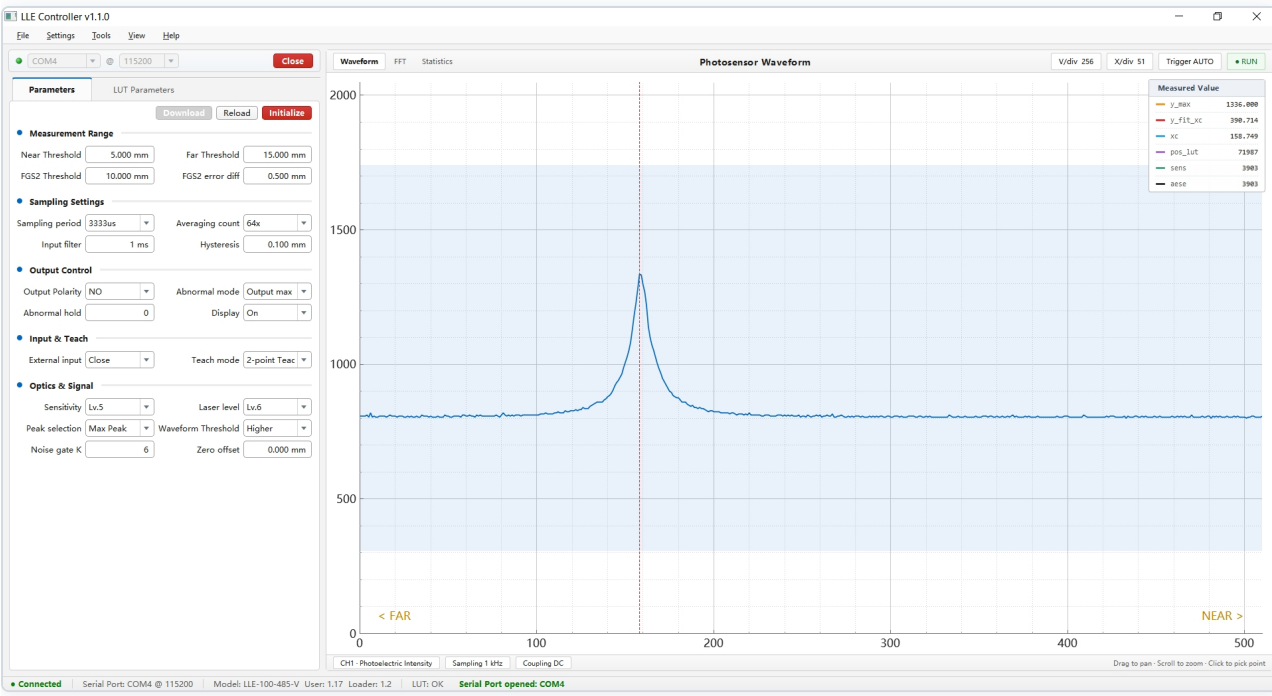


LASER DISPLACEMENT SENSOR

LLE Controller

The upper-computer control software for the LLE / CGI series of laser displacement sensors.



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01 Safety Guidelines

When using this software to control laser displacement sensors, please observe the following guidelines.

WARNING • LASER RADIATION

- Do not look directly at the laser beam emitted by the sensor, nor direct it toward the eyes of others.
- During installation, alignment and debugging, first turn off the laser in the software (see Section 5.3) and only activate it after proper adjustment.
- Determine the laser safety rating of the sensor from the product label and the sensor hardware manual.

CAUTION • FIRMWARE UPGRADE

Power loss, unplugging the cable, or force-closing the software during a firmware upgrade may prevent the device from starting. Ensure a stable power supply and connection before upgrading (see Section 8.1).

02 Understanding the LLE Controller

The LLE Controller is the software companion for LLE / CGI series laser displacement sensors. By connecting a sensor to a computer via a USB serial cable, you can perform all daily tasks from one interface.

WHAT YOU WANT TO DO	FEATURE	SECTION
See the real-time waveform	Basic display	§4.3
Ensure accurate, stable measurement	Exposure calibration	§5.2
Set range and determine output	Parameters & threshold teaching	§6, §5.4
View measurement results live	Monitoring window	§5.3
Record data over a period of time	Data collection & playback	Ch. 7
Update the device program	Firmware upgrade	§8.1

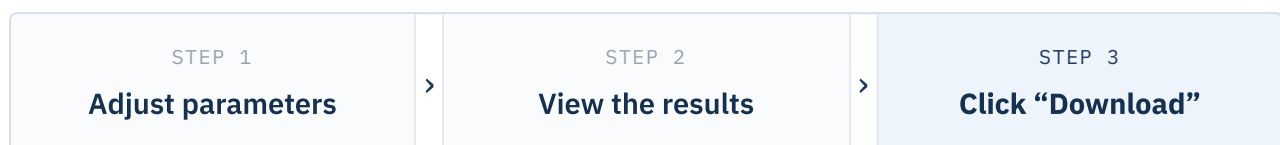
2.1 Operating Environment

ITEM	REQUIREMENT
Computer system	Windows 10 / 11, or Linux (x86-64)
Connection method	USB serial cable (supplied with the sensor)
Runtime libraries	Included with the installation package — no separate installation required

2.2 A key concept: temporary effect vs. permanent storage

All modified parameters take effect immediately, so you can test and view the results while adjusting. However, these changes are stored only temporarily on the device and are lost when power is removed.

After confirming that the adjustments are correct, click [Download](#) on the Parameters page to save the settings permanently on the device. This is the step most easily overlooked when using this software:



NOTE

If there are unsaved changes, a prompt appears when you close the software — you can still save them at that point.

03 Installation & First Connection

3.1 Launching the Software

- **Windows:** double-click `LLEController.exe`
- **Linux:** enter the program directory and run `./LLEController`

NOTE

Only one LLE Controller can run on a computer at a time. If startup reports that an instance is already running, locate and close it (it may be minimized). If the prompt persists, restart the computer to restore normal operation.

3.2 Connecting the Sensor

1. Connect the sensor to the computer with the USB serial cable.
2. Start the LLE Controller.
3. Select the port in the top-left corner of the main interface (`COMx` on Windows, `/dev/ttyUSB0` on Linux). Keep the baud rate at the default of **115200**.
4. Click `Open`.

After a successful connection, a green **“Connected”** message and the device model appear in the status bar at the bottom of the window; the waveform area on the right begins updating in real time.

NOTE

The sensor does not transmit any data automatically on power-up. No response after plugging in is normal — connect through the software, which initiates communication.

TIP

Next time you start the software it automatically re-opens the previously used port — usually no manual selection is needed.

04 Main Interface Guide

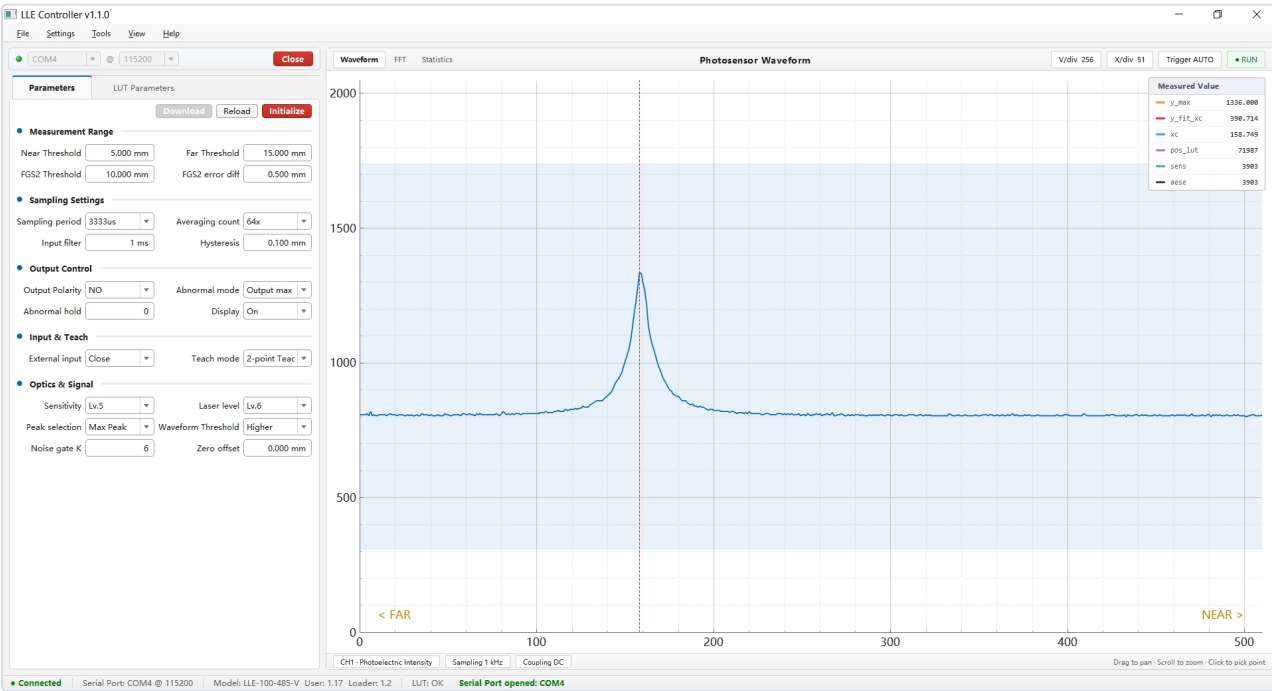


Figure 1 · Main interface — connected, with the real-time waveform running.

The main interface is divided into four areas.

4.1 Serial Port Strip (top-left)

Select the port and baud rate, then enable or disable the connection. Port and baud rate are locked while connected; disconnect first to change them. Advanced options such as slave address and communication timeout live under [Settings ▶ Serial Port Settings...](#) and generally need no modification.

4.2 Parameter Page (left)

All adjustable sensor parameters are divided into five functional groups (see Chapter 6). The three buttons at the top:

BUTTON	ACTION
Download	Save the current parameters permanently on the device (retained when powered off).
Reload	Discard unsaved changes and read the device's current parameters again.
Initialize	Restore factory settings. This action cannot be undone — use with caution.

4.3 Waveform Region (right)

A real-time display of the light-intensity distribution received by the sensor's internal photosensitive element — the most intuitive indicator of whether the sensor is working properly.

- A sharp, non-flat-topped peak indicates good condition.
- A flattened peak top (clipped at the very top edge) means the light intensity is too high; measurement may fail — see Section 5.2.
- No peak detected means the light is too weak or the target is outside the measurement range.

Common interactions: drag to pan, scroll to zoom, double-click to restore the automatic field of view. The left of the plot shows **< FAR** and the right shows **NEAR >**, indicating distance direction; the light band between the two thresholds is your effective measurement range.

The floating layer in the top-right shows the measurement values for the current frame, where `xc` is the core spot-position reading for advanced users. For daily use, simply read the measurement values in the monitoring window (Section 5.3).

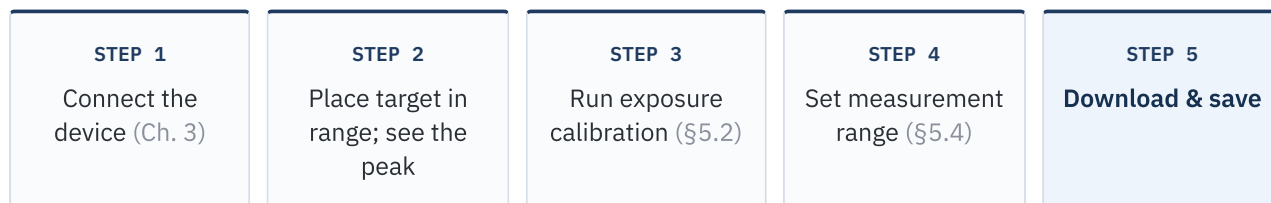
4.4 Status Bar (bottom)

From left to right: connection status, serial-port information, device model and firmware version, calibration-table status, and error messages. When problems occur, the status bar often points directly at the cause.

05 Basic Operations

5.1 Quick Onboarding

For a new device or a newly installed environment, follow these steps in order.



5.2 Get a Good Waveform (Exposure Calibration)

The prerequisite for accurate measurement is a healthy waveform: a clear peak without a sharp, flattened top. The simplest approach is automatic exposure calibration.

1. Confirm the target is within the measurement range.
2. Open **Tools ▶ Monitoring Window...**
3. On the **Exposure Calibration** tab, click **Start Exposure Calibration** and wait for completion (progress is shown).
4. After success, the new sensitivity and laser grade appear on the Parameter page (shown in orange, indicating a pending save).
5. Go to the Parameters page and click **Download** to save.

If calibration fails, the interface displays the reason:

PROMPT	MEANING	HOW TO HANDLE
R1	Target not detected	Move the target within the measurement range and try again.
R2	Laser level cannot be adjusted further	Check whether target reflection is too strong or too weak; adjust the target or installation distance.
R3	Cannot enter the stable region	Check whether the target surface is highly reflective or transparent; change the measurement position and try again.

NOTE

Exposure calibration requires newer device firmware. If the function is missing from the menu, or an “insufficient version” error appears, upgrade the firmware (Section 8.1). Otherwise adjust manually: reduce sensitivity (and, if necessary, the laser power level) on the Parameters page until the peak no longer clips and reaches an appropriate height.

5.3 Real-time Monitoring of Results

Open **Tools ▶ Monitoring Window...** to view and control results in real time.

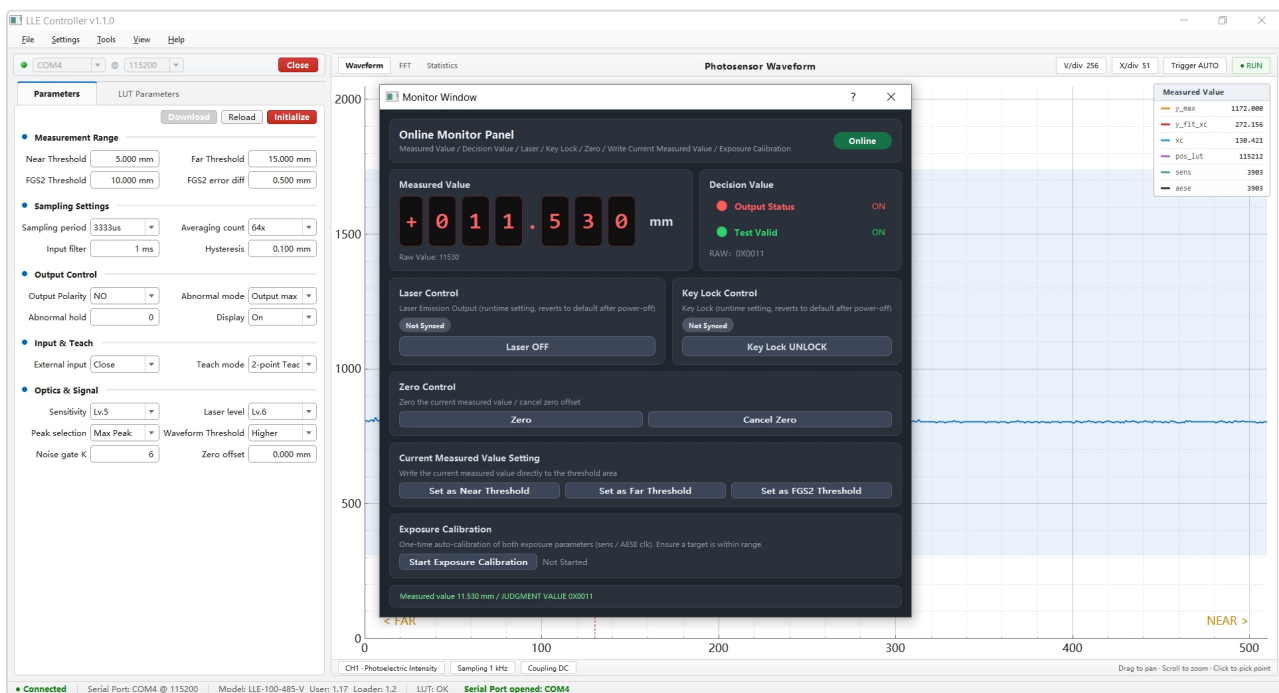


Figure 2 · Online monitoring panel.

CARD	FUNCTION
Measured value	Current measurement result (mm), shown in a large font.
Decision value	Output status (ON / OFF) and measurement validity.
Laser control	One-touch laser activation. Temporary — returns to default after power-off.
Key-lock control	Lock / unlock the device's physical buttons to prevent accidental touches. Temporary.
Zero-reset control	Set the current position as zero; “Clear Zero” restores it. Download to save permanently.

CARD	FUNCTION
Current-value settings	Threshold teaching — see Section 5.4.
Exposure calibration	See Section 5.2.

5.4 Set the Measurement Range (two methods)

Method 1 — Enter values directly. On the Parameters page, under the Measurement Range group, enter the proximal and distal thresholds.

Method 2 — Teaching (recommended). Let the device “remember” the physical location:

1. Place the target at the desired boundary position.
2. Open the monitoring window and confirm the measurement is valid (“Test Valid” is ON).
3. On the **Current Measurement Value Settings** tab, click **Set as Proximal Threshold** (or Distal / FGS2 Threshold).
4. Repeat for the other boundary.
5. Go to the Parameters page and click **Download** to save.

CAUTION

If the target exceeds the measurable range (measurement invalid), the software refuses to write and shows a warning, preventing incorrect thresholds from being set.

5.5 Saving, Reloading & Factory Reset

OPERATION	METHOD
Save current parameters permanently	Parameters page ► Download
Discard unsaved changes	Parameters page ► Reload
Factory reset	Parameters page ► Initialize (irreversible; re-teach & recalibrate after)

06 Parameter Settings

The following explains the purpose of each parameter and when to adjust it, organized by the five groups on the Parameter page. For scenarios not mentioned here, keep the default values.

6.1 Measurement Range

PARAMETER	DEFAULT	WHEN TO ADJUST
Proximal / Distal threshold	5.000 / 15.000 mm	Define the valid measurement range. The target is evaluated only within this range; teaching setup is recommended (§5.4).
FGS2 threshold / deviation	10.000 / 0.500 mm	Reference position and tolerance when using FGS2 identification mode.

6.2 Sampling Settings

PARAMETER	DEFAULT	WHEN TO ADJUST
Sampling period	Level 3	Smaller for fast movement / quick response; larger for smooth operation. Available range depends on device model.
Average count	64×	Increase when reading jitter is high; decrease to keep fast tracking.
Input filtering	1 ms	Increase when the external input signal jitters (e.g. from mechanical switches).
Hysteresis	0.100 mm	Increase when the target fluctuates near the threshold, causing frequent output reversals.

6.3 Output Control

PARAMETER	DEFAULT	WHEN TO ADJUST
Output polarity	Normally open	Select normally open / normally closed to match the connected control system.
Abnormal mode	Max output value	Output behavior for abnormal measurements: output the maximum value or hold the last valid value.

PARAMETER	DEFAULT	WHEN TO ADJUST
Abnormal hold	0	Number of hold cycles allowed for temporary exceptions without changing the output.
Display screen	On	Turn off the digital display on the sensor body when desired.

6.4 Input & Teaching

PARAMETER	DEFAULT	WHEN TO ADJUST
External input	Off	Select the function to trigger from the external terminal (turn off laser, teaching mode, zeroing, etc.).
Teaching mode	2-point	Select the teaching mode (1-point, FGS2, or 2-point) based on on-site requirements.

6.5 Optics & Signal

This group determines waveform quality. Use exposure calibration for automatic adjustment (§5.2); adjust manually only in special scenarios.

PARAMETER	DEFAULT	WHEN TO ADJUST
Sensitivity	Level 1	Equivalent to “exposure time” (levels 1–6). Lower if the peak clips; raise if the waveform is too weak.
Laser grade	Level 1	Projection brightness (levels 1–9). Adjust together with sensitivity.
Peak selection	Max peak	Which peak to select when there are multiple reflection points (e.g. multi-layer glass, complex surfaces).
Waveform threshold	High	Keep high for excessive ambient interference or false positives; lower for weak signals or missed detections.
Noise gate K	6	Generally needs no adjustment; fine-tune between 2 and 12 when background noise is abnormal.
Zero offset	0.000 mm	Written automatically by the “reset” function; do not enter manually.

07 Data Acquisition & Playback

Use data acquisition to record raw measurement data over a period of time — for vibration analysis, troubleshooting occasional anomalies, or retaining acceptance records.

7.1 Data Collection

Open **Tools ▶ Data Acquisition...**

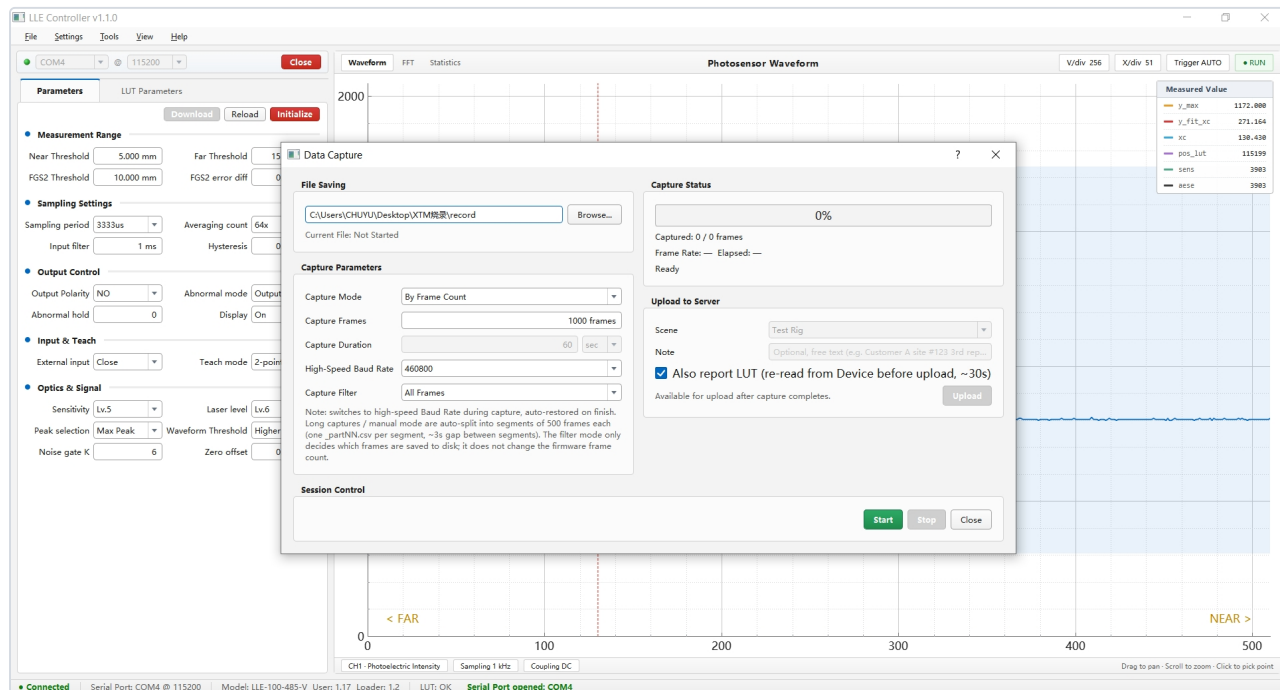


Figure 3 · Data-collection dialog.

1. Select a save location.
2. Select the amount: by frame count (default 1000 frames) or by duration (up to 24 hours).
3. Click **Start** and wait for completion.

Data is saved as a CSV file and opens directly in Excel. Long-running collection is split into multiple files automatically — this is normal.

ATTENTION

- During collection the software temporarily raises the communication rate and restores it afterward. Do not disconnect the cable midway.
- Allow roughly a 3-second interval between samplings.
- If collection is interrupted unexpectedly, the collected data is retained and can be resumed directly.

Collection filter: by default all data is recorded. When troubleshooting occasional issues, record only abnormal data (invalid measurement or abnormal waveform frames) to significantly reduce file size.

Upload to server (optional): after collection, upload the data to the technical-support team for analysis with one click. Follow the prompts to select a scenario and enter notes; failed uploads retry automatically.

7.2 Play Back Record Files

Open **Tools ▶ View Record File**, select a previously recorded CSV file, and check the curves you want to play back and view.

7.3 Real-time Point Analysis (advanced)

Open **Tools ▶ Data Analysis...** and click the desired location on the waveform. The software computes the value fluctuation (variance) at that point in real time, to assess installation stability and environmental interference. Closing the dialog restores the normal display.

08 Equipment Maintenance

8.1 Firmware Update

Firmware is the program that runs inside the sensor. New firmware typically includes measurement-algorithm improvements and bug fixes. Open [Firmware Update...](#)

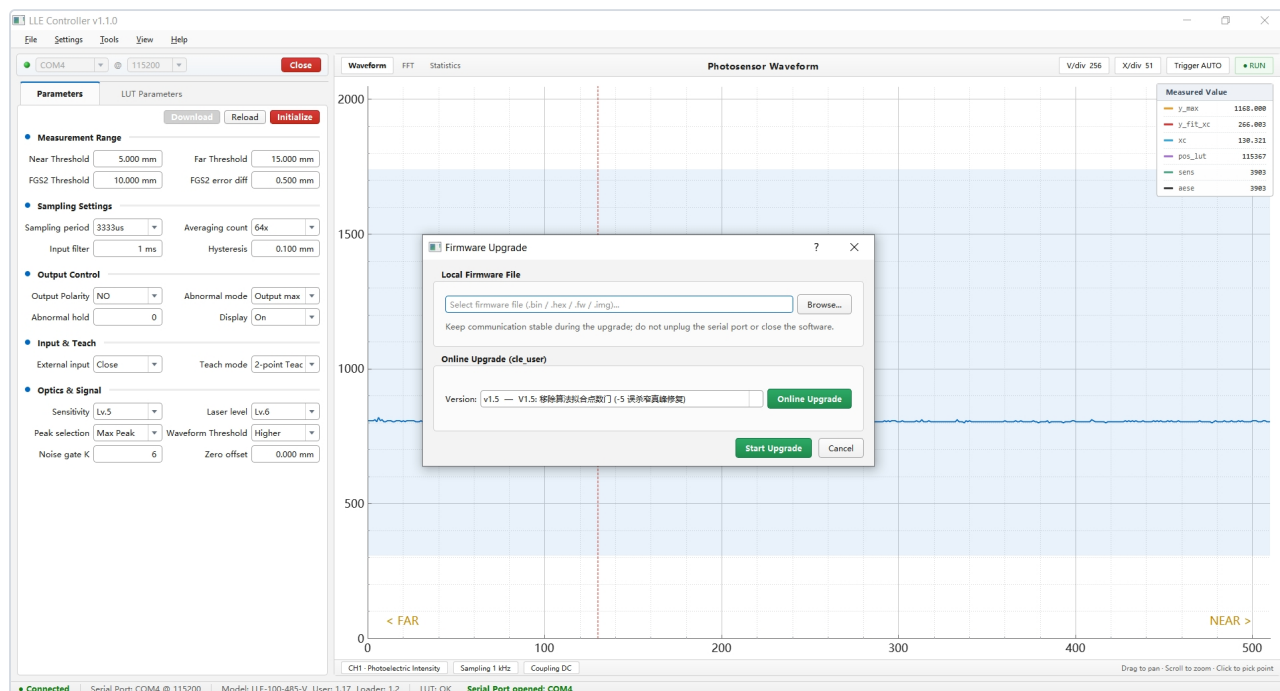


Figure 4 · Firmware-upgrade dialog.

- **Online upgrade (recommended):** the software lists available versions with update descriptions. Select one and click **Online Upgrade** — download and verification complete automatically.
- **Local file upgrade:** when you receive a firmware file from technical support, click **Browse** to select it, then click **Start Upgrade**.

WARNING

During the upgrade (typically 1–2 minutes) do not power off, unplug the serial cable, or close the software — doing so may prevent the device from starting. The real-time display pauses automatically during the upgrade; this is normal.

If the upgrade fails, the software shows the failed step. Keep a stable connection and try again; if it still fails, contact technical support.

8.2 Read / Write the Calibration Table (LUT)

The calibration table contains measurement and calibration data programmed at the factory and needs no manual access in daily use. Use it only under technical-support guidance, via [Tools ► LUT Parameters...](#)

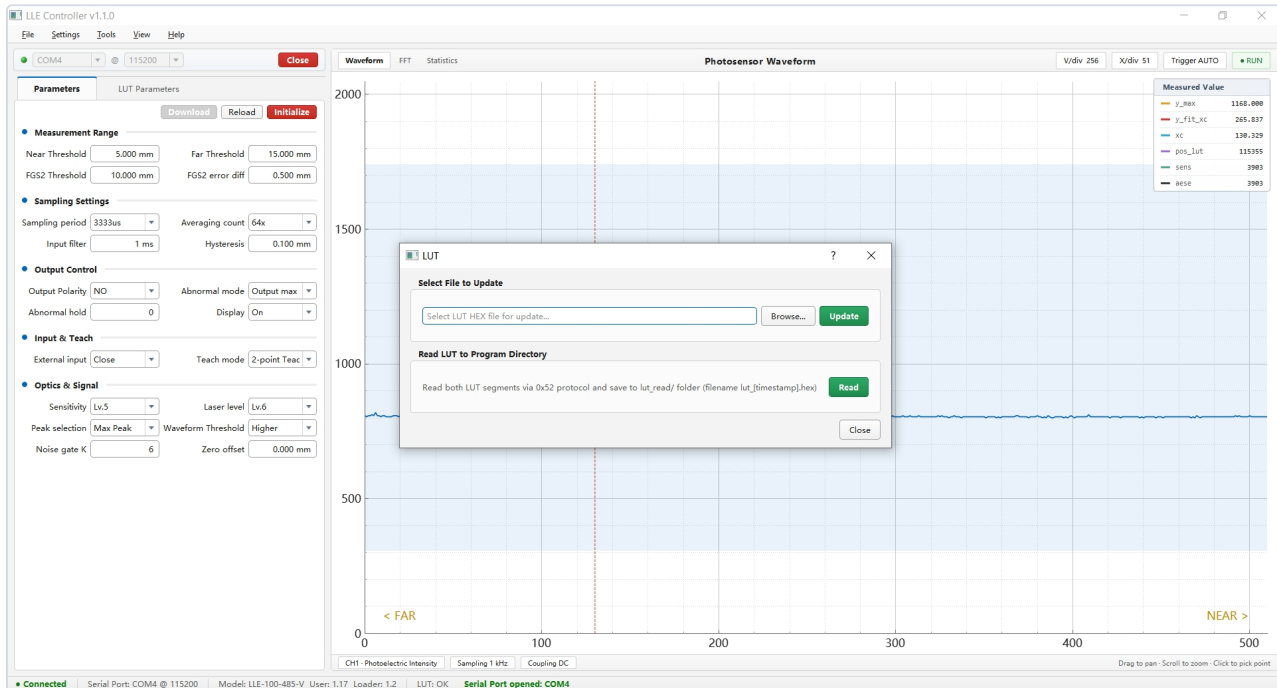


Figure 5 · LUT operation dialog.

- **Read:** back up the calibration table from the device to your computer (about 30 seconds; do not disconnect).
- **Update:** write a calibration file provided by technical support to the device.

WARNING

Writing an incorrect calibration table directly results in inaccurate measurements. Use only a calibration file that matches the device serial number.

8.3 Advanced Serial Port Settings

Open [Settings ► Serial Port Settings...](#)

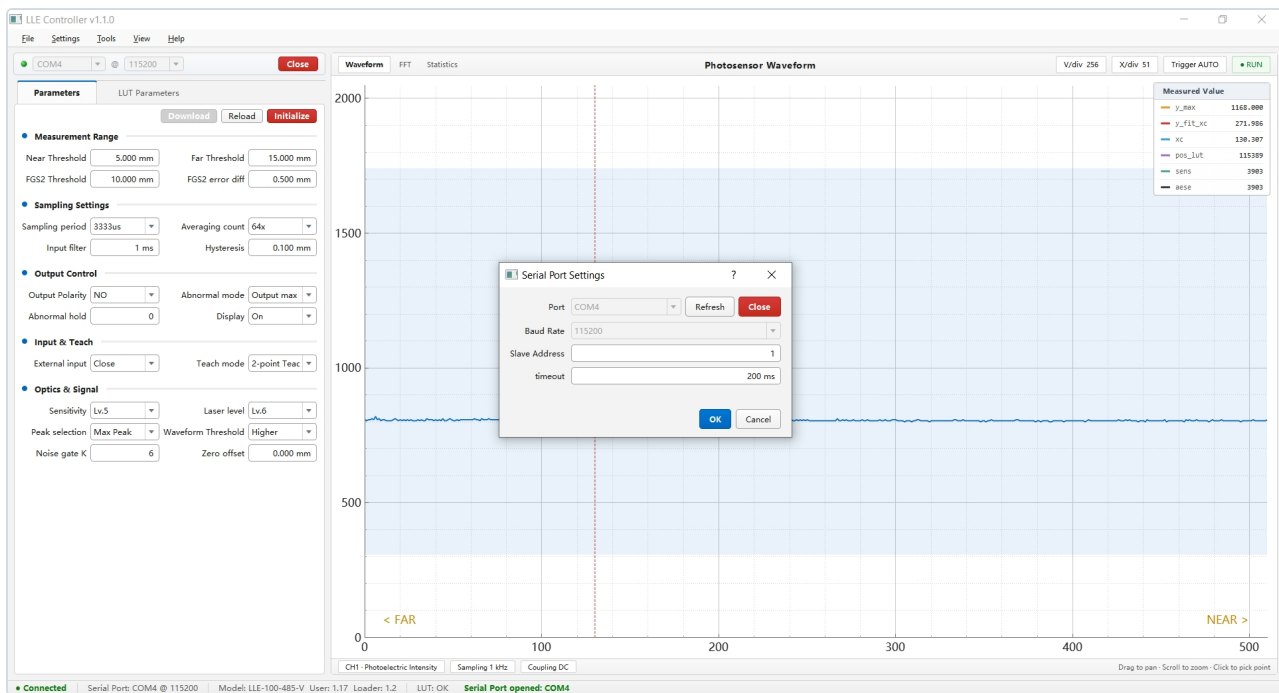


Figure 6 · Serial-port settings dialog.

Keep the slave address (default 1) and timeout (default 200 ms) at their factory values; change them only when the device requires special configuration or technical support instructs you to.

09 Fault Diagnosis

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Startup message: “Another LLE burning program is running”	An instance is already running, or a remnant remains from a previous failed exit.	Close the running instance (check the taskbar); if not found, restart the computer.
No waveform or data after opening the serial port	Cable / power issue; wrong port or baud rate; port occupied by another program.	Check each item per Section 3.2.
Flat-topped waveform, peak clipped	Excessive exposure.	Run exposure calibration (§5.2) or manually reduce sensitivity.
Measurement value is invalid	Target outside the range; waveform clipping; signal too weak.	Examine the waveform first: confirm a clear peak without a flat top and that the target is within the thresholds.
Parameter reverted after power loss	Not saved after modification.	Click Download on the Parameters page (see §2.2).
Output fluctuates near the threshold	Target position jitters right at the boundary.	Increase the “hysteresis” parameter (§6.2).
Status bar shows “Old Firmware Compatibility Mode”	Device firmware is too old.	Upgrade the firmware first (§8.1), then use other features.
Data collection interrupted mid-process	High-speed communication disturbed (long cable, environmental interference).	Lower the “high-speed baud rate” in the collection dialog and retry; collected data is not lost.

10 Getting Help

- **Software version:** [Help](#) ▶ [About](#)
- **Device model & firmware version:** the status bar at the bottom of the window.
- **System integration** (PLC / upper-computer interface), secondary development, or command-line automation: refer to the accompanying *LLE Controller Integration & Protocol Manual*.
- **When contacting technical support**, provide: device model, firmware version, and a description of the issue. If available, attach data-collection files (Chapter 7).

A Parameter Quick Reference

GROUP	PARAMETER	RANGE	DEFAULT
Measurement range	Proximal threshold	mm, 3 decimals	5.000
	Distal threshold	mm	15.000
	FGS2 threshold	mm	10.000
	FGS2 deviation	mm	0.500
Sampling	Sampling period	5 levels (model-dependent)	Level 3
	Average count	1 / 8 / 64 / 512	64×
	Input filtering	1–256 ms	1
	Hysteresis	mm	0.100
Output control	Output polarity	Normally open / closed	NO
	Abnormal mode	Max value / last value	Max value
	Abnormal hold	0–9999	0
	Display screen	Off / On	On
Input & teaching	External input	7 function options	Off
	Teaching mode	1-point / FGS2 / 2-point	2-point
Optics & signal	Sensitivity	Levels 1–6	Level 1
	Laser grade	Levels 1–9	Level 1
	Peak selection	Max peak / peaks 1–5	Max peak
	Waveform threshold	High / Mid / Low	High
	Noise gate K	2–12	6

B Glossary

TERM	MEANING
Waveform	The light-intensity distribution curve received by the sensor's photosensitive element; indicates whether the measurement status is normal.
Peak saturation (clipping)	The top of the waveform is flattened, indicating excessive light intake; reduce exposure.
Exposure calibration	One-click function that automatically adjusts exposure and laser intensity for optimal waveform quality.
Teach	Set thresholds directly from object positions instead of entering values manually.
Threshold	Effective boundary position of the measurement interval.
Hysteresis	Output hysteresis that prevents frequent output switching when the target jitters at a boundary.
Download	Save parameters permanently to the device (computer → device).
Zeroing	Set the current location as the measurement zero point.
LUT (calibration table)	Factory-calibrated data that determines measurement accuracy; requires no daily adjustment.
Firmware	The program running inside the sensor.

This manual is based on LLE Controller v1.1.0. Updates to product appearance, interface, or functionality may occur without separate notice.