Demonstration set for studying electricity

LABOTRIX ELECTRO E3

PRODUCT PASSPORT

Kyiv

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Contents

1. Product Basics
2. Technical specifications
3. Equipment
4. Safety precautions
5. Preparation for work
6. Procedure
7. Care, maintenance and possible malfunctions
8. Storage and transportation conditions
9. Warranty obligations
10. Product disposal
Contacts
WARRANTY CARD
Service notes

1. Basic product information

1.1. Product name — Demonstration set for studying electricity.

1.2. Trademark — Labotrix.

1.3. Model — Electro E3; full trade name — LABOTRIX ELECTRO E3.

1.4. Manufacturer — Labotrix Group Limited, China.

1.5. Intended use: Demonstration set of equipment for physics teachers in secondary education institutions. The set is designed to visually demonstrate the basic principles of electricity and magnetism, assemble electrical circuits of various configurations, study the operation of electrical circuits and their components. It is used to conduct demonstration and practical work in accordance with the natural sciences curriculum.

1.6. Design features: The kit is built on the principles of modular design using connecting elements for quick assembly of various circuits. Includes a wide range of passive and active components (resistors, capacitors, diodes, transistors), power supplies, transformer and various loads (lamp, motor, speaker). All elements are made at an industrial level and are suitable for multiple use in an educational environment. The kit includes a printed methodological guide for conducting demonstration experiments.

1.7. Digital learning support: The product includes access to an online teaching support course hosted in a learning management system (LMS) and designed for 70 academic hours of classes. The course is designed to meet the current curricula of secondary education institutions in Ukraine. The materials are grouped into research modules in the disciplines of physics, biology, chemistry, STEM, and each topic contains a lesson plan, a list of necessary supplies, an experiment scenario, step-by-step instructions for laboratory work with an explanation of the expected result, a video demonstration of work methods, interactive exercises and tasks for independent study, suitable for both individual and group work. All modules are designed for this equipment and tested on it, so the course works in a direct chain of "equipment → methodology → learning results". The course has a built-in assistant based on a language model with a search through the course knowledge base (Retrieval-Augmented Generation): based on the topic of the lesson, it selects relevant experiments, methodically describes the sequence of conducting the research, analyzes typical student errors and gives personal advice on how to get rid of them, changes the level of complexity to prepare for a specific class, and helps to write a research report and organize the conclusions. The assistant's knowledge base is localized and aligned with the Ukrainian curriculum. The license for the course and accompanying software is valid for 12 months from the date of transfer of access; the content, interface, and answers of the assistant are provided exclusively in Ukrainian.

2. Technical specifications

- Brand — Labotrix
- Model — Electro E3
- The article number is LTX-ELECTRO-E3
- Product type — demonstration kit for studying electricity and magnetism
- Number of component positions in the set — 47
- Connecting elements (piece) — 50
- Fixed resistance resistors: nominal values 1 Ohm, 10 Ohm, 47 Ohm, 100 Ohm, 470 Ohm, 1 kOhm, 4.7 kOhm, 10 kOhm, 20 kOhm, 100 kOhm, 1 MOhm
- Variable resistors: 1 kOhm, 10 kOhm, 100 kOhm, 1 kOhm trimmer
- Non-polar capacitors - 510 pF, 0.001 μF, 0.01 μF, 0.1 μF
- Electrolytic capacitors from 1 μF to 470 μF
- Rectifier diodes: 1N4001 — 3 pcs., 1N914 — 3 pcs.
- Transistors PNP 2N3906 — 3 pcs.
- NPN 2N3906 transistors — 3 pcs.
- Coil 200 turns, coils 300 and 600 turns - 1 pc.
- Transformer 220 V AC to 6 V AC — 1 pc.
- DC electric motor 3 V — 1 pcs
- Incandescent lamp 2.5 V — 1 pcs
- Battery of galvanic cells 3 V — 1 pcs
- Loudspeaker 3 V — 1 pcs
- Straight conductor — 4 pcs
- Straight conductor with terminal — 4 pcs
- Angled conductor with terminal — 4 pcs
- Angled conductor — 4 pcs
- T-shaped conductor — 4 pcs
- T-shaped conductor with terminal — 4 pcs
- X-shaped conductor — 2 pcs
- X-shaped conductor with terminal — 2 pcs
- Terminal for connecting an ammeter — 2 pcs
- Power supply — from a 3 V battery or a 6 V AC transformer
- Operating conditions — premises of an educational institution, air temperature from +5 to +40 °C, relative humidity from 40 to 60 % without condensate
- 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, of the interface and of the answers of the assistant — Ukrainian
- Service life (year) — 5
- Warranty period (month) — 12
- Language of marking and operating documentation — Ukrainian
- Product marking — trademark, model and a space for the inventory number
- Packaging - individual corrugated cardboard box with fixed compartments for components
- Ready to use - comes assembled in parts, no additional setup required before demonstration
- Care of the surfaces — wiping with a dry or slightly damp cloth is permitted
- User requirements - demonstrations are conducted by a physics teacher, only in the presence of an adult responsible for the safety of students

3. Equipment

- Connecting element — 50 pcs.
- Resistor 1 Ohm — 1 pc.
- 10 Ohm resistor — 2 pcs.
- Resistor 47 Ohm — 1 pc.
- Resistor 100 Ω — 2 pcs
- Resistor 470 Ohm — 1 pc.
- Resistor 1 kΩ — 2 pcs
- Resistor 4.7 kΩ — 1 pc.
- Resistor 10 kΩ — 1 pc.
- Resistor 20 kΩ — 2 pcs.
- Resistor 100 kΩ — 1 pc.
- Resistor 1 MΩ — 1 pc.
- Variable resistor 1 kOhm — 1 pc.
- Variable resistor 10 kOhm — 1 pc.
- Variable resistor 100 kOhm — 1 pc.
- Trimmer resistor 1 kOhm — 1 pc.
- Non-polar capacitor 510 pF — 1 pc.
- Non-polar capacitor 0.001 μF — 1 pc.
- Non-polar capacitor 0.01 μF — 1 pc.
- Non-polar capacitor 0.1 μF — 1 pc.
- Electrolytic capacitor 1 μF — 1 pc.
- Electrolytic capacitor 4.7 μF — 1 pc.
- Electrolytic capacitor 10 μF — 1 pc.
- Electrolytic capacitor 47 μF — 1 pc.
- Electrolytic capacitor 100 μF — 1 pc.

- Electrolytic capacitor 470 μF — 1 pc.
- Rectifier diode 1N4001 — 3 pcs.
- Rectifier diode 1N914 — 3 pcs.
- PNP transistor 2N3906 — 3 pcs.
- NPN transistor 2N3906 — 3 pcs.
- Coil 200 turns — 1 pc.
- Coil 300 turns — 1 pc.
- Coil 600 turns — 1 pc.
- Transformer 220 V AC 6 V AC — 1 pc.
- DC electric motor 3 V — 1 pcs
- Incandescent lamp 2.5 V — 1 pcs
- Battery of galvanic cells 3 V — 1 pcs
- Loudspeaker 3 V — 1 pcs
- Straight conductor — 4 pcs
- Straight conductor with terminal — 4 pcs
- Angled conductor with terminal — 4 pcs
- Angled conductor — 4 pcs
- T-shaped conductor — 4 pcs
- T-shaped conductor with terminal — 4 pcs
- X-shaped conductor — 2 pcs
- X-shaped conductor with terminal — 2 pcs
- Terminal for connecting an ammeter — 2 pcs
- Storage box — 1 pcs
- Methodological guide for conducting demonstration experiments — 1 pcs
- 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 set is designed to be placed in a special box with compartments for each type of component. All elements are ready for immediate use, no additional preparation is required. For demonstrations with a transformer, a 220 V AC power connector is required.

4. Safety measures

4.1. General requirements

- Before first use, read this passport carefully and follow all recommendations given in it. Keep the document together with the kit and the purchase document.
- The set is used by a physics teacher or specially trained staff of an educational institution. Demonstrations are carried out only in the presence of an adult responsible for the safety of the students.
- Before starting work, check all components for mechanical damage, cracks in the housings and damage to the wire insulation. Damaged elements must not be used.

- Make sure the circuit is drawn up correctly and all connections are secure before turning on the power.

4.2. Electrical safety

- The maximum voltage of the circuit when powered by a battery is 3 V (safe); when powered by the secondary winding of a transformer, it is 6 V AC, so connect the lamp, electric motor, and speaker to it only through a current-limiting resistor (see 4.3).
- When working with a transformer, the primary winding is connected to a 220 V AC network. Make sure that the transformer is located safely and is not accessible to students.
- Do not touch the conductive parts of the circuit while the circuit is closed and the power is on. Turn off the source first, then make changes to the circuit.
- Do not leave the circuit unattended when it is on. If you smell burning or smoke, immediately turn off the power and unplug the circuit.

4.3. Handling components

- The incandescent lamp has a thin filament that burns out when overvoltage occurs. Supply power directly from the 3 V battery; connect the lamp, as well as the electric motor and speaker from the secondary winding of the transformer (6 V) only through the current-limiting resistor from the kit - without it, the voltage on these loads exceeds the safe value.
- Electrolytic capacitors can explode if connected with the wrong polarity. Always observe the polarity markings.
- Diodes and transistors can fail when reverse-biased or overheated. Do not exceed the current and voltage ratings for these components.
- The motor and speaker may become hot after prolonged use. Allow them to cool before using again.

4.4. It is strictly forbidden

- Connect the transformer to the network without checking the voltage in the secondary winding circuit.
- Connect a lamp, electric motor, or speaker to the secondary winding of the transformer directly, without a current-limiting resistor.
- Modify the circuit while the power is on. Always turn off the power supply before making any modifications.
- Touch the secondary winding of a transformer while it is operating at 220 V.
- Immerse components in water or expose to moisture and solvents.
- Disassemble or modify the design of components.
- Leave the set turned on without adult supervision.

5. Preparation for work

5.1. Unpack the kit and check the presence of all components according to section 3 of the passport. We recommend that you keep the packaging for storage and transportation.

5.2. Inspect each element for visible damage. Check that the 3V battery is in good condition and has an accessible contact system for connection.

5.3. Familiarize yourself with the location of the components in the storage box. Organize them by type for quick reference during operation.

5.4. If the kit has been stored at low temperatures, keep it indoors at room temperature for at least an hour to prevent condensation on the metal contacts.

5.5. Check the battery: make sure the contacts are clean and not oxidized. If necessary, wipe them with a dry, soft cloth.

5.6. Secure the transformer in a safe place before connecting it to the 220 V AC network. Make sure that its secondary winding is not accessible to students.

6. Procedure

6.1. Assembling a simple electrical circuit

- Start with a simple circuit: a battery, a resistor, and a lamp connected in series.
- Use fasteners to securely fasten components.
- Make sure the battery polarity is correct: positive contact on the marked side.
- Turn on the circuit gradually, observing the brightness of the lamp.

6.2. Study of the influence of resistors

- Make a circuit with different resistors and observe how the brightness of the lamp changes.
- Use variable resistors for smooth current regulation.
- Compare the results for resistors of different values.

6.3. Research on capacitors

- Connect a capacitor to a battery and observe how the brightness of the lamp changes as the capacitor charges and discharges.
- Use capacitors of different capacities and compare the charging and discharging times.

6.4. Study of diodes and transistors

- Make a circuit with a diode and check for current flow in one direction.
- Use transistors to amplify the signal.
- Observe the operation of components when changing voltage polarity.

6.5. Demonstration of transformer and other loads

- Connect the primary winding of the transformer to a 220 V AC network and measure the output voltage on the secondary winding (6 V AC).

- Connect a lamp, electric motor or speaker to the secondary winding only through the current-limiting resistor from the kit: it reduces the current in the circuit to a level safe for these loads. Direct connection, without a resistor, is strictly prohibited (see 4.3 and 4.4).
- Allow the motor to spin and listen to the sound from the speaker when powered by AC current through a resistor.

6.6. Completion of work

- Turn off the power: first turn off the 3 V source, then disconnect the transformer from the 220 V AC network.
- Wait for the components that were heating to cool down.
- Carefully disassemble the circuit and place all the elements in their proper places in the storage box.

6.7. Working with an 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.

7. Care, maintenance and possible malfunctions

7.1. Cleaning

- Wipe the component housings and connector contacts with a dry, soft cloth.
- If there is oxidation on the metal contacts, use an eraser to remove the oxidation.
- It is strictly prohibited to use abrasive materials and solvents that may damage the insulation.

7.2. Periodic control

- During regular use, inspect the connecting elements for loose contacts.
- Check the battery: if the battery is low, replace it with a new one.
- Check the lamp for smoke in the filament (a sign of burnout).
- Repair and service maintenance are performed only by an authorized service center.

7.3. Possible malfunctions and ways to eliminate them

Symptom	Possible cause	User actions
The lamp does not light.	Battery is discharged; circuit open; incorrect polarity	Replace battery; check all connections; ensure correct polarity
The lamp shines dimly.	Battery is low; resistor used is too high	Replace battery; use a resistor with a lower rating
The transformer does not produce voltage	Primary winding not connected to the network; open circuit in the primary winding	Check the connection to the 220 V network; check the integrity of the wires
The electric motor does not rotate	Circuit not closed; battery discharged; wrong polarity	Close the circuit; replace the battery; ensure correct polarity
The speaker does not produce sound.	Speaker not connected to circuit; open circuit; transformer output not suitable	Check the speaker connection; close the circuit; check the output voltage
The condenser is emitting smoke.	Wrong polarity; overvoltage	Turn off the power immediately; replace the capacitor with a new compatible one.

8. Storage and transportation conditions

- Store the kit in a dry, closed room at a temperature not lower than +5 and not higher than +40 °C and a relative humidity of up to 80% without condensation.
- Place all components in a storage box with compartments by type.
- Store the battery separately in a dry place; for long-term storage, remove the battery from the box.
- Protect from direct sunlight, vibrations, mechanical shocks and aggressive substances.
- Transport in the original or a similar rigid packaging by any type of closed transport.
- Keep horizontal when transporting; do not allow heavy objects to rest against the package.
- The shelf life of the set is unlimited when the storage conditions are observed.

9. Warranty obligations

9.1. The warranty period of the product is 12 months from the date of sale specified in the warranty card.

9.2. The manufacturer guarantees that the product complies with the declared technical characteristics, provided that the rules for transportation, storage and operation set out in this passport are followed.

9.3. During the warranty period, product defects that have arisen due to the manufacturer's fault will be eliminated free of charge. The method of elimination (repair, component replacement or product replacement) is determined by the service center.

9.4. Warranty service is provided upon receipt of a correctly and completely filled out warranty card and a document confirming the fact and date of purchase.

9.5. The warranty does not apply to 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 apply to natural wear and tear of the coating and appearance of the product, as well as to 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

LABOTRIX GROUP LIMITED
Room 910, Isteelasia 1 No. 18 Fu'an Blvd, Pinghu Subdistrict,
Longgang District, Shenzhen City,
Guangdong Province, China 518111
Phone: +86 13925261264
E-mail: salesmanager@labotrix.com
Website: https://labotrix.com/

Address in Ukrainian:
LABOTRIX GROUP LIMITED
Room 910, Istilazia 1, Fuan Boulevard No. 18,
Pinghu Subdistrict, Longgang District,
Shenzhen, Guangdong Province, China 518111
Telephone: +86 13925261264
E-mail: salesmanager@labotrix.com
Website: https://labotrix.com/

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

Product name:	Demonstration set for studying electricity
Product model:	LABOTRIX ELECTRO E3
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

Buyer's phone number Buyer's signature

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 for the product is valid for 12 months from the date of sale specified in the warranty card. Within this period, components that have failed due to a manufacturing defect are repaired or replaced without payment from the buyer.
2. Before contacting, 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 section 7.3.
3. After the 12-month warranty period, repairs are carried out for a fee; the cost of work and 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