User Manual for the Model 22 Personal Noise Dosemeter & Model 22R Reader Unit

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Version 1.0 Dual Channel

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Preface

Guidelines for Safe & Efficient Use

Please read all sections of this manual before attempting to use the instrument.

Warnings

This symbol is used throughout the manual to indicate that special attention should be taken and any instructions followed carefully. Information covered in these sections relates to operations that are vital to the efficient use of the instrument.

Calibration of the dosemeter

The dosemeter should be calibrated before each measurement. It is also possible to carry out a second calibration check at the end of the measurement before the data is downloaded.

Please refer to Appendix 3 dosemeter Calibration on page 63 for details of the recommended calibration procedure for the dosemeter.

dosemeter Configuration

The MODEL 22 dosemeter can be configured to meet the requirements of many different Occupational Noise and Industrial Hygiene Regulations and Guidelines.

The Dual Channel capability allows the dosemeter to be used, for example, where there is a requirement to measure noise exposure in accordance with both OSHA and ISO standards.

Please ensure that the MODEL 22R Reader Unit is configured for the correct functions and parameters before making measurements with the dosemeter.

The Pulsar AnalyzerPlus software can also be used to configure the dosemeter and Reader unit to meet these requirements.

dosemeter Battery Performance

The NiMH rechargeable battery within the MODEL 22 dosemeter is designed to be recharged using the supplied battery chargers. Do not attempt to charge the dosemeter battery by any other means.

Before the first use

Before the dosemeters are used for the first time ensure that the units are allowed to fully charge which may take up to 3 hours.

Recharging the battery

Ensure that the instructions detailed in this manual are followed carefully when charging the dosemeter units. To ensure optimum operation, the dosemeter may be left on trickle charge when not in use.

Storage of the dosemeter

The dosemeter should be stored in a fully charged state. If the MODEL 22 dosemeter is not used for 1 hour, it will shut down and go into sleep mode.

To wake the dosemeter from the Sleep mode, shake the dosemeter until the indicator light shows. Refer to **"Shake-to-Wake" function** on **Page 22** for detailed information about this function.
The "Shake to Wake" function has been added to the MODEL 22 dosemeter to ensure that a dosemeter that is not in use powers down to the minimum possible power consumption.
The dosemeter should be kept on the charger unit when not in use to ensure optimum performance. The dosemeter should be charged at least every 14 days to maintain this optimum performance.

Battery Operating Life

The dosemeter system should be returned to Pulsar Instruments plc for calibration and servicing. During this calibration and service, the internal battery will be replaced.

Installing the dosemeter Software

The dosemeter system is supplied with the Pulsar AnalyzerPlus software program.

Pulsar AnalyzerPlus is a program that allows measurements to be downloaded from the MODEL 22R Reader unit to a PC. The Pulsar AnalyzerPlus software automatically recognises an MODEL 22R Reader unit and allows measurements to be downloaded.

Pulsar AnalyzerPlus is supplied on a CD-ROM and requires a PC running Microsoft XP SP3 or later. Install the software before connecting the dosemeter Reader Unit to the PC. AnalyzerPlus can also be downloaded from our website via: https://pulsarinstruments.com/software-download/

To install the software**:**

1. Insert the Disc in the CD-ROM drive
2. Follow the instructions on the screen

If the installation program does not automatically start, run d:\setup.exe program from the Start, Run option in the task bar where d is the letter of the CD-ROM drive.

Please note that if you are running on a network, you may need to contact your network administrator to ensure that you have sufficient access rights to install this software.

This software should be installed with full administration rights to ensure that the configuration of the software can be completed.

Pulsar Instruments plc accepts no responsibility for the installation of this software on systems where full access rights are not available.

Section 1 Introduction

Thank you for purchasing the Personal Noise Dosemeter System from Pulsar Instruments plc.

The dosemeter is a unique solution to the problems associated with the measurement of Personal Noise Exposure.

The dosemeter itself has no controls or cables which means that the unit can be used in situations where the wearer is working in confined spaces or where there is a risk of a cable being caught in machinery.

Measurements are downloaded from the dosemeter to a Reader unit via an infra-red link which removes the need for keys or controls on the instrument.

This version of the dosemeter, the MODEL 22 and the MODEL 22R Reader Unit, provide a range of configuration options which allow the system to be used to measure and record noise levels to most Occupational Noise and Industrial Hygiene Regulations.

The MODEL 22 dosemeter and MODEL 22R Reader Unit, when used with the Pulsar AnalyzerPlus software, provide Dual Channel Measurements.

Channel 1 can be configured to be any combination of the Exchange Rate (Q), Criterion Level (CL), Criterion Time (CT), Threshold (TH) and Time Weighting (TW). Channel 2 is preset to a 3dB ISO configuration as shown below:

Parameter	**Configuration Options**	
	Channel 1	**Channel 2**
Exchange Rate (Q)	3dB, 4dB or 5dB	3dB
Criterion Time	8hrs, 12hrs, 16hrs or 18hrs	8 hours
Criterion Level	80dB, 85dB, 87dB, 90dB or 95dB	85dB
Threshold	None, 80dB, 85dB or 90dB	None
Time Weighting	None or 'S' (Slow)	None

All of these configuration options can be selected from the MODEL 22R Reader Unit. In addition, the Pulsar AnalyzerPlus software allows user defined configurations to be loaded into the Reader Unit. The software includes preset configurations such as ISO, OSHA, ACGIH and US ACHPPM.

A system can be started with a single dosemeter and a Reader unit, and expanded by purchasing additional dosemeters and the appropriate number of charging units.

This manual describes the operation of the MODEL 22 dosemeter unit and MODEL 22R dosemeter Reader.

Also described are the optional RK1 Keyfob Remote Control and the WS22 Windshield. The Keyfob allows the dosemeter to be started and stopped without the MODEL 22R unit and should be ordered separately.

Please note that the MODEL 22R Reader unit supports all previous versions of the Personal Noise Dosemeter.

However some features and functions may not be available when using the MODEL 22R Reader with previous versions (Model 20, Model 20-TH) of the dosemeter.

Please refer to "Checking the Configuration" on page 18 and "Configuration of the Measurement Parameters" on page 37 for more information. Also refer to Section 7 **"Troubleshooting"** on page 51.

How the dosemeter works

The dosemeter is controlled by the Reader unit through an Infrared link. The link between the dosemeter and the Reader is used to send information in a similar way to a television remote control.

The RK1 Keyfob also provides a method to start and stop the dosemeter without using the Reader unit.

Each dosemeter contains a rechargeable battery which powers the unit throughout the measurement period. Each charge of the battery is designed for one measurement.

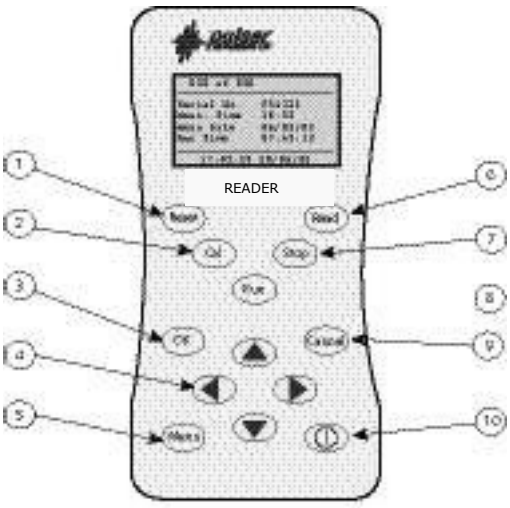
The battery contains sufficient power to carry out a single measurement for over 20 hours although the dosemeter will run for much longer provided the battery is fully charged.

Please note that although the MODEL 22R Reader unit can be used to control the previous MODEL 20 and MODEL 20-TH dosemeters, if the user attempts to program an older dosemeter with a configuration that is not supported, an error message will be displayed when the dosemeter is reset or data is read from the dosemeter.

Section 2 Layout & Controls

MODEL 22R Reader Unit

The figure below shows the layout of the MODEL 22R Reader Keypad.

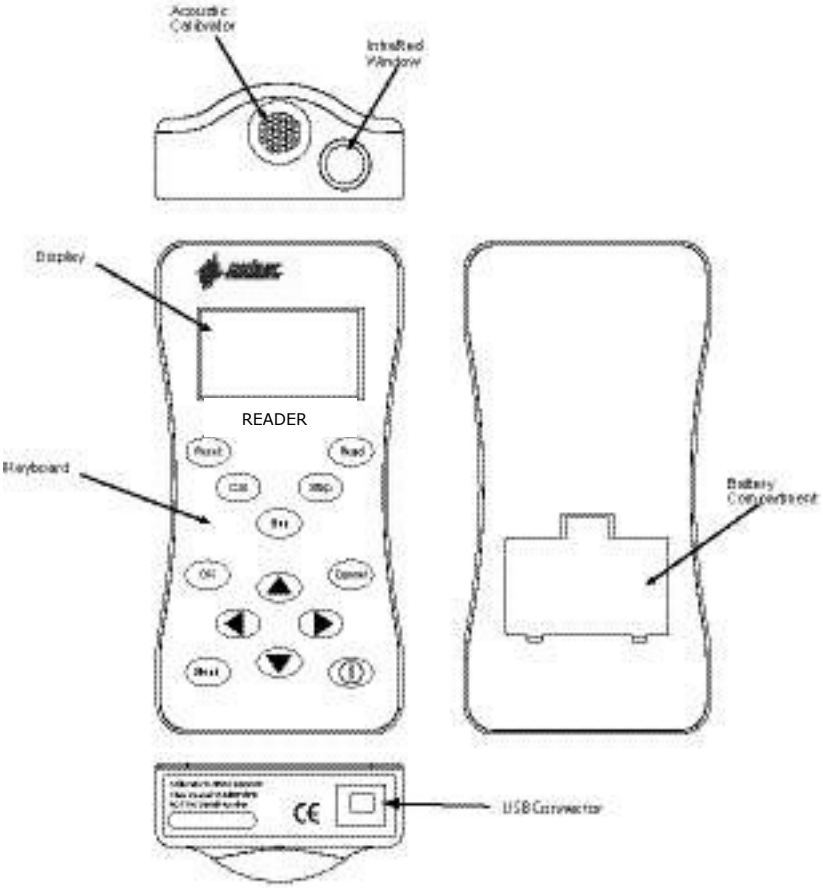


The MODEL 22R Reader unit has an integral Acoustic Calibrator that has been specifically designed to suit the unique shape and performance of the dosemeter. The Acoustic Calibrator is located on the top of the Reader unit.

Next to the Acoustic Calibrator is the Infrared Port which is used to communicate with the dosemeter.

The battery compartment is located on the rear of the Reader unit. The USB connector which is used to download data to a PC is located on the bottom of the Reader unit below the battery compartment.

1. Reset Resets the dosemeter
2. Cal Calibrates the dosemeter
3. OK Accepts changes & selects menu options
4. Arrow Keys Select/Change/Data Entry
5. Menu Displays the Reader Menu
6. Read Reads data from the dosemeter to the reader Unit
7. Stop Stops the dosemeter
8. Run Starts the dosemeter
9. Cancel Cancel Changes/Exit from Menu
10. Power Switches the Reader Unit On & Off



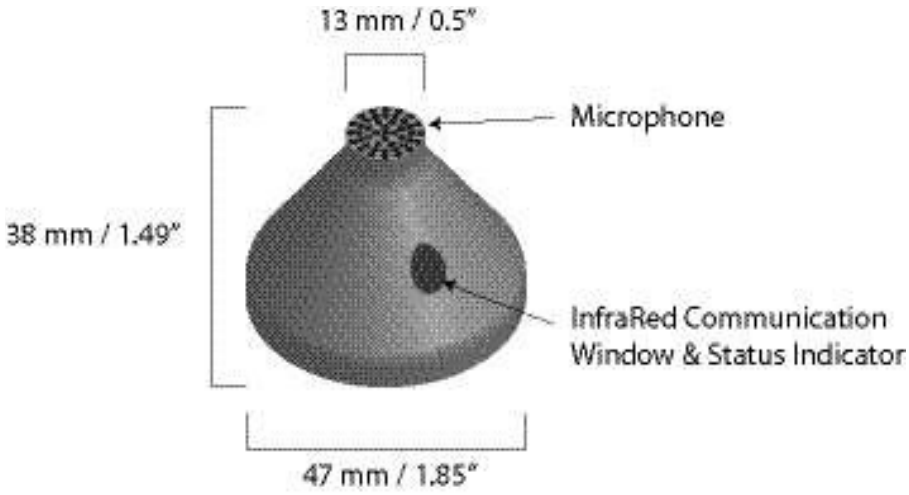
MODEL 22 dosemeter

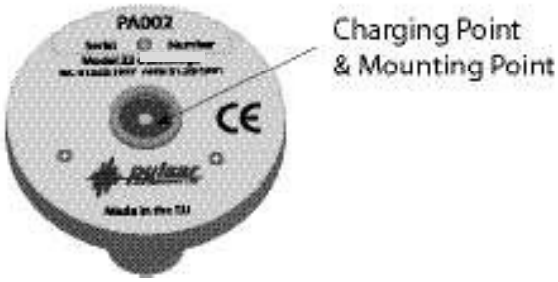
The layout of the MODEL 22 dosemeter is shown on the right.

The microphone capsule is mounted in the top of the dosemeter in a shock mount to reduce the noise generated from movement or handling of the case.

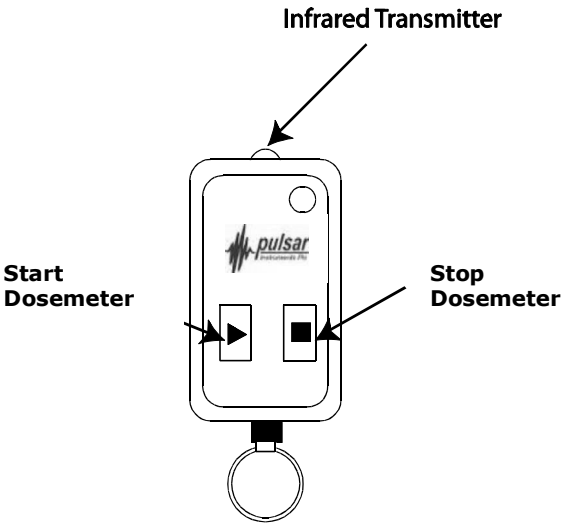
The dosemeter is controlled via an Infrared link to the Reader unit. Behind the Infrared window are the transmitter and receiver for communication with the Reader.

The charging point for the dosemeter is on the bottom in the centre and this is also used for the mounting of the dosemeter.





RK1 Keyfob Remote Control



The RK1 Keyfob Remote control is designed to start and stop the dosemeter.

The Start and Stop buttons are used to send commands to the dosemeter. When the Start or Stop buttons are pressed, the Status indicator will light to show that the button has been pressed.

The Infrared signal is sent from the transmitter on the front of the Keyfob. Ensure that this transmitter is kept clean.

If a button is pressed and the Status Indicator does not show, the battery may need to be replaced.

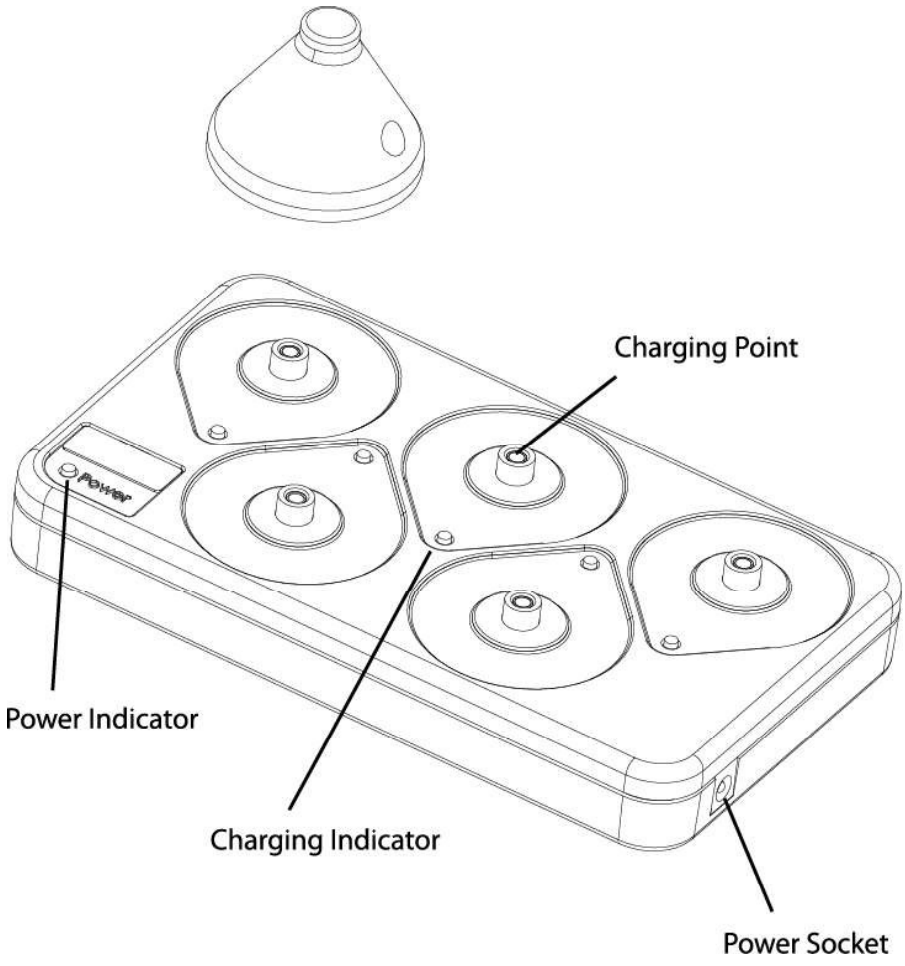
CHR22 Charger Unit

The CHR22 Charger Unit replaces all previous versions of the dosemeter chargers and is compatible with all versions of the dosemeter.

The charger has a number of new and important features which are different from the previous CHR-20 Chargers Units.

Important Features

- The maximum charge time is under 3 hours for a completely flat dosemeter. For a dosemeter that has a partially charged battery, the charge time will be much shorter
- The CHR22 Charger Unit always charges, ie there is no automatic discharge function
- The CHR22 is compatible with all previous versions of the dosemeter
- The CHR22 has a Discharge/Charge cycle button on the bottom of the unit to allow for the dosemeters to be fully discharged and recharged. This can be used where the dosemeters will not be used for more than 28 days (see page 48 for details)
- Charger Units can be "daisy chained" to allow 10 dosemeters to be charged



Section 3 Getting Started

Quick Start

There are different ways to use a dosemeter and Reader. The following simple instructions should be followed to carry out personal sound exposure measurements using a single MODEL 22 dosemeter and MODEL 22R Reader. Ensure that you have read all of the instructions and information contained in this manual before operating the equipment.

The basic operations are:

Function	**see page:**
• Ensure the dosemeter battery has been fully charged.	15
• Wake the dosemeter if it has not been used for 1 hour or longer	22
• Check configuration of dosemeter using the Reader menu	18
• Push the dosemeter into the calibration cavity on the Reader.	23
• Reset the dosemeter using the **Reset** key.	24
• Calibrate the dosemeter using the **Cal** key.	25
• Remove the dosemeter from the calibration cavity and attach it to the wearer.	26
• Start the session using the **Run** key or by using the Run key of the Keyfob unit.	28
• At the end of the shift, stop the session using the **Stop** key or use the Stop key of the Keyfob unit.	29
• Remove the dosemeter from the wearer and push into the calibration cavity on the Reader.	30
• Perform a second calibration check using the **Cal** key.	30
• Transfer the dosemeter session data to the Reader using the **Read** key.	31
• View the results	32
• Download measurements to the software	32

Unpacking the instrument for the first time

Carefully remove all of the components of the dosemeter system from the shipping container or carrying case and inspect it for possible damage or missing items. If there appears to be damage or something is missing, contact Pulsar Instruments plc or your local representative immediately.

Each MODEL 22 dosemeter is supplied with an SM1 Mounting Kit which contains the following components:

- Round Mounting Plate
- Mounting Clip System
- Certificate of Calibration

The MODEL 22R Reader Unit is supplied with the following accessories:

- USB Cable
- dosemeter Software CD
- Operating Manual
- Certificate of Calibration

Please check that any other components that you have ordered are included with your equipment.

Charging the dosemeters

Please note that this manual refers to the CHR22 Charger Unit only. The information given does not apply to any previous version of the Charger Unit. The CHR22 is identified by a Black Case with the older charger units having a White Case.

The CHR22 Charger Unit has a maximum charge time of under 3 hours. If the dosemeter is not fully discharged, the charge time will be shorter than this.

It is essential that this procedure is carefully followed otherwise damage will occur to the dosemeter battery.

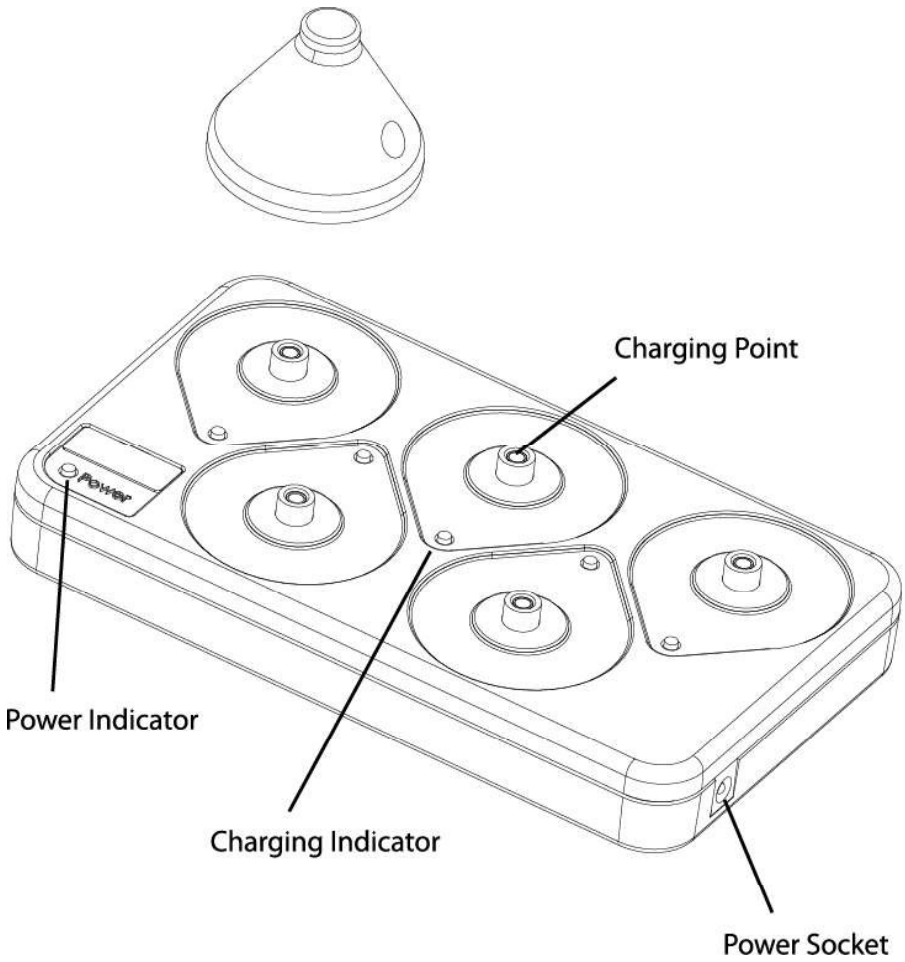
Before using the dosemeters for the first time, ensure that the units are allowed to charge fully. The dosemeters should be regularly recharged to maintain the performance of the battery pack (inside the dosemeter).

For further information regarding the charging and maintenance of the dosemeter, please refer to Page 47 "Maintenance & Care".

Connect the Charger to the mains power supply and switch on the power supply.

Ensure the dosemeter is in Stop Mode and carefully screw it onto the "charging stud" on the CHR22 Charger unit.

Do not over tighten the dosemeter onto the Charger. The dosemeter should be screwed onto the charger until the indicator changes status and then one more half turn.



During the charge cycle, the green indicator will flash to show that the charging is in progress.

Once charging has finished, the green indicator stops flashing and remains on continuously.

At this time the dosemeter is receiving a trickle charge to keep it topped up. To ensure optimum operation, the dosemeter may be left on trickle charge when not in use.

Summary of Charger Indicators

No Indicator	dosemeter Not Connected
Green LED Flashing	dosemeter Charging
Green LED On	dosemeter Charged

The CHR22 dosemeter Charger will display errors during charging if, for example, the dosemeter battery does not charge as expected. In this case, the Green LED will flash quickly to indicate a charging error.

Removing the power from the CHR22 Charger

If the power is removed from the CHR22 Charger unit and then reconnected, the charging cycle will restart.

However, if the batteries in the dosemeters still contain charge when this occurs, the charging time will be shorter than the standard charge time.

Inserting the MODEL 22R Reader Batteries

The MODEL 22R Reader unit requires batteries to operate. The dosemeter contains a rechargeable battery pack which is replaced when the dosemeter is returned for service and recalibration.

The batteries for the MODEL 22R Reader unit are located under the black cover on the back of the instrument.

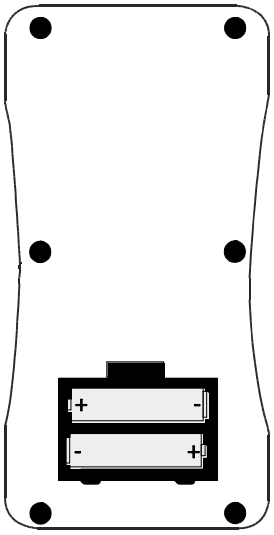
Before changing the main batteries, ensure that the Reader is switched off. The memory and clock of the Reader unit are protected when the main batteries are removed from the instrument.

The memory of the instrument is protected and the clock is kept for a maximum of 10 minutes.

Locate the battery compartment cover and remove it from the instrument. Remove the batteries from the Reader unit and replace with batteries of equivalent type and quality.

The battery should be of alkaline type AA (LR6 / AM3 / MN1500 / Mignon).

Ensure that the polarity of the batteries is correct. Replace the battery cover and switch the Reader unit on.



Remove the battery cover and replace the batteries.

Ensure the correct polarity when replacing the batteries

Switching on the Reader Unit

Press the Power button on the Reader to switch on. The Reader will power on and will display the start screen.

The Reader unit will automatically switch off after 4 minutes of inactivity.

The backlight of the display will switch on when any key is pressed and will automatically switch off after 10 seconds to preserve battery power.

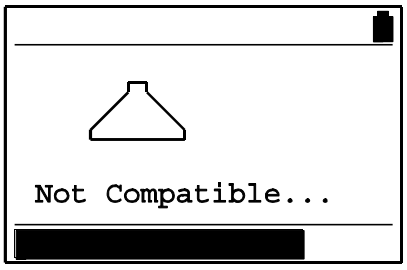
Checking the configuration

Before making a measurement with the dosemeter system, ensure that the configuration of the parameters listed below are as required to meet the regulations or guidelines for which the measurement is being made.

Pulsar Instruments plc accepts no responsibility for the accuracy of measurements made where the configuration of the dosemeter and Reader unit is not correct for Local, National or International Regulations.

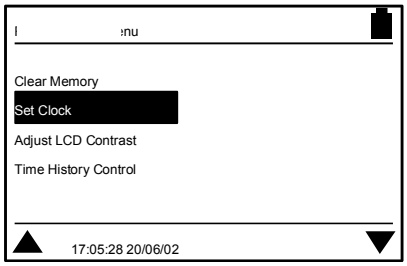
If you are in doubt about the correct settings for your system, please contact your local Pulsar Instruments representative or contact Pulsar Instruments plc directly.

Please note that the MODEL 22R Reader Unit will not allow a MODEL 20 or MODEL 20-TH dosemeter to be programmed with settings that are not compatible with these older instruments. If the user attempts to program a MODEL 20 or MODEL 20-TH dosemeter with an incorrect configuration, an error message will be displayed as shown below.



Clock (Time & Date)

The MODEL 22R Reader unit has a clock and calendar which is used to stamp the measurement with the current time and date. It is vital that the time and date of the clock in the Reader unit is correct.

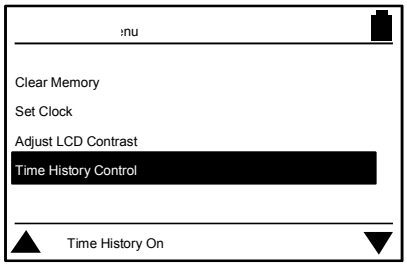


The current time and date is displayed at the bottom of the display. If the Clock has not been set, the Reader unit will show "Clock not set".

The current Time and Date are shown at the bottom of the display. If the Time and Date are not correct, press the OK button to enter the Clock Set menu.

The Time is set in the format hh:mm:ss and the Date is set in the format dd/mm/yy. For details of the procedure to set the clock, refer to section 4 **Configuration & Options**. This is the default configuration and can be changed in the Pulsar AnalyzerPlus software.

Time History Measurement



The Reader unit can be configured to download Time History data from the dosemeter at the end of the measurement.

The current setting for the Time History download is shown at the bottom of the screen. If the setting is not as required, the setting can be changed.

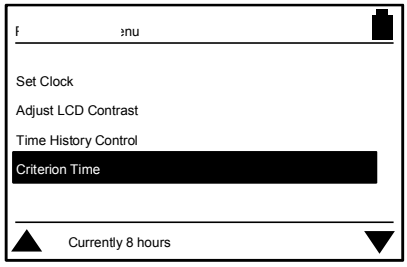
For details of the procedure to change the Time History storage function, refer to section 4 **Configuration & Options**.

Please note that the Time History data is stored as 1 Minute LAeq samples for 3dB Exchange Rates, and as 1 Minute Lavg samples for 4dB or 5dB samples.

Please note that this manual refers to the MODEL 22 dosemeter and MODEL 22R Reader Units that provide Dual Channel Measurement. The configuration options for the Criterion Time, Criterion Level, Threshold Level, Time Weighting and Exchange Rate detailed below apply to Channel 1. Channel 2 is preset as shown in Section 1.

Criterion Time (CT)

From the menu, select the Criterion Time position. The current setting is displayed at the bottom of the screen.



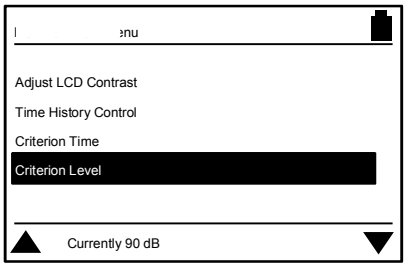
If the setting for the Criterion Time is not correct, the value can be selected from the list provided.

For further details of the procedure to change the Criterion Time, please refer to section 4, **Configuration & Options**.

The Criterion Time is programmed into the dosemeter when it is Reset by the Reader Reset key.

Criterion Level (CL)

From the menu, select the Criterion Level position. The current setting for the Criterion Level is shown at the bottom of the screen.

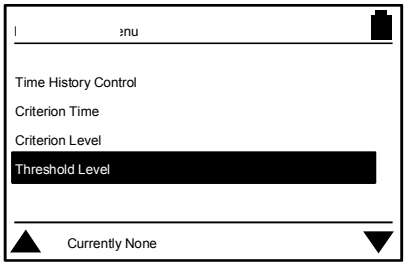


If the setting for the Criterion Level is not correct, the value can be selected from the list provided.

For further details of the procedure to change the Criterion Level, please refer to section 4, **Configuration & Options**.

The Criterion Level is programmed into the dosemeter when it is Reset by the Reader Reset key.

Threshold Setting (TH)



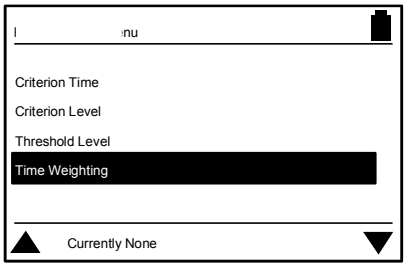
From the menu, select the Threshold Level position. The current setting for the Threshold Level is shown at the bottom of the screen. If the setting for the Threshold Level is not correct, the value can be selected from the list provided.

For further details of the procedure to change the Threshold Level, please refer to section 4, **Configuration & Options**.

The Threshold Level is programmed into the dosemeter when it is Reset by the Reader Reset key.

Time Weighting Setting (TW)

From the menu, select the Time Weighting position. The current setting for the Time Weighting is shown at the bottom of the screen.



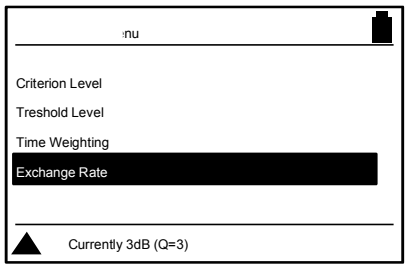
If the setting for the Time Weighting is not correct, the value can be selected from the list provided.

For further details of the procedure to change the Time Weighting, please refer to section 4, **Configuration & Options**.

The Time Weighting is programmed into the dosemeter when it is Reset by the Reader Reset key.

Exchange Rate Setting (Q)

From the menu, select the Exchange Rate position. The current setting for the Time Weighting is shown at the bottom of the screen.



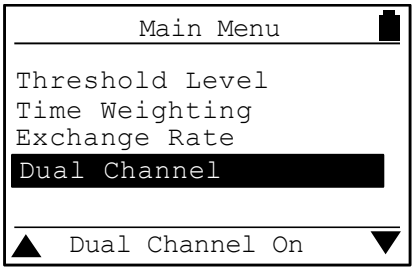
If the setting for the Exchange Rate is not correct, the value can be selected from the list provided.

For further details of the procedure to change the Exchange Rate, please refer to section 4, **Configuration & Options**.

The Exchange Rate is programmed into the dosemeter when it is Reset by the Reader Reset key.

Dual Channel

The Dual Channel menu option allows the simultaneous measurement of Channel 1 and Channel 2 to be made.

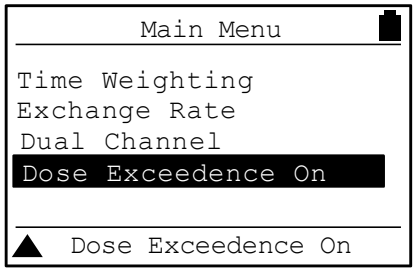


The options are to switch the Dual Channel Measurement On and Off.

It is recommended that this option is left switched ON.

Dose Exceedence

The MODEL 22 dosemeter can indicate when the 100% Noise Dose value has been exceeded during the measurement.



When this option is switched on, the LED indicator on the dosemeter will flash twice every second to indicate that the noise exposure has exceeded the 100% Dose value.

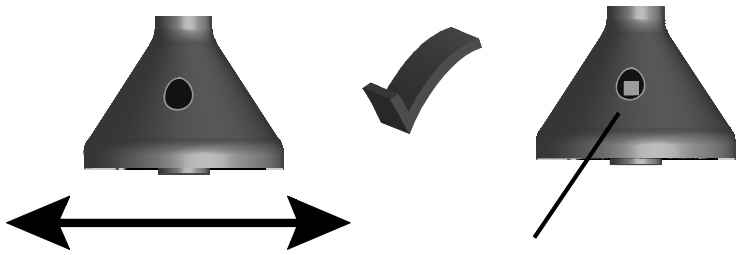
As the % Dose value is a cumulative value, once the indicator has started to flash more quickly it will continue to do so for the remaining measurement duration.

"Shake to Wake" function

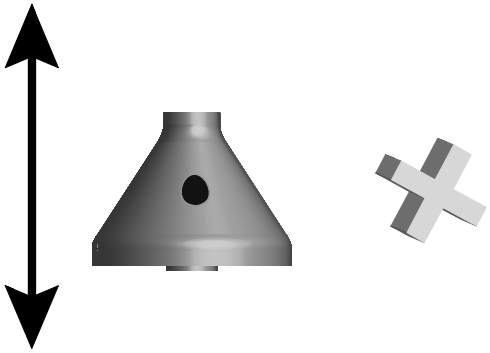
A new feature added to the MODEL 22 dosemeter is the "Shake to Wake" function. Please read the information below carefully before using the dosemeter.

In the MODEL 22 dosemeter, a function has been added to lengthen the battery life of the unit. If the dosemeter has not been used for 1 hour and it is not measuring data, it will go into Sleep mode. This reduces the amount of power required to run the dosemeter and a fully charged unit will remain charged and ready for use for up to 28 days.

Shake the dosemeter in this direction to activate the sensor and wake the instrument



The status indicator will flash when the dosemeter wakes



The dosemeter may not wake if shaken in this direction

If the dosemeter is in Sleep mode, it will not communicate with the Reader Unit until it has been woken by physically shaking the dosemeter.

To check if the dosemeter is in Sleep mode point the Reader Unit at the dosemeter and press the Stop button. If the status indicator flashes (blue), the dosemeter is awake and can be used.

If the dosemeter does not respond, it is in Sleep mode and must be woken before use. The MODEL 22 dosemeter has an internal sensor that must be activated to wake the dosemeter from Sleep mode.

To wake the dosemeter, shake the unit as shown in the diagram above. When the sensor is activated, the dosemeter status indicator will flash (blue) twice and the dosemeter can be used.

Note that the sensor may be activated when the dosemeter is removed from the charger unit or when it is handled. If the indicator light does not flash when the dosemeter is shaken, check that the dosemeter is not already awake by pointing the Reader Unit at the dosemeter and pressing the Stop button.

If the indicator shows, the dosemeter is awake and ready to use.

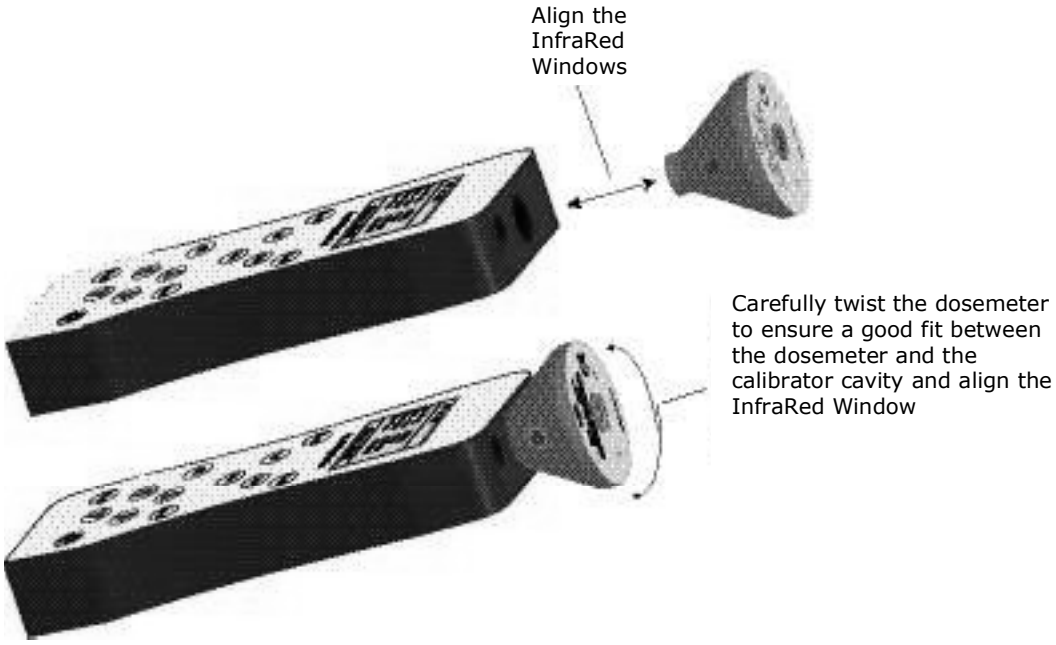
Please note that if the dosemeter is running, it will ***not*** go into Sleep mode. The dosemeter will only enter Sleep mode if it has been ***stopped*** for more than 1 hour and does not receive commands from the Reader unit.

Please note that if the internal battery in the dosemeter is not charged, it will not be possible to wake the dosemeter from Sleep mode. Ensure that the dosemeter is fully charged before attempting to use the unit.

Insert the dosemeter in the Acoustic Calibrator

Before the dosemeter can be reset or calibrated, it must be inserted into the Acoustic Calibrator cavity to allow communication between the dosemeter and the Reader unit.

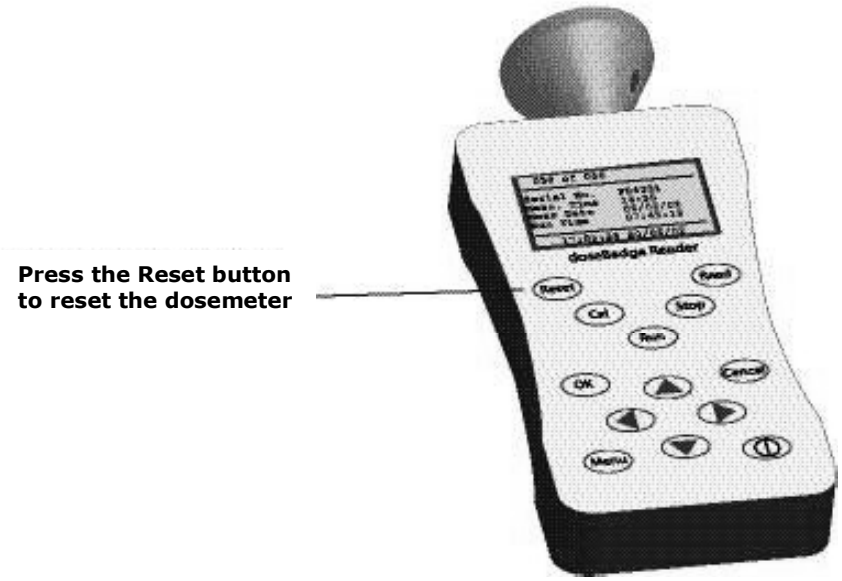
The figures here show the alignment of the dosemeter in the Reader cavity. Ensure that the Infrared window of the dosemeter is aligned with the Infrared Port of the Reader unit.

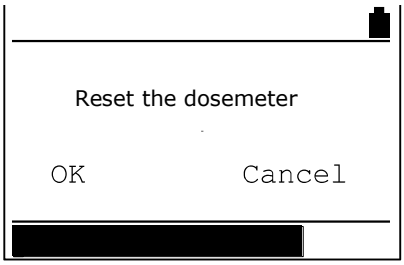


The dosemeter must be pushed firmly into the calibrator cavity to make sure that there is a good quality seal around the microphone. If the dosemeter is not pushed into the calibrator cavity, the acoustic calibration level will be reduced and the calibration will fail.

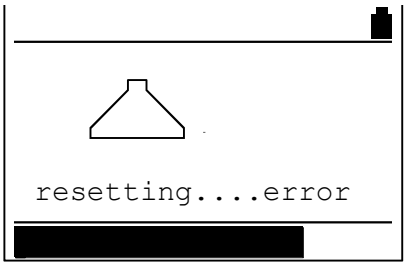
Resetting the dosemeter

The dosemeter must be reset before a measurement is made. Resetting the dosemeter will clear any information from the dosemeter, program the dosemeter with the user configuration, set the date and time and prepare the unit for calibration.





The Reader will communicate with the dosemeter and when the Reset is complete, the indicator on the dosemeter will flash twice. If there is an error, the Reader will indicate the problem.



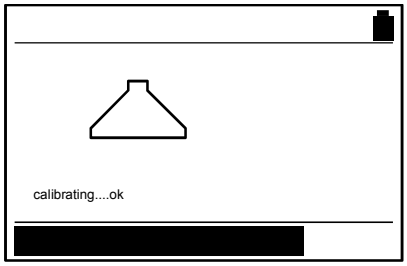
When the dosemeter is Reset, the configuration of the dosemeter as described above is programmed into the instrument by the Reader.

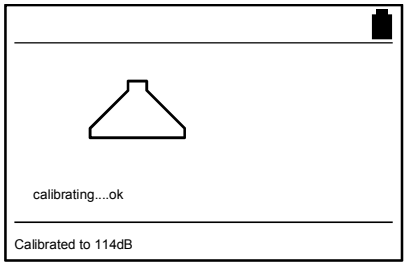
Press the OK or Cancel button to return to the main screen.

Calibrating the dosemeter

The dosemeter must be calibrated before operation to ensure that the measurements are correct. To calibrate the dosemeter, press the **Cal** key.

Press the Cal button to calibrate the dosemeter





When the calibration is complete, the Reader unit will display the calibration information.

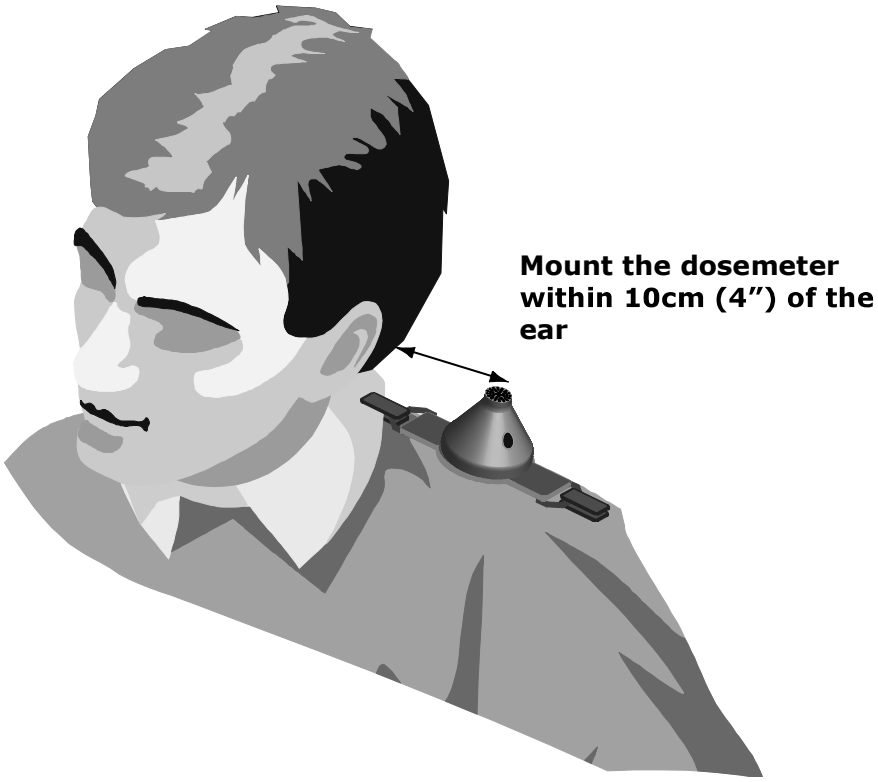
If the calibration of the dosemeter cannot be completed successfully, the Reader will display an error message. See Section 7 "Troubleshooting" for more details.

The Reader will display the calibration information until a key is pressed.

Additional information regarding the calibration of the dosemeter is provided in Appendix 3 dosemeter Calibration on page 63.

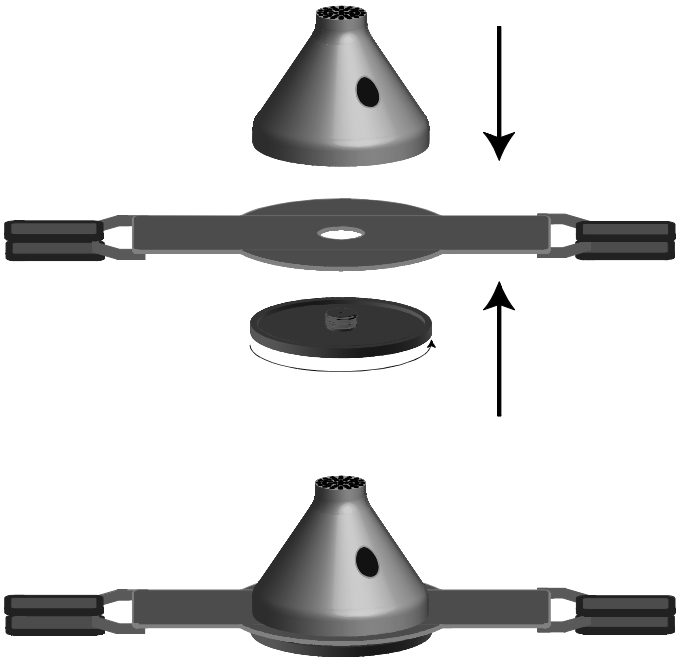
Mounting the dosemeter

The dosemeter is supplied, as standard, with accessories to mount the dosemeter on the shoulder of the wearer. There may be applications where the dosemeter must be mounted in an alternative location, such as on a hard hat or other clothing or safety equipment.



The dosemeter should be mounted to the wearer on the shoulder as shown above. Ensure that the dosemeter will not generate noise itself when the wearer moves.

The dosemeter window should be at the front to ease the starting and stopping of sessions using the Infrared link with the Reader.

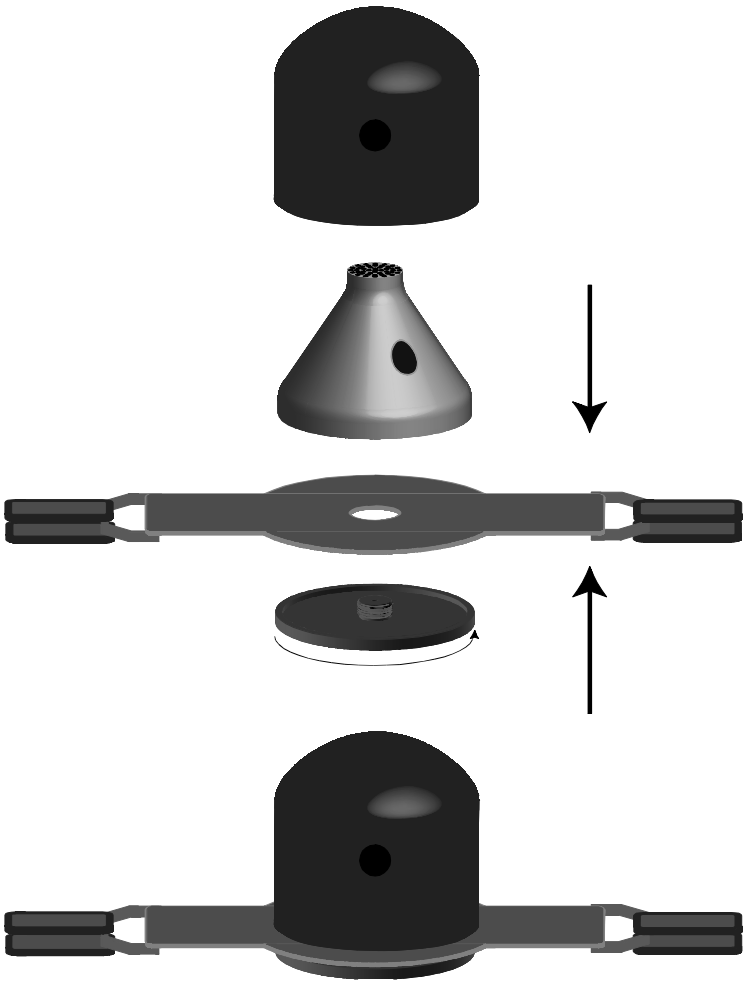


Using the dosemeter Windshield

The optional WS22 dosemeter Windshield can be used to reduce the effects of air movement upon the noise measurements. The windshield also reduces the effects of impacts upon the noise measurements which may cause false Peak(C) readings.

The windshield is secured between the dosemeter case and the mounting plate or patch. Ensure that the hole in the windshield is aligned with the Infrared window of the dosemeter.

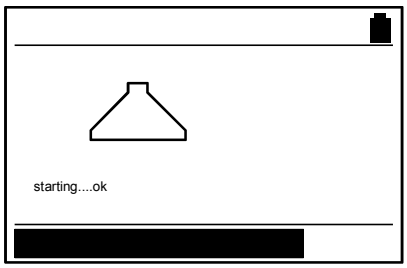
The WS22 dosemeter windshield can also prevent dust ingress into the microphone capsule.



Starting the measurement

To start a measurement session, hold the Reader with the Infrared link aimed at the Infrared link window of the dosemeter. The Reader and dosemeter can be up to 50cm apart. Press the **Run** key. The Reader will program the start time and date into the dosemeter.

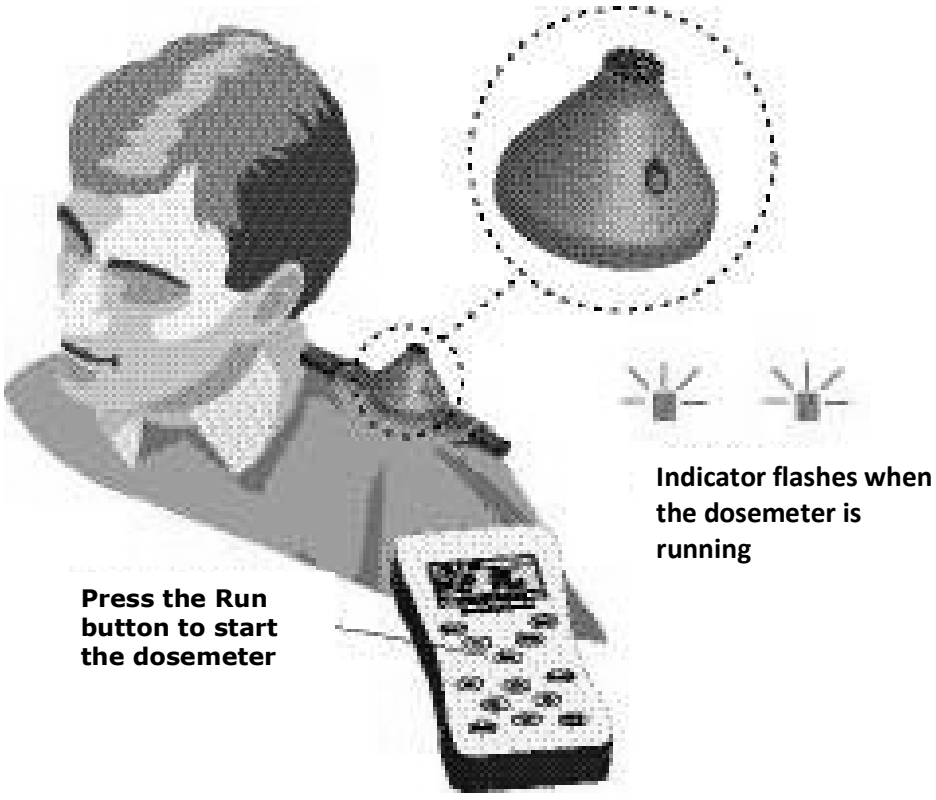
The Reader will show the status of the communication between the dosemeter and the Reader on the display.



Do not move the Reader away from the dosemeter until the indicators show in the dosemeter.

An indicator will show in the badge window for up to 2 seconds to show that it has received the message and started running. If an indicator does not show then try again.

When the dosemeter is running (and making a measurement), the indicator will flash quickly to indicate that the unit is operating.



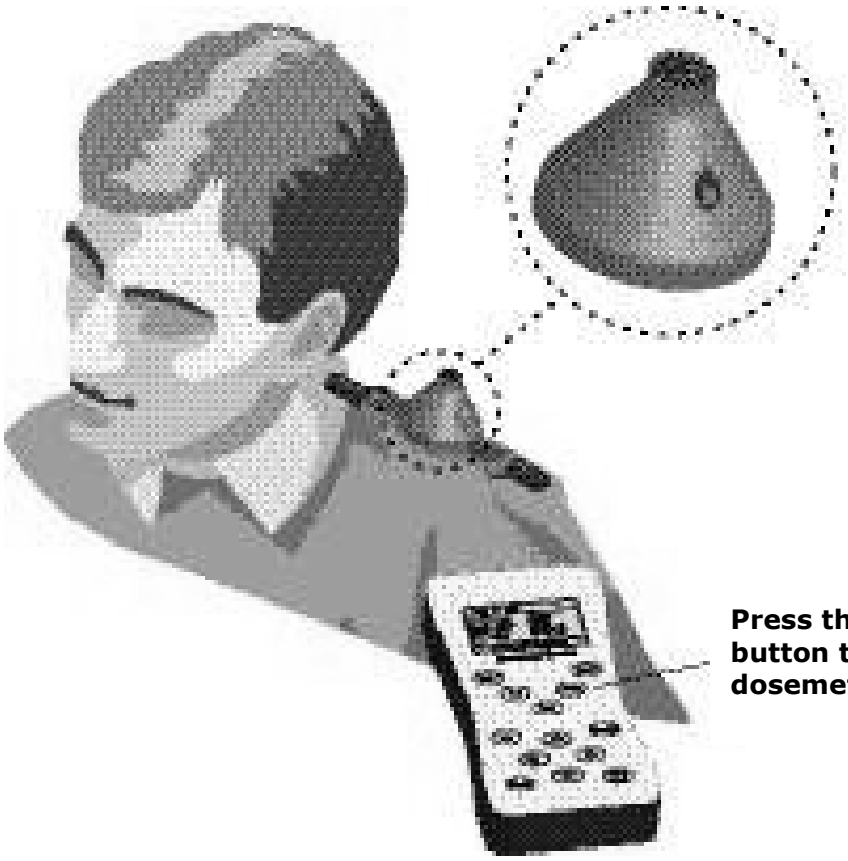
The dosemeter can now be left on the wearer. The wearer should be instructed to avoid knocking the meter as this can affect the Peak measurements and add to the noise dose.

Using the RK1 Keyfob Remote Control

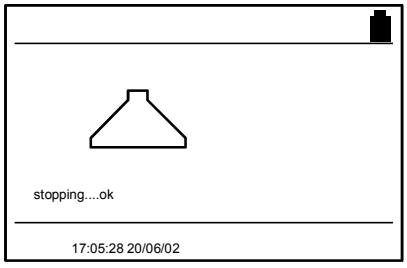
The dosemeter can also be started using the RK1 Keyfob Remote Control. Point the Keyfob at the dosemeter Infrared window and press the Run button. The dosemeter will start in the same way as described above for the Reader unit.

Stopping a measurement

At the end of a measurement period, hold the Reader up to the dosemeter as shown above and press the **Stop** key.



The Reader will show the status of the communication between the dosemeter and the Reader on the display.



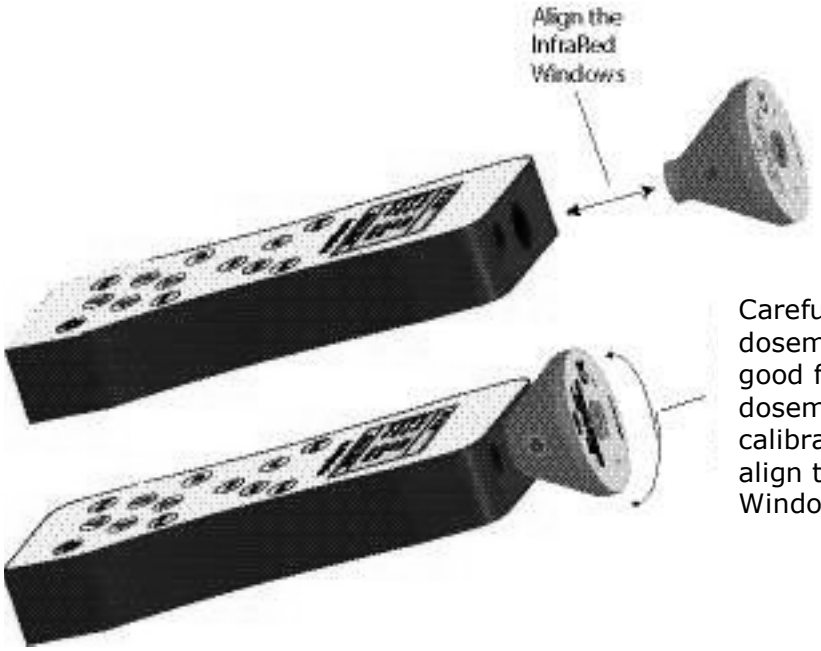
An indicator will flash through the dosemeter window to indicate the change from Run to Stop. Handling the dosemeter will now have no affect on the measurements and so the dosemeter can now be removed from the wearer.

The dosemeter can also be stopped using the RK1 Keyfob Remote Control.

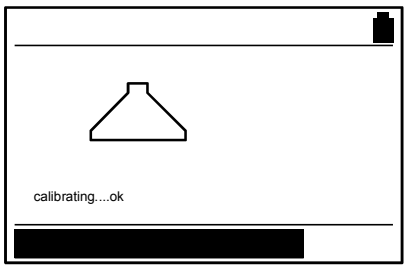
Checking the Calibration of the dosemeter

The calibration of the dosemeter can be checked by removing the unit from the wearer and performing the same calibration procedure as described above. This records the second calibration value into the dosemeter.

Insert the dosemeter into the Acoustic Calibrator on the Reader unit, ensuring that the Infrared Port on the Reader is aligned with the Infrared window on the dosemeter.



Carefully twist the dosemeter to ensure a good fit between the dosemeter and the calibrator cavity and align the InfraRed Window



Press the **Cal** button to perform the second calibration.

The Reader will show the status of the communication between the dosemeter and the Reader on the display.The second calibration does not affect the measurement information and is used for information only.

The Reader will display the calibration information until a key is pressed.

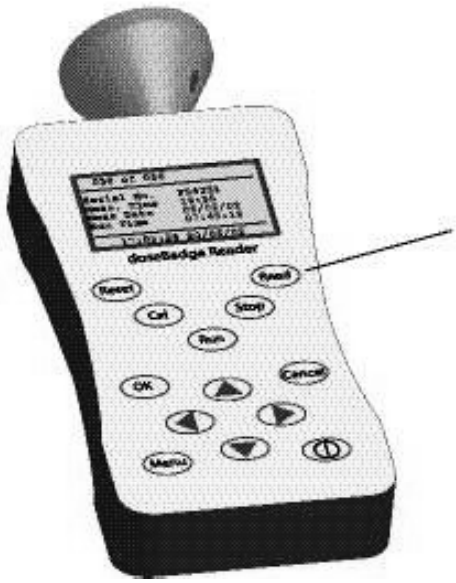
Additional information regarding the calibration of the dosemeter is provided in Appendix 3 dosemeter Calibration on page 63.

Downloading the measurements to the Reader Unit

The dosemeter must be in the Acoustic Calibrator cavity on the Reader before the measurements are downloaded.

If the Time History Measurement configuration has been set to Off, no Time History data will be downloaded from the dosemeter. Ensure that the Time History configuration is set to the required setting before reading measurement data from the dosemeter.

To download the measurement information from the dosemeter to the Reader, press the **Read** key. The Reader will display the status of the communication during the download period.



Press the Read button to download the measurement data from the dosemeter to the Reader

The Reader unit downloads the measurement parameters before downloading the Time History. If there are errors during the download of the Time History data, the Reader will store the measurement parameters and show the message "Trace Error" at the bottom of the display.

The measurement data is downloaded automatically from the dosemeter and is then displayed on the screen of the Reader unit.

Viewing stored measurements

When the measurement download has been completed, the Reader unit will display the last measurement data.

The different measurement parameters can be viewed by pressing the Down Arrow button. For further details, please refer to section 5 **Reviewing & Downloading Measurements**.

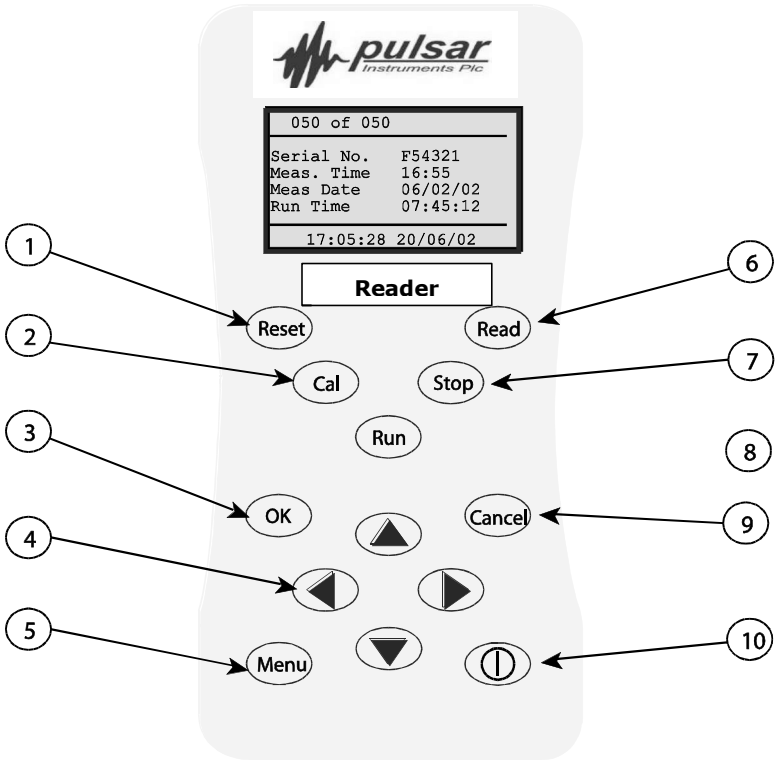
Downloading stored measurements to the dosemeter software

Measurements can be downloaded from the Reader unit to the dosemeter software supplied with the MODEL 22R Reader unit. If the Pulsar AnalyzerPlus software has been installed, connect the Reader unit using the supplied USB cable to the PC. The Pulsar AnalyzerPlus software will automatically connect to the Reader and the measurement information can be downloaded.

Refer to section 5 **Reviewing & Downloading Measurements** for details of connecting the Reader to a PC.

Section 4 Configuration & Options

MODEL 22R Reader Keypad

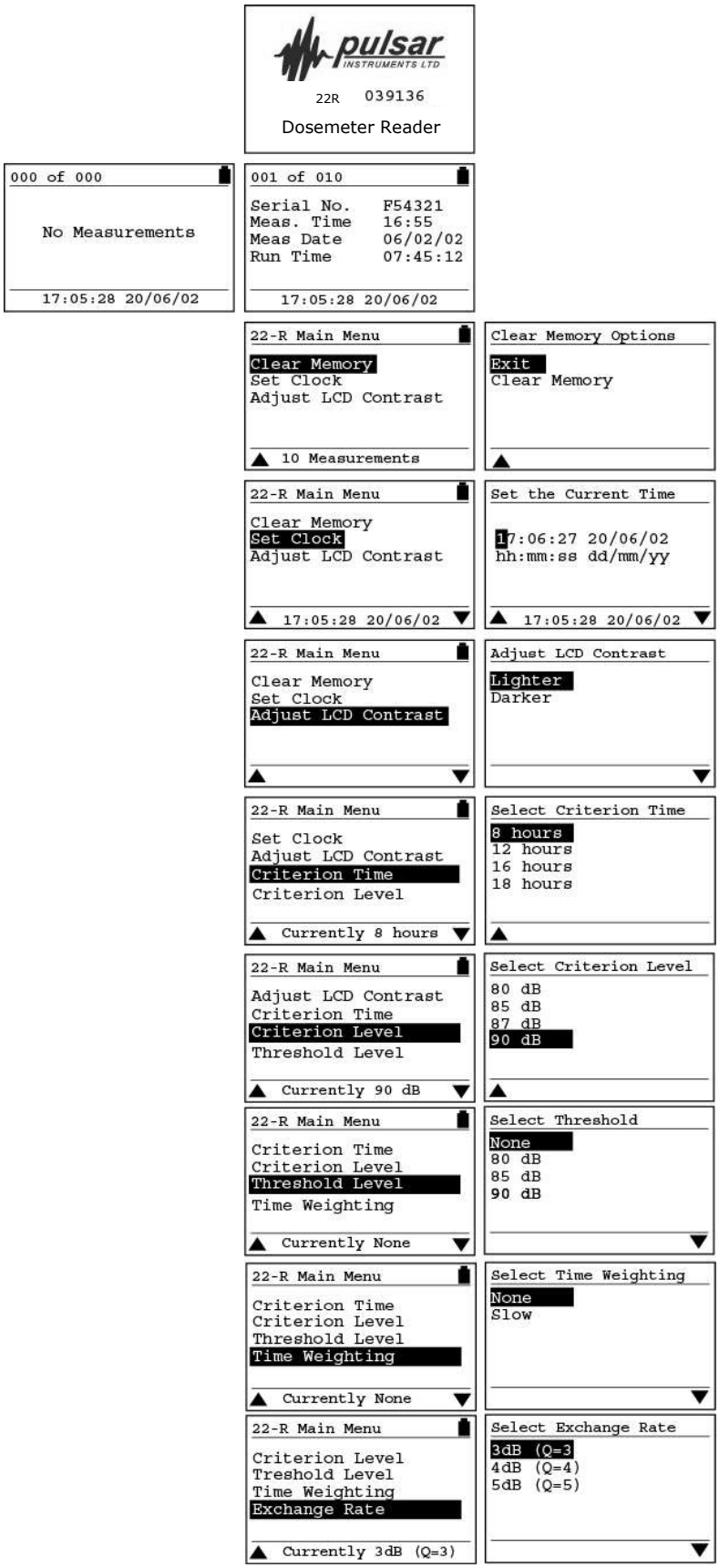


The keypad of the MODEL 22R Reader unit has the following keys as shown in the figure above:

(1) Reset	Resets the dosemeter. All information in the dosemeter is deleted and the configuration data programmed.
(2) Cal	Calibrates the dosemeter using the internal Acoustic Calibrator. This key is also used for the second calibration check if required.
(3) OK	Accepts data entry or confirms menu options.
(4) Arrow Keys	Allows the user to move around the menus and information shown on the display.
(5) Menu	Displays the menu options.
(6) Read	Downloads the measurement information from the dosemeter to the Reader.
(7) Stop	Stops the dosemeter measurement.
(8) Run	Starts the dosemeter measurement.
(9) Cancel	Exits from the menu options.
(10) Power	Switches the Reader on and off. The Reader will automatically switch off after 2 minutes of inactivity.

Menu Structure

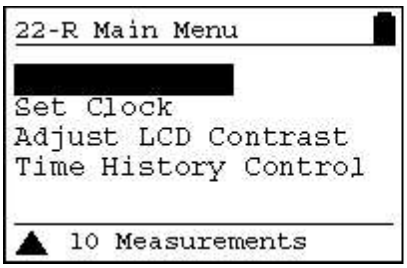
The menu system of the MODEL 22R Reader unit is entered by pressing the Menu key. The menu system can be exited by pressing the Cancel key at any time. The layout of the menu system is shown below:

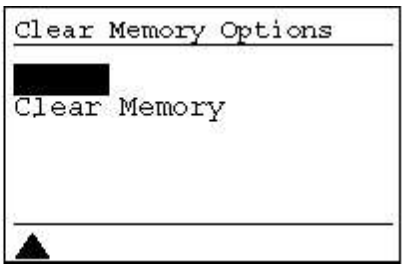


Clear the memory of the Reader

The MODEL 22R Reader has a memory of 192kB which allows a large number of measurements to be stored. Please refer to the Specification for full details of the memory available.

The memory of the MODEL 22R Reader unit can be cleared when required. Please ensure that all measurements have been downloaded to the Pulsar AnalyzerPlus software before clearing the memory.

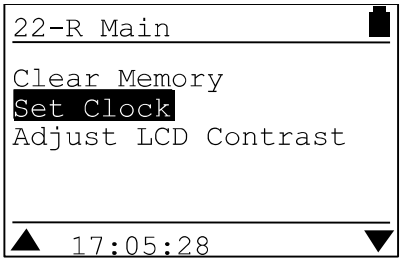


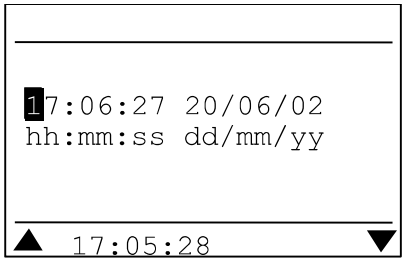


To clear the memory, access the menu by pressing the Menu button and select the Clear Memory option.

Set Clock

The MODEL 22R Reader unit has a clock and calendar which is used to stamp the measurement with the current time and date. It is vital that the time and date of the clock in the Reader unit is correct. To check the current time and date, press the menu button to enter the menu options. If the Reader time and date is not set then the display shows "Please set clock".



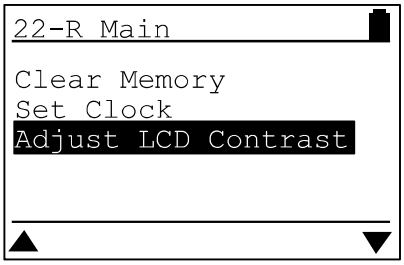


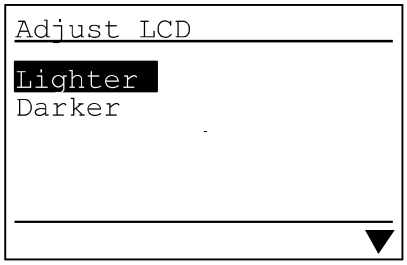
The current Time and Date are shown at the bottom of the display.

If the Time and Date are not correct, press the OK button to enter the Clock Set menu.

The default time format in the Reader unit is hh:mm:ss and the default date format dd/mm/yy. However, the Pulsar AnalyzerPlus software allows the user to change these to suit the country where the dosemeter will be used. Please refer to the Pulsar AnalyzerPlus software for further details.

Adjust Display Contrast

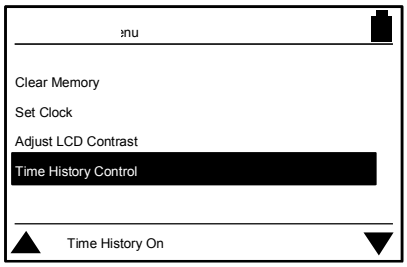


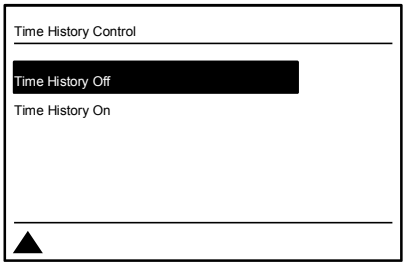


The contrast of the LCD display can be adjusted to accommodate different ambient light conditions. To change the contrast of the LCD display, press the OK key on Lighter or Darker repeatedly until the required contrast is achieved.

Time History Measurement Mode

The dosemeter system can be configured to download Time History data from the dosemeter at the end of the measurement. The Time History data download can be selected to be either On or Off as required.





Please note that selecting the On option will increase the download time over the No Time History option.

The current setting for the Time History download is shown at the bottom of the screen. If the setting is not as required, the setting can be changed.

In the Dual Channel version of the MODEL 22 dosemeter, the Time History data for Channel 2 is always stored as 1 minute LAeq samples.

For Channel 1, when the Exchange rate is set to 3dB, the Time History data is stored as 1 Minute LAeq samples. When the exchange rate is set to 4dB or 5dB, the Time History data is stored as 1 Minute L_{AVG} samples.

In addition, the 1 Minute Peak(C) level and 1 Minute dosemeter Battery level are also stored and downloaded and stored as a Time History. These two parameters are not displayed on the Reader unit and are only available via the Pulsar AnalyzerPlus software.

The data stored can be viewed in the Pulsar AnalyzerPlus software. Please refer to the software program for details of the data storage type.

Also refer to the Troubleshooting guide on page 51 for further information.

Configuration of the Measurement Parameters

The MODEL 22 dosemeter, when used with the MODEL 22R Reader unit, allows configuration of several different measurement parameters which can be adjusted to meet the requirements of Local, National or International Standards as required.

The version of the dosemeter referred to in this manual provides Dual Channel measurements. Channel 2 is preset to a 3dB ISO configuration and cannot be altered by the user.

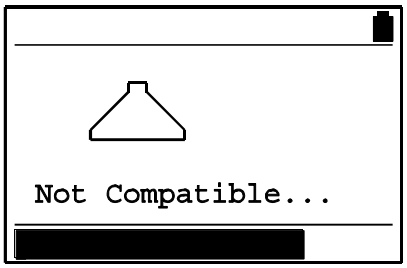
The following parameters can be configured for Channel 1 as required.

- Criterion Time
- Criterion Level
- Threshold Level
- Time Weighting
- Exchange Rate

Please note that any changes of the dosemeter configuration will only be programmed into the dosemeter when it is Reset by the Reader unit.

The Glossary on page 54 provides additional information about these different parameters.

Please note that the MODEL 22R Reader Unit will not allow a MODEL 20 or MODEL 20-TH dosemeter to be programmed with settings that are not compatible with these older instruments. If the user attempts to program a MODEL 20 or MODEL 20-TH dosemeter with an incorrect configuration, an error message will be displayed as shown below.

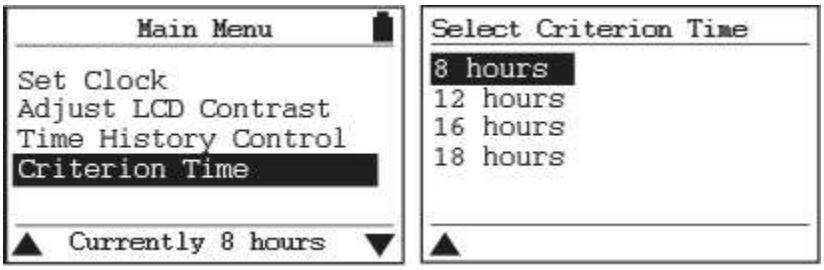


Criterion Time (CT)

The Criterion Level, displayed as CT by the Reader unit, is used by the dosemeter system for the calculation of the following measurement functions:

$L_{EP,d}$ or TWA
% Noise Dose
Estimated % Noise Dose

To check the setting for the Criterion Time (CT), press the menu button and select the Criterion Time option. The current setting for the Criterion Time is shown at the bottom of the screen.



By default, the Criterion Time is set to 8 hours. The Criterion Time can be selected from the following durations:

8 hours
12 hours
16 hours
18 hours

If the setting for the Criterion Time is not correct, the value can be selected from the list by pressing the OK button and selecting the required value.

Criterion Level (CL)

The Criterion Level, displayed as CL by the Reader unit, is used by the dosemeter system for the calculation of the following measurement functions:

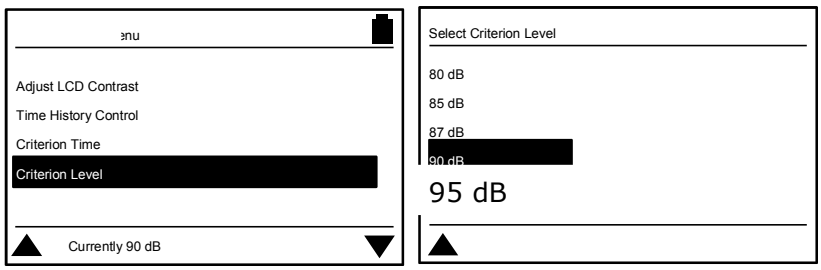
% Noise Dose
Estimated % Noise Dose

To check the setting for the Criterion Level (CL), press the following buttons. The current setting for the Criterion Level is shown at the bottom of the screen.

The Criterion Level can be selected from the following levels:

80dB
85dB
87dB
90dB
95dB

If the setting for the Criterion Level is not correct, the value can be selected from the list.



Threshold Level

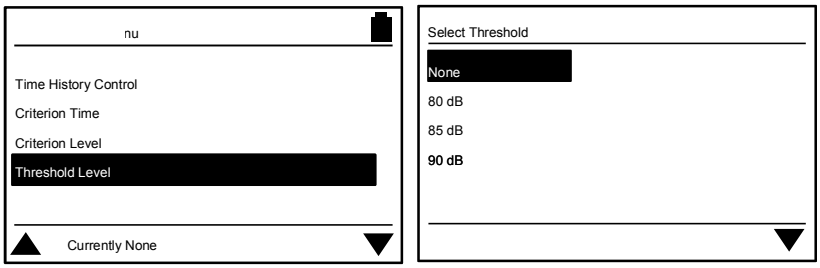
The Threshold Level, displayed as TH by the Reader Unit, is used in the calculation of all of the noise parameters. If the Threshold is set, all noise levels below this value are effectively ignored in the measurement data.

To check the setting for the Threshold Level (TH), press the menu button and select the Threshold Level option. The current setting for the Threshold Level is shown at the bottom of the screen.

The Threshold Level can be selected from the following levels:

None
80dB
85dB
90dB

Please note that for many applications, the Threshold Level should be set to None. This applies in the European Union and in many other countries that use the 3dB Exchange Rate.



Ensure that this parameter is set to meet the requirements of any regulations that are to be met.

Measurements made with an incorrect Threshold Level ***cannot*** be recalculated after the measurement has been made.

Time Weighting

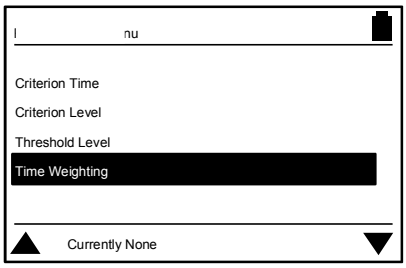
The Time Weighting, displayed as TW by the Reader Unit, is used in the calculation of all of the noise parameters. If the Time Weighting is set, all noise levels are weighted before being used in the calculations.

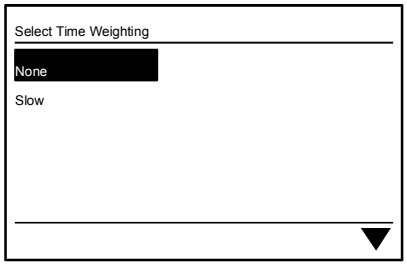
To check the setting for the Time Weighting (TW), press the menu button and select the Time Weighting option. The current setting for the Time Weighting is shown at the bottom of the screen.

The Time Weighting can be selected from the following levels:

- None
- Slow

Please note that for many applications, the Time Weighting should be set to None. This applies in the European Union and in many other countries that use the 3dB Exchange Rate.





Ensure that this parameter is set to meet the requirements of any regulations that are to be met.

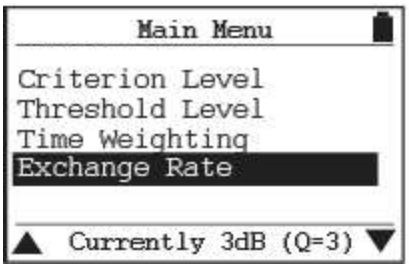
Measurements made with an incorrect Time Weighting ***cannot*** be recalculated after the measurement has been made.

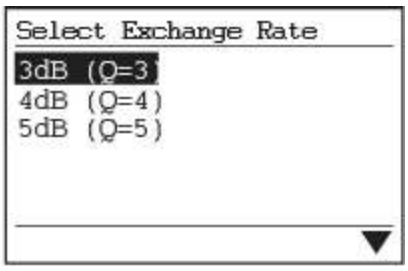
Exchange Rate

The exchange rate is used in the calculation of all of the noise parameters.

To check the setting for the Exchange Rate (Q), press the menu button and select the Exchange Rate option. The current setting for the Exchange Rate (Q) is shown at the bottom of the screen.

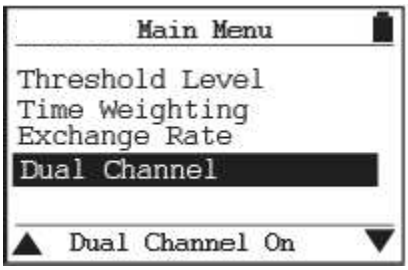
Ensure that this parameter is set to meet the requirements of any regulations that are to be met. Measurements made with an incorrect Exchange Rate ***cannot*** be recalculated after the measurement has been made.

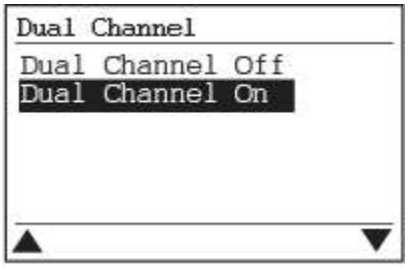




Dual Channel Measurement

The MODEL 22 dosemeter provides Dual Channel measurements. This can be switched On or Off



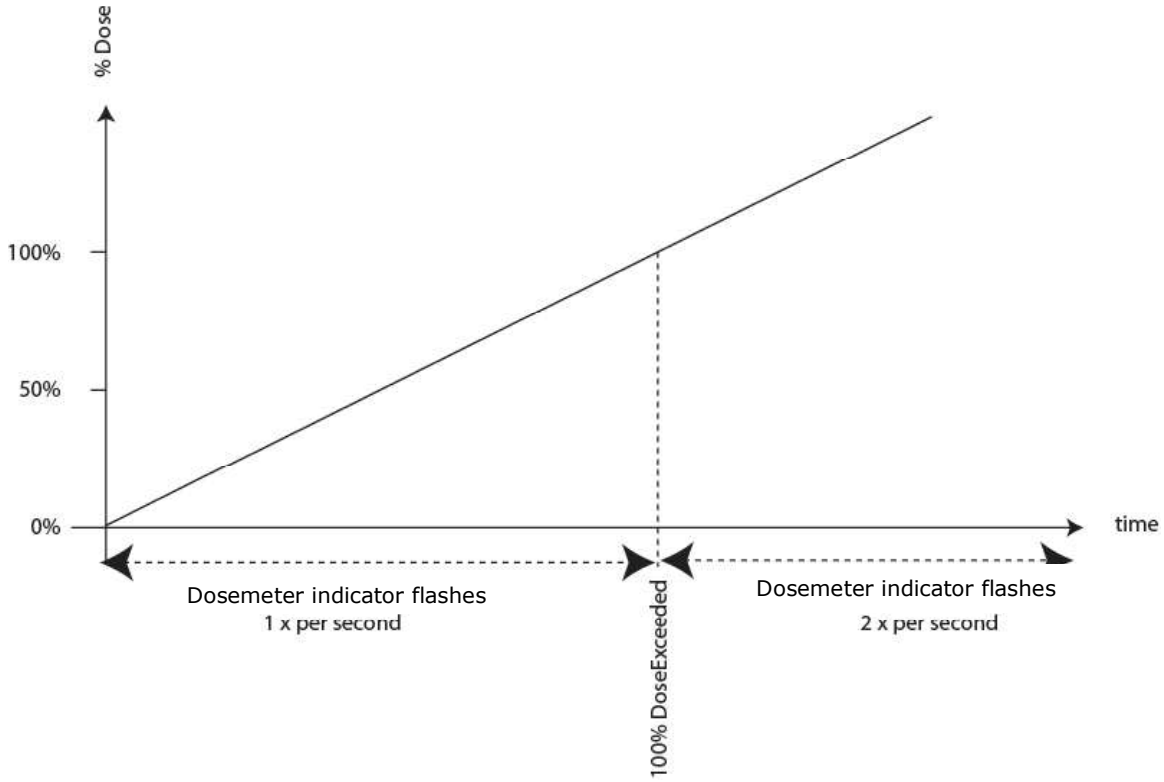


It is recommended that the Dual Channel measurement function is left switched on.

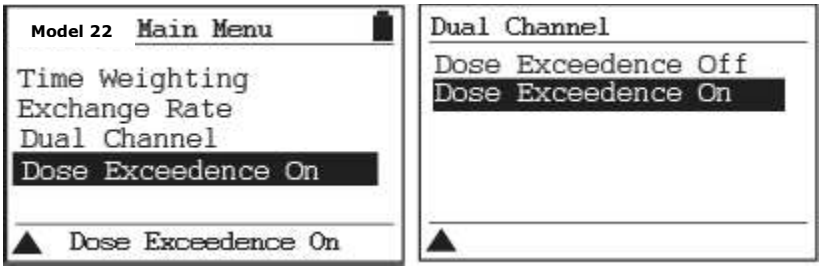
% Dose Exceedence

The version of the MODEL 22 dosemeter referred to in this manual provides a visual display of when the accumulated noise has exceeded the % Dose level.

For example, if the Criterion Level is set to 90dB, the 100% Noise Dose is equivalent to a level of 90dB over 8 hours. If this % Dose level is exceeded during the measurement the dosemeter indicator will flash twice per second.



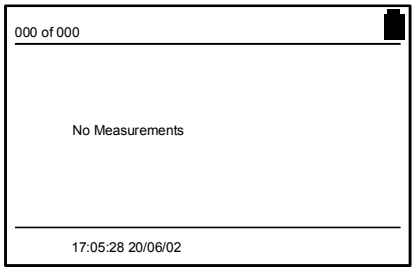
This function can be switched On or Off as required.



Section 5 Reviewing & Downloading Measurements

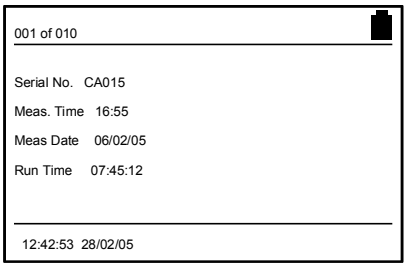
Once measurements have been downloaded from the dosemeter into the Reader unit, they are stored in the memory of the Reader automatically. The measurements can be reviewed on the display of the Reader unit or they can be downloaded from the Reader to the Pulsar AnalyzerPlus software.

Reviewing stored measurements



Press the Cancel button to exit any menus and return to the Measurement Display Mode. If there are no measurements stored in the Reader unit, the following information will be displayed:

Where measurements are stored, the Reader will show the last measurement to be downloaded as follows:



This display shows that there are 10 measurements stored in the memory of the Reader and that the measurement shown is number 1 of 10.

The arrow keys allow the measurement information to be viewed and the different measurements to be accessed as follows:

The information stored for each measurement will be determined by the configuration of the dosemeter.

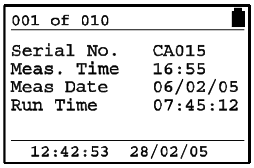
Please note that the information provided by the 3dB configuration will include L_{Aeq} and $L_{EX,8}$ data only if the Threshold Level is None ***and*** if the Time Weighting is None. If either of these parameters are set to other values, the measurement data will be displayed as L_{AVG} and TWA.

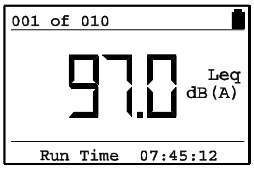
L_{Aeq} and $L_{EX,8}$ data cannot be calculated where a Threshold or a Time Weighting are used. Ensure that the dosemeter is correctly configured before making measurements. Measurement data cannot be recalculated after the measurement has been made.

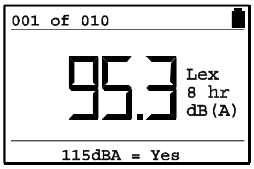
An example of the measurement data parameters provided are shown on the next page.

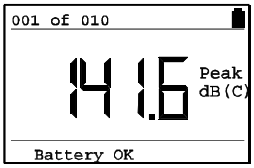
Please note that the Pulsar AnalyzerPlus software allows the user to select which additional measurement functions are displayed on the Reader display. When these additional parameters are downloaded, they are automatically stored in the Reader unit but are not displayed on the screen.

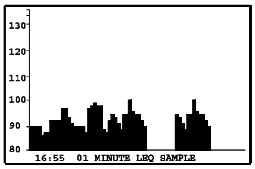
LAeq & LEX,8 Measurement Data

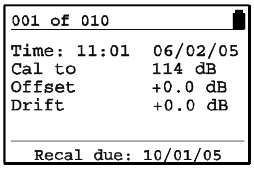


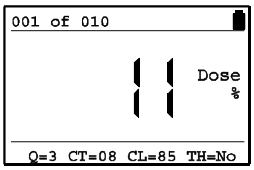


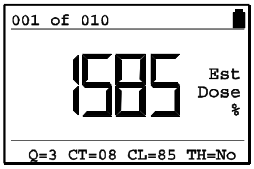


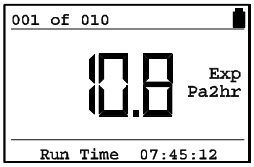


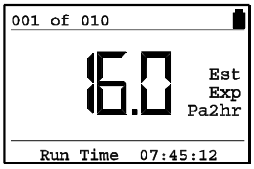


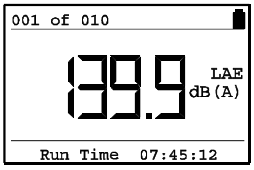


* 

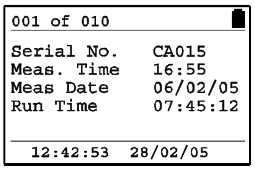
* 

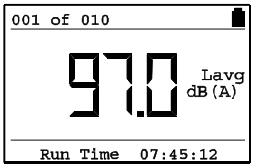
* 

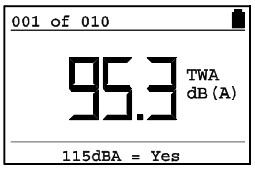
* 

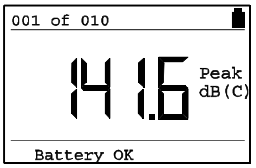
* 

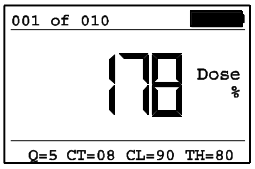
Lavg & TWA Measurement Data











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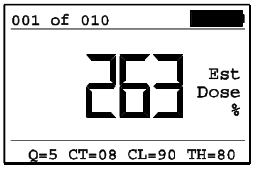

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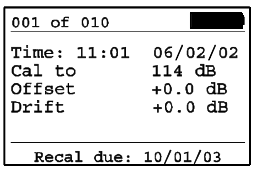
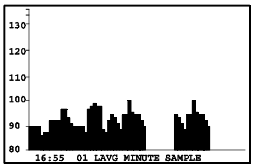




***These options can be turned off using AnalyzerPlus software**

Time History Display

The measured Time History Data is displayed on the Reader display.

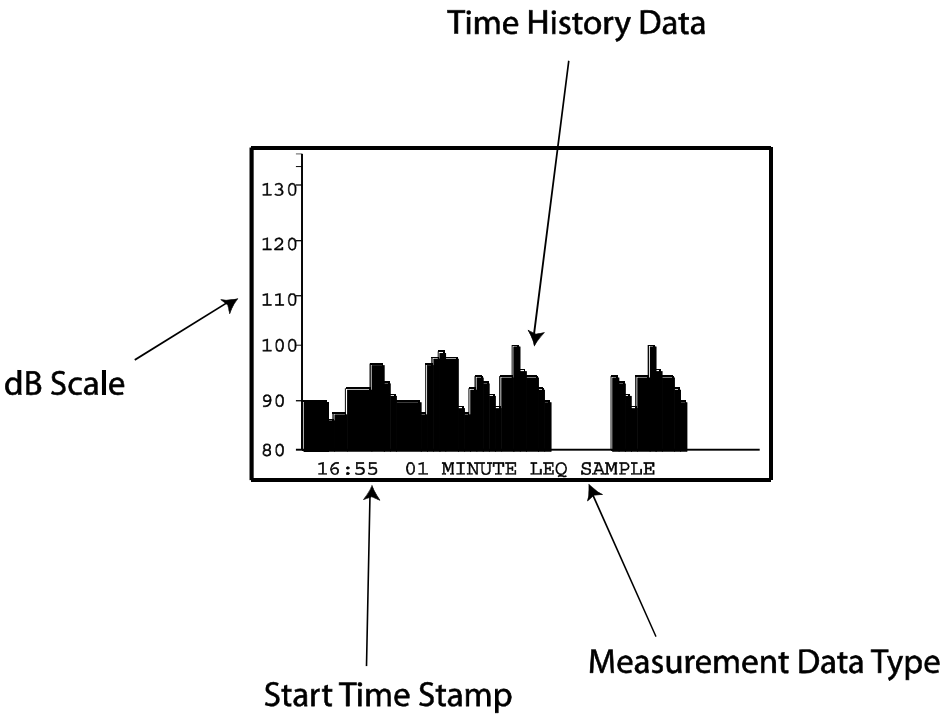
The Time History graph is drawn with a fixed range of 80dB to 130dB in 10dB steps with a marker at 133dB (for overload).

If the measurement was paused, the display will show a solid bar over the full height of the display.

The stored time history data is compressed into a sample size so that the entire time history will be displayed on a single graph. For example, a 3 hour 50 minute measurement will be displayed as 2 minute Leqs to allow all of the measurement information to be shown on the display.

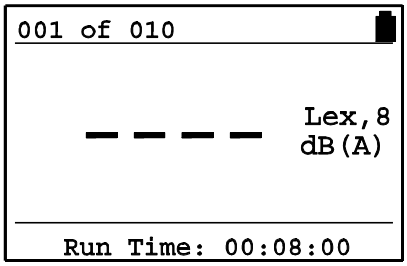
The graph also displays the start time of the Time History and the sample size.

The figure below shows an example of a Time History measurement. The Time History display is either Leq for 3dB Exchange Rate, No Time Weighting and no Threshold, or L_{AVG} for any other configuration.



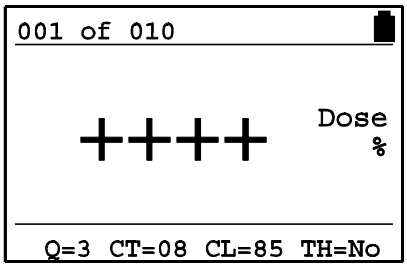
Other Information

Other information may be displayed by the Reader unit during the measurement review. These are covered below.



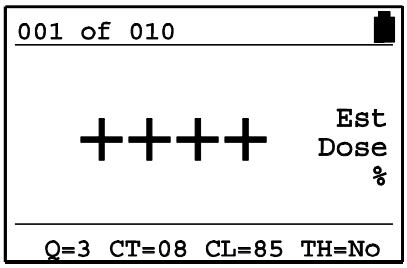
Shown when:

The Run Time and Leq are too low for the Reader unit to accurately calculate an $L_{EX,8}$ value.



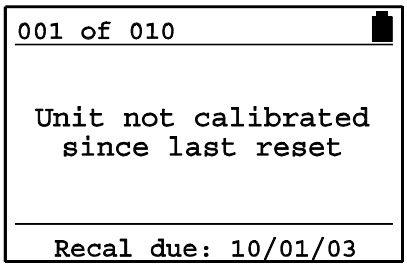
Shown when:

The value for the % Noise Dose is too large to be calculated.



Shown when:

The value for the Estimated % Noise Dose is too large to be calculated.



Shown when:

The dosemeter was not calibrated before the measurement was started.

Downloading measurements to a PC

Measurements that have been stored in the Reader unit can be downloaded to a PC using the Pulsar AnalyzerPlus software. The Pulsar AnalyzerPlus software automatically recognises a MODEL 22R Reader unit and allows measurements to be downloaded, analysed and measurement reports created.

Pulsar AnalyzerPlus is supplied on a CD-ROM and requires a PC running Microsoft Windows XP SP3 or later. A USB communications port is required for connection to the MODEL 22R Reader unit via the supplied USB Cable.

To install the software:

1. Insert the Disc in the CD-ROM drive
2. Follow the instructions on the screen

If the installation program does not automatically start, run d:\setup.exe program from the Start, Run option in the task bar where d is the letter of the CD-ROM drive.

Please note that if you are running on a network, you may need to contact your network administrator to ensure that you have sufficient access rights to install this software. This software should be installed with full administration rights to ensure that the configuration of the software can be completed.

Pulsar Instruments plc accepts no responsibility for the installation of this software on systems where full access rights are not available.

Connecting the Reader to a PC

The Reader unit must be connected to a PC to allow measurements to be downloaded to the software. The Reader unit is supplied with a USB Cable which must be used to download the information.

The USB Cable can only be inserted into the Communications socket in one orientation. If the connector will not fit into the socket do not force it. Ensure that the orientation of the connector is correct and that the arrow on the cable is pointing downwards.

When the cable has been connected to the Reader and the PC, ensure that the Reader is switched on. If the Pulsar AnalyzerPlus software program is running, it will automatically detect the Reader unit and allow the measurements to be downloaded.

Once the connection is made, the measurements can be downloaded. For more information, please refer to the Pulsar AnalyzerPlus software for more information.

Section 6 Maintenance & Care

Annual Verification & Servicing

It is strongly recommended that all dosemeters and Readers are returned to Pulsar Instruments or an authorised service centre at least every 12 months for verification, calibration and servicing.

This should only be carried out by Pulsar Instruments plc or a service centre authorised by Pulsar Instruments plc for the service and calibration of the dosemeter.

The date that the Reader and dosemeters are due for "recalibration" can be seen on the print-out and in data transferred to the computer.

Cleaning

The dosemeter, Reader and Keyfob should only be cleaned with a damp, lightly soaped cloth. No solvent-based cleaners should be used as they may damage the dosemeter window or the case labels.

The dosemeter microphone grill must be protected against soiling as blocked grill holes can deteriorate the performance of the unit. Attempting to remove dirt from these holes with sharp implements can damage the sensitive membrane underneath.

The MODEL 22R Reader Unit should be cleaned with a damp cloth only. Ensure that the Infrared port and the Acoustic Calibrator are free from damage and dirt. Do not insert any sharp objects into the Acoustic Calibrator.

Storing the dosemeter

If the dosemeter is left unused for a period of time longer than a few days, it is recommended that the dosemeter be fully charged. This will avoid any potential damage to the internal batteries through unwanted discharge.

If the dosemeter is not used for 1 hour, it will go into Sleep mode to protect the internal battery and to prolong the operating life. To use the dosemeter, the Shake-to-Wake sensor must be activated. Please refer to page 22 for details.

If the dosemeter is left unused, the internal batteries must be left charged. When fully charged and not used, the dosemeter battery will remain charged for at least 14 days. If the unit is stored longer than this and the batteries are left to become totally discharged, THEY WILL EVENTUALLY BE DAMAGED.

To ensure optimum operation, dosemeters that have not been used for one month should be recharged.

To prevent damage please ensure that the dosemeters are recharged every 2 weeks (14 days).

Cycle Charge of the dosemeter battery

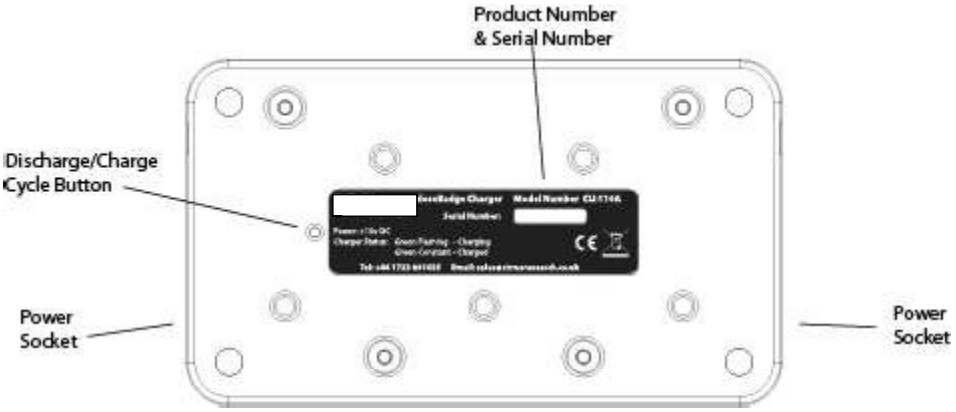
The CHR22 Charger Unit provides a Discharge/Charge cycle that allows the performance of the battery to be kept at an optimum level.

This cycle fully discharges the battery before charging. Please note that this is not the normal operation of the CHR22 Charger Unit.

To carry out this charge cycle, connect the dosemeters to the CHR22 Charger and connect the power supply.

Press the Discharge/Charge cycle button located on the bottom of the charger as shown below.

If you press the button through the hole on the bottom of the charger, it will discharge all badges that are currently connected, then charge them. This can take up to about 3 hours depending on the battery type and initial charge state.



The internal NiMH (Nickel-Metal Hydride) battery, like all rechargeable batteries, will self-discharge. When arranged into a battery the individual cells within the battery, not being identical, will not all discharge at the same rate.

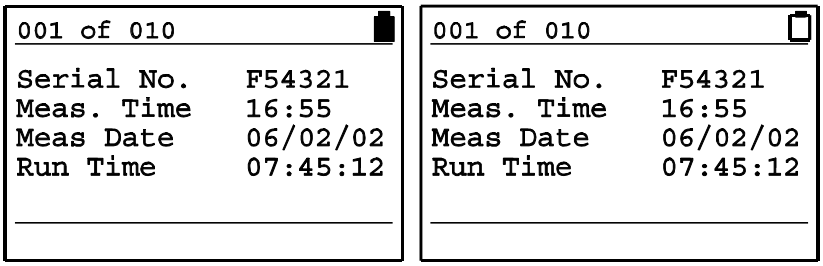
This means that the first cell to discharge may be forced into a 'reverse current' situation by the other cells and will be damaged. If the batteries are simply left discharged, there is no way of preventing this as the discharge is within the cell.

Even if they are removed from the dosemeter the self-discharge will still occur. To prevent this, it is recommended that the dosemeter be charged monthly when not being used for measurements.

If the dosemeters are left on a charger without power, the dosemeters will discharge. To ensure that the dosemeters do not discharge, remove them from the Charger unit when the Charger is not connected to the power supply.

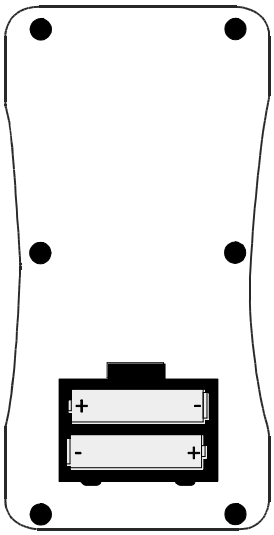
Changing the Reader Batteries

The dosemeter Reader unit shows the battery level in the top right hand corner of the display as shown below. The figure on the left below shows a full battery level and the figure on the right shows the battery level at 10% of the full capacity.



The batteries for the MODEL 22R Reader unit are located under the black cover on the back of the instrument. Before changing the main batteries, ensure that the Reader is switched off.

The memory of the Reader unit is protected when the batteries are removed. The clock of the Reader will be reset after 15 minutes when the batteries are removed.



Remove the battery cover and replace the batteries.

Ensure the correct polarity when replacing the batteries

Locate the battery compartment cover and remove it from the instrument.

Remove the batteries from the Reader unit and replace with batteries of equivalent type and quality.

The battery should be of alkaline type AA (LR6 / AM3 / MN1500 / Mignon).

Ensure that the polarity of the batteries is correct. Replace the battery cover and switch the Reader unit on.

Additional information regarding the calibration of the dosemeter is provided in Appendix 3 dosemeter Calibration on page 63.

Changing the RK1 Keyfob Battery

When the red indicator of the Keyfob becomes dim, the internal battery requires changing.

Carefully remove the small screws on the back of the Keyfob, and lift off the back. Slide the battery out and replace with a Lithium battery type CR2025. This is not a rechargeable battery.

Ensure that the PCB is located correctly within the case and replace the back cover. Replace the two screws and secure the case.

Section 7 Troubleshooting

The following information is designed to solve common problems found when using the dosemeter system. If you cannot solve the problem, please contact your local representative or Pulsar Instruments plc directly. There are no user serviceable parts inside the dosemeter, Reader or Charger.

The MODEL 22 dosemeter

Symptom	Possible Cause	Solution
The dosemeter will not Reset	The dosemeter has not been used for more than 1 hour and is in Sleep Mode	Wake the dosemeter by shaking. Refer to page 22 for details.
	The dosemeter battery is flat	Charge the dosemeter.
	The Infrared window on the dosemeter is not aligned with the Infrared Port on the Reader	Align the Infrared window on the dosemeter with the Infrared Port on the Reader unit.
The dosemeter will not Calibrate	The dosemeter has not been used for more than 1 hour and is in Sleep Mode	Wake the dosemeter by shaking. Refer to page 22 for details.
	The dosemeter battery is flat	Charge the dosemeter and then reset the dosemeter using the Reader Unit.
	The dosemeter is not pushed into the Acoustic Calibrator	Insert the dosemeter into the Acoustic Calibrator cavity on the Reader unit.
	The Infrared window on the dosemeter is not aligned with the Infrared Port on the Reader	Align the Infrared window on the dosemeter with the Infrared Port on the Reader unit.
	The dosemeter and Reader unit have been stored at different temperatures and the calibration offset is outside of acceptable tolerances.	Allow the dosemeter and Reader unit to return to room temperature. This may take up to 30 minutes.
The dosemeter will not Start	The dosemeter has not been used for more than 1 hour and is in Sleep Mode	Wake the dosemeter by shaking. Refer to page 22 for details.
	The dosemeter battery is flat	Charge the dosemeter and then reset the dosemeter using the Reader Unit.
	The Infrared window on the dosemeter is not aligned with the Infrared Port on the Reader	Align the Infrared window on the dosemeter with the Infrared Port on the Reader unit.
	The Reader is too far away from the dosemeter	Move the Reader closer to the dosemeter and retry.
	The communication between the Reader and the dosemeter was not completed	Ensure that the communication between the Reader and dosemeter is completed before moving the Reader unit.

The indicator does not show when the dosemeter is shaken	The dosemeter is already awake	Point the Reader Unit at the dosemeter and press the Stop key. The indicator will flash if the dosemeter is awake.
The dosemeter runs for 1 minute and then stops	The dosemeter was not reset before the measurement was started. The low battery flag is still set in the dosemeter.	Ensure that the dosemeter was Reset before Calibration to clear the low battery flag.
There is no Time History data for the measurement	The Time History setting in the Reader is configured to Off.	Turn the Time History download function on.

The MODEL 22R Reader

Symptom	Possible Cause	Solution
The Reader will not switch on	The Reader Batteries are flat	Replace the batteries in the Reader unit.
The Reader gives an error when Resetting the dosemeter: **"No Badge"**	The dosemeter battery is flat	Charge the dosemeter.
	The Infrared window on the dosemeter is not aligned with the Infrared Port on the Reader	Align the Infrared window on the dosemeter with the Infrared Port on the Reader unit.
	The ambient light is too high and is interfering with the Infra Red Communications.	Avoid using the dosemeter in very bright sunlight. Shield the Infra Red windows from very bright light.
The Reader gives an error when Resetting the dosemeter: **"Not Compatible"**	The dosemeter is a MODEL 20 or a MODEL 20-TH and the configuration is not supported by these units.	Change the configuration to suit the MODEL 20 or MODEL 20-TH dosemeters or use a MODEL 22 dosemeter.
The Reader gives an error when calibrating the dosemeter: **"No Badge"**	The dosemeter battery is flat	Charge the dosemeter.
"Too Low"	The dosemeter is not pushed into the Acoustic Calibrator	Insert the dosemeter into the Acoustic Calibrator cavity on the Reader unit.
	The ambient light is too high and is interfering with the Infra Red Communications.	Avoid using the dosemeter in very bright sunlight. Shield the Infra Red windows from very bright light.
The Reader gives an error when Calibrating the dosemeter: **"Not Compatible"**	The dosemeter is a MODEL 20 or a MODEL 20-TH and the configuration is not supported by these units.	Change the configuration to suit the MODEL 20 or MODEL 20-TH dosemeters or use a MODEL 22 dosemeter.
The Reader gives an error when downloading (Reading) the dosemeter: **"No Badge"**	The dosemeter battery is flat	Charge the dosemeter.
	The Infrared window on the dosemeter is not aligned with the Infrared Port on the Reader	Align the Infrared window on the dosemeter with the Infrared Port on the Reader unit.

	The ambient light is too high and is interfering with the Infra Red Communications.	Avoid using the dosemeter in very bright sunlight. Shield the Infra Red windows from very bright light.
The Reader gives an error when Reading the dosemeter: **"Not Compatible"**	The dosemeter is a MODEL 20 or a MODEL 20-TH and the configuration is not supported by these units.	Change the configuration to suit the MODEL 20 or MODEL 20-TH dosemeters or use a MODEL 22 dosemeter.
There is no Time History data for the measurement	The Time History setting is configured to Off.	Turn on the Time History download option.
"Trace Error"	There has been an error during the download of the Time History Data.	
The Reader will not download to the software	The connection between the Reader and the PC is not correct	Ensure that the cable is connected between the Reader and the PC.
	The Reader is not switched on	Switch on the Reader and try again.
	The AnalyzerPlus software is not running	Run the AnalyzerPlus software from the Programs, Pulsar Instruments, AnalyzerPlus directory and try again.

CHR22 Charger

Symptom	Possible Cause	Solution
The dosemeter will not charge	The power is not connected to the Charger	Ensure that the PS22 Power Supply is connected to a supply and to the Charger unit.
No lights appear on the charger unit	The power is not connected to the Charger	Ensure that the PS22 Power Supply is connected to a supply and to the Charger unit.
	The mains power supply is damaged	Contact your local representative.
The Green charging light does not flash when the dosemeter is connected.	The dosemeter is not properly connected to the charger	Screw the dosemeter fully onto the charger unit.
The charger unit is not charging the dosemeters		Perform a Power-on Self-Test. Press and hold the Discharge/Charge Cycle button and connect the power. Hold the button for 2 seconds. The LED charge indicators will flash in sequence then all of the indicators will show. If the LED charge indicators continue to flash, contact Pulsar Instruments plc or your local representative.

Section 8 Glossary & Terminology

The following section lists the acoustic terminology that is found in this manual and in the MODEL 22 Personal Noise Dosemeter and MODEL 22R Reader unit. For further information, please contact your local representative or Pulsar Instruments plc directly.

Terminology

The dosemeter and Reader can produce the following metrics as defined in the relevant standards. Some of these are available on the Reader display, others require a printer or the computer software supplied.

When the data is downloaded from the MODEL 22R Reader unit to the dosemeter software, the following parameters are provided:

L_{Aeq}

The level which, if maintained constant for the same period as the measurement, would contain the same amount of energy as the fluctuating noise level. "A" weighted and expressed in decibels (dBA). Doubling the energy results in a 3dB change in the L_{eq}. This is denoted by Q=3. The Threshold used in the calculation of L_{AVG} (see below) is not used for the calculation of L_{Aeq}.

For example:

If the noise level in a factory was a constant 85dB and the measurement period was 4 hours, the L_{Aeq} would be 85dB(A).

L_{AVG}

L_{AVG} is the average Sound Level over the measurement period when the exchange rate (Q) is other than 3dB or where there is a Threshold applied or a Time Weighting applied.

L_{AVG} is the equivalent of L_{eq} for exchange rates other than 3dB, for example Q=5. The Threshold value is used during the calculation of L_{AVG} with any levels below the threshold not being included.

For example:

Assume the threshold level is set to 80dB and the exchange rate is 5dB (which are the settings for OSHA's Hearing Conservation Amendment). If a one hour measurement was taken in an environment where the noise levels varied between 50dB and 70dB, the sound level would never exceed the threshold level and the instrument would record no value for the L_{AVG}. If the sound level exceeded the 80dB threshold for only a few seconds, then only these seconds would contribute to the L_{AVG} giving a level of around 40dB which is much lower than the actual ambient sound levels in the environment.

$L_{EP,d}$

The $L_{EP,d}$ is the average of the measured L_{eq} over an eight hour period. The $L_{EP,d}$ will be lower than the L_{eq} when the measurement duration is less than eight hours, equal to the L_{eq} for a measurement of eight hours, and higher than the L_{eq} for measurements over eight hours.

For example:

If a noise measurement was made for 4 hours and the L_{Aeq} value was 90dB(A), the $L_{EP,d}$ value would be calculated to be 87dB(A) as the measurement duration is half the Criterion Time of 8 hours and the exchange rate is 3dB.

$L_{EX,8h}$

Under the EU Physical Agents (Noise) Directive which was introduced in member states of the EU in February 2006, the terminology for the Daily Personal Noise Level or $L_{EP,d}$ has been changed to be $L_{EX,8h}$. The calculation is the same and the data is calculated from the LAeq and Measurement Duration in the same way as for $L_{EP,d}$.

TWA

The Time Weighted Average is the average of the measured L_{AVG} over an eight hour period. The TWA will be lower than the L_{AVG} when the measurement duration is less than eight hours, equal to the L_{AVG} for a measurement of eight hours, and higher than the L_{AVG} for measurements over eight hours.

% Dose

A percentage of a fixed dose value based on the criterion level and criterion time. The criterion level and time are set by local standards.

For example, some Regulations may mandate the use of 85dB for 8 hours as the limit for a daily noise exposure. If the noise level was a constant 85dB for 8 hours, this would generate a % Dose of 100%.

Estimated Dose

Estimates the % dose (described above) that would have been received by the wearer if the average level measured had existed for the period defined by the criterion time.

For example, if for a 4 hour measurement the % Dose was 50%, the Estimated Dose would be 100% for the 8 hours of the Criterion Time.

Exposure (Pa^2s, Pa^2hr)

The noise exposure expressed in linear terms rather than using the logarithmic dB unit or % dose. Expressed in Pascal squared hours (Pa^2hr) or Pascal squared seconds (Pa^2s).

Estimated Exposure

Estimates the exposure (described above) that would have been received by the wearer if the average level measured had existed for the period defined by the criterion time. Expressed in Pascal squared hours (Pa^2hr).

L_{AE} or SEL

The level which, if maintained constant for a period of 1 second would have the same sound energy as that actually received by the dosemeter during the measurement period. For example, if the measurement duration was 8 hours and the L_{eq} was 85dB(A), the L_{AE} would represent all of the noise energy over the 8 hour period 'squashed' into a duration of 1 second. L_{AE} is the same as SEL (Sound Exposure Level)

Threshold

Sound Levels below the threshold are excluded from all averaging.

For example, OSHA measurements use an 80dB threshold and call for a hearing conservation program to be implemented when the eight hour TWA exceeds 85dB (50% dose).

Criterion Level (CL)

In dB, the normalised eight hour average weighted sound level corresponds to the maximum permitted daily exposure or 100% noise dose.

Criterion Time (CT)

The time, in hours, used in the calculation of the % Dose and Estimated % Dose measurement parameters. By default, this is set to 8 hours but can be configured to other durations in the Reader unit.

Peak

The true peak level of the pressure wave (not the highest sound pressure level which is termed the L_{max}). The MODEL 22 dosemeter measures the true Peak level.

Overload

Indicated when the noise level exceeds the upper design limit of an instrument. In the dosemeter this is set to 130dB(A) Sound Level.

Glossary

A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise
Acoustic Calibrator	An instrument that provides a reference noise source that is used to calibrate and check the performance of a Sound Level Meter
ANSI S1.25:1991	The American (US) Standard for Personal Sound Exposure Meters (PSEM)

C Weighting	A standard weighting of the audible frequencies used for the measurement of Peak Sound Pressure level
CE Marking	A label used to show that the Sound Level Meter conforms to the specification of a European Directive
dB(A)	Decibels 'A' weighted
dB(C)	Decibels 'C' weighted
Decibel (dB)	The unit of sound level and noise exposure measurement
Fast Time Weighting	A standard time weighting applied by the Sound Level Meter
IEC 61252:1993	The International Standard for Personal Sound Exposure Meters (PSEM)
Integrating Averaging Sound Level Meter	A Sound Level Meter which accumulates the total sound energy over a measurement period and calculates an average
L_{AE}	Sound Exposure Level (SEL) with 'A' frequency weighting
$L_{Aeq,t}$	Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB with 'A' weighting
L_{AS}	Sound level with 'A' Frequency weighting and Slow Time weighting
L_{ASmax}	The maximum Sound level with 'A' Frequency weighting and Slow Time weighting
L_{Cpeak}	Peak Sound pressure level with 'C' frequency weighting
$L_{EP,d}$	Daily personal noise exposure as defined by ISO 1999. This is the $L_{Aeq,t}$ normalised over an 8 hour reference period. $L_{EP,d}$ assumes that the noise level for the rest of the 8 hour reference period is "quiet"
L_{eq}	Equivalent continuous sound pressure level. A measure of the average sound pressure level during a period of time, t, in dB
Overload	The input to the Sound Level Meter is too high for the current measurement range. Change the range
Peak	The maximum value reached by the sound pressure at any instant during a measurement period (in dB usually with C frequency weighting)
Personal Sound Exposure Meter	An instrument for measuring the noise exposure of a person
SEL	Sound Exposure Level, displayed as L_{AE}
Slow Time Weighting	

	A standard time weighting applied by the Noise Measurement Instrument
Sound Level	Sound Pressure Level with a Frequency weighting, such as dB(A)
SPL	Sound Pressure Level, the basic measure of noise loudness, expressed in decibels
Time History	A sample of the noise levels taken every 1 minute throughout the measurement period.
Type 1	Laboratory & Field Grade for Sound Level Meters. Personal Noise Dosemeters to the IEC 61252 Standard do not have a Class or Type
Type 2	General Field Grade for Sound Level Meters. Personal Noise Dosemeters to the IEC 61252 Standard do not have a Class or Type
TWA	Time Weighted Average. The daily personal exposure level calculated from the L_{AVG} and the measurement duration. TWA replaces $L_{EP,d}$ in the OSHA Q=5 version of the dosemeter
L_{AVG}	The continuous A weighted sound level measured over the measurement period with an exchange rate of 5dB. L_{AVG} replaces Leq in the OSHA Q=5 version of the dosemeter
% Dose	The noise level measured expressed as a percentage of a fixed level. For example, the reference 100% level would be a continuous level of 90dB for 8 hours. The Criterion Time (CT) and Criterion Level (CL) are used for the 8 hours and 90dB level
% Estimated Dose	The % Dose projected forward over an 8 hour duration, assuming that the noise level continued at the same level for the rest of the 8 hour reference period. The Criterion Time (CT) and Criterion Level (CL) are used for the 8 hours and 90dB level
Exposure in Pa^2hr	The noise level measured expressed in as a linear term in Pa^2hr (Pascal Squared Hours). For example, a noise level of 94dB for 4 hours would be $1Pa^2$ x 4 hours (94dB = 1Pa) giving an Exposure of 4 Pa^2hr. The 8 hour period is taken from the Criterion Time (CT)
Estimated Exposure in Pa^2hr	The Noise Exposure above projected forward over an 8 hour duration, assuming that the noise level continued at the same level for the rest of the 8 hour period. The 8 hour period is taken from the Criterion Time (CT)

Appendix 1 Specifications

The MODEL 22 Personal Noise Dosemeter and the MODEL 22R Reader Unit have been designed to meet the requirements of IEC 61252:1993 Personal Sound Exposure Meters and the ANSI S1.25:1991 Personal Noise Dosemeters. The MODEL 22 dosemeter and the MODEL 22R Reader unit must be used as a combination to ensure compliance with these standards.

Applicable Standards

MODEL 22 dosemeter
IEC 61252:1993 Personal Sound Exposure Meters
ANSI S1.25:1991 Personal Noise Dosemeters Class Designation 2AS-90/80-5

Model 22-R Reader Unit
Internal Acoustic Calibrator to IEC 60942:2003 Class 2

Measurement Range (Typical)

70dB(A) to 130dB(A) RMS
120dB(C) to 140dB(C) Peak

Measurement Functions:

The MODEL 22 dosemeter and MODEL 22R Reader Unit support Dual Channel measurements. The measurement data is divided into three sections. In all situations the Overall Measurement Data is stored.

If the dosemeter is configured with Channel 1 and Channel 2 having identical parameters, the Pulsar AnalyzerPlus software will only display Channel 1.

Overall Measurement Data:
Dosemeter Configuration
Calibration Record
Measurement Duration
Highest Peak(C) Sound Level
Overload Exceedence
115dB(A) Maximum Sound Level Exceedence
Battery Status

Channel 1 Measurement Data

For 3dB Exchange Rate:
L_{Aeq}, $L_{EX,8h}$, L_{AE}, % Dose, Exposure (Pa^2h)
Estimated % Dose, Estimated Exposure (Pa^2h)

For 4dB & 5dB Exchange Rates (and configurations with Time Weighting or Threshold):
L_{AVG}, TWA, % Dose, Estimated % Dose
1 Minute Time History of:
- L_{Aeq} (3dB) or L_{AVG} (4dB or 5dB)
- Peak(C) Level
- Battery Level

Channel 2 Measurement Data

L_{Aeq}, $L_{EX,8h}$, L_{AE}, % Dose, Exposure (Pa^2h)
Estimated % Dose, Estimated Exposure (Pa^2h)

Memory

The MODEL 22R Reader Unit can store the following measurement data:

With 8 hours of 1 minute Time History
Up to 93 measurements
With 12 hours of 1 minute Time History
Up to 64 measurements
With 24 hours of 1 minute Time History
Up to 33 measurements

Weightings

Frequency	'A' for all Sound Level measurements. 'C' for Peak Sound Pressure
Time	None or Slow

Exchange Rate

3dB, 4dB or 5dB

dosemeter Configuration

Channel 1: Independent User Configuration of:

Exchange Rate
3dB, 4dB or 5dB
Criterion Level
80dB, 85dB, 87dB, 90dB, 95dB
Criterion Time
8hrs, 12hrs, 16hrs, 18hrs
Threshold
None, 80dB, 85dB, 90dB
Time Weighting
None, 'S' (Slow)

Channel 2: Preset to:

Exchange Rate
3dB
Criterion Level
85dB
Criterion Time
8hrs
Threshold
None
Time Weighting
None

Power

MODEL 22 dosemeter
Internal NiMH Battery with intelligent charging system

MODEL 22R Reader
2 x AA/LR6

CU Series Chargers
PS22 Mains Power Supply

Memory Backup	The memory of the MODEL 22R Reader is protected when the main batteries are removed.

Calibration

Internal Acoustic Calibrator to IEC 60942:2003 Class 2

Calibration Level	114dB
Calibration Frequency	1kHz

Output

dosemeter	Infrared to MODEL 22R Reader unit
Reader	USB2.0

Dimensions

dosemeter	Microphone Apex 13.0mm, Base 47mm, Height 38mm
MODEL 22R Reader	160mm x 80mm x 38mm

Environmental

Temperature	-10°C to +50°C Operating -20°C to +60°C Storage
Humidity	Up to 99% RH Non-Condensing

Weight

MODEL 22	45 gms (1.6oz)
MODEL 22R Reader	400 gms (14oz)

Software

The Pulsar AnalyzerPlus download program supplied as standard. Compatible with Microsoft Windows XP SP3 or later.

Appendix 2 Ordering Information

The dosemeter measurement kits can be ordered with standard numbers of dosemeters.

Number of dosemeters	Standard Measurement Kit
1	Model 22-1 dosemeter measurement system
2	Model 22-2 dosemeter measurement system
5	Model 22-5 dosemeter measurement system
10	Model 22-10 dosemeter measurement system

Additional or spare components can be added to a system. The following components are available:

MODEL 22	dosemeter
MODEL 22R	Reader unit
PS22	Mains Power Supply. (Specify UK, EU or USA Standard Plug)
WS22	dosemeter Windshield
SM1	Mounting Kit for dosemeter
RK1	Keyfob Remote Control
K3	Carrying Case for dosemeter System
CHR22	5 way dosemeter Charger
	Pulsar AnalyzerPlus software

Appendix 3 dosemeter Calibration

As with all noise instruments, calibration is an essential part of the process of making a measurement and helps to ensure that your measurements are accurate and valid. It also helps to ensure that your equipment is operating correctly.

When calibrating your noise measurement instruments, you should always follow the instructions and information provided by the manufacturer.

This section provides detailed information regarding the calibration of the dosemeter system.

First Calibration

The initial calibration of the dosemeter, after the unit has been reset by the MODEL 22R Reader, is the only one that affects the measurement data.

The second calibration, which is made after the measurement had been completed, is a check that the calibration level is within acceptable tolerances.

Resetting the dosemeter prepares it for a new measurement by clearing all previous data, ensuring the time and date are correct, setting the required measurement parameters and clearing any previous calibration offsets or corrections.

The first calibration is conducted by applying a fixed sound pressure level of 114dB to the dosemeter from the MODEL 22R Reader, internally reading the levels reported by the dosemeter and then storing a calibration offset within the dosemeter.

This calibration offset is subsequently used by the Reader to correct the data measured. There is no user requirement to apply this offset as it is applied automatically by the dosemeter.

All the data reported by the Reader and the Pulsar AnalyzerPlus software is already corrected and no further corrections or adjustments are needed.

Calibration offsets between +/-0.3dB are accepted within the dosemeter.

Second Calibration

Once the first calibration has been carried out, any subsequent calibration will follow the same process expect that a new calibration offset is not stored nor applied.

Subsequent calibrations are checks only and do not affect the measurement data (only the calibration offset from the first calibration is applied).

The Reader device reports subsequent calibrations as a 'drift'.

The drift is considered to be the difference between the actual calibration offset (from the first calibration) and the notional offset from subsequent calibration checks.

There is no limit to the amount of drift reported by the second calibration.

For example:

First Calibration

Level of Reader calibrator = 114.0dB

1st calibration level reported to Reader by dosemeter = 114.1dB.

Calibration Offset = -0.1dB. (114.0 – 114.1)

The Reader will correct all data from this dosemeter by -0,1dB until the next time that the dosemeter is reset and recalibrated.

Second Calibration

Level of Reader calibrator = 114.0dB

2nd calibration level reported to Reader by dosemeter = 113.9dB.

Drift = 0.2dB. (114.1dB – 113.9dB)

The Reader will correct all data from this dosemeter by -0.1dB until the dosemeter is reset.

Second Calibration and Drift

In most applications, drifts of between +/-0.5dB are acceptable; that is that the second calibration check differs from the first calibration results by up to +/-0.5dB.

Drift can occur for a number of reasons, some of which are:

1. A temperature change between the 1st and 2nd calibration in either the dosemeter or Reader.
2. A barometric pressure change between the 1st and 2nd calibration in either the dosemeter or Reader.
3. A relative humidity change between the 1st and 2nd calibration in either the dosemeter or Reader.
4. Battery level in the dosemeter.

The dosemeter Reader contains an acoustic calibrator and sensors which compensate for temperature, pressure and humidity. This ensures that the calibration level provided by the Reader unit is consistent.

However the dosemeter may not be at the same temperature, pressure or humidity as the Reader at the point of calibration.

It is important that both the dosemeter and Reader are left together, in the same environment, for a period of at least 30 minutes prior to calibration.

This allows the temperature of both the Reader and the dosemeter to stabilise.

Recommended calibration procedure

The recommended process for both first and second calibrations is as follows:

1. Charge the dosemeter battery using the CHR22 charger in the same vicinity as the MODEL 22R Reader.

2. Once fully charged, remove the dosemeter from the CHR22 charger for a period of roughly 5 to 10 minutes.

3. Calibrate the dosemeter using the MODEL 22R Reader.

4. Carry out the measurement.

5. Stop the dosemeter.

6. Charge the dosemeter before carrying out the second calibration and downloading the measurement data.

If the recommended battery recharge cannot be conducted after a long measurement then leave the dosemeter in the same environment as the Reader for at least 30 minutes so that both units are stable and matched for environmental conditions.

Appendix 4 Resetting the dosemeter and Reader Unit

Resetting the dosemeter

If, in the event that the dosemeter does not respond correctly to commands from the Reader Unit and if all of the troubleshooting steps have been followed, this reset procedure can be followed.

This procedure should only be followed if the MODEL 22 dosemeter does not respond to commands from the MODEL 22R Reader Unit. Please ensure that all of the troubleshooting listed above has been followed before carrying out this procedure.

In particular, ensure that the section covering the Shake-to-Wake function has been read and understood.

Please contact Pulsar Instruments plc or your local distributor for further details.

The purpose of this procedure is to perform a hard reset on a MODEL 22 (dosemeter). This procedure should only be followed, if you have been instructed to do so by Pulsar Instruments, on an individual unit.

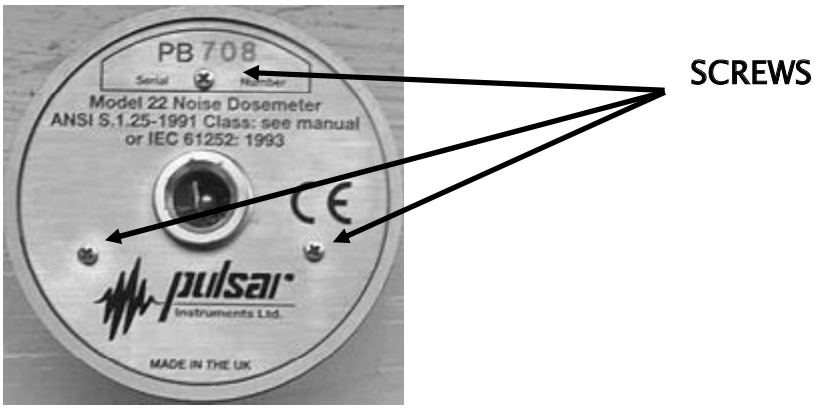
The actions described in this procedure should not erase any data from your dosemeter unit, but Pulsar Instruments plc do not take any responsibility for loss of data or any damage that occurs to your dosemeter from following this procedure.

Please fully read and make sure you understand the whole procedure before starting it. If you do not feel confident about following the procedure, please do not attempt it!

Warnings

This symbol is used throughout this procedure to indicate that special attention should be taken and any instructions followed carefully.

1. With a small, high quality Philips PH00 screwdriver remove the three screws from the base of the dosemeter.

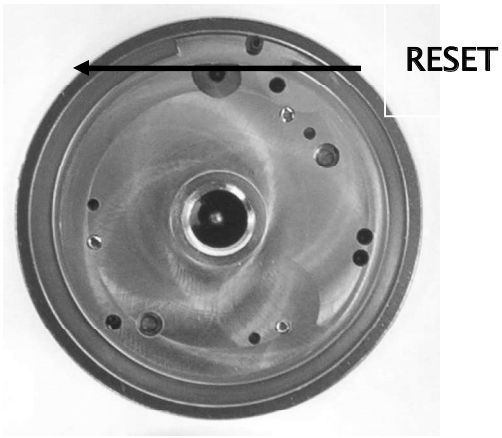


2. Place the metal label and three screws to one side.

These screws are extremely small and easily lost. Please place them in small container or similar.

3. Take a thin small metal object (a pin or bent open paperclip is ideal) and insert it into the hole highlighted blue in the picture below.

Care must be taken to insure that it is the correct hole. Use the locating pin in the case and the notch in the baseplate as a reference.



4. Move the metal object in the hole until you see the Blue LED flash through the optical window on the dosemeter. What you are trying to do with the metal object is connect the pin directly below the hole with the silver metal baseplate.

5. Insert the dosemeter into the calibrator cavity on the top of your dosemeter reader. Test the dosemeter is now communicating.

6. Place the metal label back onto the bottom of the dosemeter. Rotate the label until all three holes are lined up.

Care must be taken lining up the three holes. If all three holes are not lined up, rotate the metal label further. Inserting a screw into the incorrect hole could seriously damage your dosemeter!

7. Carefully place the three small screws through the holes in the metal label and screw them into the baseplate.

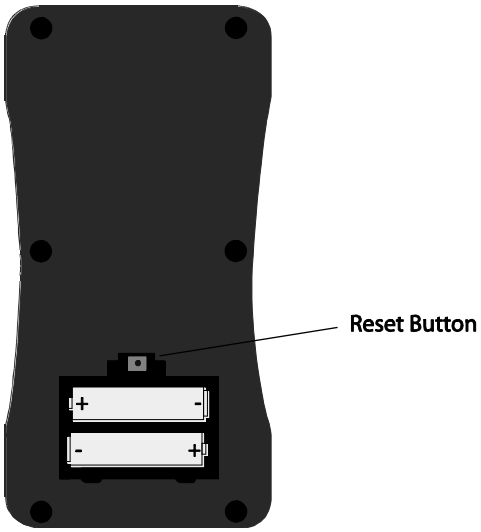
DO NOT over tighten the three small screws as damage to their heads will occur.

8. Place the dosemeter onto a CHR22 charger, and allow the dosemeter to go through a full charge cycle before using.

Resetting the MODEL 22R Reader Unit

The MODEL 22R Reader Unit can be reset to the factory settings by pressing the Reset Button that is located within the Battery Compartment on the back of the Reader Unit.

Please note that this reset procedure will not clear the memory, and will only reset the internal microprocessor of the Reader unit. This may be required if the Reader unit has been stored without batteries for a long period of time and the internal backup battery is discharged.



Appendix 5 EU Declaration of Conformity

Pulsar Instruments plc – Hunmanby, UK
EU Declaration of Conformity

CE

Manufacturer: Pulsar Instruments plc
Evron Centre, John Street
Filey, North Yorkshire, YO14 9DW
United Kingdom
Telephone +44 1723 518011

Equipment Description

The following equipment manufactured after 1st January 2006:

MODEL 22R dosemeter Reader Unit
MODEL 22 Personal Noise Dosemeter
RK1 Keyfob Remote Control Unit
CHR22 Charger Unit

Along with their standard accessories

According to EMC Directive 2014/30/EU
According to Low Voltage Directive 2014/35/EU

meet the following standards:

EN 61000-6-3 (2007)
EMC: Generic emission standard for residential, commercial and light industrial environments.

EN 61000-6-1 (2007)
EMC: Generic immunity standard for residential, commercial and light industrial environments.

EN 61252: 1997/A1:2001
Electroacoustics Specification for personal sound exposure meters.

Signed Dated 5th September 2017

Engineering Director

Warranty Information.

1. This document is a summary of the full warranty document and explains the Pulsar Instruments plc warranty in ordinary English; not in legal or complex terms.
2. The warranty covers any acoustic instrument such as a sound level meter, acoustic calibrator, real time acoustic analyser or personal sound exposure meter (dosemeter) manufactured by Pulsar Instruments plc after September 1st 2011.
3. The warranty covers all faults on, and minor accidental damage to, the instrument except the microphone capsule for the period defined in para (5) below.
4. Minor accidental damage does not include blatant mis-use, damage caused by the use of any accessories or components not specified or recommended by Pulsar Instruments, damage caused through non-Pulsar Instruments modification, continued use outside of Pulsar Instruments' recommended procedure or conditions or use contrary to the any advice provided by Pulsar Instruments.
5. The initial period of the warranty is 2 (two) years or 104 weeks from the date of purchase as a new instrument from Pulsar Instruments plc or their formally approved distributors OR 130 weeks from the date the instrument passed its final manufacturing inspection at Pulsar Instruments plc - whichever is the shorter.
6. A shorter 1 (one) year or 52 week warranty is offered for used, ex-demo or ex-rental equipment unless a special arrangement is made and a written confirmation of the special warranty is given by Pulsar Instruments plc.
7. Any rechargeable battery only has the battery manufacturer's one year warranty, however the battery will be replaced during the annual "Traceable Calibration."
8. On completion of the annual "Traceable Calibration" by Pulsar Instruments plc, or an official Pulsar Instruments Calibration Centre, the instrument will automatically be given an additional free one year warranty.
9. It follows that should the instrument be calibrated by Pulsar Instruments plc, or an official Pulsar Instruments Calibration Centre every year, the warranty is effectively continuous to a maximum of 15 (fifteen) years from the date of purchase.
10. There will be a charge for this "Traceable Calibration" and the price is published in the Calibration Price List. The customer is responsible for all shipping, duty and other charges relating to the annual "Traceable Calibration".
11. Where a repair service is conducted under warranty, Pulsar Instruments plc will cover the shipping, duty and other costs relating to the repair of the instrument.
12. Pulsar Instruments endeavours to ensure stocks of instrument components for the full fifteen year period but do not guarantee to do so as certain components do become obsolete or discontinued.
13. If a sub-component becomes obsolete and stocks are depleted then Pulsar Instruments will endeavour to facilitate a repair but will not offer the same length warranty.
14. In the event of any dispute on the terms of the warranty Pulsar Instruments plc will accept pendulum arbitration by the United Kingdom's Institute of Acoustics Ltd.
15. The warranty does not in any way reduce any legal right of the buyer or user of the sound level meter; it is in addition to all legal rights determined by the European Union.
16. Pulsar Instruments plc reserves the right to amend or update these terms and conditions without prior notice.

Pulsar Instruments Offices

The address given below is the Pulsar Instruments plc head office. Pulsar Instruments plc also have approved distributors and agents is many countries worldwide. For details of your local representative, please contact Pulsar Instruments plc at the address below.
Website at the address shown below.

Pulsar Instruments plc
Unit 2
Hunmanby Industrial Estate
Hunmanby
YO14 0PH
United Kingdom

Telephone: +44 (0)1723 339715

Email: sales@pulsarinstruments.com
Website: www.pulsarinstruments.com