

775 & 775C UNIVERSAL LIGHT MONITOR

USER MANUAL



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INTRODUCTION

Using the 775 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 temperature. The 775 also measures temperature as $^{\circ}\text{C}$ or $^{\circ}\text{F}$ and thermal radiation in W/M^2

The 775C 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 the manufacturer.

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)

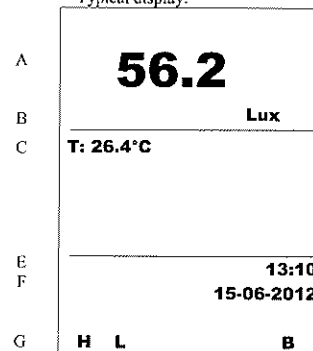
IR= Thermal radiation (Infra Red)

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.

Note that the buttons should be pressed firmly ensure reliable operation.

Typical display:



- A: Current reading
B: Units of measurement
C: Subsidiary reading (Current temperature)
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 **L** indicates logging is in operation (later firmware versions)

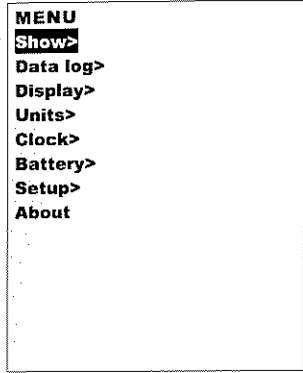
A battery level gauge appears at **B**.

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:



MENU
Show>
Data log>
Display>
Units>
Clock>
Battery>
Setup>
About

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. Units manufactured after July 2015 have improved hardware (version 10) that allows faster charging.

The firmware and hardware versions are displayed as "F.f : H.h" when the unit is turned on or by pressing Set>About. F.f is the firmware version H.h is the hardware version.

Underneath this line, if a humidity sensor is fitted, the sensor version is shown as RHx where x is the RH sensor type.

The hardware version is not displayed on units with firmware version less than 2.9

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 $75\mu\text{W/lumen}$ in museums and galleries, though some organisations try to keep UV levels below $25\mu\text{W/lumen}$.

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/M^2 , again some organisations keep the level below 6mW/M^2 .

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\W/Lum-mW/M²`.

When measuring low levels of UV the 775 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\Lux-Footcandl`.

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.

Magazine reprints on the subject of museum lighting, UV etc can be obtained from the manufacturer.

Suggested light levels for various other 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
Mimic work	3000/5000 Lux

Temperature

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

Thermal Radiation (Infrared)

Thermal radiation is measured using a thermopile. This is sensitive to all radiation from the near ultraviolet to the far infrared (to about $40\mu\text{M}$ wavelength). By default this is measured in W/M^2 (Watts per square Meter).

One of the features of a thermopile is that it also detects radiation that is being emitted by the sensor due to its temperature (an unavoidable law of nature). This emitted radiation depends on the temperature of the thermopile. The obvious way to eliminate this effect is to maintain the sensor at a constant temperature; but the power required to do this makes it impossible on a battery operated instrument. The 775 compensates by measuring the temperature of the sensor and calculating a correction.

DISPLAY

Brightness

As supplied the 775 automatically adjusts the display brightness to suit the ambient light level. For a fixed brightness press Set\Display\Manual and select a brightness level between 0 (dim) and 127 (bright) before pressing Set.

To make the display brightness automatic again press Set\Display\Auto

The display uses a large amount of battery power, the brighter it is the quicker the batteries run down.

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 775 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 \uparrow and \downarrow 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 \uparrow and \downarrow 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 775C. A standard 775 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 775C.

When the unit is turned on and connected to a Microsoft Windows PC with the supplied USB cable it will be recognised as a standard external disk drive. Depending on the PC settings a window will appear asking what to do, it is suggested that the "Open folder to view files" option is selected. 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.

Once a list of logger files is displayed in Windows Explorer 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 PC it should be deleted from the logger to free up space. This can be done from Windows Explorer or by pressing Set\Data log\Format which **deletes ALL files on the flash drive**.

Microsoft Windows XP, Vista and 7 should be able to use the logger without any special drivers or other software. When the 775C is plugged in for the first time Windows may say that it is searching for drivers, these should be found without assistance.

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 read from or written to the LED left of the screen flashes green.

Storage Capacity

The storage capacity is over 73,000 readings of all 4 parameters (UV, Visible light, temperature and humidity). The other values (e.g. dewpoint and $\mu\text{W/Lumen}$) are calculated from the 4 saved parameters.

Log Period	Log time for 73,000 records
10 seconds	8+ Days
1 Minute	50+ Days
10 Minutes	500+ Days (about 1 year, 4 Months)
1 Hour	Over 8 years

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). The internal flash memory has a capacity of 2,048,000 characters.

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 on the internal USB flash drive (see above) with a name of the form MMddhhmm.CSV where:

MM=month
dd=day
hh=hour
mm=minute

The unit can be used while logging.

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.

Stop Logging

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

Viewing the Results using RView

The 775C 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 "Accessories" section on 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 Thermal radiation (Ir) 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_rrrrrr*NNNNNNNN*ssssssss
```

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)

rrrrrr = no of records in file

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

ssssssss = Misc logger status values

Batteries

The 775 is designed to use 4 off AAA size 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 GP "Reeyko" NiMH batteries. These 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 (eg Sanyo "eneloop"), but we have not tested these.

Non Standard Batteries

In an emergency any AAA size 1.2 – 2V battery can be used in the 775 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 of battery in the instrument.
- Do not try to charge anything other than NiMH cells in the 775. This may cause damage to the instrument and/or the batteries.

Charger

The 775 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 0.6A.

The 775 can also be charged by plugging it into a PC USB port using the cable supplied (or equivalent).

Charging

To charge the batteries plug the charger into the mains and connect to the instrument using the USB cable supplied. Turn on the 775 by pressing any button briefly and charging will start indicated by the red lamp to the left of the display.

The 775 needs to be on for charging to start but can be allowed to turn off while charging continues.

When charging is complete the red lamp turns off.

Normal charge time for completely dead batteries is 3-4 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 775 to warm up/cool down for 10 minutes before starting to charge.

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

After charging completes further charging is not permitted until either:

- The unit is used for 5 hours.
- 5 Days have passed.
- The batteries are replaced.
- The time or date are changed by the user

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

If the batteries get completely dead then they may need to be charged outside the unit or replaced. With later firmware versions completely dead batteries can be charged.

Fast Charge

With firmware greater than V3.0, while charging is taking place the battery level indicator is replaced by a + symbol, if the unit has hardware version greater than 9.9 and is connected to a high current charger it charges faster and "++" is displayed. The fast charge can be disabled by pressing Set\Battery\Limit and re-enabled by pressing Set\Battery\No Limit.

Battery Life

A fully charged set of GP "Reeyko" 820mAh NiMH batteries will typically power a 775 or 775C for:

- 20 hours at maximum display brightness (2,400 30 sec readings)
- 33 hours at normal display brightness (4,000 30 sec readings)
- 120,000 log readings spread over 1 month
- 50,000 log readings spread over 1 year
- 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.

Temperature

The 775 is fitted with a solid state temperature sensor that should not normally require calibration. This sensor is part of the Thermal Ir sensor and so can be replaced easily.

UV & Visible Light

The 775 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 775 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 775 has a cosine angular response it may give different readings to the now obsolete 762 which is relatively directional. In other words the 775 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 775.

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:

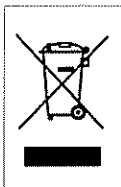
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

SERVICE AND SUPPORT

For support and repairs contact the manufacturer:

Littlemore Scientific Engineering
Gutchpool Farm
Gillingham
Dorset UK
SP8 5QP

Tel: 01747 835550
Fax: 01747 835552
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	2 - 10,000 mW/M ²
UV proportion range	0 - 10,000 μ W/Lumen
Thermal radiation sensor	Bismuth/Antimony thermopile with KBr window
Thermal radiation range	0-1000W/M ²
Thermal radiation power	0 - 1000 W/M ²
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 Thermal radiation: 0.1 up to 100 then 1
Accuracy	Light: 5% \pm 1 displayed digit UV: 15% \pm 1 displayed digit Temperature: \pm 0.5°C (\pm 0.9°F) Thermal radiation: 5% \pm 10 W/M ²
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 73,000 readings of all 4 parameters
Computer Interface	Built in USB flash drive
Batteries	4 off AAA NiMH rechargeable
Battery life	30 hours of normal use or 120,000 log readings
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 sensor probe
Weight	240g (8.5 oz) with batteries.