

User Manual

Promobot Robox

promo-bot.ai

Educational platform

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1. ROBOX DESCRIPTION

Promobot Robox is a kit for learning the basics of robotics. It consists of distance sensor, servo with motor, interface conversion block and special software. Promobot Robox helps you to learn how to control servos, analyze data from different devices, program in Python and C++, and work with industrial data buses.

1.1. Package Contents

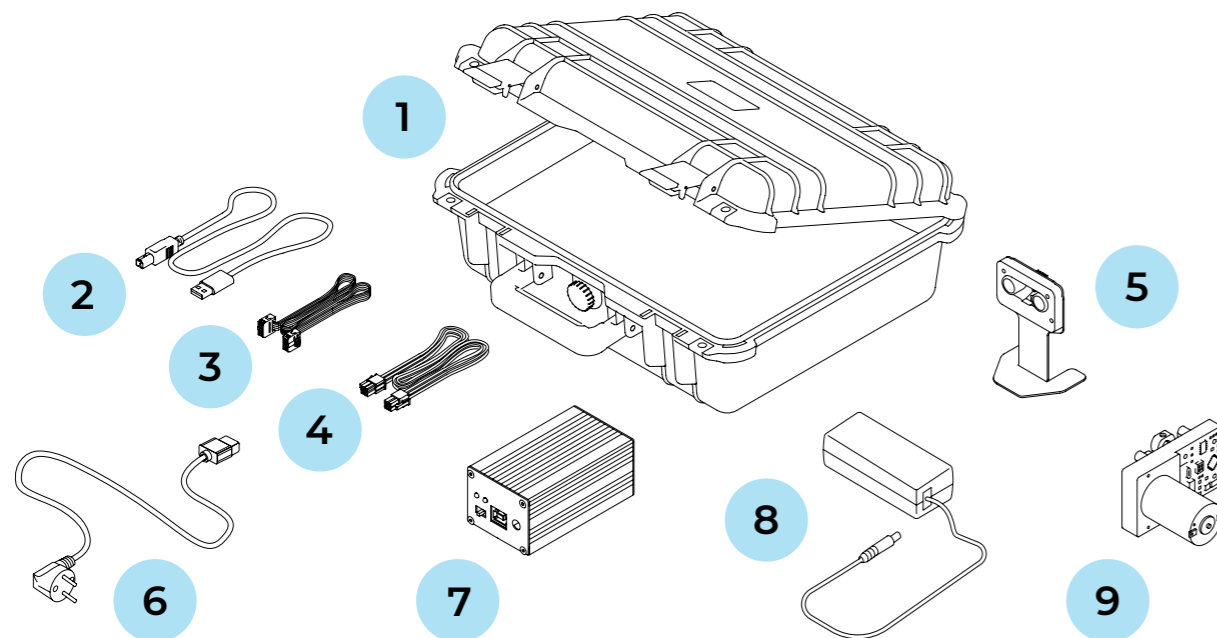


Figure 1. Robox Kit

- | | |
|---|---|
| 1. Transport case | 5. Distance sensor with stand |
| 2. Cable for connecting the interface conversion block to a PC | 6. Cable for connecting the power supply to the network 220/110 V |
| 3. Cable for connecting the distance sensor to the interface conversion block | 7. Interface conversion block |
| 4. Cable for connecting the servo to the interface conversion block | 8. Power supply for 220/110 V mains |
| | 9. Servo |

2. COMPONENT CHARACTERISTICS

2.1. Robox Interface Conversion Block

Interface conversion block is a converter of USB and RS-485 interfaces. It allows to connect servo and distance sensor to a PC, which makes it possible to develop programs for controlling the servo and use data from the distance sensor in programs.

Technical Characteristics:

- Input voltage ~220/110 V
- Output voltage 12 V
- Interface USB 2.0
- Device operation interface RS-485

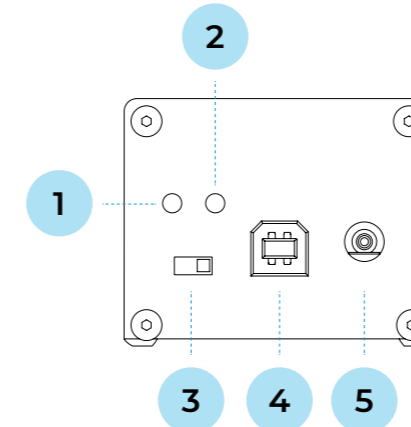


Figure 2. Side A of the interface conversion block

1. Output power indication
2. Input power indication
3. Power switch
4. USB port for connecting to a PC
5. Power port

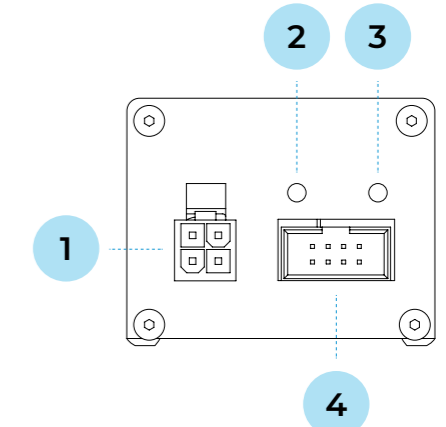


Figure 3. Side B of the interface conversion block

1. Port for connecting a servo
2. Indication of data reception from a servo (RX)
3. Indication of data transmission to a servo (TX)
4. Port for connecting a distance sensor

2.2. Servo

A **servo** is a high-performance actuator designed specifically for the needs of robotics. The servo can be used to create highly complex moving mechanisms such as robotic manipulators, pan-tilt modules, etc.

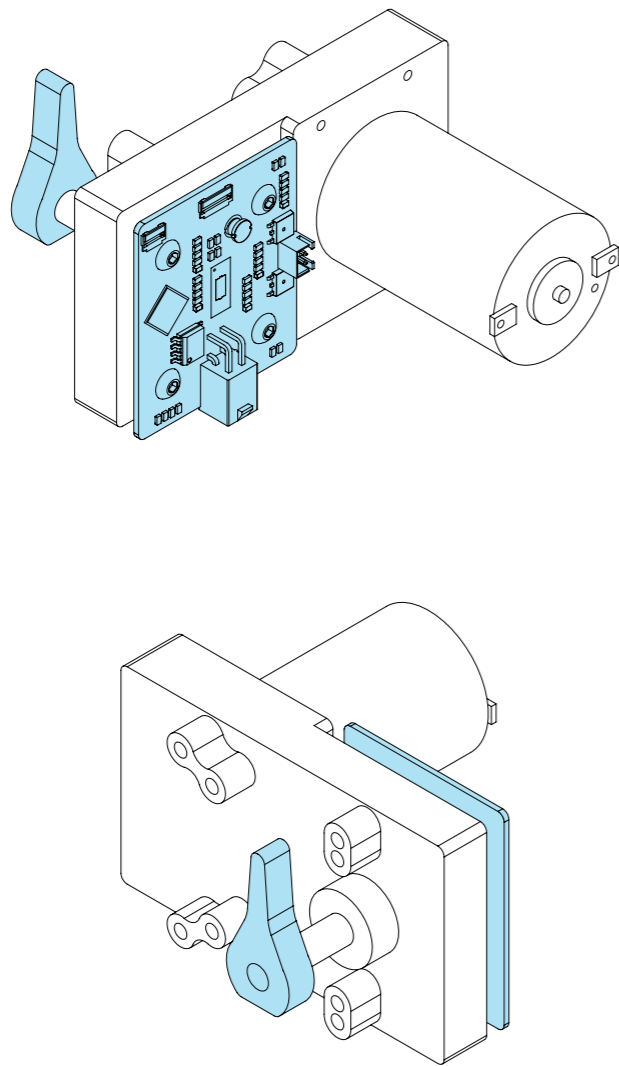


Figure 4. The servo

Key features:

- Multiple servos (up to 250) can be serially connected to each other via RS-485 bus
- PID position control loop
- PID speed control loop
- High resolution of servo position measurement (14-bit)
- High precision of motor current measurement
- Fast servo integration due to MODBUS protocol
- Possibility to connect an external shaft angle sensor for easier installation
- Flexible adjustment of many parameters for individual solutions
- Servo can be remotely flashed via RS-485 bus

Technical Characteristics:

- Power supply voltage 8–40 V
- Rated consumption (no load) 125 mA
- Rated consumption (retention) 2.0 A
- Torque holding (24 V) 35.82 kg/cm
- Gear ratio 1:32
- Magnetic encoder resolution 0.02 °
- Idle speed (24V) 80 rpm
- Weight 500 g

2.3. Distance Sensor

The **distance sensor** is designed to detect obstacles and determine the distance to them. The device uses both ultrasonic (US) measurement signals and infrared (IR) signals. This construction gives an advantage in situations when the ultrasonic sensor alone is insufficient, such as: complex obstacle geometries, sound absorbing surfaces and other specifics.

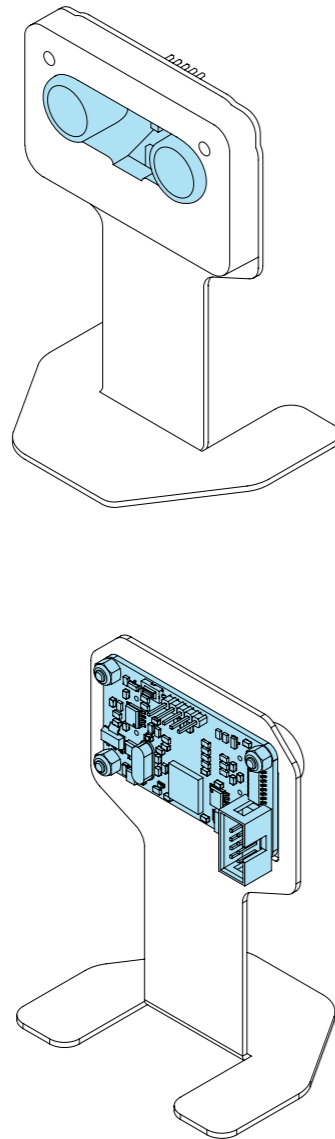


Figure 5. The distance sensor with its stand

Key features:

- "Hybrid" operating mode — infrared and ultrasonic measurements
- Multiple sensors (up to 250) can be serially connected to each other via RS-485 bus
- Fast sensor integration due to MODBUS protocol
- Possibility to remotely firmware the sensor via RS-485 bus

Technical Characteristics:

- Power supply voltage 9–12 V
- Rated consumption (measurement mode) 70 mA
- Frequency of ultrasonic signal 40 kHz
- Sound pressure of ultrasonic emitter 120 dB
- Sensitivity of ultrasonic receiver 64 dB
- Operating angle of ultrasonic sensor 30°
- Max measurable/sensing distance (ultrasonic sensor) 255 cm
- Min measurable/sensing distance (ultrasonic sensor) 4 cm
- IR emitter wavelength 940 nm
- Max measurable/sensing distance (infrared sensor) 200 cm
- Min measurable/sensing distance (infrared sensor) 2 cm
- Operating angle of infrared emitter 35°
- Operating angle of infrared receiver 25°

3. WORK AREA

The work area for working with the Robox should be a room, which means that the kit is not designed for outdoor use, as it is a technologically complex electrical product that requires protection against moisture. Outdoor use of Robox can cause it to malfunction.

When selecting a location to work with the Robox kit, follow the general safety rules for operating electrical appliances: place the kit away from sources of dampness, water vapour, flammable liquids and gases. Ensure compliance with safety regulations.

- The organization of the work area for the Robox kit requires compliance with health and safety regulations and fire safety rules.
- The work area should be equipped with a laptop or personal computer and have a level surface (tabletop). The recommended size of the work area is 60 x 60 cm.
- For better lighting, the work area should be located close to a source of daylight. For evening work, use artificial light.
- The work area should have access to a power supply 220/110 V. Make sure that there are no people in the area where the Robox and PC cables are connected to the power supply.

4. SAFETY PRECAUTIONS

Observe the following instructions in order to work safely with the Robox kit:

- Follow the general safety rules for the use of electrical appliances.
- If you don't know how to work with electronics, consult a specialist or an experienced user before starting work.
- Make sure there is enough free space on the working surface. Clear up some space before starting work, if necessary.
- The Robox kit is not intended for use by people with reduced physical, sensory or mental capabilities unless they are under control or instructed to use the device by a specialist responsible for their safety.
- Regularly inspect the power cable for damage and wearout. You should use the power cable only if it is completely undamaged.

5. GETTING STARTED



Attention! The work must be carried out strictly in the order described below.

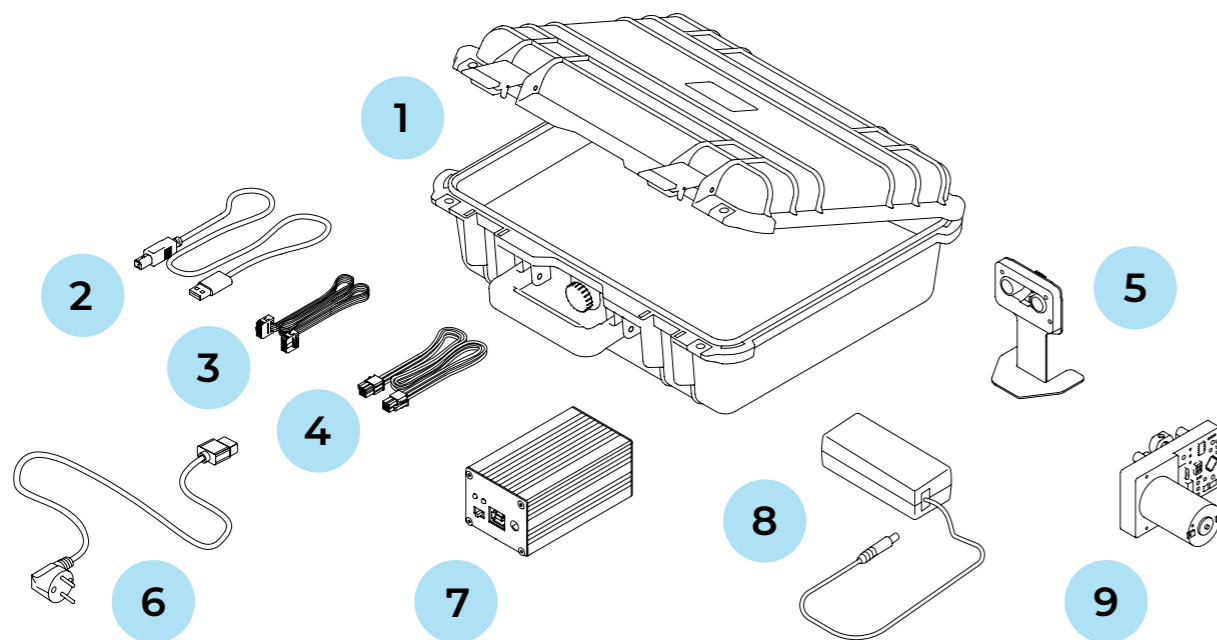


Figure 6. Robox Kit

- | | |
|---|--|
| 1. Transport case | 5. Distance sensor with stand |
| 2. Cable for connecting the interface conversion block to a PC | 6. Cable for connecting the power supply to the network 220V/110 V |
| 3. Cable for connecting the distance sensor to the interface conversion block | 7. Interface conversion block |
| 4. Cable for connecting the servo to the interface conversion block | 8. Power supply for 220/110 V mains |
| | 9. Servo |

1. Open the Robox transport case, remove all the kit components shown in Figure 6 from the polyethylene foam logement.
2. Connect the power supply (8) to the 220/110 V mains using the cable (6).
3. Ensure that the power circuit break button on the interface conversion block is in the OFF position.
4. Connect the power supply (8) to the interface conversion block (7).
5. Connect the servo using the cable (4) to the interface conversion block (Figure 7).

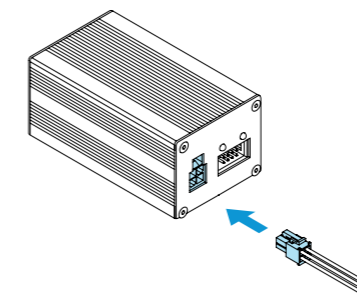


Figure 7.
Connecting cable for the servo

6. Connect the distance sensor using the cable (3) to the interface conversion block (Figure 8).

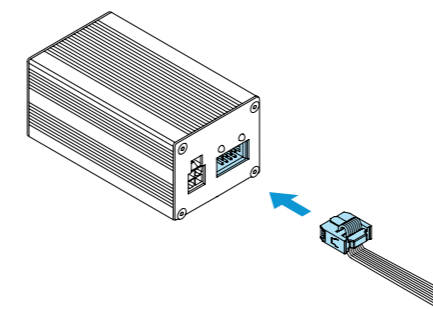


Figure 8.
Connecting cable for the distance sensor

7. Turn on the interface conversion block, check the input and output power indication (Figure 9).

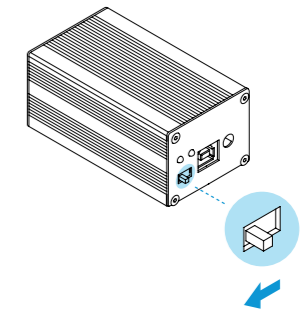


Figure 9.
Turning on the interface conversion block and checking the power supply

8. Connect the interface conversion block to a PC using the USB cable (2) (Figure 10).

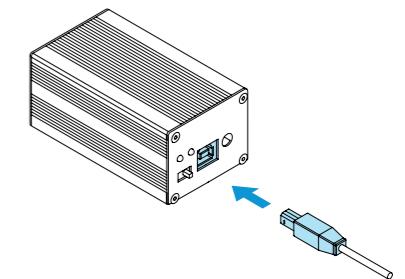


Figure 10.
Connecting the interface conversion block to a PC

9. To continue working with the Robox kit and for more information, visit the website: github.com/Promobot-education/robox/

6. COMPLETION OF WORK

To complete your work with Robox, proceed as follows:

1. Set the power circuit break button of the interface conversion block to the OFF position.
2. Disconnect the power supply from the 220/110 V mains.
3. Disconnect each cable shown in Figure 11 one by one from the interface conversion block.

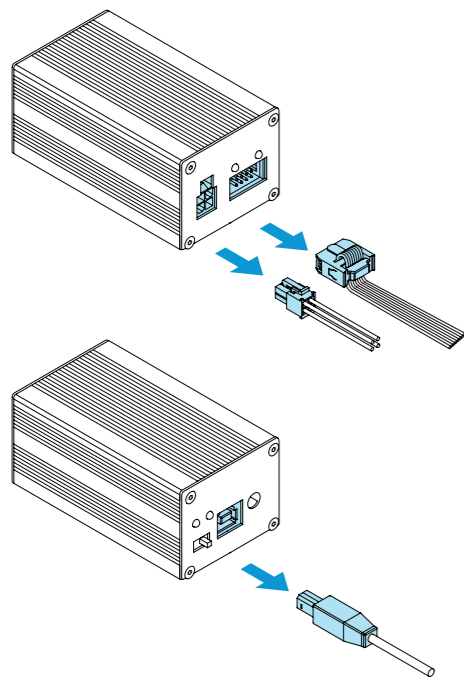


Figure 11.
Disconnecting the cables from the interface conversion block

4. Place the interface conversion block, power supply, cables, distance sensor and servo at the appropriate locations in the polyethylene foam logement of the transport case as shown in Figure 12.

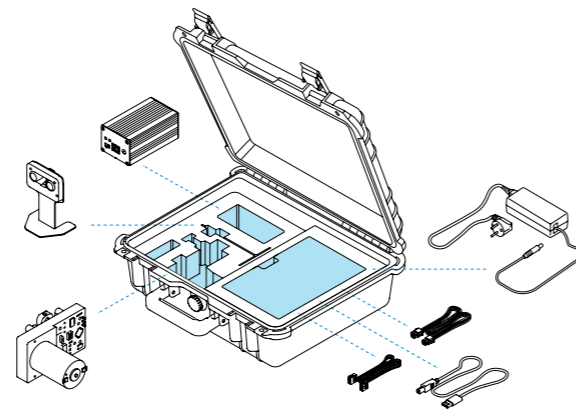


Figure 12.
Arrangement of the Robox kit components in the polyethylene foam logement

7. USE, TRANSPORT AND STORAGE CONDITIONS

1. Before use make sure that all devices from Robox kit are in a good working condition. Visually inspect the Robox kit then turn it on and check its operability.
2. The Robox kit can be used for a long time if the conditions of use and storage are observed and faults are rectified in a timely manner.
3. Do not use abrasives or solvents to clean the device.
4. Do not use aggressive chemicals (acids, etc.) that can react with plastic parts of the Robox and cause it's damage.
5. Do not allow liquids to enter the technological gaps of the Robox kit devices. Do not immerse Robox kit devices in liquid.
6. The Robox kit in its transport case can be transported by all types of enclosed transport. It is recommended to transport at air temperatures between +10°C and +35°C and a relative humidity of up to 70%.
7. If transporting the Robox kit in sub-zero temperatures, it is necessary to leave it to warm up to at least +10°C. Let the Robox kit stand powered-off in a heated room for at least two hours before turning it on.
8. Ensure that the Robox kit transport case is not a subject to any impact or movement inside the vehicle during transportation.
9. The Robox kit should be stored in a heated and ventilated room away from direct sunlight, at a temperature between 0°C and +40°C (+25°C recommended) and a relative humidity of 65%. To avoid undesirable consequences, unauthorized persons or children should not be allowed in the storage area.

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