

Digital laboratory for the physics classroom (student set)

LABOTRIX SENSE PHY L5

PRODUCT PASSPORT

Kyiv

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1. General Information about the Product

- 1.1. **Product name** — Physics Digital Laboratory Student Kit.
- 1.2. **Trademark** — Labotrix.
- 1.3. **Model** — Sense Phy L5; full trade designation — LABOTRIX SENSE PHY L5.
- 1.4. **Manufacturer** — Labotrix Group Limited, China.
- 1.5. **Intended use:** the set is designed for educational experiments, practical classes and research projects of students in physics: the study of mechanical motion and force, electrical circuits, thermal phenomena, and changes in gas pressure in a sealed vessel. The set is designed for one student group to work at one workstation; demonstration experiments in front of the whole class and higher-complexity tasks are carried out by the teacher using their own laboratory set. The kit is used in physics lessons and elective classes in lower and upper secondary school. The laboratory combines hardware, multimedia content and elements of generative artificial intelligence, which makes classes inclusive and engaging for students of different levels of preparedness: working with the platform develops attention, logical and imaginative thinking, creative abilities and collaboration skills, and students complete tasks individually or in groups, developing learning independence and interaction.
- 1.6. **Design features:** the set includes six types of wireless sensors, seven devices in total (photogates — two units, the remaining sensors — one each): each is equipped with a color liquid crystal display with a diagonal of at least 1.8 inches and shows the measurement result directly on its own housing. The devices operate autonomously, without a datalogger or an external analog-to-digital converter, and are powered by built-in batteries, which are charged with a separate charger from the set, designed to charge four sensors at the same time. Several sensors simultaneously transmit measured values to a computer or mobile device, where a program with a Ukrainian-language interface displays tables and graphs and allows the results to be exported to a spreadsheet editor. The devices are stored and transported in a box with a foam insert.
- 1.7. **Digital learning support:** together with the product, the right of access to an online teaching support course is transferred; the course is hosted in a learning management system (LMS) and is designed for 70 academic hours of lessons. The course is compiled to match the current curricula of general secondary education institutions of Ukraine. The materials are grouped into research modules in the subjects of physics, biology, chemistry, STEM, and every topic contains a lesson plan, a list of the required equipment, an experiment scenario, a step-by-step laboratory work instruction with an explanation of the expected result, a video demonstration of working techniques, interactive exercises and tasks for independent study and for project work, suitable both for individual and for group work. All modules are compiled for this very equipment and have been tested on it, therefore the course works along the direct chain "equipment → methodology → learning outcomes". A language-model-based assistant with retrieval over the course knowledge base (Retrieval-Augmented Generation) is built into the course: for the topic of the lesson it selects appropriate experiments, sets out the sequence of conducting the study in methodological terms, examines typical student errors and gives personal advice on how to get rid of them, changes the level of

difficulty to match the preparation of a particular class and helps to draw up a report on the study and to organize the conclusions. The knowledge base of the assistant is localized and aligned with the Ukrainian curriculum. The license for the course and the accompanying software is valid for 12 months from the date on which access is transferred. The content of the course and the answers of the assistant are provided in Ukrainian, while the interface of the learning platform is multilingual: the Ukrainian localization is enabled by default, an English-language interface is available as an option.

- 1.8. **Processing of the measured data on the platform:** the sensors of the set transmit measurement results to the electronic platform automatically — the student does not copy the reading off the screen and does not enter numbers by hand. The built-in artificial intelligence agent works with this data set right away: it builds graphs and tables from it, processes the results obtained, shows the patterns that appeared during the experiment, compares the measured values with the reference values for this work and leads the student towards independently formulating a hypothesis, a conclusion and an interpretation, keeping the student within the defined "knowledge corridor" — it does not prompt a ready answer but narrows the search down to the correct direction. Work with the platform is arranged so that it is suitable both for individual performance and for work in a group.

2. Technical Specifications

- Brand — Labotrix
- Model — Sense Phy L5
- SKU — LTX-SENSE-PHY-L5
- Product type — Physics Digital Laboratory Student Kit
- Number of sensors in the set (pieces) — 7 (6 types; photogates — 2 pcs.)
- Types of sensors in the set — photogate (photo-shutter sensor), force sensor, voltage sensor, current sensor, temperature sensor, gas pressure sensor
- Photo-shutter sensor (photogate), 2 pcs — resolution 0.1 ms within a time range of 0–10 s
- Force sensor — resolution 0.01 N within a range from –50 to +50 N
- Voltage sensor — resolution 0.01 V within a range from –25 to +25 V
- Current sensor — resolution 0.01 A within a range from –3 to +3 A
- Temperature sensor — resolution 0.01 °C within the range from –50 to +200 °C
- Gas pressure sensor — resolution 0.1 kPa within 0–700 kPa
- Sensor display — color liquid crystal, diagonal not less than 1.8 inches
- Method of connection with a computer, a mobile device or a cloud service — wireless (Bluetooth), a wired connection via USB is additionally supported
- Autonomy of the sensors — measurement and data transmission without a datalogger and without an additional analog-to-digital converter
- Sensor power source — built-in battery recharged from the set's charger
- Charger — charges at least 4 sensors at the same time

- Software — display of the data in tables and graphs, export of the results to spreadsheet editors
- Software compatibility — with the operating system of the device used at the educational institution (Windows, macOS)
- Language of the interface of the data acquisition software — Ukrainian by default, English available as an option
- Digital learning support — online course in a learning management system (LMS)
- Course volume (academic hour) — 70
- Course subjects — physics, biology, chemistry, STEM
- Composition of the materials — research modules, experiment scenarios, step-by-step laboratory work instructions, video demonstrations, interactive exercises and tasks
- Compatibility of the materials with the equipment — full, along the chain "equipment → methodology → learning outcomes"
- Language-model-based assistant — built into the course, with retrieval over a localized knowledge base (Retrieval-Augmented Generation)
- Validity period of the license for the course and the software (month) — 12
- Language of the course and of the answers of the assistant — Ukrainian; interface of the platform — multilingual, the Ukrainian localization by default, an English-language interface available as an option
- Transfer of the results to the platform — automatic, without manual entry of numbers
- Processing of the measured data by the artificial intelligence agent — plotting of graphs and tables, analysis of the results, identification of the patterns of the experiment
- Comparison with reference values — provided for every laboratory work of the course
- Support in formulating the conclusions — within the defined "knowledge corridor", without a ready answer
- Language of marking and operating documentation — Ukrainian
- Product marking — trademark, model and a space for the inventory number
- Packaging — individual box of corrugated cardboard with the contents secured
- Documentation supplied — product passport with warranty card, operating manual and teaching guide for the teacher and for the student
- Operating conditions — premises of an educational institution, air temperature from +5 to +40 °C, relative humidity from 40 to 60 % without condensate
- Care of the sensor surfaces — wiping with a dry or slightly damp cloth is permitted
- Format of accompanying materials — printed operating manual and electronic teaching materials in a digital course
- Work organization — a set for one student workstation; the teacher conducts whole-class demonstrations and handles higher-complexity tasks using their own set
- User requirements — the teacher connects the experimental equipment and conducts the briefing; students work under supervision

- Service life (year) — 5
- Warranty period (month) — 12

3. Package Contents

- Wireless photo-shutter sensor (photogate) — 2 pcs
- Wireless force sensor — 1 pcs
- Wireless voltage sensor — 1 pcs
- Wireless current sensor — 1 pcs
- Wireless temperature sensor — 1 pcs
- Wireless gas pressure sensor — 1 pcs
- Charger for sensors — 1 pcs
- Box (case) with a foam insert liner for the sensors — 1 pcs
- Right of access to the online course with a language-model-based assistant (license) — 1 pcs
- Operating manual and teaching materials for the experiments, separately for the teacher and separately for the student — 1 set
- Software (download link) — 1 set
- USB cable for a wired connection of the sensor to the computer — 1 pcs
- Product Passport and Warranty Card — 1 pcs
- Individual transport packaging — 1 pcs

Stands, clamps and other fixtures for mounting the sensors during the experiment are not included in the set and are provided by the physics classroom. Before first use, it is recommended to fully charge the sensors' batteries.

4. Safety Precautions

4.1. General requirements

- Before first use, read this passport and keep it together with the product.
- The set is designed for one student or a pair of students to work under the guidance of a teacher who has completed occupational safety training.
- Inspect the unpacked set for mechanical damage; the use of damaged sensors is prohibited.
- Before the experiment, make sure that the computer or mobile device the set works with is functional and has sufficient charge.

4.2. Electrical safety

- The voltage sensor is designed for low-voltage educational circuits; do not connect it to the AC mains.
- Do not exceed the rated measurement limits of the voltage (25 V) and current (3 A) sensors — exceeding them may damage the device.
- Charge the sensors only with the charger supplied in the set; do not leave the batteries unattended during extended charging.
- Do not short-circuit the contacts of the sensors and the charger with metal objects.

4.3. Working with mechanical sensors

- Mount the force sensor and the photogate on a stable stand before starting the measurement, to avoid the equipment falling.

- Do not exceed the rated load limit of the force sensor (50 N) and do not use it as a lever or a clamp.
- Connect the gas pressure sensor to the vessel only through the provided adapter; do not create pressure exceeding 700 kPa.
- Make sure that foreign objects do not block the photogates' optical beam while the body passes through.

4.4. It is strictly prohibited

- Immerse the sensors and the charger in water or other liquids.
- Disassemble the sensors, batteries or charger yourself.
- Dropping the sensors, squeezing their housing or subjecting them to impacts.
- Use the sensors to measure mains voltage or in circuits that exceed the rated limits.
- Leave sensors that are charging near flammable materials or unattended overnight.

5. Preparation for Use

- 5.1. Unpack the set and check its completeness against section 3 of this passport; it is recommended to keep the packaging.
- 5.2. Inspect each sensor for cracks in the housing and damage to the connectors.
- 5.3. Fully charge the sensors from the charger supplied in the set before first use.
- 5.4. Install the software on the computer or the mobile device according to the instructions in the operating manual.
- 5.5. Switch the sensors on one after another and make sure that each of them has appeared in the list of active devices of the software.
- 5.6. Prepare the physics classroom's stand and clamps to mount the photogates and the force sensor according to the experiment diagram.
- 5.7. Study the teaching materials of the course in order to choose the experiment that corresponds to the topic of the lesson.

6. Operating Procedure

6.1. Preparation of the sensors and selection of the experiment

- Switch on the required sensors and make sure that the software has detected the connection with the computer or the mobile device.
- Choose an experiment from the course's teaching materials and assemble the experimental setup according to the diagram.

6.2. Measuring mechanical quantities

- Mount the photogates along the path of the body's motion to measure transit time or speed; install the force sensor at the point where force is applied.
- Before the body starts moving or force is applied, start data recording in the software.

6.3. Measuring electrical quantities

- Connect the voltage sensor in parallel, and the current sensor — in series, to the section of the educational circuit, observing polarity.
- Observe the readings on the sensor's screen or in the software in real time.

6.4. Measuring temperature and gas pressure

- Immerse the temperature sensor in the medium under study, or attach the gas pressure sensor to the vessel through the adapter.
- Record the readings for the time needed for the value to stabilize.

6.5. Processing of the results and finishing the work

- Save the data obtained in the format offered by the software and, if necessary, export them to a spreadsheet editor.
- Turn off the sensors, disconnect them from the experimental setup and return them to the box.

6.6. Work with the online course

- Obtain an account at the educational institution and activate the right of access to the course; the validity period of the license is counted from the date on which access is transferred.
- Select the topic of the lesson in the course list: every topic is accompanied by a plan, a list of equipment, an experiment scenario, a step-by-step instruction, a video demonstration and interactive tasks.
- Formulate a query to the assistant on the topic of the lesson — it will suggest appropriate experiments, set out the sequence of actions, examine typical errors and advise how to correct them.
- Set the level of difficulty of the tasks to match the preparation of the class; on the basis of the results of the work the assistant will help to draw up the report and to organize the conclusions.
- Start recording the sensor readings: the data arrive at the platform automatically, there is no need to copy them out manually.
- Open the graph or the table of the measured values and ask the agent to process the result: it will show the patterns, compare the data with the reference values of the work and lead the student to formulating a hypothesis and a conclusion.

7. Care, Maintenance and Troubleshooting

7.1. Cleaning

- Wipe the sensors and connectors with a dry or slightly damp soft cloth.
- Do not wash the sensors under running water or immerse them in liquid.
- Wipe the charger contacts with a dry cloth to remove dust.
- Do not use solvents, abrasive agents or alcohol to clean the housings.

7.2. Periodic inspection

- At least once a month, check the condition of the batteries and their charging speed.
- Check the integrity of the photogates' optical channel and the sensor connectors.

- Repair and replacement of damaged sensors and the charger are performed only by an authorized service center.

7.3. Possible malfunctions and methods of their elimination

Symptom	Possible cause	User actions
The sensor does not appear in the device list of the software	The battery is discharged; the wireless module is disabled on the computer	Charge the sensor; turn on the computer's wireless module
The photogates do not detect the body passing through	The optical beam is blocked by dust or a foreign object; the body passes beside the beam	Wipe the optical windows; adjust the trajectory of the body's motion
The voltage or current sensor shows zero	Incorrect connection polarity; a break in the educational circuit	Check the connection and polarity, check the circuit continuity
The force sensor reading changes with no load applied	The sensor was not zero-calibrated before the measurement	Perform zero calibration in the software before the experiment
The gas pressure sensor shows unstable values	Leaky connection between the adapter and the vessel	Check and tighten the adapter connection
The battery discharges quickly	The sensor remained on after the experiment ended; the battery is worn out	Turn off the sensor after use; contact the service center if necessary

8. Storage and Transportation Conditions

- Store the set in a dry closed room at a temperature not lower than +5 and not higher than +40 °C and relative air humidity not more than 80 % without condensation.
- Before long-term storage (more than a month), charge the sensors' batteries to approximately half capacity.
- Protect the sensors and the charger from direct sunlight, moisture and dust.
- Transport the set in the original or a similar rigid packaging, with the sensors secured in the cells of the foam insert.
- Do not place heavy objects on the packaging with the set.
- The storage period before commissioning is unlimited provided that the stated requirements are observed.

9. Warranty Obligations

- 9.1. The warranty period of operation of the product is 12 months from the date of sale specified in the warranty card.
- 9.2. The manufacturer guarantees that the product conforms to the declared technical specifications provided that the transportation, storage and operating rules set out in this passport are observed.
- 9.3. During the warranty period, defects of the product that have arisen through the fault of the manufacturer are remedied free of charge. The

method of remedy (repair, replacement of a component or replacement of the product) is determined by the service center.

- 9.4. Warranty service is provided on presentation of a correctly and completely filled-in warranty card and of a document confirming the fact and the date of purchase.
- 9.5. The warranty does not cover cases where the malfunction is caused by:
- mechanical damage, in particular cracks, chips and deformation of the housing and of the components of the product;
 - violation of the operating, storage or transportation rules set out in this passport;
 - ingress of liquid or foreign objects into the product, and also the action of insects and animals;
 - independent disassembly, repair or modification of the product, in particular repair at unauthorized workshops;
 - use of the product other than for its intended purpose;
 - force majeure circumstances (fire, flood, earthquake, etc.).
- 9.6. The warranty does not cover the natural wear of the coating and of the appearance of the product, nor consumables.

10. Product Disposal

- The product must not be disposed of together with unsorted municipal waste. This is indicated by the marking in the form of a crossed-out container on the product or its packaging.
- After the end of the service life, hand the product over to a collection point for the corresponding waste or to an organization holding the appropriate permit.
- Hand over the packaging elements (cardboard, polymer materials) to the corresponding streams of recyclable materials.

Contacts

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Conditions of use and storage of the product

The product is intended for educational work in general secondary education institutions and is used only under the control and supervision of a teaching staff member; the recommended age of students — from 10 years, that is, students of grade 5 and of higher grades. Keep the product in a dry, clean and ventilated room at a temperature from +5 to +40 °C and relative air humidity up to 80 % without condensation, separately from heat sources and out of direct sunlight, moisture and dust. Use the product exclusively for its intended purpose and do not allow drops, impacts or other mechanical damage. If you notice damage, a crack or any malfunction, stop working with the product immediately and inform the teacher or the responsible person of the educational institution; repairing the product on your own is prohibited.

WARRANTY CARD

Name:	Digital laboratory for the physics classroom (student set)
Product model:	LABOTRIX SENSE PHY L5
Serial number:	
Date of sale:	
Warranty period:	12 months from the date of sale
Trading organization:	
Signature of the seller:	

The goods have been received in working order, without visible damage, complete, and have been checked in my presence. I have no claims regarding the quality of the goods; I have read and agree to the operating and warranty service conditions.

Full name of the buyer _____

Telephone of the buyer _____ Signature of the buyer _____

Dear Customer!

Thank you for choosing Labotrix products. After-sales service of this product is provided in accordance with the regulations of the company and the legislation of the country of sale. So that we can serve you quickly and without unnecessary formalities, check that this warranty card is filled in correctly at the moment of purchase and keep it together with the payment document throughout the entire warranty period. When applying for repair, hand the product over to the seller or to the service center together with the filled-in card.

Procedure for applying

1. The right to free warranty service of the product is valid for 12 months from the date of sale specified in the warranty card. Within this period, components that have failed because of a manufacturing defect are repaired or replaced at no cost to the buyer.
2. Before applying, make sure that the malfunction is not caused by the reasons listed in section 9 of this passport and, if possible, use the table of possible malfunctions in subsection 7.3.
3. After the end of the 12-month warranty period, repairs are performed on a paid basis; the cost of the work and of the spare parts is determined depending on the nature of the malfunction.

Grounds for refusal of warranty service

The company reserves the right to refuse free service or to perform the work on a paid basis if at least one of the following circumstances is established:

- absence of the warranty card, its incomplete or corrected completion, and also the absence of a document confirming the purchase;
- non-conformity of the serial number of the product with the number specified in the card, or damage to the factory marking;
- traces of independent disassembly, repair or modification of the product;
- damage caused by violation of the operating rules, connection to an unsuitable power source or external mechanical impact;
- damage as a result of force majeure circumstances.

Service Records

Date of entry	Description of the malfunction	Work performed	Position, signature, full name of the responsible person