

765 & 765C
ENVIRONMENTAL MONITOR
Firmware V6+

USER MANUAL



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CONTENTS

INTRODUCTION.....	1
BASIC OPERATION	2
Set Button	2
Firmware and Hardware	3
Updating Firmware.....	4
UNITS OF MEASUREMENT	5
Ultra-Violet (UV).....	5
Visible Light.....	5
Temperature, Humidex & Heat Index.....	6
Humidity	7
Atmospheric Pressure.....	7
DISPLAY	8
CLOCK.....	8
Setting the Time.....	8
Setting the Date	8
Date Format.....	8
Hiding the Clock.....	8
DATA LOGGING	9
Data Storage and Download.....	9
Storage Capacity	10
Show Status.....	10
Start Logging.....	10
Stop Logging.....	11
Format	11
Erase	11
Viewing the Results using RView.....	11
Data Format.....	12
Batteries	13
Non Standard Batteries.....	13
Charger.....	13
Charging	14
Battery Life.....	14
CALIBRATION	14
Humidity.....	14
Humidity Test Kit.....	15
Temperature	16
UV & Visible Light	16
MAINTENANCE	17
Long term storage.....	17
USA FCC Radio interference statement	17
SERVICE AND SUPPORT.....	18
SPECIFICATIONS	19

INTRODUCTION

One of the primary responsibilities of the custodian of artworks and museum artefacts is to preserve them for future generations. How they are stored and displayed is central to this, the 765 Environmental Monitor is an easy to use tool to help in achieving the safest long term protection.

For many years it has been recognised that one of the major causes of damage to museum objects and other antiquities is the fading and rotting effect of light on the object. The most damaging part of the illumination is its ultraviolet (UV) content.

Using the 765 measurements can be taken of the proportion of UV present as microwatts per lumen ($\mu\text{W}/\text{lumen}$), the total amount of UV as milliwatts per square meter (mW/M^2) and the amount of visible light present (Lux).

Most objects are also sensitive to humidity and temperature. The 765 also measures humidity as % relative humidity and temperature as $^{\circ}\text{C}$ or $^{\circ}\text{F}$.

The 765C logging version can be left for extended periods to log the above parameters at a user set interval (10 seconds to 1 hour). The saved data can then be transferred to a computer for display, graphing etc.

We always want to improve our products. If you have any suggestions please send them to us.

BASIC OPERATION

To take a reading the appropriate yellow button is pushed depending on the measurement required and the reading is taken.

UV= Ultra Violet ($\mu\text{W}/\text{lumen}$ or mW/M^2)

Vis= Visible light (Lux or Foot-candles)

T= Temperature (Centigrade or Fahrenheit)

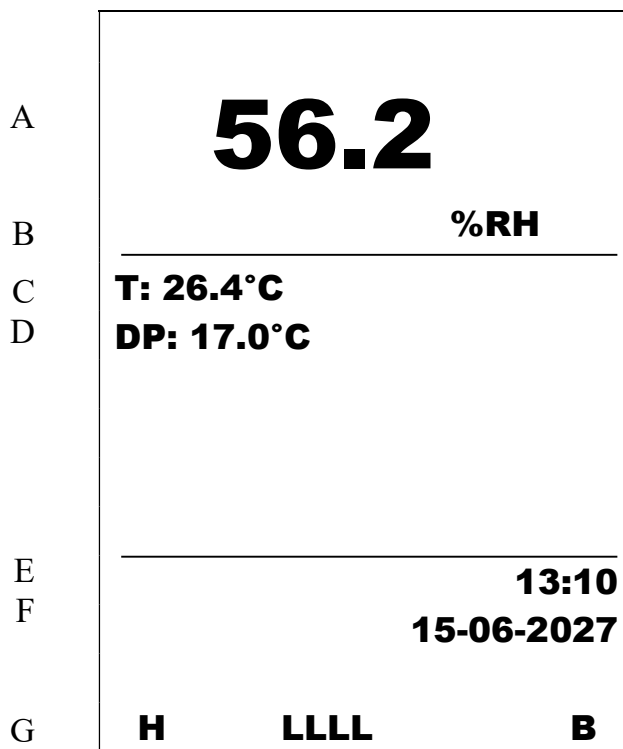
RH= Humidity (%Relative Humidity)

The unit automatically turns off 20 seconds after the button is released unless a button is held down for over 3 seconds, this will cause readings to be taken continuously until a button is pressed again.

If the T and UV buttons are pressed together then all parameters are displayed at the same time. Hold both the buttons down for over 3 seconds for a continuous readout.

RH & T pressed together shows atmospheric pressure and other information (see below). This only works with later models (Hardware version greater than 13).

Typical display:



- A: Current reading
- B: Units of measurement
- C: Subsidiary reading (Current temperature)
- D: Subsidiary reading (DP = Dew Point)
- E: Current time (24 hour clock)
- F: Current date

G: **H** shows that the reading is “Held” and the unit will turn itself off after 10 seconds of inactivity. A round blob “●” shows the unit is in continuous reading mode until a button is pushed, nothing here means that a single reading is being taken.

The **LLLL** indicates the number of records that have been stored when logging is in operation.

A battery level gauge appears at **B**, if the unit is charging the charge current is shown (mA)

The above format is slightly different for some parameters and can be altered by the user if required, see below.

The current time and date can be hidden by pressing Set\Clock\Hide-Unhide.

Set Button

The blue Set button is used to access advanced functions, change units etc. If it is pushed once a menu similar to that below is shown:



The first menu item “Show” is highlighted, different menu items can be highlighted using the **↑** and **↓** buttons. The wanted action is done by highlighting the appropriate menu item and pressing the **Set** button. To abort without doing anything press the **X** button. In some cases a further sub-menu is displayed with more choices.

Elsewhere in this manual directions in the form Set\item1\item2 are given. This means Press Set, select item1 in the first menu, press Set again, select item2 in the next menu and press Set.

To take a measurement without having to look at the display while the reading is taken (for example where the operators head may affect the reading) proceed as follows:

1. Position the monitor where the reading is to be taken.
2. Push the appropriate button for 1-2 seconds and release.
3. Hold the monitor in position for at least 2 seconds.
4. Without operating any buttons by mistake move the monitor so the reading can be noted before it turns itself off.

Firmware and Hardware

The unit firmware is the embedded computer program that controls the unit. The firmware is updated periodically to add additional features and to correct any faults that have become apparent. Any unit's firmware is updated at the factory whenever it is returned for calibration/repair.

The hardware is the physical unit itself including the electronic circuit inside.

When the unit is turned on (or select set>About) the model type etc is shown.

The firmware version is displayed as "F.f", with the hardware version beneath, eg "P523-05"

Updating Firmware

The 765 can update its internal firmware from a file supplied by the manufacturer. This enables program bugs to be fixed and new functions to be installed without returning the unit. An update file is named similar to “76x Va-b.bin” where Va-b is the firmware version. The file is encrypted and no unofficial update file from any third party will be accepted by the unit. Update files are available for download from the manufacturer’s web site www.elsec.com.

The update process is robust but do this with care. If the procedure is interrupted at the wrong time (eg by power failure, dropping the unit etc) it may get confused and not work at all. If this happens, try taking the batteries out for 10 seconds or so and replace them. If that does not help leave the batteries out, it will have to be returned to the manufacturer for firmware re-installation and recalibration. Note that we have not seen this happen, but it is a theoretical possibility.

Make sure you are installing an update version that is greater than the one installed on the unit.

To install a firmware update:

- Make sure the unit is charged
- Turn on and connect the unit to the computer USB port. The flash drive will be detected by the computer and be shown in Finder/File explorer
- Copy the update file into the 765 flash drive. One way to do this would be to drag the file onto the flash drive icon. The copying process may take 20-30 seconds.
- Using the computer rename the file copied to the 765 flash drive to “76.bin”. This action is included to make it difficult to do the update by mistake. Think of this as a “are you sure” step.
- Unplug the USB cable from the unit.
- Select Setup\Update. The update is installed and if no problems are encountered “Done OK” is displayed. If any errors are encountered the update is not done.
- Allow the unit to turn off. The next time it is turned on the new firmware will be used.
- The update file is normally deleted from the unit. Do this manually if it is not.

UNITS OF MEASUREMENT

Ultra-Violet (UV)

Traditionally UV has been measured in museums as the proportion of ultraviolet present. This result is useful for checking a particular lamp or window because the proportion of UV does not change rapidly with the distance from the light source. Using a simple rule the amount of UV on an object can be limited. It is usual to arrange that the proportion of UV should not exceed 75 μ W/lumen in museums and galleries, though some organisations try to keep UV levels below 25 μ W/lumen

The damage is done by the total amount of UV falling on the object so it is useful to be able to measure this directly, especially if non standard amounts of illumination are required. The amount of UV should be as little as possible but in general should not exceed 20mW/M², again some organisations keep the level below 6mW/M².

Both the above units are displayed when the UV button is pressed, one in large characters, the other smaller at the bottom of the screen. Which is displayed where can be swapped by pressing Set\Units\UV

When measuring low levels of UV the 765 can take up to 5 seconds to take the reading. So, to get a reasonably quick response, when initially turned on, the unit only measures for one second and if UV levels are low this will show as zero. If the "UV" button is pushed again the full 5 seconds is allowed for the measurement and if a low level of UV is present it will be detected and displayed.

Visible Light

This can be displayed either in Lux or Foot-candles. To change the units press Set\Units\Light

A visible light readout is provided to control illumination and limit damage done by visible light. Normal museum light levels should be limited to 150-250 Lux.

Once measurements have been made the light level can be altered if necessary and UV filters can be fitted on windows, fluorescent tubes or other UV producing light sources as required. These filters often deteriorate over a period of years so it is essential to re-check them periodically.

Suggested light levels for various purposes are given below:

Corridor, stairs etc	100/150 Lux
Warehouses, storage bays	100/150 Lux
General office work	300/500 Lux
Rough bench/machine work	300/500 Lux
Medium bench/machine work	500/700 Lux
Drawing offices	750/1000 lux
Fine bench work	1000/1500 Lux
Fine inspection	1500/3000 Lux
Minute work	3000/5000 Lux

Temperature, Humidex & Heat Index

Temperature can be measured in degrees Centigrade or Fahrenheit. To change the units, press `Set\Units\Temperature`.

Humidex & Heat Index

In hot weather conditions the 765 displays values for the Humidex (Hmdx) and the Heat Index (HI). These are index numbers used by meteorologists to describe how hot the weather feels to the average person by combining the effect of heat and humidity. Heat Index is normally used in USA, Humidex in Canada. These are displayed when the T button is pressed, but only if the temperature is high enough and the calculation is valid. The 765 can display warning messages if the heat index is above certain values, this can be enabled by selecting `Set\Units\Temperature\HI Warnings`. The warning levels come from the US Government Weather Service web site:
<https://www.weather.gov/ama/heatindex>

Warning Message	Heat Index		Effect on the body
	°C	°F	
Caution	27-32	80-90	Fatigue possible with prolonged exposure and/or physical activity
+Caution	32-39	90-103	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	39-51	103-124	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
+Danger+	52	125+	Heat stroke highly likely

The heat index calculation is accurate to $\pm 0.7^{\circ}\text{C}$ ($\pm 1.3^{\circ}\text{F}$) in shade.

In sunlight the heat index can be 13°C (15°F) higher.

Humidity

Humidity is measured as % relative humidity (%RH). This is the fraction of the maximum amount of water that the air can hold at the current temperature and pressure.

In general if the temperature is reduced the amount of water it can hold gets less. So if the temperature of some air is reduced its humidity rises, and at some point the air will not be able to hold the water it has and water will start to condense out (form mist/cloud or drops of water on a surface), the relative humidity has reached 100%. The temperature at which this happens is the dewpoint. The 765 displays the dewpoint with the humidity.

The temperature/dewpoint difference is often used as a measure of the likelihood of condensation (fog) occurring, particularly in meteorology. If the temperature is only one or two degrees above the dewpoint in the evening then fog is likely as the temperature falls during the night.

The UK National Trust tries to keep the indoor relative humidity between 50% and 65%, aiming for 58%.

Also shown in later versions of the 765 with a pressure sensor is the Absolute Humidity in g/m^3

Atmospheric Pressure

Later versions of the 765 (V13 hardware or greater) have a pressure sensor. The values for this are displayed by pressing the RH and T buttons at the same time. The main reading is the atmospheric pressure in Hectopascals (hPa).

Shown below this are:

- Temperature (T)

- Relative humidity (RH)

- Local air density (kg/m^3)

- Density altitude in feet (DA)

DISPLAY

Invert

The display can be shown upside down by pressing Set\Display\Invert. To make it the normal way up again press Set\Display\Invert again.

CLOCK

The 765 has a built in clock, this is used for Data Logging.

Setting the Time

To set the time proceed as follows, the procedure can be abandoned at any time by pressing the X button:

1. Press Set\Clock\Set time. The display shows the current time with the hours highlighted.
2. Use **↑** and **↓** buttons to adjust the hours to the correct value and press the Set button.
3. The minutes are now highlighted. Repeat 2 above to set the minutes. When the set button is pressed the seconds are set to zero.

Setting the Date

To set the date proceed as follows, the procedure can be abandoned at any time by pressing the X button:

1. Press Set\Clock\Set date. The display shows the current date as Day-Month-Year with the day highlighted (note that the date is *always* shown in this order regardless of the date format setting as described below).
2. Use **↑** and **↓** buttons to adjust the day to the correct value and press the Set button.
3. The month is now highlighted. Repeat 2 above to set the month.
4. The year is now highlighted, repeat 2 above to set the year.

Date Format

The time and date are shown at the bottom of the display with every reading. The date is normally displayed as day-month-year, this can be changed to the American format (month-day-year) by pressing Set\Clock\DMY-MDY. The format can be restored to day-month-year by repeating this.

Hiding the Clock

If the date and time are not needed they can be hidden by pressing Set\Clock\Hide-Unhide. Repeat to unhide.

DATA LOGGING

Data logging is an optional extra and is only available on the 765C. A standard 765 unit can be upgraded to include data logging by returning it to the manufacturer. If data logging is not fitted then the relevant menu items are not displayed.

If data logging is fitted “Data log” is one of the options when the Set button is pushed.

Data Storage and Download

The logged data is stored in files on an USB flash drive or “USB data stick” that is built into the 765C.

When the unit is turned on and connected to a computer with the supplied USB cable it will be recognised as a standard external disk drive. Depending on the computer settings a window will appear asking what to do, it is suggested that the “Open folder to view files” option is selected. On a PC, if necessary, go to “My computer” or “Computer” on the start menu and the new drive should appear on the list where it can be clicked to show any data logger files.

Do not try to format the 765 flash drive from the computer. If you do, then erase the flash drive (see below).

Do not try to read the flash drive from the computer while the 765 is using it (eg while it is logging). The USB flash protocols do not really allow for this. In due course it is hoped to improve the 765 firmware to allow for this.

Once a list of logger files is displayed in Windows Explorer (or Finder on a Mac) they can be dragged to the PC desktop or any other folder in the normal way. When a logger file has been transferred to the computer it should be deleted from the logger to free up space. This can be done from Windows Explorer/Finder or by pressing Set\Data log\Format which **deletes ALL files on the flash drive.**

Logging will continue until the memory is full or a low battery condition is detected.

When connected to the PC a “U” is displayed on screen to the left of the Clock.

When the internal flash disk is being used the LED left of the screen flashes yellow.

Storage Capacity

The storage capacity is over 3.7MB, or 180,000 readings of all 4 parameters (UV, Visible light, temperature and humidity). The other values (e.g. dewpoint and $\mu\text{W}/\text{Lumen}$) are calculated from the 4 saved parameters.

If the 765 is limited by battery life the maximum logging time will be approximately:

Log period	10 Sec	1 Min	10 Min	1 Hr
Life (Days)	21	125	346	394
Readings	180,000	180,000	49,814	9456

If the unit has external power the logging time will be limited by memory:

Log Period	180,000 records
10 seconds	21 Days
1 Minute	125 Days
10 Minutes	1250 Days (3.4 yr)
1 Hour	21 yr

The storage capacity is shared between the data files. So leaving old data files on the flash drive will limit the space available for new data.

Because the data is saved as text, the larger the data values, the more memory each reading takes (for example “100000” has more characters than “1.1”). The maximum space per set of 4 readings is 28 characters (usually it will be much less).

Show Status

To see how much data has been saved, when logging was started etc select Set\Data log>Status and the information is shown on the screen for 30 seconds. Press the X button to clear the screen sooner.

Start Logging

To start logging press Set\Data log\Start and then select the log period and press Set again. The unit turns off and logging starts at the beginning of the next minute, 10 minutes or hour as appropriate.

The Log Period is how often readings are taken, if the log period is short then memory space will run out sooner.

The log start time will be delayed so that measurements are taken at the start of each minute, 10 minutes, hour etc.

Every time logging is started a new file is created, named by start time.

The unit can be used while logging.

Stop Logging

To stop logging press Set\Data log\Stop. This stops further readings being taken.

Format

This option on the “Data log” menu formats the internal flash drive (see below). **This causes all the files on the flash drive to be deleted.** Do not format the disk from the PC.

Erase

The Erase option on the “Data log” menu completely erases all data on the flash drive and then formats it. Not normally required.

Viewing the Results using RView

The 765C does not require any software on the PC. The data can be viewed using a standard spreadsheet. We provide the program “RView” to enable users to easily view the data as a graph or text.

RView can be downloaded from the Littlemore Scientific web site, www.elsec.com.

For more detailed information on RView see the help file.

When RView is started an empty window is shown. One or more data files can be opened by selecting File\Open on the menu or pressing the appropriate button on the toolbar.

When a data file is opened the information is displayed as a graph in it’s own window. More than one graph can be open at any time.

The graph can then be manipulated in the following ways:

Change the graphed parameters. If ‘Show’ is selected on the menu a list of parameters that can be plotted is shown with the current selection ticked. The various items can be ticked/unticked to change what is shown.

Make the graph bigger/smaller. Use the standard window controls on the top right of the graph window and/or drag the edges of the graph as required.

Zoom to see part of the data in more detail. Move the mouse cursor to one corner of the area of interest, click and hold the left mouse button while moving the mouse cursor so that the area of interest has a box drawn round it. When the mouse button is released the graph is redrawn showing only the selected area.

Change the temperature units. Select ‘Show’ on the menu and the current units are shown (°C or °F) click on this to change the units.

Move the Legend. When the graph is first drawn the legend box may hide part of the data. This can be moved by clicking on the box and dragging it to a new location. If it changes to a free floating window it can be removed completely or put back on the graph by clicking on it again.

Check the time/value of a point on the graph. Move the mouse cursor to the point of interest, the time and value represented by the position is shown on a status bar at the bottom of the window.

Add/Change the title of the graph. Press the Titles button on the toolbar and enter the title as required.

Print the graph. Select File/Print on the menu.

Copy the Graph to the Clipboard. Select edit/copy on the menu or press the appropriate button on the toolbar. The saved image can now be pasted into other programs, documents etc.

Data Format

The data is saved as a CSV file (comma separated variable). This is a plain, human readable text file, each record of Lux, UV, temperature and RH is on one line, each value separated by a comma.

The .CSV files can be opened directly in any spreadsheet, eg Microsoft Excel.

NOTE: If your PC is setup for European number format (ie decimal point shown as “,” and thousands separator as “.”) then Excel will open the file with all the data in one column. The easiest way to avoid this is to rename the file from “abc.csv” to “abc.txt”, if the file is now opened Excel will ask for the record separator character, this should be entered as “,”.

The first line has column titles separated by commas and a fifth value giving information about the log start time, period etc. This data will look similar to:

```
2014-10-12_1308_000010_0010901*AName***0000544771  
YYYY-MM-DD_HHmm_hhmmss_rrrrrrr*NNNNNNNN*sssssssss
```

YYYY-MM-DD = Log start date

HHmm = Log start time, hours and minutes (seconds always zero)

hhmmss = Log interval (hh=hours, mm=minutes, ss=seconds)

rrrrrrr = no of records in file

NNNNNNNN = Logger name, with extra * to make 8 characters

sssssssss = Misc logger status values

Batteries

The 765 is designed to use 4 off AAA size nickel-metal hydride (NiMH) rechargeable batteries. The instrument is supplied with these fitted.

The supplied batteries should last for several years and hundreds of charge cycles.

The batteries can be replaced by removing the back cover from the instrument. Ensure replacement batteries are fitted the correct way round. Always use a completely fresh set, unused, all from the same packet.

We recommend the use of “POWEROWL” NIMH Batteries or Panasonic “Eneloop” NiMH batteries (we use the white ones, the black “Eneloop Pro” are also fine but the 765 does not need their high current capacity). These types have the advantage that they will keep their charge for over a year if the instrument is not used unlike other types that will go flat in a month or two. There are other makes of NiMH that have similar properties which should work. Get the “low self discharge” or “precharged” types.

Non Standard Batteries

In an emergency any AAA size 1.2 – 2V battery can be used in the 765 with the following limitations:

- If using non-rechargeable types (eg alkaline) NEVER try to charge the batteries. To disable charging press Set\Battery\Never. Charging can be re-enabled by pressing Set\Battery\Allowed.
- Do not mix different types or ages of battery in the instrument.
- Do not try to charge anything other than NiMH cells in the 765. This may cause damage to the instrument and/or the batteries.

Charger

The 765 is supplied with an international charger. Before use the appropriate mains plug need to be clipped onto it. As standard we supply a UK 13A plug, European 2 pin and USA 2pin. An Australian style plug is also available.

Any 5V USB charger/power supply can be used that is capable of supplying a current of 1.0A (5W).

Charging

To charge the batteries plug the charger into the mains and connect to the instrument using the USB cable supplied. Turn on the 765 by pressing any button briefly and charging will start indicated by the red lamp to the left of the display.

When charging is complete the red lamp turns off.

Normal charge time for completely dead batteries is 1-2 hours.

The unit senses charging is complete by measuring the battery temperature. This can be confused if the unit is moved from somewhere with a very different temperature to the place where it is charged. If in doubt leave the 765 to warm up/cool down for 10 minutes before starting to charge.

Charging is only permitted between 0 and 40°C (32-104°F).

The unit can be forced to start charging by pressing Set\Battery\Start

If the batteries get completely dead plug in the charger and leave it for ~5 minutes. Then unplug the charger, wait for 20 seconds and plug it in again.

Battery Life

A fully charged set of GP “Recyko” 820mAH NiMH batteries will typically power a unit for:

- 15 hours at maximum display brightness (~2000 readings).
- 2 years switched off (maintaining clock only)

These values may be affected by very low or high temperatures

CALIBRATION

The calibration information is kept in non-volatile ROM. If this fails the instrument displays “Mem Fail” when turned on and will load default calibration values and future readings may be 25% in error. If this happens a question mark “?” is displayed on the top right of the display with suspect readings.

Humidity

Like most other RH sensors the 765 should be checked every 6 months or a year. This can be done by returning the unit to the manufacturer, by using the optional humidity test kit or by comparison to another known good source.

The 765 is fitted with a solid state sensor that should not require recalibration unless it is damaged by solvents, dirty water or atmospheric pollutants.

Humidity Test Kit

A test kit is available to test the accuracy of the humidity readings. This utilises the fact that some salts provide a known humidity above a saturated solution. The humidity sensor is placed in a sealed chamber with a saturated solution of a salt.

The kit consists of two sample chambers, a support stand, 2 different salt standards and some pure water. The calibration salts are Magnesium Chloride (MgCl) and Sodium Chloride (NaCl), these are not particularly toxic (Sodium Chloride is common table salt) but normal care should be exercised and they should be kept away from skin, eyes and mouth.

Notes:

It is important that the procedure is done at a constant temperature so that when the calibration is done the temperature of the saturated salt is the same as the air above it. The best place is an underground room, if this is not available use somewhere with a constant temperature, away from sunlight, heaters, open windows etc. A closed wooden desk draw or cupboard is quite good.

If Magnesium Chloride is left exposed to the air (ie with the lid off) it will absorb moisture from the air until it overflows and makes a mess.

The humidity test procedure is as follows:

1. Read through the whole procedure before doing anything.
2. Put a level teaspoon of Magnesium Chloride in the bottom of one chamber and the same amount of Sodium Chloride in the bottom of the other. Be very careful not to contaminate the two salts with each other. Label the 2 chambers.
3. Put a few drops of the pure water onto the salts to make a paste, there should be plenty of undissolved salt but none of it should be dry. The level of the paste should be well below the side hole where the sensor is to be inserted, if any paste gets into the side hole then clean the chamber in running water, dry and start again.
4. Put both the top and side lids on the chambers and leave them on a level surface in a constant temperature environment for at least 2 hours.
5. Insert the 765 sensor probe into the side hole of the Magnesium Chloride chamber, push it all the way in. A support stand is provided to place under the unit so that it and the sample chamber are level. Be sure not to get any paste on the sensor.
6. Leave for at least 2 hours, preferably overnight, in the constant temperature environment. The 765 does not have to be on.
7. Take a humidity reading, it should be within 3.5% of the expected reading (see below).

°C	RH%
5	33.6
10	33.5
15	33.3
20	33.1

25	32.8
30	32.4
35	32.1

8. Repeat steps 5, 6 & 7 with the Sodium Chloride chamber. The expected humidity for saturated sodium chloride is given below.

°C	RH%
5	75.7
10	75.7
15	75.6
20	75.5
25	75.3
30	75.1
35	74.9

9. If the sample chambers are to be kept charged then put both top and side lids on and keep on a level surface. Otherwise clean them in running water and dry thoroughly.

Temperature

The 765 is fitted with a solid state temperature sensor that should not normally require calibration. This sensor is part of the RH sensor and so can be replaced in the same way as above.

UV & Visible Light

The 765 calibration should not drift with time but to be sure of accuracy the instrument can be returned to the manufacturer for a calibration check every 2-5 years.

The 765 has a very carefully defined frequency response (i.e. which wavelengths of light it is sensitive to). Other light meters are often more sensitive to infra red light than they should be and so will give a higher reading with light sources that contain infrared (e.g. ordinary filament light bulbs).

Because the 765 has a cosine angular response it may give different readings to the now obsolete 762 which is relatively directional. In other words the 765 is more sensitive to light coming at an oblique angle than the 762.

Note that the human eye has a logarithmic response, this means that if two light meters are placed side by side they may give different readings even if it looks like they are getting a similar amount of light. To compare the readings on 2 meters they each need to be placed in the exactly same position under exactly the same lighting conditions with the operator being very careful not to shade the meters differently.

MAINTENANCE

The sensor windows should be kept clean and grease free. Grease and finger marks that look clear may be opaque to UV. Ensure that solvents do not come into contact with plastic parts, especially the acrylic window over the visible (left-hand) sensor.

It is permissible to use a cloth dampened with clean water, ethanol, methylated spirits or iso propyl alcohol (IPA) to clean the outside of the 765.

Keep all fluids and other contaminants away from the humidity sensor in the probe at the top of the instrument.

Long term storage

If the instrument is to be stored unused for over a year the batteries should be removed.

USA FCC Radio interference statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

SERVICE AND SUPPORT

For support and repairs contact the manufacturer:

Littlemore Scientific
Gutchpool Farm
Gillingham
Dorset UK
SP8 5QP

Tel: 01747 835550
Email: support@elsec.co.uk
<http://www.elsec.com>



This equipment complies with EU Directive 2002/96/EC

The symbol of the crossed container on the equipment shows that the product, at the end of its useful life, must be collected separately from other refuse. When it is disposed of in the European Union it should be placed with other electronic waste at the place designated by the waste collection authority.

SPECIFICATIONS

Method of radiation detection	Twin silicon photodiodes connected to microprocessor.
Visible wavelength range	400-700nm (CIE response). No correction required for different light sources.
Visible power range	0.1 - 200,000 Lux (0.1 – 20,000 Foot-candles)
UV wavelength range	300-400 nm
UV power range	5 - 10,000 mW/M ²
UV proportion range	0 - 10,000 μ W/Lumen
RH sensor	Solid state type
RH range	0-99%RH
Display resolution	Lux: 0.1 up to 100 then 1 Foot-candles: 0.1 up to 100 then 1 UV: 0.1 up to 100 then 1 Proportion of UV: 1 μ W/Lumen Temperature: 0.1°C or °F RH: 0.1%
Accuracy	Light: 5% \pm 1 displayed digit UV: 15% \pm 1 displayed digit Temperature: \pm 0.5°C (\pm 0.9°F) RH: \pm 3.5% 10%-90%, otherwise \pm 5%
Angular response	Cosine (Light & UV)
Readout	128x64 OLED Display with automatic brightness control
Data logging time intervals (Time till full)	10 seconds (8 days), 1 minute (50 days) , 10 minutes (500 days), 1 hour (8 years)
Data logging storage capacity	Over 180,000 readings of all 4 parameters
Computer Interface	Built in USB flash drive
Batteries	4 off AAA NiMh rechargeable
Battery life	20 hours of normal use
External charger	5-6V DC, 1A USB
Operating Temperature	0-60°C
Operating Humidity	0-99%, non condensing
Dimensions	170 x 60 x 15mm 6.7 x 2.4 x 0.6 inches Including RH/Temperature probe
Weight	240g (8.5 oz) with batteries.

