

Luxmeter
LX 100



Table of contents

| | | |
|---|--|----|
| 1 | Introduction..... | 4 |
| 2 | General information..... | 4 |
| | 2.1 Photometric values..... | 4 |
| | 2.2 Factor value according to the light sources..... | 6 |
| | 2.3 Order of magnitude of Lux according to applications..... | 6 |
| 3 | Operating principle..... | 7 |
| | 3.1 Keyboard presentation..... | 7 |
| 4 | Setting..... | 8 |
| | 4.1 Screen control..... | 8 |
| | 4.2 About..... | 8 |
| 5 | During measurement..... | 9 |
| | 5.1 Range..... | 9 |
| | 5.2 Illuminance..... | 9 |
| | 5.3 Averaged illuminance..... | 9 |
| | 5.4 Relative illuminance..... | 10 |
| 6 | Running informations..... | 11 |
| | 6.1 Over-range..... | 11 |
| | 6.2 Power source..... | 11 |
| 7 | Maintenance..... | 11 |
| | 7.1 Servicing..... | 11 |
| | 7.2 Regular checking..... | 11 |
| | 7.3 Batteries replacement – adaptors..... | 11 |
| 8 | Main specifications..... | 11 |
| | 8.1 Range details..... | 11 |
| | 8.2 Specifications..... | 12 |
| | 8.3 Standard reference..... | 12 |
| 9 | Delivery and packaging..... | 12 |

1 Introduction

LX100 instrument is a portable instrument totally automatic built for the measurement of illuminance. It displays result in Lux or foot candles (footcandle) and provides:

Instantaneous measurement

Display illuminance for local measurements

With timed measurement:

Illuminance min/max values display
Illuminance averaged value calculation

In addition:

It includes a pause function to eliminate any unrepresentative and unwanted illuminance or just to memorize on the screen a local result. It allows a relative measurement to reference point for the quantification of increase illuminance or decrease illuminance.

Data are saved when the instrument is stopped or in case of battery failure.

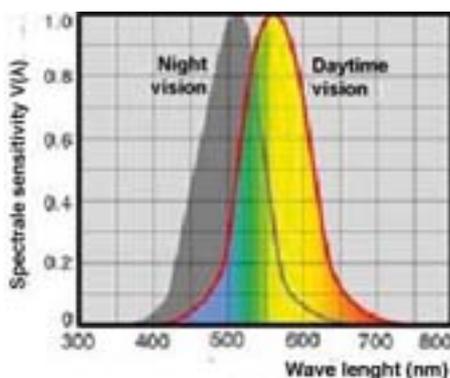
Its sensor is composed by a silicium photodiode, which spectral response is the photopic curve according to CIE standard.

LX 100 instrument is mainly an efficient and easy- to-use instrument : with small size, it has a large display with a resolution of 64*128 pixels, and involving a very high technology.

2 General information

2.1 Photometric values

Photometric values are values which allows 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 on spectral efficiency which is relative to spectral for daytime vision or photopic.

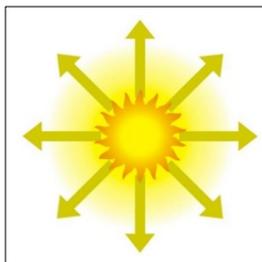


Photopic curve of spectral sensitivity of human eye during diurnal vision

Luxmeter

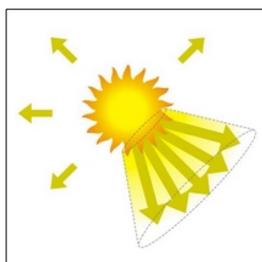
Photometer destined to measurement of **illuminance**, it is equipped with a photo-electric detector and very often a silicium photodiode coupled with a filter for modify its response to be close-in the most possible of the function of reference $V(\lambda)$ defined in the CIE.

Luminous flux



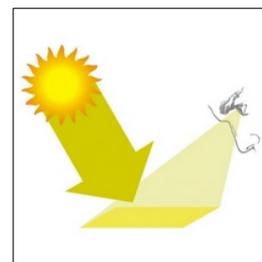
The luminous flux of a source is the assessment, according to the sensitivity of the eye, of the amount of light radiated throughout the area by this source. It is expressed in lumens (lm).

Luminous intensity



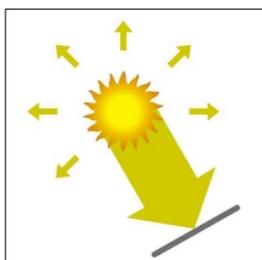
The light intensity is the luminous flux emitted per unit of solid angle in a given direction. It is measured in candelas, equivalent to **1 lm / sr**.

Luminance



The luminance of a source is the ratio between luminous intensity emitted in one direction and the apparent surface of the luminous source in the considered direction. Luminance is expressed in candelas per square meter (cd/m^2).

Illuminance



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

Use:

For each application, it's advisable to control means of measure to obtain valid and consistent results. Means of use of the instrument has at least so much importance on the result than the quality of the instrument.

It is imperative to take account of the most important parameters including:

1. Position correctly the **LX100** cell, according to adequate and representative plan of the current study (eg: workstation).
2. Avoid illumination unrepresentative of the study area
3. Deviate significantly from the cell to avoid mitigation area of illumination.

Functions "pause" and "relative level" integrated into **LX100** instrument will allow to avoid these different problems.

2.2 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 |  |

2.3 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 Operating principle

3.1 Keyboard presentation

When being switched on, "measurement screen" is displayed. From this screen, the operator has access to three others screens by pressing  on keyboard; return to measurement screen is obtained by activating .



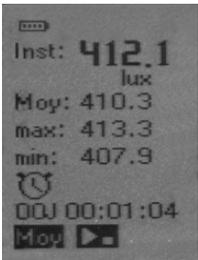
| | | |
|-------|--|---|
| ① ② ③ | Function keys  | Directly associated with texts to displayed shown above on display, they measurement setting. |
| ④ | Key "leave current screen".  | |
| ⑤ | Screen key  | From measurement screens, gives access to other screens |
| ⑥ | On/Off key  | |

Instrument offers 2 groups of screens

1. Screens representing the 3 different modes of measurement



Instantaneous



Average



Relative

2. Configuration screens



Brightness



Informations

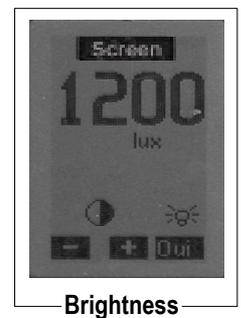
Accessible from principal measurement screen by successive pushes on  key , those different screens allow instrument setting. They also inform users.



4.1 Screen control

To optimize display reading, the operator can :

1. Adjust brightness by pressing on  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%.



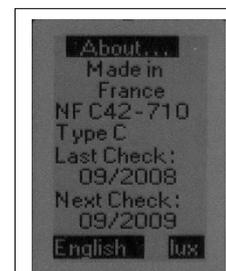
4.2 About...

Information on origin of manufacture, standard references of the instrument and dates of last and next audits.

By Pressing  and  keys you can choose language: French or English.

A press on  or  keys allows the choice measurement unit : Lux or Footcandle.

Note: unit, lux or fc is independent of the used language.



About – English



About - French

5 During measurement

5.1 Range

The digital processing of the instrument avoids for users choice of a range of measurement, **LX100** instrument displays results of measurement in lux or fc on all of its dynamics. To cover the whole field, the screen automatically presents the different formats and units.

5.2 Illuminance

From the start, the instrument measures and displays twice a second the instantaneous value of illuminance expressed in Lux or fc. This value gives information to users about illuminance local conditions.

Min. and max. values completes the screen.

User can at any time by pressing the keys :

-  : Reset minimum and maximum values
-  : Enable pause
-  : Continue measurement



Lux mode



Footcandle mode



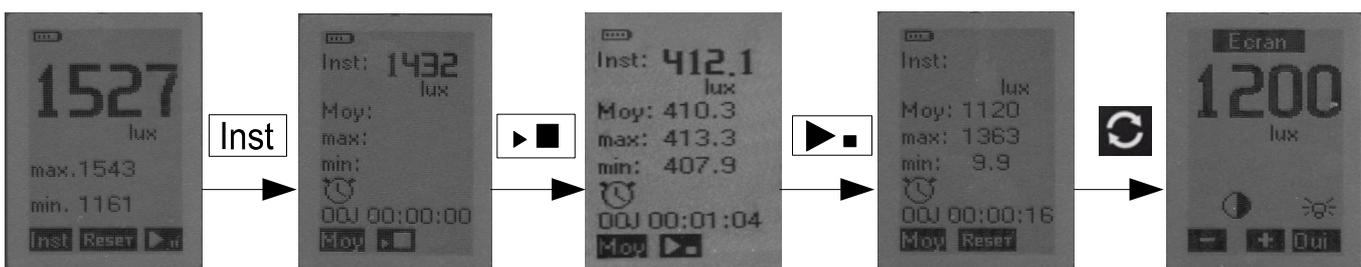
Illuminance

5.3 Averaged illuminance

Measurement principle :

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

- Instantaneous value at rate of two displays per second
- Average value
- Max and min values



From the start screen, user accesses to the Moy measurement of illuminance on a period controlled by stopwatch, he proceeds as follows:

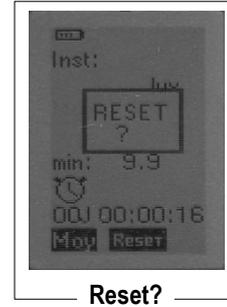
- 1 x  Access to **Moy** screen. Measurement is not launched yet.
- 1 x  Launching of the stopwatch, it indicates seconds -minutes-hours-days (max : 03D00H00M00). First values, (average, max and min). During measurement, no other function is accessible.
- 1 x  Stop of measurement, "**Reset**" is displayed.
- 1 x  In case of poor readability, user can at this moment modify brightness and/or activate backlight.

New measurement

After recording results in his folder, user can launch a new measurement, he proceeds as follows:

1x **Reset** : a sign RESET? alerts the user of the future reset of memory backup. In case of change of mind, pressing  or  inhibits the action.

2x **Reset** : Memory is erasing, visualised by the progress bar. Memory is erased, the operator can launch a new measurement.



Reset?



Erased data

Stop of the instrument

In case of stop of the instrument, intentionally or accidentally (low battery), results are saved automatically and systematically presented to the user before the launch of a new measure.

5.4 Relative illuminance

Principle:

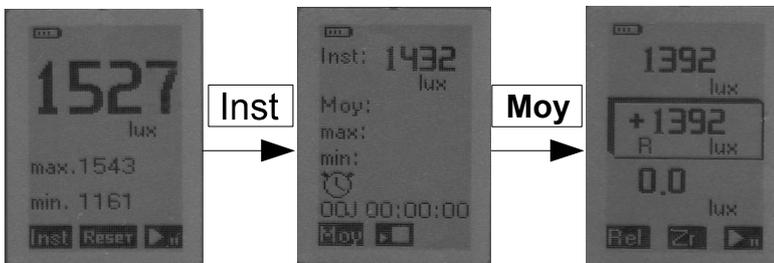
To find the contribution on measurement result by the contribution or removal of a light source, LX100 instrument allows a relative measurement from an existing situation.

For example: knowing the impact of deleting or adding a lighting (neon tubes) in a room.

Proceed as follows:

From the start screen, user accesses to the measurement of the illumination **Rel**

1 x **Inst** then 1 x **Moy** : access to the screen. The function is not yet launched.



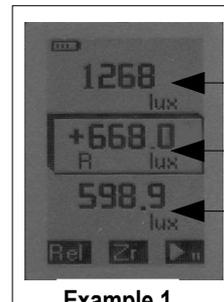
Value displayed at the top of the screen represents instantaneous illuminance

1x **Zr** : Press Zr key – screen shows:

Down: the instantaneous value of illuminance (598.9 lux here), it will serve as reference. It remains fixed and stored.

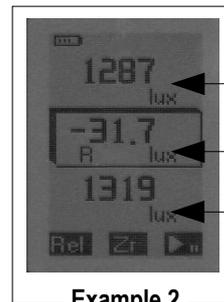
At the top: the value of fluctuating instantaneous illuminance (1268 lux here)

In the middle : in the panel marked R, it is the difference between instantaneous value displayed at the top and reference value stored down. This value can be positive or negative according to fluctuations of illuminance compared to the moment of memorisation of the reference value (**Zr** key).



Example 1

Fluctuating instantaneous illuminance
Relative illuminance
Reference illuminance

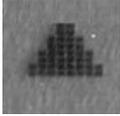


Example 2

Fluctuating instantaneous illuminance
Relative illuminance
Reference illuminance

6 Running informations

6.1 Over-range



Under conditions of measuring range excess, defined at 150,000 lux, an over-range pictogram appears. It comes fleetingly for an illuminance exceeding 150 000 lux . Displayed value will be 150.1 klux.

6.2 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.

7 Maintenance

7.1 Servicing

The LX 100 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.

7.2 Regular checking

Like most measuring instruments, it is strongly recommended to regularly control and calibrate **LX100** instrument. The sensor sensitivity decreases depending on measurement durations and illuminance intensity. Return to the manufacturer each year will provide necessary metrological traceability.

7.3 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.

8 Main specifications

8.1 Range details

| Lux value | Display | Unit | Lux resolution | Accuracy* |
|------------------|----------------|------|----------------|-------------------------------|
| 0 to 10 | 0.0 to 10.0 | lx | 0.1 | ±3% of reading or ±3 lux |
| 10 to 99 | 10.0 to 99.9 | lx | 0.1 | |
| 100 to 999 | 100.0 to 999.9 | lx | 0.1 | |
| 1000 to 999 | 1000 to 9999 | lx | 1 | |
| 10000 to 99999 | 10.00 to 99.99 | klx | 0.01 | |
| 100000 to 150000 | 100.0 to 150.0 | klx | 0.1 | |
| Fc value | Display | Unit | Fc resolution | Accuracy* |
| 0 to 1 | 0.00 to 1.00 | fc | 0.01 | ±3% of reading or ±0.28 fc |
| 1 to 99 | 1.00 to 99.99 | fc | 0.01 | |
| 100 to 999 | 100.0 to 999.9 | fc | 0.1 | |
| 1000 to 9999 | 1000 to 9999 | fc | 1 | |
| 10000 to 13940 | 10.00 to 13.94 | 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.

8.2 Specifications

| | |
|---|--|
| Measuring range | 0.0 to 150000 lux |
| Directional sensitivity (f2) ¹ | < 6% |
| Linearity (f3) ¹ | < 3% |
| Measurement capability | 72 hours – 03D00H00M |
| 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 dimension without sensor | 120 x 58 x 34 mm |
| Housing weight with sensor and batteries | 185 g |
| Digital electronic | Low drift |
| Conformity | Compliant with 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 adaptor |

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

8.3 Standard reference

This instrument is based on recommendations and requirements of the NF C 42-710 standard, February 1988, C class

9 Delivery and packaging

- **LX100** housing with silicon photodiode sensor and glass filter correction.
- Transport case
- 3 batteries LR3-AAA
- Calibration certificate
- **LX100** user manual



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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