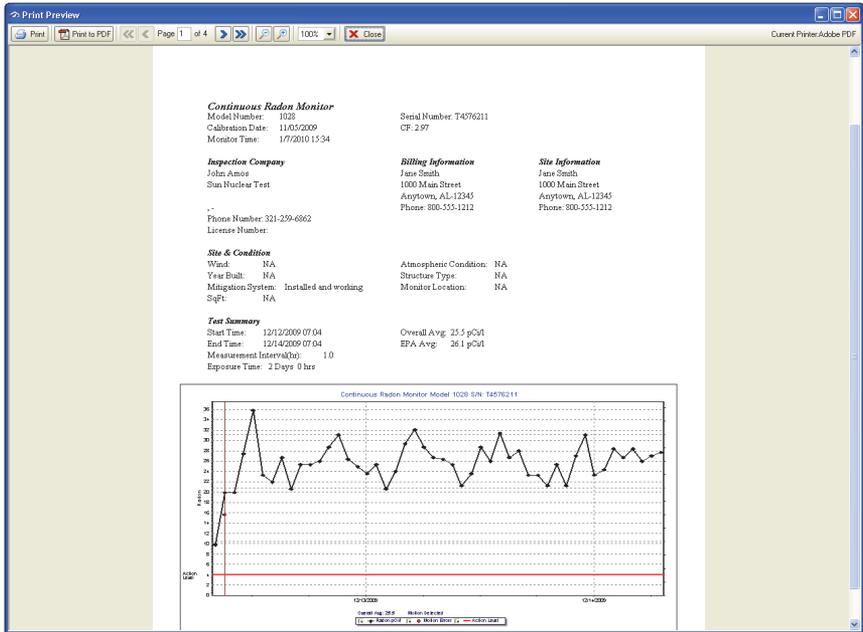

Figure 27. Print Preview Screen

3   To save the report as an Adobe PDF file, open the 'Print Preview' window then click the **Print to PDF** button at the top of the screen. In the file window, select a file name and directory where the file will be stored. Click **Save**.

4   To change the printer or printer setup, click **File > Print Setup**. The standard Windows printer dialog box opens.

5   To extract data to insert it in a report, use one of the following options:

- Click the **Copy Data** toolbar button or select *Edit > Copy Raw Data* from the menu. The current data is copied to the Windows clipboard and can be pasted into another application, such as MS Word or MS Excel.

- Click the **Copy Chart** toolbar button or select *Edit > Copy Chart* from the menu. The current chart is copied to the Windows clipboard and can be pasted into another application, such as MS Word or MS Excel.

- Click the **Write Into File** toolbar button or select *Edit > Write Raw Data* from the menu. The raw data is saved to a text (.txt) file. Raw data does not contain header data, such as customer information. The saved text file can be opened in any program that supports .txt files.

Specifications

Recommended System Requirements

Characteristic	Details
Operating System	Windows 8.1, Windows 7, or Windows XP (32-bit or 64-bit)
	Note: Windows XP is not recommended since Microsoft no longer supports it.
Computer	Minimum • Processor: x486 • Total RAM: 128 MB • Disk space: 10 MB • USB port: one • Display resolution: 1024 x 768 • Color depth: 32-bit

Models 1028 and 1029 Specifications

Description	Value
Measurement Range	0.1 to 9999 picocuries/liter (pCi/l) or 1 becquerels per cubic meter (Bq/m^3) to 99.99 kilo becquerels per cubic meter (kBq/m^3)
Accuracy	$\pm 25\%$ or 1 pCi/l, whichever is greater after 24 hours

Detector	Diffused-junction photodiode
	• Model 1028—quantity 1
	• Model 1029—quantity 2
	  Active volume—9.4 cm^3
	  Dome volume—63 cm^3

Measurement Interval	0.5 (1029 only), 1, 2, 4, 8, 12, 16, 20 or 24-hour intervals, selectable by user
Test Duration	1, 12, 24, 36, 48, 60, 72, 84, 96, 100, 999 hours, selectable by user (maximum of 720 measurements) If 999 is selected, measures until memory is full or to 720 data points, whichever occurs first
Sensitivity	• 1028—3 counts per hour per picocurie per liter (cph/pCi/l) • 1029—6 counts per hour per picocurie per liter (cph/pCi/l)
Display	16-digit reflective LCD display
Status Light	Green LED (light emitting diode) indicates radon detections
Keypad	6-digit membrane switches with multiple functions
Disturbance Sensor	Inertial switch
Environmental sensors (1029 only)	• Temperature—0 to 120 $\pm$ 2 degrees F • Pressure—10 to 15 $\pm$ 0.5 psi • Humidity—20 to 90% relative humidity $\pm$ 5%
Operating Environment	• 45 to 95° F (7 to 35° C) • 20 to 80% relative humidity, non-condensing

Table 2. Models 1028 and 1029 Technical Specifications

Description	Value
Storage Environment	• –22 to 122° F (–30 to 50° C) • 10 to 90% relative humidity, non-condensing
Printer Data Port	RS-232, 9-pin, D-connector allows printer data to be sent to optional thermal printer
Serial Data Port	RS-232, 9-pin, D-connector for two-way communication with PC
USB Data Port	USB-A connector allows two-way communication with PC
Power Supply	• Domestic: Transformer converts 120 VAC to 12 VDC, 200 mA, 60 Hz • International: Transformer converts 100-240 VAC to 18 VDC, 1 A, 50-60 Hz
Battery Power/Backup	One fresh 9V alkaline battery usually supplies approximately 100 hours of operation while a fresh lithium-ion battery usually supplies approximately 300 hours of operation. "*Battery OK*" message indicates battery OK for 60 hours of operation.
Tripod threaded fitting	Standard 1/4-20 UNC threaded fitting on bottom of case
Handle	Integrated handle for carrying or for use with cable lock
Weight	2 lbs (0.91 kg)
Dimensions	9.3W x 4.8D x 2.9H inches (236 x 122 x 74 mm)

Table 2. Models 1028 and 1029 Technical Specifications (Continued)

Support and Maintenance

Maintaining Hardware

Repairs

WARNING: The unit contains high-voltage circuits. Do not open the case. There are no user-serviceable parts inside the device.

If there are problems with the device, contact Sun Nuclear Support. See *Contacting Sun Nuclear Support* on page 54.

Inspection

Inspect the device and all cables for physical damage before and after each use. Do not use any cable that is damaged or has broken insulation. Replace the cable immediately. If any device damage, mechanical or electrical degradation, or measurement errors are suspected, contact Sun Nuclear Corporation for repair or replacement.

Storage

CAUTION: Always leave a fresh 9V battery in the unit to keep the 3V internal battery from discharging.

Store the radon monitor in an indoor, protected environment. Do not store the radon monitor in the trunk of a car for extended periods. Keep the unit dry. For long term storage, store in a cool, dry place and leave a 9V battery in the unit to protect the internal battery. Periodically inspect the 9V battery and replace if leakage or corrosion are found.

See also *Storage Under Power* on page 16.

Cleaning

Clean the unit with a soft dry cloth. Do not use liquid cleaners, solvents, or abrasives.

Disposing and Recycling

Do not discard unit as waste. Recycle the components in accordance with local regulations.

Do not throw in trash; dispose of in an environmentally friendly way.

Service and Calibration

For service or calibration, the unit must be returned to Sun Nuclear Corporation. The recommended calibration frequency for the Model 1028 or 1029 radon monitor is one year. See your State or Proficiency listings for requirements.

Battery Life

Any 9V battery will operate the radon monitor. Alkaline batteries generally provide a good balance between long life and cost; lithium-ion batteries tend to be more expensive but last longer. Since battery capacity varies widely between types of batteries and even between individual batteries of the same type, the predicted battery life of 100 hours using a fresh alkaline battery (or 300 hours using a fresh lithium-ion battery) is only an estimate. An individual unit may have longer or shorter life.

Maintaining Software

The radon monitor has Windows software that is installed on a computer. Software upgrades or patches may become available after purchase; these changes to the software add features, improve operation, fix problems, or adapt to operating system changes.

These upgrades, when available, can be downloaded from the Sun Nuclear Support website for Radon products (see *Support Website* on page 54). Navigate to "Support," then select "Radon Downloads."

Verifying Software Version

The version of software may be verified as follows:

1   Launch the Radon Monitor application.

2   Connect to the radon monitor.

3   Select *Help > About* from the menu. The About Radon Monitor message displays the version number of the application.

Removing Software

To remove the radon monitor software from the computer, open the **Control Panel** and then select **Add or Remove Programs**. In the list of programs, select **Radon Monitor** and then click **Remove**. This will remove all of the radon monitor program files.

Multiple Software Installations

Two or More Radon Monitor Units

The Radon Monitor software only needs to be installed on a computer one time, regardless of the number of radon monitor units being used with that computer.

When connecting to a radon monitor, the software identifies the serial number of the connected radon monitor and creates a unique serial number directory for

each radon monitor device. During measurement, the setup template includes the serial number, which is validated against the radon monitor device communicating data to the PC.

Two or More Computers

If you have more than one computer, the radon monitor software may be installed on each one.

Optional Serial Connection

Serial Port Setup

Serial or USB port setup is automatic, unless there is a hardware conflict. When the radon monitor software is launched and the monitor is plugged in, the software automatically detects the unit on an available COM port. If the software does not detect the radon monitor automatically, it may be necessary to select a specific port.

Connecting with a Serial Cable

If the computer does not have a USB port, the radon monitor can be connected using a serial cable as follows:

1 Connect an optional serial cable between the computers 9-pin COM port and the 9-pin PC PORT connector on the radon monitor (Figure 28 on page 50). For serial cable part number, see *Options and Accessories* on page 2. Serial cable can also be used with optional printer.

2 If desired, plug the power supply into an AC outlet with 110 to 240 VAC, single phase, 50-60 Hz.

Figure 28. Optional Serial Connection to a Computer

Port Selection

Normally the software tries to connect to the radon monitor on COM 1. But if COM 1 is in use, select another COM port as follows:

1   Click the **Select Serial Port** toolbar button or select *Setup > Serial Port* from the menu. The 'Setup Port' dialog box opens.
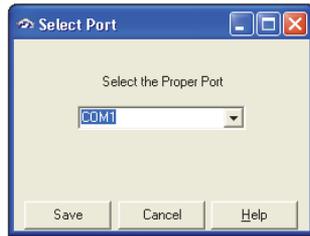

Figure 29. Setup Port Dialog Box

2   Click the Ports drop-down list then select the desired port (usually the last port in the list).

3   Click **Save**. When the program is opened again, the selected COM port will be used.

Radon Monitor Troubleshooting

Indication	Probable Cause	Recommended Action
Unit will not turn on	Power not connected and 9V battery missing or discharged.	Connect power and/or replace 9V battery.
Unit will not turn on with power or good battery connected	Internal 3V battery discharged.	Contact Sun Nuclear Support. Unit will need to be returned for internal battery replacement. The user should not attempt to replace this battery.
Time/Date entries lost when changing battery	Reset occurred.	Re-enter settings.
System error message in format "ERR=XX XX XX XX" displayed	Monitor has experienced an abnormal condition.	See *ERR Message* on page 52.
Error message "RS232 communications have been lost" when trying to connect to PC	Radon monitor is turned off or has turned off automatically.	Turn on radon monitor by pressing "5" and entering PIN and pressing "5" again.
	Wrong COM port selected for serial or USB connection.	Click *Setup > Select Serial Port*. Select a different COM port from the pull-down list.
Error message "Notice: Press 5" displayed	Monitor has experienced an abnormal condition.	See *Notice Message* on page 52.

51

Indication	Probable Cause	Recommended Action
Display showed "Motion Detected" but motion not recorded on report	Test interrupted before being completed. Motion occurred as test was terminated.	Print results and count number of measurements. If less than expected, test terminated prematurely. Rerun test.
Monitor displays an AVERAGE value, but no CURRENT value	The monitor lost power recently, which cleared the CURRENT value. However the AVERAGE is maintained.	Run test with a fresh 9V battery.
Hourly readings on the radon monitor always seem to show the same numbers (such as 0.0, 0.3, 0.7, etc.), especially at lower radon levels; values between lower numbers are not measured	At very low radon levels, only 1, 2, or even 0 (zero) radon-emitted alpha particles may be detected in an hour interval. The one-detector SNC radon monitor, such as a model 1027 or 1028, has a sensitivity roughly in the range of 3.0 counts per hour per pCi/L (check the unit's calibration factor for the actual number). If only one count is detected in an hour, the monitor has measured 1 cph / 3.0 cph per pCi/L is equal to 0.3333 pCi/L, which rounds to 0.3. Two counts would be 0.6666 pCi/L, which rounds to 0.7.	Device working normally, no need for action. By performing radon measurements over a longer period of time, such as 48 hours, the average of discrete hourly measurements is capable of measuring any value, even at low radon levels. For example, a radon level of 0.5 pCi/L measured over 48 hours might have individual hourly measurements of 0.0, 0.3, 0.7, or 1.2, but the average of all 48 hourly measurements would still read 0.5 pCi/L.

System Errors

ERR Message

If an error message appears on the display in the format "*ERR=XX XX XX XX*," the radon monitor experienced an unusual system error. Normally this indicates a hardware or firmware failure. Make a note of the 8-digit error code and contact a Sun Nuclear Support representative for assistance.

Note: Firmware version 0102 can cause a data error of 00 00 00 40 when attempting to print a report with a graph when no data is in the radon monitor. If this occurs, please call Sun Nuclear Support. See Contacting Sun Nuclear Support on page 54.

Notice Message

If the message "NOTICE: Press 5" appears in the display upon waking up, there has been an error.

1 To read the error, press **5**. The display:

- Briefly displays "ERROR Stopping Test"
- Then displays "Read using PC"
- Then displays "Start Test = 5"

However, the error condition has not been cleared.

2   Connect device to computer and launch Radon Monitor application.

3   On the menu, click **Com Port** and verify the correct Com port is selected.

4   Select **View > View Notices**, then **Read Notices from Monitor**. Make note of the error explanation that displays on screen. This information may be useful to Sun Nuclear Support.

5   Select **Save to Log** and save the error code text to a log file.

6   Select **Clear Notices from Monitor** to remove the error code from the device.

7   Download measurement data and continue with test.

8   If error condition continues, an error message appears again after the test and must be cleared again. If this occurs, device likely requires service. See *Contacting Sun Nuclear Support* on page 54.

Contacting Sun Nuclear Support

Visit the Sun Nuclear Radon website, https://support.sunnuclear.com/radon/ for links to product information, including instructional videos and Radon FAQs, Calibration and Repair services, online RMA form, Support, Downloads and useful links.

To view product information or to download product assets, click the links under **Radon Downloads**.

If you need additional assistance, you may request support in two ways:

- Customers **without** a current support/maintenance agreement can submit a support request using our online form, or visit our FAQ's page on the same website, https://support.sunnuclear.com/radon.
- Customers **with** a current support/maintenance agreement also have the option to contact the Sun Nuclear Support team by telephone: +1 321-259-6862.

Support Website

Visit the Sun Nuclear Support website to request support via an online form.

1 Open an internet browser and navigate to https://support.sunnuclear.com/radon.

2 In the left panel, click **Contact Support**.

3 To open a new support case, click the **New Case form** link, enter your email address and the serial number of any Sun Nuclear instrument used at your facility, then click **Log in** to open the Support Dashboard.

Warranty

The Sun Nuclear Product Warranty can be found on the Sun Nuclear Radon Support website, https://support.sunnuclear.com/radon/.

Appendix A: Regulatory Supplement

In addition to the regulatory information contained in the body of this manual, the following supplemental regulatory information is provided.

Sun Nuclear Corporation Symbols

The following symbols are used in this guide and in Sun Nuclear Corporation's product labels.

WARNING: This symbol indicates a risk of electric shock.

WARNING: This symbol indicates a hazard that could result in major injury or equipment damage.

CAUTION: This symbol indicates a potential hazard that could result in a minor injury or equipment damage.

Important or supporting information.

Manufacturer's Identification (name and address).

Date of Manufacture.

Serial Number.

Catalog Number.

Consult instructions for use. This equipment must be used in accordance with the instructions in this manual. Read all instructions and safety labels before use.

Do not throw in trash; dispose of in an environmentally friendly way.

Operator Responsibility

This guide is intended for an operator who is experienced with the use of radon detection devices. The operator of the device bears the full responsibility for validating measurement results. The device and its accessories must not be used for any other purpose than described in this guide. Violation will result in loss of warranty.

Reporting Health or Safety Related Issues or Concerns

Should the need arise to report any safety or health related issues or concerns regarding the use of Sun Nuclear products, contact Sun Nuclear Support. See *Contacting Sun Nuclear Support* on page 54.

Modifications to Equipment

Any changes or modifications to the device that are not expressly approved by Sun Nuclear Corporation could void your warranty.

Interaction with Other Electrical Equipment

The device can only be connected to external computer equipment that is compliant with IEC 60950-1, Safety of Information Technology Equipment.