

User's Guide

EXTECH[®]

INSTRUMENTS

A FLIR COMPANY

Light Meter

SD Card real-time datalogger

Model SDL400



Introduction

Congratulations on your purchase of the Extech SDL400 Light Meter. This meter displays and stores light meter readings in three ranges: 2,000 / 20,000 / 100,000 LUX or Foot candles from the supplied domed light sensor. The meter automatically ranges light meter measurements and the light sensor spectrum meets C.I.E.

This meter also displays and logs temperature readings from a connected Type J or Type K thermocouple.

Logged data readings are stored on an SD card for transfer to a PC. This meter is shipped fully tested and calibrated and, with proper use, will provide years of reliable service.






Safety

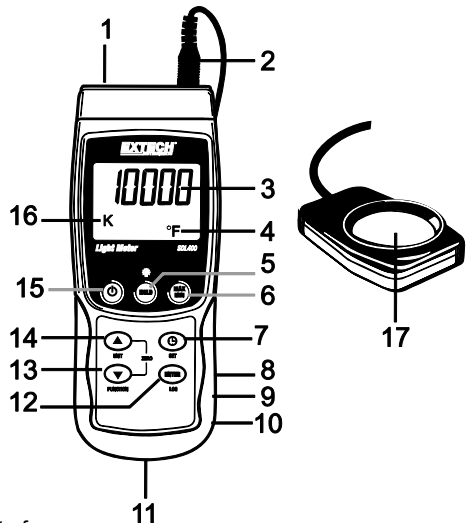
International Safety Symbols



This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.

Meter Description

1. Temperature (thermocouple) input jack
2. Light Meter Sensor input plug
3. Measurement reading
4. Temperature units of measure
5. HOLD and Backlight  key
6. MAX-MIN key
7. SET and Clock  key
8. PC interface jack
9. Reset button
10. Power Adaptor jack
11. SD card slot
12. ENTER and LOG key
13. Down arrow  / FUNCTION / ZERO key
14. Up arrow  / UNIT / ZERO key
15. Power ON-OFF  key
16. Thermocouple type or Light measurement unit of measure
17. Light Sensor dome




Notes:

Items 8, 9, and 10 are located behind the snap-off compartment cover on meter's right side.


Battery compartment, tilt stand, and tripod mount are located on the rear of the instrument

Getting Started

Power ON-OFF

- Power the meter by pressing and holding the power button  for at least 1.5 seconds.
- Press and hold the power button for at least 1.5 seconds to power OFF the meter.
- This meter is powered by six (6) 1.5VDC 'AA' batteries or by optional AC adaptor. If the meter will not switch ON please check that fresh batteries are installed in the rear battery compartment or, in the case of the AC adaptor, check that the adaptor is connected correctly to the meter and to an AC source.

Display Backlight

To turn the display backlight ON or OFF, press and hold the backlight  button for at least 1.5 seconds. The meter will beep when switching the backlight ON or OFF unless the beeper is disabled as described in the Setup Mode section of this user guide.

Light Meter Sensor Connection

The supplied light sensor is connected to the meter via the DIN jack at the top right of the meter. When taking measurements snap off the light sensor's protective cover and then replace the cover when finished.

Light Meter Units of Measure

The currently selected unit of measure is shown to the left of the light measurement reading on the meter's LCD. To change the unit of measure, press and hold the UNIT button until the desired unit of measure appears and then release the UNIT button. The available light measurement units are LUX and FOOT CANDLE (ft-cd).

Thermocouple Temperature Sensor Connection

A type K or J thermocouple temperature sensor can be connected via the sub-miniature thermocouple jack at the top left of the meter. The display icon for the type of thermocouple selected (J or K) is shown on the meter's LCD to the left of the temperature measurement. To change the type, use the Setup Mode.

Temperature Measurement Units of Measure

The currently selected unit of measure is shown below the temperature measurement reading on the meter's LCD. To change the unit of measure, press and hold the UNIT button until the desired unit of measure appears and then release the UNIT button. The available temperature measurement units are °C and °F.

Measurements

Light Meter Measurements

1. Connect the light sensor to the top of the meter as previously described
2. Power the meter by holding the power button for at least 1.5 seconds
3. Select the Light Measurement mode by pressing and holding the FUNCTION button for at least 1.5 seconds (if necessary). The 'LigHt' icon indicates the Light Meter mode
4. Select the desired unit of measure LUX or Foot candles by pressing and holding the UNIT button for at least 1.5 seconds (if necessary)
5. Place the sensor on a surface, or hold in hand, with the domed area facing the light source under test. The light sensor is dome shaped to accommodate light reaching it from various angles.
6. Read the measurement on the meter's LCD
7. This instrument measures light intensity (illuminance) in LUX or Foot candle measurement units

ZERO Adjustment (Light Measurement readings only)

To zero the light meter display, simply press and hold both arrow keys (▼ ▲) for at least 1.5 seconds. This is typically done with the protective sensor cover installed to ensure that a complete absence of light displays a zero reading. This zero function can also be used as a relative, or offset, function but remember to re-zero the meter with the protective cap on after such use.

Temperature Measurements

1. Connect the temperature sensor to the top of the meter as previously described
2. Power the meter by holding the power button for at least 1.5 seconds
3. Select the Temperature Measurement mode by pressing and holding the FUNCTION button for at least 1.5 seconds (if necessary). The 'tP' icon indicates the temperature mode of operation
4. Select the desired Thermocouple Type (K or J) in the Setup Mode
5. Select the desired unit of measure (C or F) in the Setup Mode
6. Hold the thermocouple in the air in the area under test
7. Read the temperature measurement on the meter's LCD

Important Safety Note on Thermocouple Ratings

The temperature range of this meter extends up to 1300°C (2372°F); however the range of thermocouple probes vary greatly; be sure to select a probe rated for the expected temperature measurement ranges.

Data Hold

To freeze a displayed reading on the LCD, momentarily press the HOLD button (the HOLD display icon will appear above the held reading). To release the held reading press the HOLD button again.

Setup Mode

Basic settings at a glance

To view the current configuration of the meter with regard to time, date, and datalogging sampling rate press the SET button momentarily. The meter will now display the configuration in quick succession. If the information is missed on the first try, simply press the SET button again until all of the information is noted.

Accessing the Setup mode

1. Press and hold the SET button for at least 1.5 seconds to access the Setup menu.
2. Press the SET button momentarily to step through the available parameters. The parameter type is shown on the bottom of the LCD and the current selection for that type is shown above it.
3. When a parameter is displayed that is to be changed, use the arrow keys to change the setting. Press the ENTER button to confirm a change.
4. Press and hold the SET button for at least 1.5 seconds to exit the Setup mode. Note that the meter automatically switches out of the Setup mode if no key is pressed within 7 seconds.
5. The available Setup parameters are listed below. Additional detailed information is provided below this list:

dAtE Set the clock (Year/Month/Date; Hours/Minutes/Seconds)

SP-t Set the datalogger sampling rate (Hours/Minutes/Seconds)

PoFF Automatic power-off management (Enable or disable the auto-power off function)

bEEP Set the beeper sound ON/OFF

dEC Set the numerical format; USA (decimal: 20.00) or European (comma: 20,00)

SdF Format the SD memory card

tCF Units of measure selection for temperature readings (C or F)

tYPE Select the Thermocouple type (K or J)

Setting the Clock Time

1. Access the **dAtE** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow keys to change a value
3. Use the ENTER button to step through the selections
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode)
5. The clock will keep accurate time even when the meter is switched off. However, if the battery expires the clock will have to be reset after fresh batteries are installed

Setting the Datalogger Sampling Time (Rate)

1. Access the **SP-t** parameter as described in the Accessing Setup Mode section above
2. The sampling rate can be set to '0' seconds (for manual logging) or 1, 2, 5, 10, 30, 60, 120, 300, 600, 1800, 3600 seconds for auto logging. Use the arrow keys to select the sampling rate
3. Press the ENTER button to confirm the entry
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode)

Enabling/Disabling the Auto Power OFF Feature

1. Access the **PoFF** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow buttons to select ON (enable) or OFF (disable). With the Auto Power OFF feature enabled, the meter will automatically switch OFF after 5 minutes of inactivity.
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Beeper Sound ON or OFF

1. Access the **bEEP** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow buttons to select ON (enable) or OFF (disable).
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Numerical Format (comma or decimal)

European and USA numerical formats differ. The meter defaults to USA mode where a decimal point is used to separate units from tenths, i.e. **20.00**; The European format uses a comma, i.e. **20,00** to separate units from tenths. To change this setting:

1. Access the **dEC** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow buttons to select USA or EUro.
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

SD Card FORMATTING

1. Access the **Sd-F** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow buttons to select YES to format the card (select NO to abort). Note that all data on the card will be lost if formatting is attempted.
3. Press ENTER to confirm selection.
4. Press ENTER again to re-confirm.
5. The meter will automatically return to the normal operating mode when formatting is complete. If not, press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode.

Set the Temperature Units of Measure (C or F)

1. Access the **t-CF** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow buttons to select the desired unit of measure
3. Press ENTER to confirm setting.
4. Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode (or simply wait 7 seconds for the meter to automatically switch to the normal operating mode).

Set the Thermocouple Type (K or J)

1. Access the **tYPE** parameter as described in the Accessing Setup Mode section above.
2. Use the arrow buttons to select the desired sensor type.
3. Press ENTER to confirm setting.
 - Press and hold the SET button for at least 1.5 seconds to exit to the normal operation mode.

System Reset

If the meter's keys become inoperable or if the display freezes the Reset button can be used to reset the instrument.

- Use a paper clip or similar item to momentarily press the reset button located on the lower right side of the instrument under the snap-off compartment cover.
- After pressing the Reset button, switch the instrument ON by pressing and holding the POWER key for at least 1.5 seconds. If using the power adaptor unplug the adaptor and then plug it back in again to power the meter.

Max-Min Reading Record and Recall

For a given measurement session, this meter can record the highest (MAX) and the lowest (MIN) readings for later recall.

1. Press the MAX-MIN button momentarily to access this mode of operation (REC icon appears)
2. The meter is now recording the MAX and MIN readings.
3. Press the MAX-MIN button again to view the current MAX readings (MAX icon appears). The readings on the display are now the highest readings encountered since the REC icon was switched on (when the MAX-MIN button was first pressed).
4. Press the MAX-MIN button again to view the current MIN readings (MIN icon appears). The readings on the display are now the lowest readings encountered since the REC icon was switched on (when the MAX-MIN button was first pressed).
5. To exit the MAX-MIN mode, press and hold the MAX-MIN button for at least 1.5 seconds. The meter will beep, the REC-MAX-MIN icons will switch off, the MAX-MIN memory will clear, and the meter will return to the normal operating mode.

Datalogging and PC Interface

Types of Data Recording

- **Manual Datalogging:** Manually log up to 99 readings onto an SD card via push-button press.
- **Automatic Datalogging:** Automatically log data onto an SD memory card where the number of data points is virtually limited only by the card size. Readings are logged at a rate specified by the user.

SD Card Information

- Insert an SD card (from 1G size up to 16G) into the SD card slot at the bottom of the meter. The card must be inserted with the front of the card (label side) facing toward the rear of the meter.
- If the SD card is being used for the first time it is recommended that the card be formatted and the logger's clock set to allow for accurate date/time stamping during datalogging sessions. Refer to the Setup Mode section for SD card formatting and time/date setting instructions.
- European and USA numerical formats differ. The data on the SD card can be formatted for either format. The meter defaults to USA mode where a decimal point is used to separate units from tenths, i.e. **20.00**. The European format uses a comma, i.e. **20,00**. To change this setting, refer to the Setup Mode section.

Manual Datalogging

In the manual mode the user presses the LOG button to manually log a reading onto the SD card.

1. Set the sampling rate to '0' seconds as described in the Setup Mode section.
2. Press and hold the LOG button for at least 1.5 seconds and the lower portion of the display will show $P-n$ (n = memory position number 1-99).
3. Momentarily press the LOG button to store a reading. The REC icon will flash each time a data point is stored.
4. Use the ▲ and ▼ buttons to select one of the 99 data memory positions in which to record.
5. To exit the manual datalogging mode, press and hold the LOG button for at least 1.5 seconds. The Pn icon will switch off.

Automatic Datalogging

In automatic datalogging mode the meter takes and stores a reading at a user-specified sampling rate onto an SD memory card. The meter defaults to a sampling rate of one second. To change the sampling rate, refer to the Setup Mode section (the sampling rate cannot be '0' for automatic datalogging):

1. Select the sampling rate in the Setup Mode (refer to Setup Mode section) to a value other than zero.
2. Press and hold the LOG button for at least 1.5 seconds. The meter will flash the REC icon at the selected sampling rate indicating that readings are now being automatically recorded to the SD card. Note that if the battery is low, the meter will flash the BAT icon and datalogging will not commence. Replace the batteries at this point (see Battery Replacement section of this guide)
3. If a card is not inserted or if the card is defective, the meter will display SCAN SD indefinitely. In this case, switch the meter OFF and try again with a valid SD card.
4. Pause the datalogger by pressing the LOG button momentarily. The REC icon will stop flashing and the sample rate will display for a short time. To resume logging simply press the LOG button again momentarily.
5. To terminate the datalogging session press and hold the LOG button for at least 1.5 seconds.
6. When an SD card is used for the first time a folder is created on the card and named **LXB01**. Up to 99 spreadsheet documents (each with 30,000 readings) can be stored in this folder.
7. When datalogging begins a new spreadsheet document named **LXB01001.xls** is created on the SD card in the LXB01 folder. The data recorded will be placed in the LXB01001.xls document until 30,000 readings are reached.
8. If the measurement session exceeds 30,000 readings, a new document will be created (LXB01002.xls) where another 30,000 readings can be stored. This method continues for up to 99 documents, after which another folder is created (LXB02) where another 99 spreadsheet documents can be stored. This process continues in this same fashion with folders LXB03 through LXB10 (last allowable folder).

SD Data Card to PC Data Transfer

1. Complete a datalogging session as detailed above in the previous sections. Hint: For the first few tests, simply record a small amount of test data. This is to ensure that the datalogging process is well understood before committing to critical, large scale datalogging.
2. With the meter switched OFF, remove the SD Card.
3. Plug the SD Card directly into a PC SD card reader. If the PC does not have an SD card slot, use an SD card adaptor (available at most outlets where computer accessories are sold).
4. Power the PC and run a spreadsheet software program. Open the saved documents in the spreadsheet software program (see example spreadsheet data screen below).

Spreadsheet data example

	A	B	C	D	E
1	Position	Date	Time	Value	Unit
2	1	6/8/2011	15:00:00	600	LUX
3	2	6/8/2011	15:00:01	600	LUX
4	3	6/8/2011	15:00:02	600	LUX
5	4	6/8/2011	15:00:03	600	LUX
6	5	6/8/2011	15:00:04	600	LUX
7	6	6/8/2011	15:00:05	600	LUX
8	7	6/8/2011	15:00:06	600	LUX
9	8	6/8/2011	15:00:07	600	LUX
10	9	6/8/2011	15:00:08	600	LUX
11	10	6/8/2011	15:00:09	600	LUX
12	11	6/8/2011	15:00:10	600	LUX
13	12	6/8/2011	15:00:11	600	LUX
14	13	6/8/2011	15:00:12	600	LUX
15	14	6/8/2011	15:00:13	600	LUX
16	15	6/8/2011	15:00:14	600	LUX


RS-232/USB PC Interface

The optional 407001A software kit (software and cable) allows streaming of data to a PC via the RS232 Output jack.

AC Power Adaptor

This meter is normally powered by six (6) 1.5V 'AA' batteries. An optional 9V power adaptor is available. When the adaptor is used, the meter is permanently powered and the power button will be disabled.

Battery Replacement and Disposal

When the low battery icon  appears on the LCD, the batteries must be replaced. Several hours of accurate readings are still possible in this condition; however batteries should be replaced as soon as possible. Note that the Datalogger will not run with the low battery symbol showing.


- Remove the two (2) Phillips screws from the rear of the meter (directly above the top of the tilt stand).
- Remove and safely place the battery compartment and screws where they will not be damaged or lost.
- Replace the six (6) 1.5V 'AA' batteries observing polarity.
- Replace the battery compartment cover with the two (2) Phillips screws.



All EU users are legally bound by the battery ordinance to return all used batteries to collection points in your community or wherever batteries / accumulators are sold! Disposal in the household garbage is prohibited!

Specifications

General Specifications

Display	Backlit LCD; LCD size: 52 x 38mm (2 x 1.5")
Status indicators	Over-range (----) and low battery 
Sensor types	Light: Supplied color corrected, domed light intensity sensor (meets C.I.E.); Temperature: Thermocouple (J or K) temperature probe
Temperature compensation	Automatic compensation for thermocouple temperature measurements
Measurement Units	Temperature: °C, °F; Light: LUX, Foot candles
Zero Adjust	Light function only. Front panel push-button.
Datalogger Sampling Rate	AUTO LOGGING: 1, 2, 5, 10, 30, 60, 120, 300, 600, 1800, 3600 seconds. Note that a one (1) second sampling rate can cause some data loss on slower computers MANUAL LOGGING: Set the sampling rate to '0'
Memory Card	SD memory card: 1GB to 16GB size
Data Hold	Freeze the displayed reading
Memory Recall	Record and Recall the Maximum and Minimum readings
Display update rate	Approx. 1 second.
Data Output	RS-232 / USB PC computer interface; for use with optional software kit part number 407001A
Operating Temperature	0 to 50°C (32 to 122°F)
Operating Humidity	85% R.H. max.
Auto Power OFF	After 10 minutes of inactivity (can be disabled)
Power Supply	Six (6) 1.5 VDC batteries (optional 9V AC adaptor)
Power Consumption	Normal operation (backlight & datalogger OFF): approx. 6.5mAdc With backlight OFF and datalogging ON: approx. 30mAdc With backlight ON add approx. 16mAdc
Weight	346g (0.76 lbs.) meter only
Dimensions	Main instrument: 182 x 73 x 47.5mm (7.1 x 2.9 x 1.9")

Electrical Specifications (ambient temperature 23°C ± 5°C)

Light meter

Measurement	Range	Actual Display for each range
LUX <i>(auto range)</i>	2,000LUX	0 to 1,999 LUX
	20,000 LUX	1,800 to 19,990 LUX
	100,000 LUX	18,000 to 99,900 LUX
Foot-candles <i>(auto range)</i>	200Ft-cd	0 to 186.0 Ft-cd
	2,000 Ft-cd	167.0 to 1,860.0 Ft-cd
	10,000 Ft-cd	1,670.0 to 9,290.7 Ft-cd

Range	Resolution	Accuracy
2,000 LUX	1 LUX	± (4% + 2 dgt)
20,000 LUX	10 LUX	
100,000 LUX	100 LUX	
200 Ft-cd	0.1 Ft-cd	± (4% + 2 Ft-cd)
2,000 Ft-cd	1 Ft-cd	
10,000 Ft-cd	10 Ft-cd	
<i>Note: Accuracy tested using a standard tungsten lamp (2856 K degree temperature)</i>		

Temperature meter

Sensor Type	Resolution	Range	Accuracy
Type K	0.1 °C	-50.0 to 1300.0°C	± (0.4% + 0.5°C)
		-50.1 to -100.0°C	± (0.4% + 1.0°C)
Type J	0.1 °F	-58.0 to 2372.0°F	± (0.4% + 1.0°F)
		-58.1 to -148.0°F	± (0.4% + 1.8°F)
	0.1 °C	-50.0 to 1200.0°C	± (0.4% + 0.5°C)
		-50.1 to -100.0°C	± (0.4% + 1.0°C)
0.1 °F	-58.0 to 2192.0°F	± (0.4% + 1.0°F)	
	-58.1 to -148.0°F	± (0.4% + 1.8°F)	

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