

LX 200
Luxmeter



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I – Introduction

LX200 luxmeter is a photometer for measuring illuminance, it is equipped with a photoelectric detector and with a silicon photodiode coupled with a filter to modify its response and to get it as closed as possible of the reference function $V(\lambda)$ defined in the CIE (International Commission on Illumination). **LX200** is hand-held autonomous instrument fully automatic designed for measuring illuminance. With its memory, it allows the storage of datasets for processing on a computer.

Results are displayed in **Lux** or in **footcandle** and allows 5 measurement modes :

Instantaneous illuminance :

- Displaying of instantaneous values, maximum and minimum values.

Relative illuminance :

- Allows a relative measurement to a reference point to quantify a light input or an illuminance decrease.

Uniformity :

- Calculation of the min / ave ratio for determination of illuminance uniformity at workstation according to NF EN 12464-standards - 1 – Lighting of workplaces (inside)

Evolution of illuminance according to weather conditions :

- Storage of temporal evolution of illuminance for the follow up of environment conditions.

Mapping of illuminance – Spatial representation

- Realization and storage of cartography of light environments. Coloured representation according to levels obtained for printing of report (on a computer such as PC).

These different measurement modes are compatible with the following standards :

- NF EN 12464-1 – Lighting of workplaces (inside)
- NF EN 12464-2 – Lighting of workplaces (outside)
- NF EN 12193 – Lighting of sports facilities

Its sensor is composed of a silicon photodiode which spectral response corresponds to the photopic curve according CIE standard.

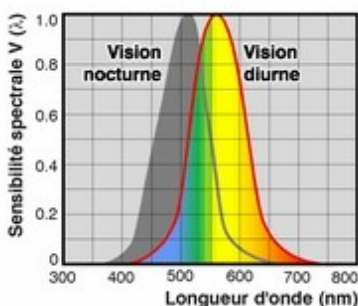
Small, with its LCD graphic display of 64*128 pixels resolution, using a high-tech electronics, **LX200** is a powerful instrument and easy to use.

II – General infos

Photometrical data

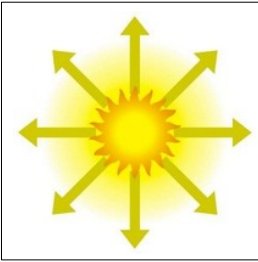
Photometrical data are data that allow to define the action of electromagnetic radiation on visual function of the eye of an observer.

The average standard eye, adopted by the CIE (International Commission on Illumination), is defined by a function of relative spectral illuminance efficiency for day vision or photopic.



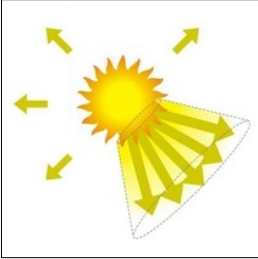
Photopic curve of spectral sensitivity of the human eye in day vision

Luminous flux



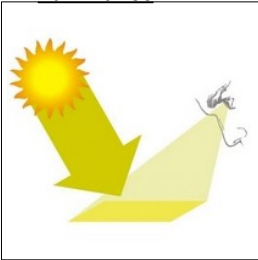
The luminous flux of a source is the evaluation, according to eye sensitivity, of the quantity of radiated light among space by this source. It is expressed in **lumen (lm)**.

Luminous intensity



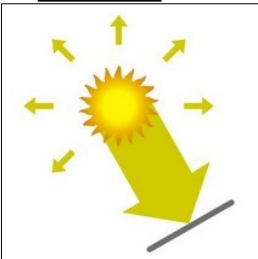
Luminous intensity is the luminous flux emitted by solid angle unit in a given direction. It is measured in **candela**, equivalent to **1 lm/sr**.

Luminance



Luminance of a source is the ratio between luminous intensity emitted in a direction and the apparent surface of the luminous source in the considered direction. Luminance is expressed in **candelas by square meter (cd/m²)**.

Eclaircissement



Illuminance of a surface is the ratio of luminous flux received to the area of this surface. Its unit is the lux, equivalent to 1 lm/m^2 . It is also expressed in **footcandle (fc)** according the ratio : $1 \text{ fc} = 10.76 \text{ lux}$.

LX200 has been designed to measure illuminance according the above terms, it allows a measurement in lux or footcandle for levels of illuminance lower than **10 lux** with a calculation accuracy of **0.1 lux** and beyond an accuracy of **1%** until the maximum level of **200 000 lux**.

Use :

For each application, you should check the measurement technique to get valid and consistent results. The way of using the instrument has at least as much importance on the result than the instrument quality.

Main parameters shall be taken into account :

1. Put correctly the **LX200** cell according to the appropriate and representative plan of the current study (ex : workstation).
2. Avoid non-representative illuminance of the studied area.
3. Sensibly move away from the cell to avoid creating attenuation area of illuminance.

« Pause » and « relative level » functions integrated in the **LX200** will allow in most cases to avoid specific problems.

III – Operating principle

Keyboard presentation

When being switched on, “measurement screen” is displayed. From this screen, to go to the 4 different measurement screens, press on ① key. ② and ③ keys are associated to each measurement modes.

⑤ key allows to access to reading setting or data transfer screens. To back to measurement screen press ④ key.



- ① ② ③ **Function keys** Directly associated to text displayed shown above on display, they allow measurement setting.
- ④ **Key “leaves current screen”** Key that returns to the current screen.
- ⑤ **Screen key** From measurement screens, give access to other screens
- ⑥ **On/Off key** Key to turn the instrument on or off.

Instrument offers 3 groups of screens

1. Screens representing the 5 different measurement modes



Instantaneous



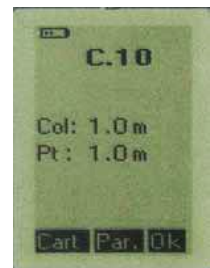
Relative



Uniformity



Temporal

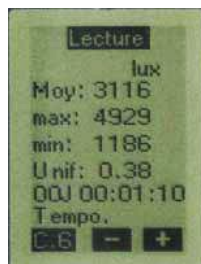


Mapping

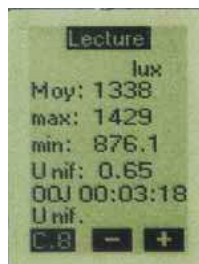
2. Reading and data transfer screens



Mapping



Temporal



Uniformity

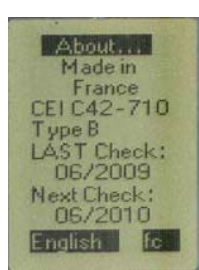


Data transfer

3 – Setting screens



Brightness




About



Calibration



IV – Setting

Accessible from the principal measuring screen by successive pushes on the key , those different screens allow setting of the instrument. They also inform users.



Brightness

To optimize display reading, the operator can :

1. Adjust brightness by pressing  and  function keys.
2. Backlight LCD display for a better reading in a dark place.
 “No” means backlight is switch off and “Yes” it is switch on.
 In this last case, battery life is reduced by about 15%.

The role of calibration screen essentially consists on recall calibration conditions and more particularly the percentage of modification of the gain compared with a nominal calibration . Calibration is reserved to the builder or to the partnership laboratory.




Brightness



Calibration

About

Information on origin of manufacture, reference standards and dates of last and next audits



By pressing  and  keys, you can choose languages.



About -English



About - French

Pressing  or  allows to choose measurement unit : Lux or Footcandle.
 Note : lux or fc unit is independent of the chosen language.

V – During measurement

Unique range

The digital processing of the instrument avoids for the operator the choice of a measuring range, **LX200** displays the result of the measurement in **lux** or **fc** on all of its dynamic. To cover the whole field, different formats and units are directly displayed.



Mode lux



Mode footcandle

Instantaneous illuminance

Once switched, the instrument displays twice a second the instantaneous value of illuminance expressed in Lux or fc. This value gives information about illuminance local conditions.

- **Max** and **min** values are also displayed.
- The operator can at any time by pressing following keys :
 - **Reset** : reset **max** and **min** values
 - **▶||** : activate **pause** function then
 - **▶|||** : continue measurement



Eclaircissement
instantané

Relative illuminance

Principle :

To know the contribution on the measurement result by providing or deleting a luminous source, **LX200** allows a relative measurement from an existing situation.

For example : Knowing the incidence of deletion or addition of lighting (neon tube) in a room.

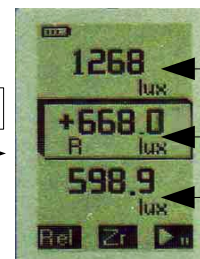
Proceed as follows:

From the start screen, here is how to proceed to make a measurement of relative illuminance **Rel** :

1 x **Inst** : access to measurement screen. The function is not launched yet.



Inst



Example 1

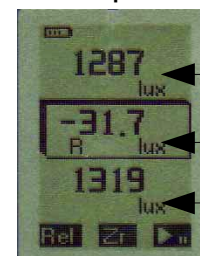
Instantaneous fluctuating
illuminance

Relative illuminance

Reference illuminance

1x **Zr** : Press **Zr** key. Screen displays :

- **Down** : instantaneous value of illuminance (here 598.9 lux) which will be the reference value. It stays memorized and fixed.
- **Up** : value of instantaneous fluctuating illuminance (here 1268 lux)
- **In the middle** : In **R** panel, difference between the instantaneous value displayed at the top and the reference value memorized at the bottom. This value can be positive or negative according to fluctuations of illuminance compared with the moment of memorization of the reference value (**Zr** key)



Example 2

Instantaneous fluctuating
illuminance

Relative illuminance

Reference illuminance

Uniformity

Principle :

From sampled data, the instrument calculates and displays on the measurement time :

- **Instantaneous** value at the rate of two displays per second
- **Average** value
- **Max and min values**
- **Uniformity of illuminance** : définined as the **min / average** ratio.

From start screen (a), here is how to proceed to calculate the **uniformity** on a time controlled by chronometer and clock :

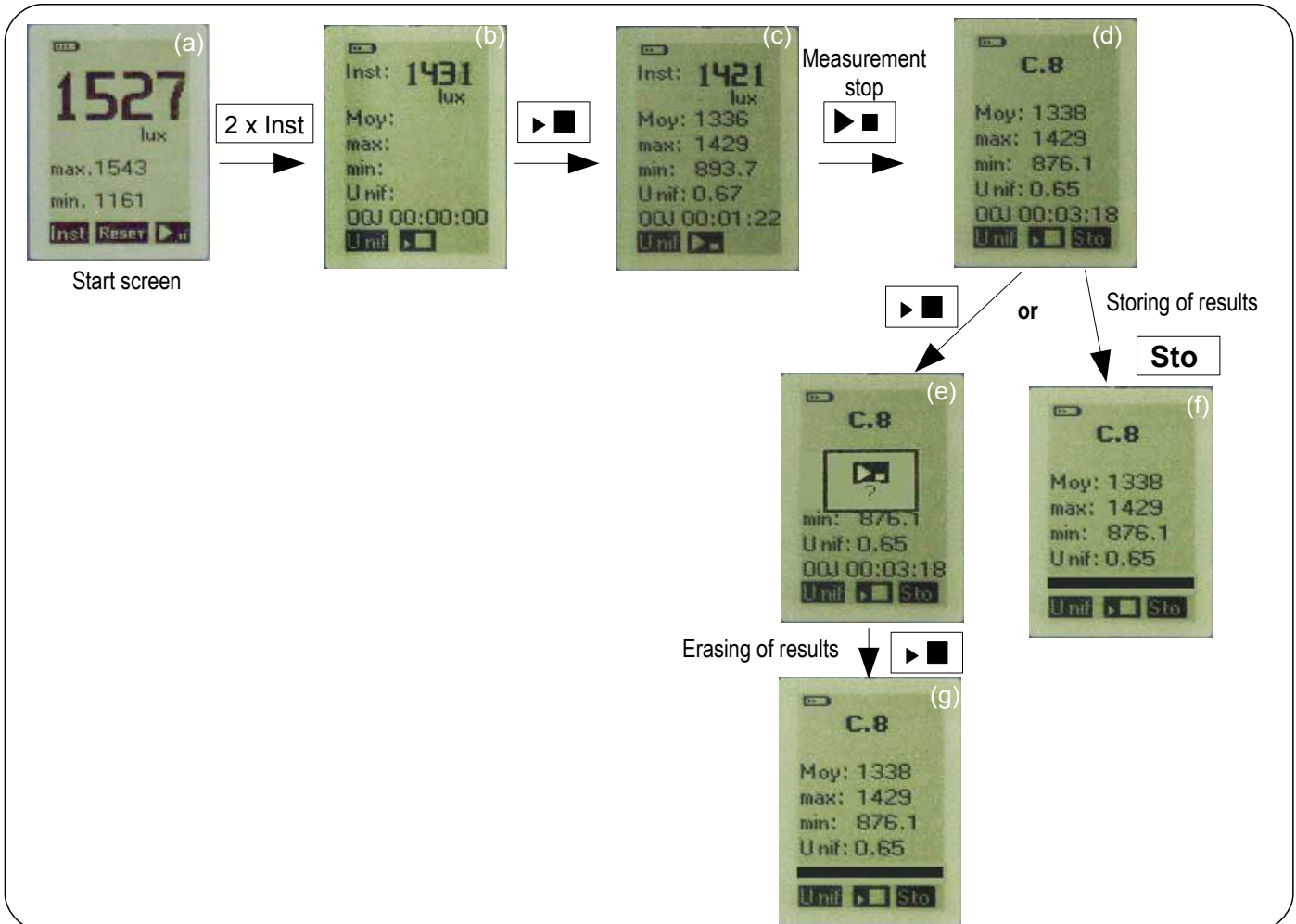
- 2 x **Inst** access to measurement screen **Uniformity (b)**. Measurement is not launched yet.
- 1x **▶■** : launching of the chronometer, it displays seconds -minutes-hours-days (max : 01D00H00M00). The first values, **Average, max and min** are displayed, calculation of uniformity is in progress and changes according to illuminance conditions (c). During the measurement, no other function is accessible.
- 1x **▶■** : stop the measurement, two possibilities for the operator (d) :
 - 1- He wants to store in memory the results.
 - 2- He ignores the measurement and launch a new measurement or erase results already acquired.

To store results, press **Sto** key, a little progress bar visualizes the action (f).

To erase results and launch a new measurement : press **▶■** key, a flashing pictogram indicates that the measurement made is not taken into account and that a new launching is possible (e).

Press **←** to back to the initial state.

Press **▶■** to erase results. An erase bar indicates the progress. The operator can launch a new measurement (g).



Temporal

Principle :

The operator can follow the evolution of illuminance during a period of time at an un fixed poste or not fixed.

Ex : evolution of street lighting on a firelane.

From start screen (a), here is how to proceed to follow the evolution of illuminance on a time controlled by chronometer and clock :

- 3 x **Inst** access to measurement **Tmp** (b). The measurement is not launched yet.
- Press on **1s** to choose the sampling rate. Values available are : 1s – 2s – 3s – 5s – 10s – 30s – 1mn – 10mn.
- Launch measurement by pressing **▶▶** key.

The chronometer indicates day-hours-minutes-seconds (max : 01D00H00M00). The first values, **Average, max and min** are displayed, calculation of uniformity is in progress and changes according to illuminance conditions.

During the measurement, no other function is accessible. (c).

- 1x **▶■** : stop the measurement, two possibilities for the operator (d) :

1- He wants to store in memory the results.

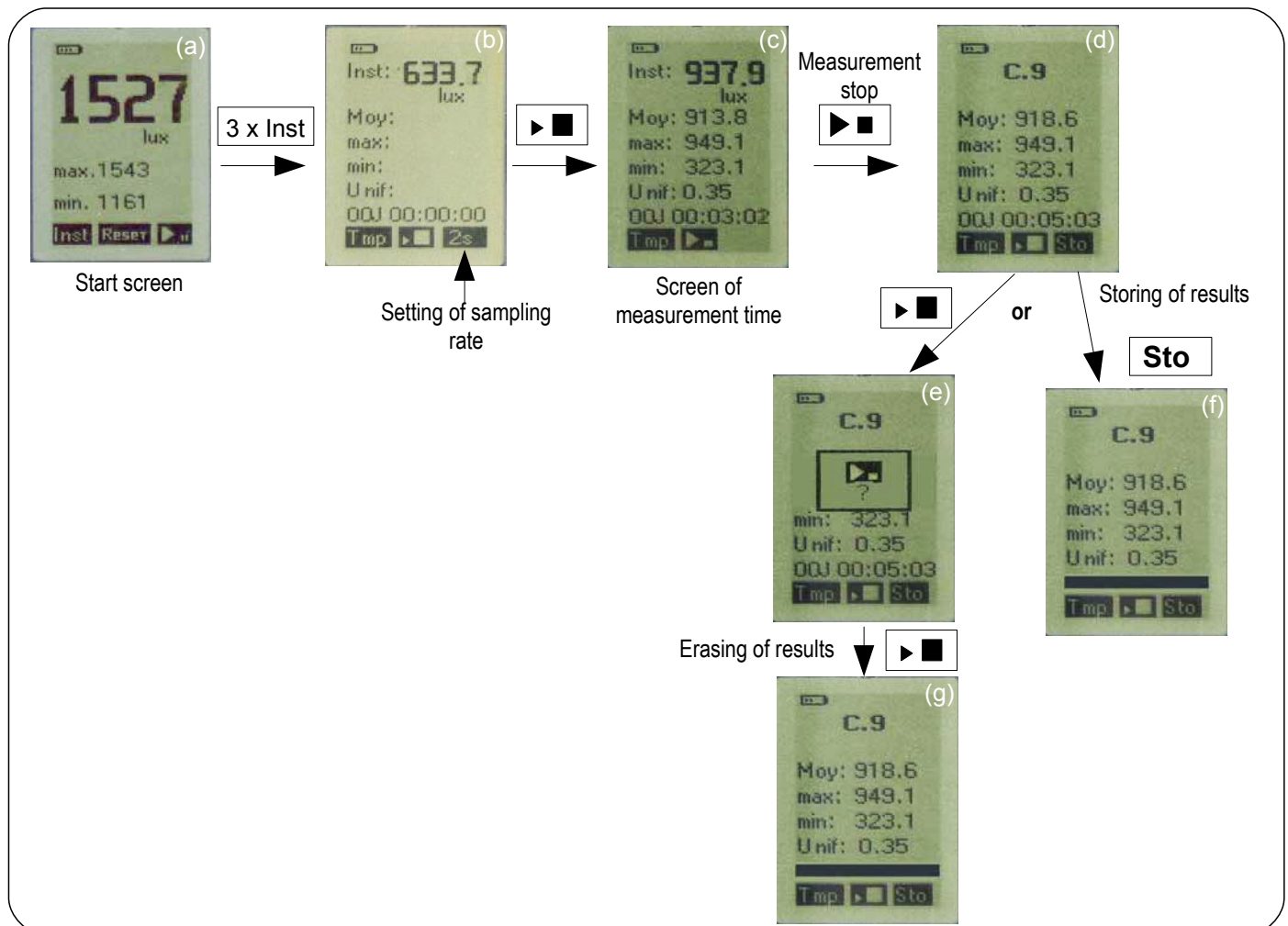
2- He ignores the measurement and launch a new measurement or erase results already acquired.

1 - Press **Sto** key to store results, a little progress bar visualizes the action (f).

2 - Press **▶■** key erase results and launch a new measurement , a flashing pictogram indicates that the measurement made is not taken into account and that a new launching is possible (e).

Press **◀** to back to the initial state.

Press **▶■** to erase results. An erase bar indicates the progress. The operator can launch a new measurement.



Mapping

Measurement principle :

The instrument allows to make a manual report of measurement point in an area to obtain a graphic representation of the distribution of the intensity of illumination.

To do that, before making measurement, you have to define :

1. the area to be treated, if possible rectangular or square
2. the origine of the measurement beginning
3. the step of advancement of the measurement in column and points

Once these three things are defined, measurements have to be made manually in the spotted places.

Ex : mapping of a rectangular room of **5 m x 4 m**.

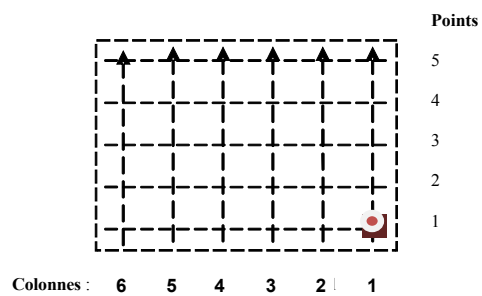
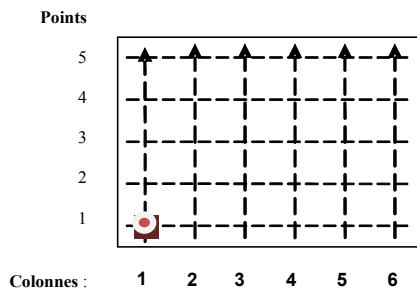
Measurement is usually made at **0.5 m** of wall.

The grid corresponds to :

- Spacing between two columns : **1 meter**
- Spacing between 2 measurement points : **1 meter**

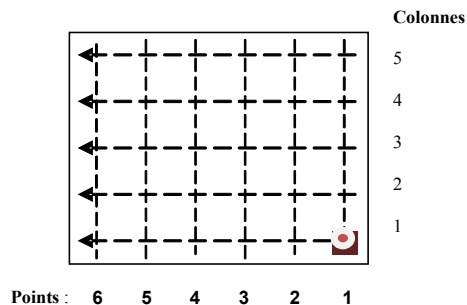
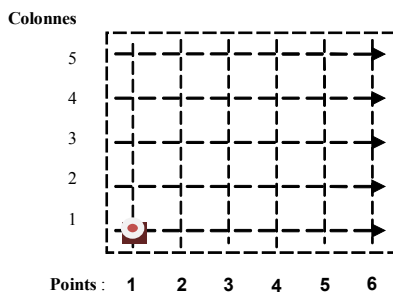
The origin of measurement has to be fix and measurements have to be made imperatively according to a strict sequence.

According to possibilities of access to the room/area and the wanted graphic representation, **4 choices** are possible for origine of measurement :



Measurements :

- column 1 : from point 1 to point 5
- column 2 : from point 1 to point 5
- column 3 : from point 1 to point 5
- column 4 : from point 1 to point 5
- column 5 : from point 1 to point 5
- column 6 : from point 1 to point 5



Measurements :

- column 1 : from point 1 to point 6
- column 2 : from point 1 to point 6
- column 3 : from point 1 to point 6
- column 4 : from point 1 to point 6
- column 5 : from point 1 to point 6

Particular cases :

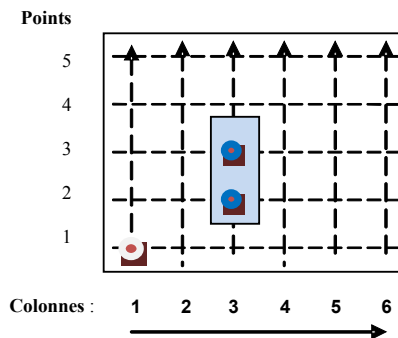
Some points are inaccessible :

For example : because of unmovable or voluminous obstacles (tool machine – furnitures,...)

In his case, points :

- **column 3 point 2**
- **column 3 point 3**

are inaccessible, the operator can't make the measurement, so he will enquires the luxmeter by a so called « no value » measurement. When processing with the software, this last one will propose a value (average of attenant value) or the operator will enquires himself this value.



The room or the area is not a quadrilateral.

The operator organizes its dataset (column/points) as it was a quadrilateral.

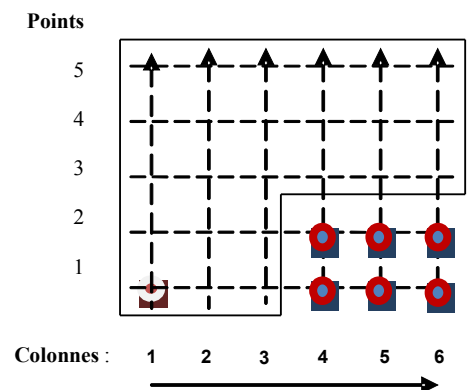
When he arrives on his sequence of measurements :

- **column 4 point 1**
- **column 4 point 2**

he will enquires the luxmeter by a so called « no value » measurement then he resumes normally his sequence for the 3 following measurements.

Same thing for the two first measurements of the columns 5 and 6.

When processing with the software, value given by the software will be accepted by the operator to get a correct graphic representation..

**Make a measurement of mapping with LX 200 instrument :**

From start screen, here is how to proceed to make a manual report of points and get a mapping of a room/area :

- 4 x **Inst** access to measurement screen **Cart (b)**.

Instrument proposes by default an advancement step of measurement :

- **distance between columns : 1 m**
- **distance between measurement points : 1m**

- Modify the advancement step pressing **Par.** key, then choose **Column** or **Point** with **1** key and set the distance of advancement with **+** and **-** keys . Adjustment step is limited to 0.50 m **(c)**.
- Back to previous screen with **←** key then press **OK** to go to à measurement screen **(d)**.

- From this screen, validate illuminance value corresponding to topographical coordinates by pressing **Val.** key **(e)**.


At each validation, instrument memorizes illuminance value, counter of point to validate increments of one and so as the last one validated. A little black block visualizes the transfer of the point to validate toward the validated point.

If a measurement is not possible (see "Principle" part), before validate the measurement, press **Pt** key, to commute from **Point (Pt)** to « **no value** » - - , then validate.

The instrument does not memorize any value. During the counting, this measurement will be automatically enquires by the software or the operator.

Measurement error :

To make a new measurement in case of handling error or ambient condition unacceptable, press twice **Pt** key to back to the coordinates of the last poin to re-measure. Make the measurement, validate and continue the sequence normally. On the same principle, press **Pt** key the required number of time to back to the sequence of measurements already made (points et columns) and repeat the entire sequence of measurements.



At the end of the sequence, for example Column 5 – Point 3, press  key to back to dataset resume screen. **(f)**. Important elements are displayed : **Min, Max, Average, Uniformity.**


• two possibilities for the operator :

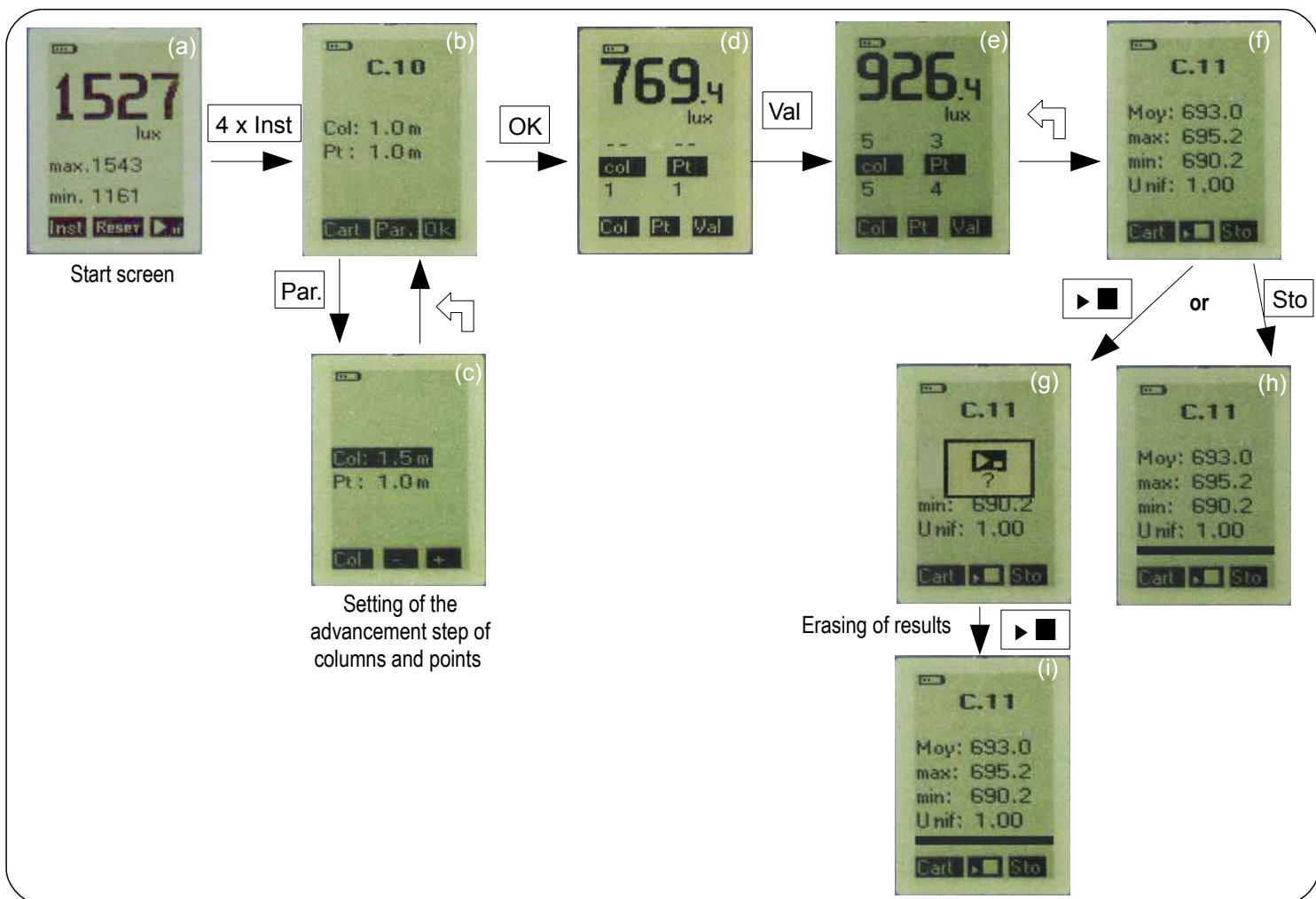
- 1- He wants to store in memory the results.
- 2- He ignores the measurement and launch a new measurement or erase results already acquired.

Press **Sto** key to store results, a little progress bar visualizes the action **(h)**.

To erase results launch a new measurement :

Press  once ,a flashing pictogram indicates that made measurement is not taken into account and a new launch is possible **(g)**. Pressing  allows a return to initial state.

A second press on  key deletes results. The operator can proceed to settings and launching a new measurement **(i)**.



Instrument shutdown


In case of accidental shutdown of the instrument (low batteries), results are automatically saved when the LX200 is operating in Temporal mode. For other modes of measurement (Instantaneous – Relative - Uniformity – Mapping), please check battery level before launching dataset.

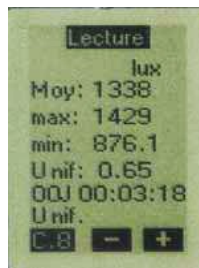
VI – After measurement

Data reading

After a requested shut-down of measurement and a data storage, it's possible to consulte dataset results :

Proceed as follow :

- Go to reading screen.
- From start screen, press twice  (SCREEN).
- With - and + keys, choose dataset, then validate with 1 key, result screen appears.



Uniformity



Temporal




Mapping

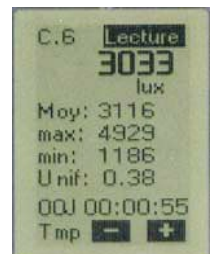
In case of accurate or localised control before a data transfer, it is possible to visualize stored data on the screen of the LX200. It is possible for **Temporal or Mapping** modes.

• Temporal

After selecting in **READING** the dataset, press 1 key, reading screen of values appears :

- and + keys allow the scrolling of values, un appui maintenu sur l'une des deux touches assure un défilement de plus en plus rapide.


To leave this screen, press  key.

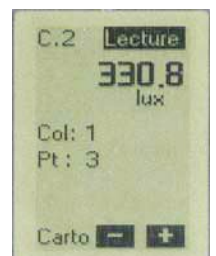


• Mapping

After selecting in **READING** the dataset, press 1 key, reading of values screen appears :


- and + keys allow the scrolling of values.

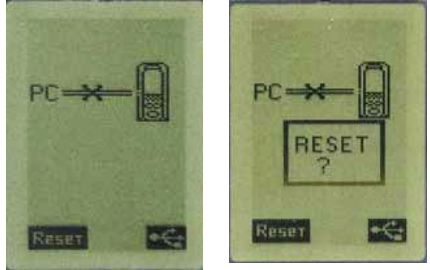
To leave this screen, press  key.



Data transfer

This screen allows data transfer toward a computer trough USB cable.
LLX20 software have been previously loaded into the computer (see notice of LLX 20 Software).

Access **Data transfer** screen :
Link the instrument to the PC with a USB cable.
From start screen of the instrument, press 3 times  key until the obtention of the data transfer screen. Then press **USB** pictogram key.





The computer automatically detects the instrument on the proper port. Software allows only transfer, the instrument stays on hold.
Date and time are displayed (they can be set by the LLX20 software).

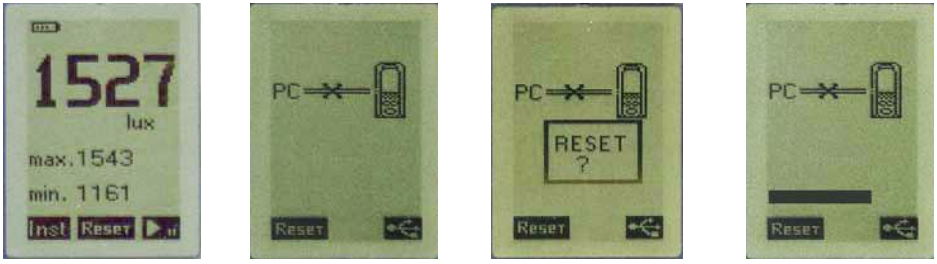
- Files formats :**
Files of values have a specific termination for each measurement modes :
- Uniformity : *.ldu
 - Temporal : *.ldt
 - Mapping : *.ldc

Reseting memory

After recording of dataset the operator can erase the memory of the instrument.
There are 2 methods :

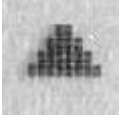
- Directly with the PC after file transfer
- By pressing **RESET** key of the instrument

From start screen, press 3 times  key, then once **RESET key**, press **RESET** again to erase all dataset or press  key to cancel deletion.



VII – Running informations

Overrange



Under conditions of measuring range excess, defined at 200,000 lux, an over-range pictogram appears. It comes fleetingly for an illuminance exceeding 200,000 lux . Displayed value will be 200.1 klux.

Power source



When the instrument is equipped with alkaline batteries, it can operate for **72 hours minimum**. A symbol informs the user about electric power remaining. If battery is low, less than 1 bar on the pictogram, the instrument stops measuring, saves current measurement and switches off.

VIII – Maintenance

Servicing

The LX 200 conception allows a reduced maintenance, which consists in changing batteries and cleaning the instrument and sensor with a slightly dampened cloth. A particular attention must be paid to the white disc covering the silicon photodiode which surface must not have dirt or scratches.

Regular checking

Like most measuring instruments, it is strongly recommended to regularly control and calibrate **LX200** instrument. The sensor sensitivity decreases depending on measurement durations and illuminance intensity. Return to the manufacturer each year will provide necessary metrological traceability.

Batteries replacement – adaptors

Batteries :

To replace batteries, open the back hatch and insert the 3 new batteries of type 1.5 V / AAA-LR3 inside.

Warning : respect meaning of batteries. If storage is very long, remove batteries.

Adaptor :

If necessary for a long period of measurement, use a USB adaptor .

Note: when using with an external power, it is recommended to remove batteries from LX100. An internal protection, however, allows to secure all if you forget it.

IX – Main specifications

Range details

Lux value	Display	Unit	Lux resolution	Minimum accuracy of calculation
From 0 to 10	From 0.1 to 10.0	lx	0.1	0.1 lux
From 10 to 99	From 10.0 to 99.9	lx	0.1	1%
From 100 to 999	From 100.0 to 999.9	lx	0.1	1%
From 1000 to 9999	From 1000 to 9999	lx	1	1%
From 10000 to 99999	From 10.00 to 99.99	Klx	10	1%
From 100000 to 200000	From 100.0 to 200.0	Klx	100	1%
Fc value	Display	Unit	Fc resolution	Minimum accuracy of calculation
From 0 to 1	From 0.00 to 1.00	fc	0.01	0.01 fc
From 1 to 99	From 1.00 to 99.99	fc	0.01	1%
From 100 to 999	From 100.0 to 999.9	fc	0.1	1%
From 1000 to 9999	From 1000 to 9999	fc	1	1%
From 10000 to 18580	From 10.00 to 18.58	Kfc	10	1%

Specifications

Measuring range.....	from 0.1 to 200 000 lux from 0.01 to 18 580 fc
Spectral response.....	as per standard photopic curve V(λ) NF C 42 -710 class B and DIN 5032-7.
Error limit V(λ) (f1).....	< 6%
True cosine evolution (f2).....	< 6%
Linearity (f3).....	< 3%
Measurement capability.....	see chart p.18
Display.....	Backlit LCD graphic 128 x 64
Working and storage temperature.....	from 0°C to +50°C
Housing dimensions (without sensor).....	120 x 58 x 34 mm
Weight (housing+batteries+sensor).....	185 g
Conformity.....	as per RoHS
Power supply.....	3 batteries 1.5V type LR3-AAA
Autonomy.....	72 hours minimum in continuous operation.
Electromagnetical compatibility.....	according to 89/336/CEE
Mini-USB plug.....	for USB power supply adapter and data transfer

Standards

This instrument is based on the recommendations and requirements of NF C 42-710 –February 1988 Class B – DIN 5032-7 and CIE n°69 standards.

Measuring capacity and storage

You can make 32 datasets with the luxmeter. Files can be memorized according to their modes : **Uniformity – Temporal – Mapping**. Each dataset can contain **16370** values.

- **Uniformity mode :**

Max 24H of continuous measurement : 01J 00:00:00

- **Temporal mode :**

Measurement capacity is linked to sampling rate :

Sampling	Measurement time XXD HH:MM:SS
1s	00D 04:32:00
2s	00D 09:05:00
3s	00D 13:38:00
5s	00D 22:44:00
10s	01D 21:28:00
30s	05D 16:26:00
1 mn	11D 08:52:00
10 mn	99D 23:59:00

- **Mapping mode :**

Each measurement uses 2 points of memory. So 8185 measurements can be stored, distributed between column and point.

Example : If there are 10 columns, number of points will be : $8185 / 10 = 818$.

On the scale of users, the number of points per column is virtually unlimited.

X – Delivery and packaging

- **LX200** housing with silicon photodiode sensor and glass filter correction.
- Transport case
- 3 LR3-AAA batteries
- Calibration certificate
- User manual
- **LLX200** software



Once returned to KIMO, required waste collection will be assured in the respect of the environment in accordance to 2002/96/CE guidelines relating to WEEE.

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