Extended set of sensors and actuators

LABOTRIX SENSORKIT R3

PRODUCT PASSPORT

Kyiv

2026

Contents

1. General Information about the Product

1.1. **Product name** — Extended Sensor and Actuator Kit for Robotics.

1.2. **Trademark** — Labotrix.

1.3. **Model** — Sensorkit R3; full trade designation — LABOTRIX SENSORKIT R3.

1.4. **Manufacturer** — Labotrix Group Limited, China.

1.5. **Intended use:** the Labotrix Sensorkit R3 set expands the functional capabilities of an educational robotic arm, adding practical tasks in the field of the Internet of Things (IoT), industrial automation, and the design of intelligent scenarios for interacting with the environment. The sensors record the readings of the surrounding environment and the user's actions, while the actuators execute the required action in response — this way, students practically build scenarios for the robot's real-time response to external events. The set is used either independently — with the hub controller and a computer, or together with the Labotrix Arm R1 robotic arm, when the sensor readings control its movement. The product is intended for educational institutions: computer science, physics, technology, and robotics lessons, club and project work.

1.6. **Design features:** the set includes a hub controller (controller) based on a 32-bit microcontroller with a clock frequency of 168 MHz and 12 electronic modules — sensors of physical quantities, manual controls, and actuators, each in a separate protective housing with a unified 4-pin connector. The modules are connected with ready-made cables, without soldering or tools, to the universal ports of the set's hub controller, and the hub controller itself, if necessary, is additionally connected with cables to the educational robotic arm. The module housings have mounting holes compatible with construction set elements such as LEGO, which allows them to be attached to models and fixtures.

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 robotics, 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, 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 tasks, 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, the interface and the answers of the assistant are provided exclusively in Ukrainian.

2. Technical Specifications

- Brand — Labotrix
- Model — Sensorkit R3
- SKU — LTX-SENSORKIT-R3
- Product type — an extended set of sensors and actuators for educational robotics systems
- The set's hub controller (controller) — 32-bit microcontroller, clock frequency 168 MHz; unified ports for connecting the set's modules
- Number of electronic modules in the set (piece) — 12
- Module connection type — unified 4-pin connector with a key, without soldering and without the use of tools
- Module signal types — analog (ADC), digital discrete, digital serial I2C, single-wire digital bus, pulse-width modulation (PWM)
- Module operating supply voltage (volt DC) — from 3.3 to 7, nominal 5; micro servo drive — 4.8
- Current consumption of a typical module (milliampere) — approximately 50
- Power source of the modules — the set's hub controller; a separate power source is not required for the modules
- Universal connection ports of the hub controller used by the set (piece) — 6, of which 2 ports additionally support analog-to-digital signal conversion
- Programming environments — graphical (block-based) and text-based in Python
- Visualization of sensor readings — the readings are displayed as graphs and numerical values on the personal computer screen in real time
- Gesture recognition sensor, number of recognized movement types (piece) — 8
- Gesture recognition sensor, recognition distance (centimeter) — from 5 to 15
- Gesture recognition sensor, maximum recognition frequency (hertz) — 240
- Gesture recognition sensor, current consumption (milliampere) — 2.2
- Combined temperature and humidity sensor, temperature measuring range (degree Celsius) — from 0 to +60, accuracy ±1 °C
- Combined temperature and humidity sensor, humidity measuring range (percent) — from 10 to 90 relative humidity, accuracy ±5 %
- Color detection sensor, number of recognized surface colors (piece) — 6, plus RGB components
- Illuminance level sensor, signal type — analog, analog-to-digital conversion range (arbitrary unit) — from 0 to 407
- Sound intensity sensor, signal type — analog, analog-to-digital conversion range (arbitrary unit) — from 0 to 1023
- Potentiometer module, output voltage range (millivolt) — from 0 to 2500
- Infrared motion sensor (PIR), detection radius (centimeter) — up to 150

- Photoelectric sensor, triggering distance — adjusted by a rotary regulator on the housing
- Micro servo drive, output shaft rotation angle (degree) — up to 180
- Micro servo drive, torque (kilogram-centimeter) — 1.6 at a voltage of 4.8 V
- Number of connecting cables in the set (piece) — 8 (6 standard for connecting the modules, 2 extension)
- Product marking — trademark, model and a space for the inventory number
- Packaging — individual box of corrugated cardboard with each module secured separately
- Documentation supplied — product passport with warranty card and operating manual
- Ready-to-use condition — supplied assembled, requires no preliminary setup
- Care of the surfaces — wiping with a dry or slightly damp cloth is permitted
- User requirements — preparation is performed by the teacher or the laboratory assistant, students work under supervision
- Language of marking and operating documentation — Ukrainian
- Digital learning support — online course in a learning management system (LMS)
- Course volume (academic hour) — 70
- Course subjects — physics, biology, chemistry, STEM, robotics
- 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, of the interface and of the answers of the assistant — Ukrainian
- Service life (year) — 5
- Warranty period (month) — 12

3. Package Contents

- Hub controller (controller) — 1 pcs
- Gesture recognition sensor — 1 pcs
- Illuminance level sensor — 1 pcs
- LED module — 1 pcs
- Color detection sensor — 1 pcs
- Combined temperature and humidity sensor — 1 pcs
- Potentiometer module with a rotary knob — 1 pcs
- Infrared motion sensor (PIR) — 1 pcs
- Sound intensity sensor — 1 pcs
- Double mechanical button module — 1 pcs
- Analog joystick — 1 pcs
- Micro servo drive with adapters and horns — 1 pcs

- Photoelectric sensor with mounting bracket — 1 pcs
- Set of connecting cables — 8 pcs (6 standard, 2 extension)
- Right of access to the online course with a language-model-based assistant (license) — 1 pcs
- Product Passport and Warranty Card — 1 pcs
- Individual transport packaging — 1 pcs

The power supply unit, the USB cable, and the robotic arm itself are not included in the set — the robotic arm is supplied as a separate product. The product does not require assembly: all modules are connected to the set's hub controller with ready-made cables, without tools.

4. Safety Precautions

4.1. General requirements

- Before using the set for the first time, read this passport, this section first of all, and thereafter keep the document together with the product.
- Only persons who have completed occupational safety instruction are allowed to work with the set; students work with the modules only under the supervision of the teacher.
- After unpacking, inspect each module and cable for the absence of mechanical damage; using damaged elements is prohibited.
- Do not apply excessive force to the module housings; persons without special training are prohibited from opening the housings of the electronic modules.
- Keep the small parts of the set (micro servo drive adapters and horns, cables) in a place inaccessible to children under 3 years of age.

4.2. Protection against static electricity and correct connection

- The module boards are partially exposed, so an electrostatic discharge from the hands can put a module out of order without visible signs of damage; before working, discharge static electricity by touching a grounded metal object.
- Hold the modules by the edges of the housing; do not touch the connector contacts or exposed board elements with your fingers.
- Do not work with the modules on synthetic carpet coverings, in synthetic clothing or in rooms with very dry air without first removing the static charge.
- The cable connectors have a key — insert them only in the correct position, without force; reversed power polarity puts the micro servo drive out of order.
- Do not leave the free end of a cable connected only to the hub controller: it can accumulate a static charge.
- Store the modules in their standard packaging or in antistatic bags, and not loose in a metal container.

4.3. Electrical safety and connection of the modules

- The modules are powered from the set's hub controller at a voltage of 5 V; a separate power source is not required for them and is not provided for by the design.
- Before connecting or disconnecting any module, completely turn off the power of the hub controller — connecting while powered puts the modules and ports out of order.

- Do not connect the set's modules to the stepper motor control ports or to the hub controller's 12 V power connector: the voltage on them exceeds what is permissible for the modules.
- Do not apply voltage from external power sources to the module inputs, and do not connect the module leads directly to each other.
- Make sure that the total current of the simultaneously connected modules does not exceed the permissible current of the hub controller's ports.

4.4. It is strictly prohibited

- Immersing the modules in water or subjecting them to the action of flame during operation or measurements, keeping them for a long time near high-temperature sources of fire.
- Independently disassembling or repairing the modules — in case of malfunction, contact the supplier or a service center.
- Connecting or disconnecting the modules while the power of the switching unit is on.
- Holding the micro servo drive's shaft with your hands or blocking the movement of the horn during operation — this causes overheating and failure of the drive.
- Using the set together with the robotic arm without observing the safety requirements of its working area: keeping your hands in the area of movement of the links while the program is running.
- Taping over or blowing out with pressurized compressed air the openings of the temperature and humidity sensor.

5. Preparation for Use

5.1. Unpack the set, take out the modules and cables; we recommend keeping the packaging for further storage and transportation.

5.2. Check the completeness against Section 3 of this passport and inspect each module and cable for the absence of mechanical damage.

5.3. Lay out the modules on a flat, dry, non-conductive surface next to the set's hub controller; route the cables so that they cannot be caught on anything.

5.4. Before first connecting the modules, discharge the static charge from your hands by touching a grounded metal object.

5.5. Make sure that the hub controller is switched off and the power supply unit is disconnected from the mains before connecting the first module.

5.6. Choose the appropriate hub controller port for each module: the light sensor, sound sensor, and potentiometer — only a port with an analog-to-digital converter; the micro servo drive — a port with support for pulse-width modulation; the remaining modules — any free universal port.

5.7. Connect the cable by its colored mark to the corresponding port of the hub controller, and the opposite end — to the module, following the connector's key; apply power only after all connections are complete.

6. Operating Procedure

6.1. Connection of the modules

- Choose the hub controller port according to the module's signal type and connect it with the ready-made cable, aligning the connector's key with the slot until it clicks lightly into place.
- Remember or write down the port number to which each module is connected — this number will need to be specified when composing the program.
- If a module needs to be moved farther from the hub controller (for example, onto a link of the robotic arm or onto a model), use the extended connecting cable from the set.

6.2. Connection to the computer and the robotic arm

- Connect the hub controller to the computer — after this, control blocks for all connected modules become available in the programming environment.
- If the robotic arm is involved in the operation, connect it to the hub controller with power and communication cables according to the robotic arm's instructions.
- Turn on the power of the hub controller only after all connections are complete, and proceed to composing the program.

6.3. Taking readings and controlling the actuators

- In the block-based programming environment or in Python, an appropriate control block is chosen for each module, and the number of the port to which it is connected is specified.
- The sensor readings (gestures, color, temperature and humidity, illumination, sound, potentiometer position, pressing of the buttons and joystick, presence of an object) are used in the program as the values of variables or transition conditions; at the same time, they are displayed on the computer monitor as graphs or numerical values in real time.
- The actuators — the LED module and the micro servo drive — are switched on by a command that sets the color and brightness of the light, or the rotation angle of the output shaft.

6.4. Joint work with the robotic arm

- During joint operation, the readings of the set's sensors are used to control the movement of the robotic arm — for example, stopping or changing the trajectory based on a signal from the motion, color, or distance sensor.
- Follow all safety requirements set out in the robotic arm's instructions: do not keep your hands in its working area while the program is running.

6.5. Finishing the work

- Wait for the program to finish and turn off the power to the hub controller.
- Disconnect the modules only with the power completely removed; coil the cables without sharp bends.

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 tasks, 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.

7. Care, Maintenance and Troubleshooting

7.1. Cleaning

- Before cleaning, turn off the hub controller and disconnect the power supply unit from the mains.
- Wipe the module housings with a dry or slightly damp soft cloth; the use of solvents, large amounts of alcohol, and abrasive agents is prohibited.
- Do not immerse the modules in water and do not wash them under running water.
- Clean the optical windows of the sensors (gestures, color, illumination) and the lens of the motion sensor only with a dry soft cloth or an air blower bulb.
- Clean the sound sensor's microphone only by blowing off dust, without touching the membrane.

7.2. Periodic inspection

- Before each lesson, check the integrity of the module housings, connectors, and cables; a module with a cracked housing or a damaged connector must not be used.
- Regularly check the completeness of the set — the small parts of the micro servo drive (horns, adapters) are lost most often; check the tightness of the photoelectric sensor's ring in the bracket.
- Repair and replacement of module components are performed only by an authorized service center.

7.3. Possible malfunctions and methods of their elimination

Symptom	Possible cause	User actions
The module does not appear in the device list or does not return a value	Support for the set's modules has not been added in the programming environment	Add the corresponding extension in the robotic arm's programming environment
The hub controller is not detected by the computer	The cable is damaged or poorly connected, the hub controller is switched off	Check the cable and the connection, make sure that the hub controller is switched on

Symptom	Possible cause	User actions
The sensor always returns the same value	The module is connected to a different port than specified in the program, or the cable is broken	Check the port number in the program, replace the cable if necessary
The light sensor, sound sensor, or potentiometer module does not work	The module is connected to a port without an analog-to-digital converter	Reconnect the module to the appropriate port with the power removed
The micro servo drive does not rotate	The module is connected to a port without support for pulse-width modulation	Reconnect the module to the appropriate port
The micro servo drive hums, heats up, or does not hold its position	Mechanical blocking of the shaft or overload	Remove power, clear the obstruction, check that the set angle does not move the horn beyond the limits of its travel
The module stopped working after reconnection	The connection was made with the power on, or damage from a static discharge	Check the module on another port; if necessary, contact the supplier

8. Storage and Transportation Conditions

- Store the set in its standard packaging, in a dry room, without sharp temperature fluctuations and without condensation.
- Do not store the modules loose together with metal objects — mechanical damage and short-circuiting of contacts are possible.
- For long-term storage, place the modules in antistatic bags.
- During transportation, protect the set from impacts and vibration; transport the cables coiled, without tension on the connectors.
- The product may be transported by any type of closed transport that protects against precipitation, in its original packaging.
- 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:	Extended set of sensors and actuators
Product model:	LABOTRIX SENSORKIT R3
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