sauermann®

LX 200

Luxmeter

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

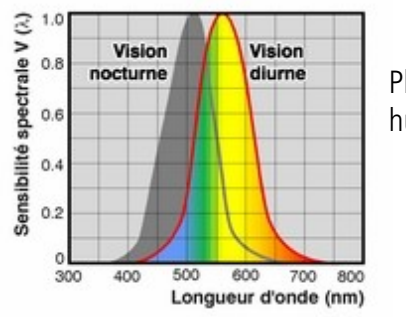
These different measurement modes are compatible with the following standards :
NF EN 12464-1 – Lighting of workplaces (inside)
NF EN 12464-2 – Lighting of workplaces (outside)
NF EN 12193 – Lighting of sports facilities

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.

2 General information

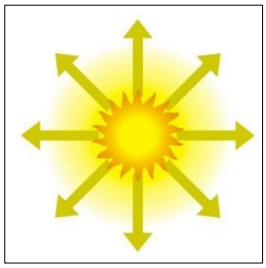
Photometrical data

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.



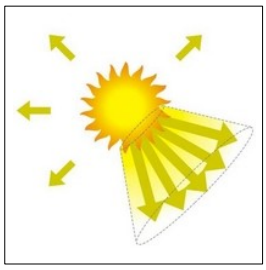
Photopic curve of spectral sensitivity of the human eye in day vision

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

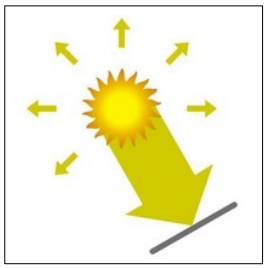


Luminous intensity is the luminous flux emitted by solid angle unit in a given direction.
It is measured in **candela**, equivalent to **1 lm/sr**.

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/m^2).

Illuminace



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

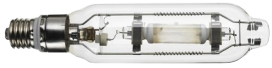
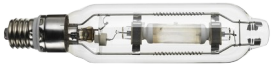
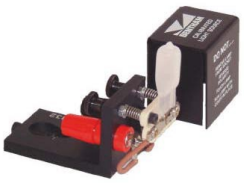
1. Put correctly the LX200 cell according to the appropriate and representative plan of the current study (ex: workstation).
2. Avoid non-representative illuminance of the studied area.
3. Sensibly move away from the cell to avoid creating attenuation area of illuminance.

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

2.1 Factor value according to the light sources

The following table indicates the factor value corresponding to different light sources with their examples. The device is adjusted with an incandescent standard white light source owning its own spectral response. The following lighting sources have a different spectral response. Therefore, the presented coefficients in the following table enable to correct the measurement according to these different sources.

The correction is carried out by multiplying the measured value by the F factor : Corrected value = F x measured value.

Sources	**F Factor**	**Examples**
Fluorescent tube with three bands	1.149	
High pressure mercury lamp	1.201	
Sodium vapour lamp	1.179	
Metal halide lamp with three additives	1.076	
Rare-earth metal halide lamp	0.911	
White led : neutral colour	0.961	
Halogen quartz lamp / tungsten (standard source)	1	

2.2 Order of magnitude of Lux according to applications

Here are a few examples of order of magnitude according to different current situations.

Environment	**Lux**
Outside with open air	500 to 25000
Outside with direct sunlight	50000 to 100000
Full moon night	1
Overnight lit street	20 to 70
Apartment well lit	200 to 400
Factory : electronic assembling	1500 to 3000
Hotel reception hall	200 to 500
Shop	750 to 1500
Hospital operating room	750 to 1500
Classroom	200 to 750

3.1 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.

①②③ **Function keys**
Directly associated to text displayed shown above on display, they allow measurement setting.

④ **Key "**leaves current screen" ESC

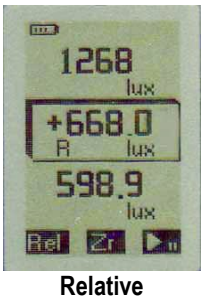
⑤ **Screen key**
From measurement screens, give access to other screens

⑥ **On/Off** key

Instrument offers 3 groups of screens

1. Screens representing the 5 different measurement modes

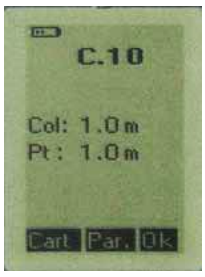
Instantaneous



Relative

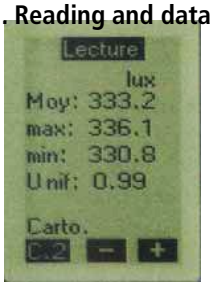
Uniformity

Temporal

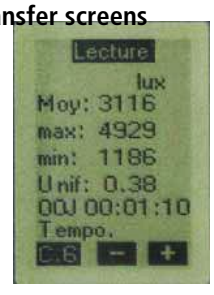


Mapping

2. Reading and data transfer screens



Mapping



Temporal

Uniformity

Data transfer

3 – Setting screens

Brightness

About

Calibration

4 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.

4.1 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

4.2 About

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

By pressing **French** and **English** keys, you can choose languages.

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

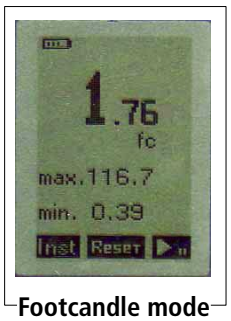
About -English

About - French

5.1 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.

Lux mode



Footcandle mode

5.2 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

▶II : activate **pause** function then

▶II : continue measurement

Instantaneous illuminance

5.3 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.

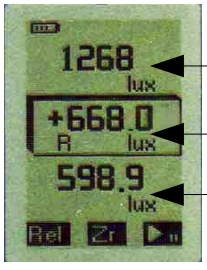
For example : Knowing the incidence of deletion or addition of lighting (neon tube) in a room.

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.

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

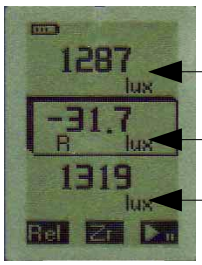
Inst



Instantaneous fluctuating illuminance
Relative illuminance
Reference illuminance

Example 1

Down: instantaneous value of illuminance (here 598.9 lux) which will be the reference value. It stays memorised 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)



Instantaneous fluctuating illuminance
Relative illuminance
Reference illuminance

Example 2

5.4 *Uniformity*

Principle:
From sampled data, the instrument calculates and displays on the measurement time:
I**nstantaneous** 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 controled by chronometer and clock:

2 x [Inst] access to measurement screen **Uniformity (b)**. Measurement is not launched yet.

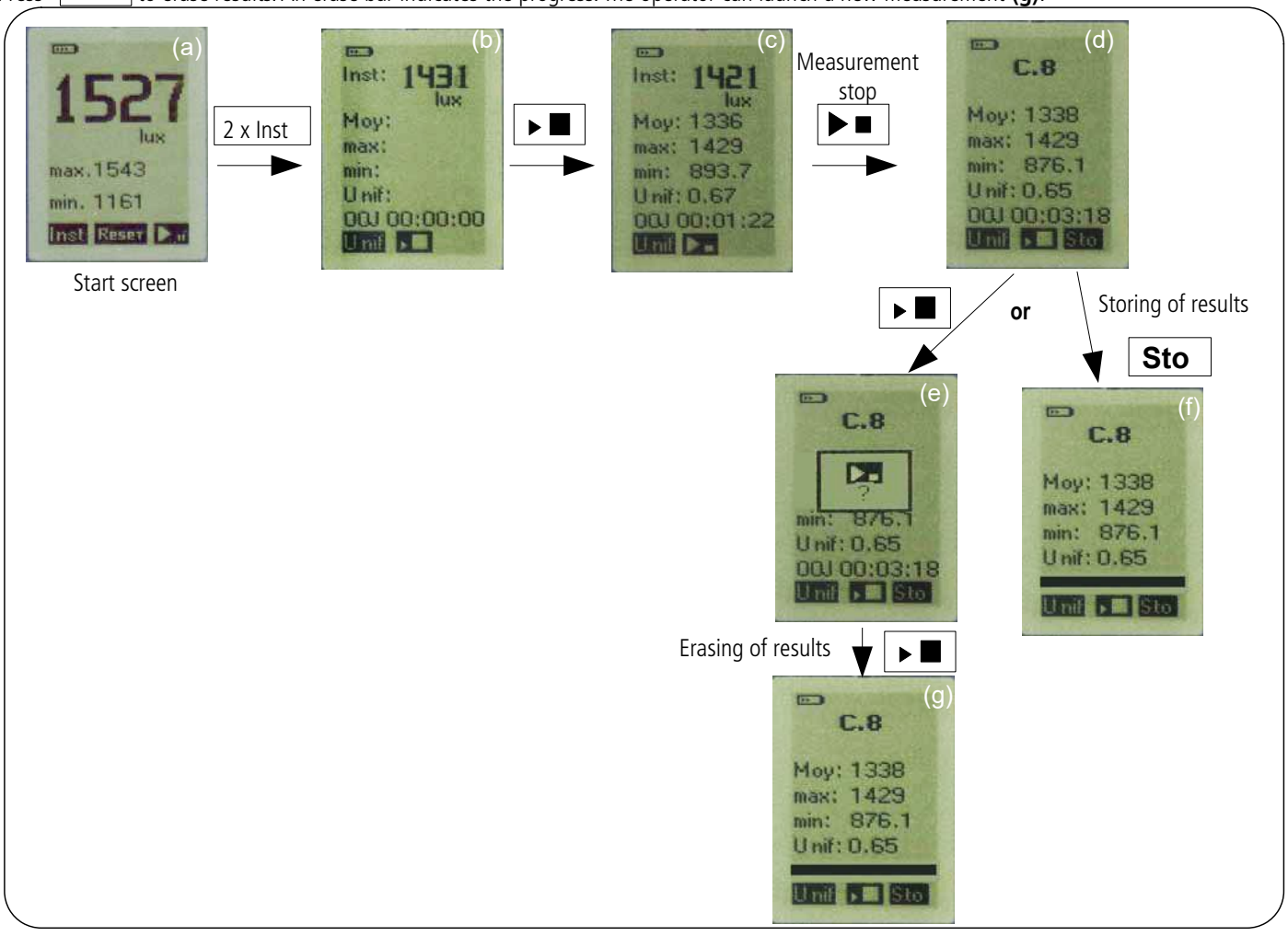
1x [▶■] : launching of the chronometer, it displays seconds -minutes-hours-days (max : 01D00H00M00). The first values, **Average**, **max and min** are displayed, calculation of uniformity is in progress and changes according to illuminance conditions **(c)**.
During the measurement, no other function 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 [ESC] to back to the initial state.

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



5.5 *Temporal*

Principle:
The operator can follow the evolution of illuminance during a period of time at un fixed poste or not fixed.
Ex : evolution of street lighting on a firelane.

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 ▶II key.

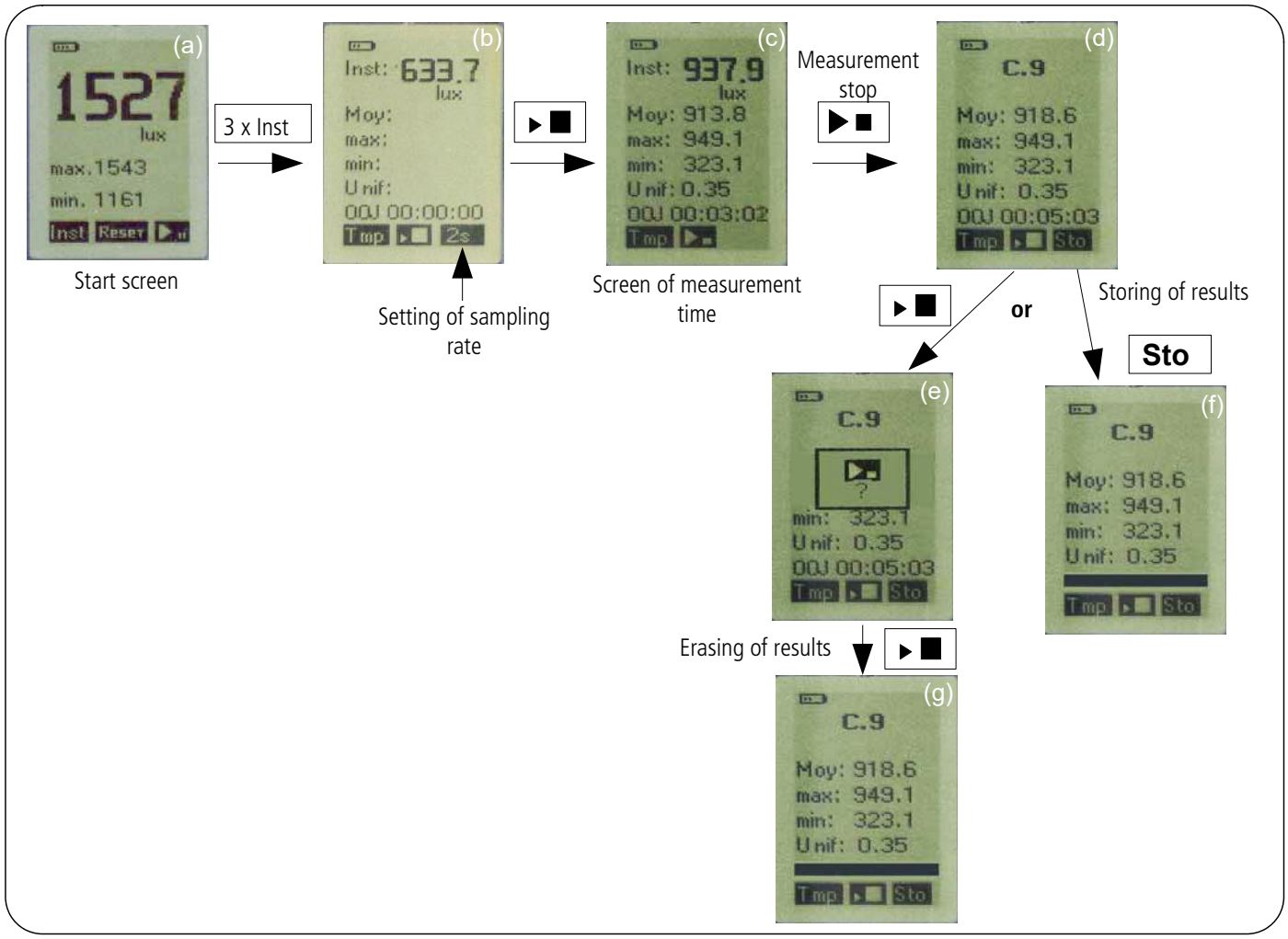
The chronometer indicates day-hours-minutes-seconds (max : 01D00H00M00). The first values, **Average**, **max and min** are displayed, calculation of uniformity is in progress and changes according to illuminance conditions.
During the measurement, no other function is accessible. **(c)**.

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 ESC to back to the initial state.

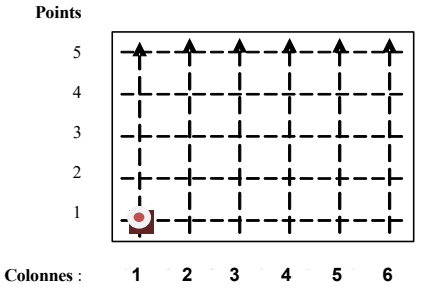
Press ▶■ to erase results. An erase bar indicates the progress. The operator can launch a new measurement.

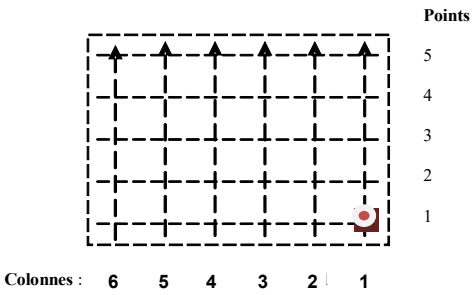


5.6 Mapping

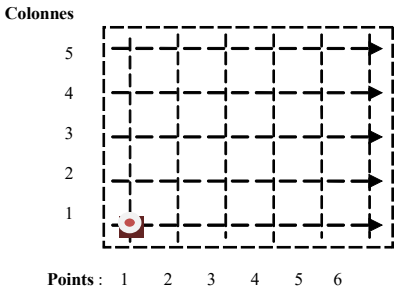
Measurement principle:
The instrument allows to make a manual report of measurement point in an area to obtain a graphic representation of the distribution of the intensity of illumination.
To do that, before making measurement, you have to define:
1. the area to be treated, if possible rectangular or square
2. the origine of the measurement beginning
3. the step of advencement of the measurement in column and points
Once these three things are definined, measurements have to be made manually in the spoted places.

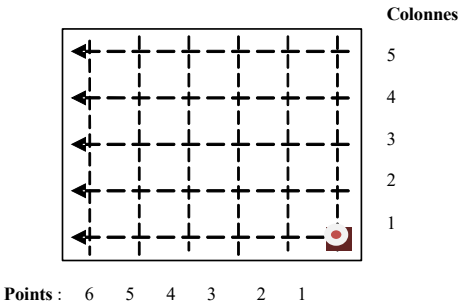
Ex : mapping of a rectangular room of **5 m x 4 m.**
Measurement is usually made at **0.5 m** of wall.
The grid corresponds to:
Spacing between two columns: **1 meter**
Spacing between 2 measurement points: **1 meter**
The origin of measurement has to be fix and measurements have to be made imperatively according to a strict sequence.
According to possibilities of access to the room/area and the wanted graphic reprsentation, **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

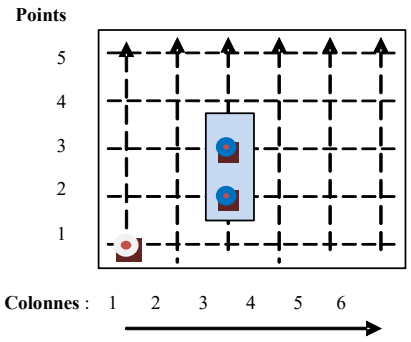




Measurements:
- column 1 : from point 1 to point 6
- column 2 : from point 1 to point 6
- column 3 : from point 1 to point 6
- column 4 : from point 1 to point 6
- column 5 : from point 1 to point 6

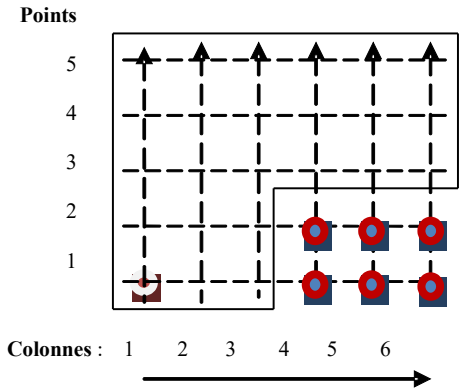
Particular cases:

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 enquiries 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 enquiries 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 enquiries 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 ESC 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 memorise 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 ESC key to back to dataset resume screen. **(f)**.
Important elements are displayed: **Min, Max, Average, Uniformity.**

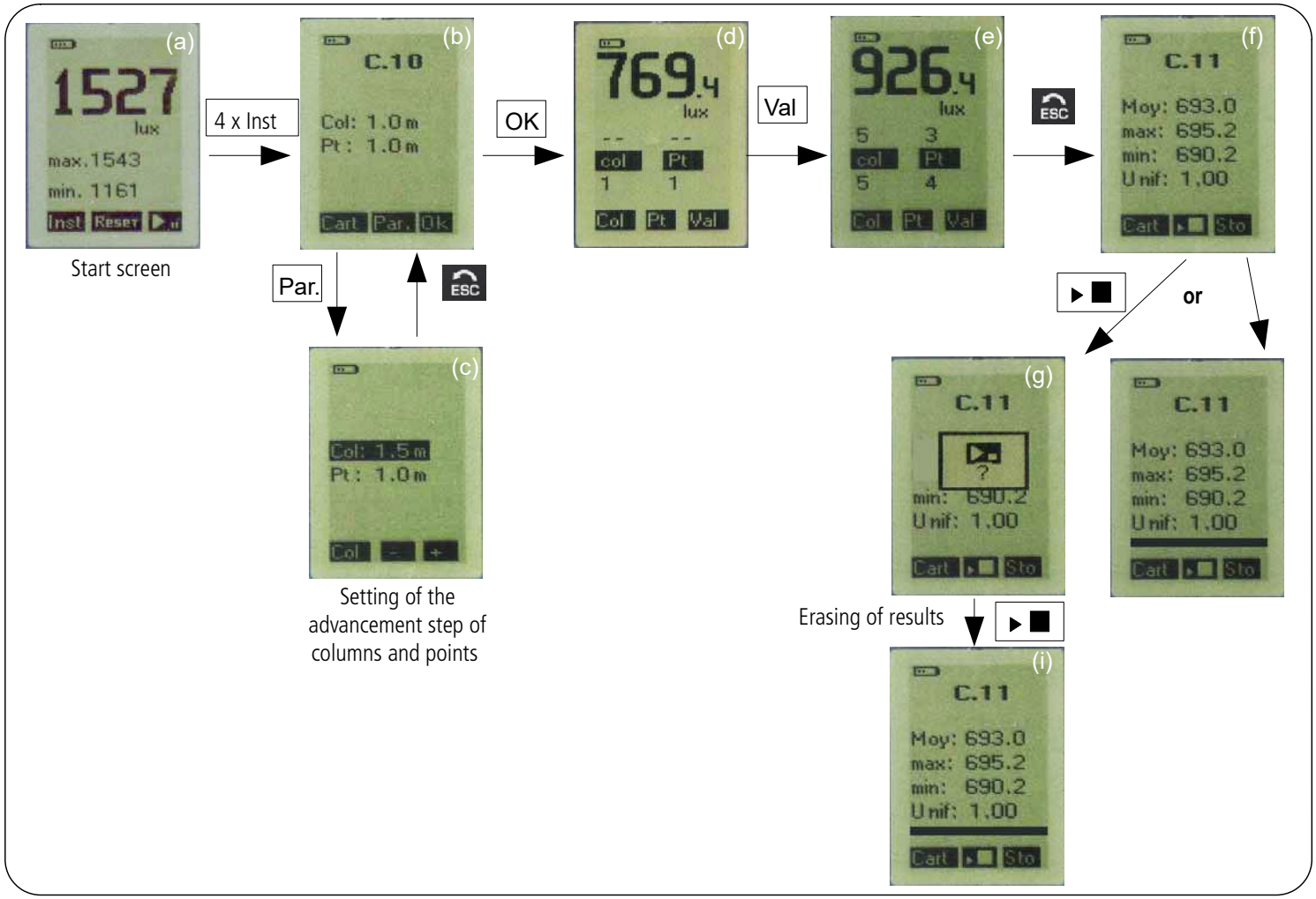
two possibilities for the operator:

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 visualises 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 possibme **(g)**.
Pressing ESC 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)**.



5.7 Instrument shutdown

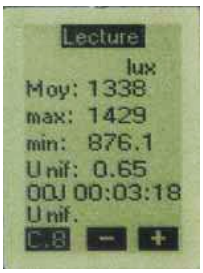
In case of accidental shutdown of the instrument (low batteries), results are automatically saved when the LX200 is operating in Temporal mode. For other modes of measurement (Instantaneous – Relatve - Uniformity – Mapping), please check battery level before launching dataset.

6 After measurement

6.1 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.



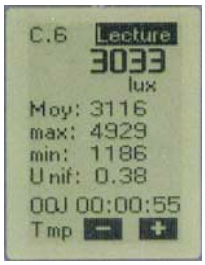
Uniformity

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**

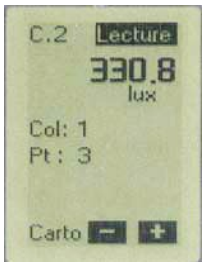


After selecting in **READING** the dataset, press 1 key, reading screen of values appears:

- and + keys allow the scrolling of values, keep pressing on one opf the two buttons to make it scroll faster.

To leave this screen, press ESC key.

- **Mapping**

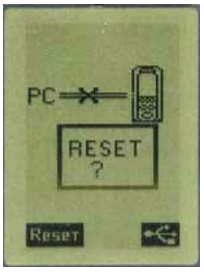


After selecting in **READING** the dataset, press 1 key, reading of values screen appears:

- and + keys allow the scrolling of values.

To leave this screen, press ESC key.

6.2 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).

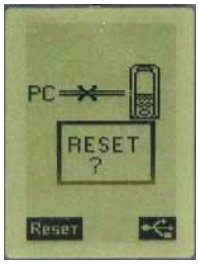
Files formats:
Files of values have a specific termination for each measurement modes :

- Uniformity: *.ldu
- Temporal: *.ldt
- Mapping: *.ldc

6.3 Reseting memory

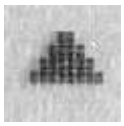
After recording of dataset the operator can erase the memory of the instrument.
There are 2 methods :
Directly with the PC after file transfer
By pressing **RESET** key of the instrument

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



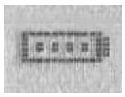
7 Running informations

7.1 Overange



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.

7.2 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.

8 Maintenance

8.1 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 dirts or scratches.

8.2 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.

8.3 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.

9.1 Range details

Lux value	Display	Unit	Lux resolution	Accuracy*
From 0 to 10	From 0.0 to 10.0	lx	0.1	±2 % of reading or ±2 lux
From 10 to 99	From 10.0 to 99.9	lx	0.1	
From 100 to 999	From 100.0 to 999.9	lx	0.1	
From 1000 to 9999	From 1000 to 9999	lx	1	
From 10000 to 99999	From 10.00 to 99.99	Klx	0.01	
From 100000 to 200000	From 100.0 to 200.0	Klx	0.1	
Fc value	**Display**	**Unit**	**Fc resolution**	**Accuracy***
From 0 to 1	From 0.00 to 1.00	fc	0.01	±2 % of reading or ±0.19 fc
From 1 to 99	From 1.00 to 99.99	fc	0.01	
From 100 to 999	From 100.0 to 999.9	fc	0.1	
From 1000 to 9999	From 1000 to 9999	fc	1	
From 10000 to 18580	From 10.00 to 18.58	Kfc	0.01	

** All the accuracies indicated in this technical datasheet were stated in laboratory conditions, and can be guaranteed for measurements carried out in the same conditions, or carried out with calibration compensation.*

9.2 Specifications

Measuring range	0.0 to 200 000 lux 0.00 to 18 585 fc
Directional sensitivity (f2)[1]	< 6%
Linearity (f3)[1]	< 2%
Measurement capability	See table p.18
Backlit LCD display	128 x 64
Conditions of use	From 0°C to +50°C. In non-condensation condition. From 0 to 2000 m.
Storage temperature	From 0°C to +50°C
Housing dimensions without sensor	120 x 58 x 34 mm
Housing weight with sensor and batteries	185 g
Digital electronic	Low drift
Conformity	Compliant with the RoHS directive
Power supply	3 batteries 1.5 V type LR3-AAA
Autonomy	72 hours minimum continuous operation.
European directives	2004/108/EC EMC; 2006/95/EC Low voltage; 2011/65/EU RoHS II; 2012/19/EU WEEE
Mini-USB plug	For USB power supply adapter, for data transfer

[1] The f2 and f3 coefficient are defined according to the French NF C 42-710 standard.

9.3 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.

9.4 Measuring capacity and storage

You can make 32 datasets with the luxmeter. Files can be memorised 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.

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