FoXee Training Kit

Training tool for technical education

based on the principles used in real practice and Industry 4.0

Teco, a manufacturer of the Tecomat Foxtrot control system, presents the FoXee Training Kit for educational programmes at elementary and secondary schools as well as universities. The kit is built around the control unit on the Tecomat Foxtrot PLC platform.

The **FoXee Training Kit can be easily connected to:**

- analogue and digital sensors,
- step, DC engines and modellers,

known and used in the field of educational robotics and purely training single-chip systems such as Arduino and Raspberry PI or the Lego, Fisher and Merkur sets which have, however, been designed as toys from the very beginning .

Unlike toys, the **FoXee Training Kit** is based on full-fledged industrial programmable controllers the programming of which is fully compatible with the international standard **IEC EN 61131** used by all world manufacturers of systems in this category.

The FoXee Training Kit represents the fastest and most effective tool bridging the gap between experimenting with technical toys and professional work.

FoXee Training Kit – main features:

- Designed as a smartphone- or internet-connectible set for building exciting functional models within a short period of time, the FoXee Training Kit gives students and pupils the unique opportunity to gain genuine hands-on experience.

- The FoXee Training Kit makes it possible to start with basic logical tasks (Boolean algebra) button - bulb, engine, and continue with programming the FoXee wheel robot, conveyor belts and various manipulators, eventually forming a whole factory by means of communication channels used to expand the inputs, outputs, and mainly to communicate with the Internet towards Industry 4.0 and IoT.

- The FoXee Training Kit is based on 3D- printed parts, which is one of the pillars of the proclaimed Industry 4.0 initiative. Students are encouraged to further develop their skills by working on their own projects, which may, for example, include developing their own FoXee Training Kit at schools.

TECO Advanced Automation

The FoXee Teachning Kit has been developed and is further developed in collaboration with Teco a.s. and Smart Bit s.r.o.

Smart BIT s.r.o.

- The FoXee Training Kit is fully integrated into the Internet, can be monitored, controlled and programmed via the Internet, and thanks to integrated webserver it can also be connected via the Internet browser where the TecoRoute service provides a high level of cyber security to enable a secure connection to the project, for example, from home. Of course, the MQTT protocol which became popular in connection with the IoT is supported.

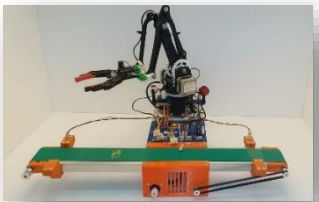
- Methodological support and teacher trainings are provided in the form of FoXee Training Kit video courses, work instructions and sheets. Technical support is provided by means of individual consultations at school or in FoXee Lab in Hradec Králové, Czech Rep.

Description of FoXee Training Kit Modules:

The core of the kit is the FoXee Basic set consisting of a central unit (training PLC) adapted to suit training purposes and the Mosaic program (IEC-61131 programming). The kit also includes modules for constructing, for example, a "**wheel robot**", modules for building a "**factory on the table**" or modules for "**controlling your home**" and other modules that Teco is gradually launching onto the market.







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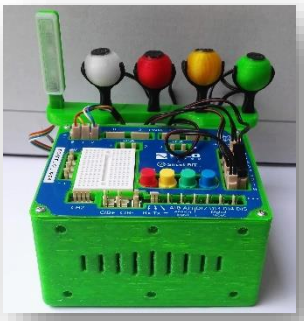
I. FoXee Basic Set:



The Basic Set includes a training PLC, 4 colour LEDs and one RGB LED strip. The base is built on Tecomat Foxtrot PLC with a processor module, Wi-Fi connection, Ethernet port, TCL2 and CIB extension bus and basic inputs and outputs on plug-in connectors used in hobby robotics. Voltage is adapted to 5 V and 12 V levels. It also contains a non-soldering field for easy connection of simple complementary electrical circuits.

The cube contains screw driving points for mechanical attachment of the motor and a high-capacity battery ensuring long-term operation without a cable connection, e.g. a wheel or belt robot, or points for attaching mechanical elements from the Lego, Mercury or Variant sets and their combinations.

The set is built on the CP-1972 module, which is an OEM variant of the basic modules of the Foxtrot modular programmable controller. It includes 4 binary inputs, 2 analogue inputs, 2 analogue outputs, 13 binary (transistor) outputs, TCL2 and CIB communication interface for expansion modules, up to to 3 serial channels (CH1 with fixed RS-485 interface) and Ethernet interface. The module is equipped with a L-series central unit (CPU) that is designed for applications with performance requirements. It includes backup CMOS RAM for user programs, data, spreadsheets, user registers and DataBox, flash memory for user backup, MMC / SD / SDHC memory card slot and real time circuit. The also includes the Mikrotik RBmAPL-2nD Access Point which supports 802.11b / g / n Wi-Fi with PoE supply.

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II. FoXee Robot:

The FoXee robot is designed for riding on a flat surface such as flooring. Its construction makes it possible to demonstrate the effects of real physical phenomena such as inertia and delays which you do not encounter in the virtual world.

i. FoXee Robot Module:

The FoXee Robot Module enables the upgrade of the Basic set to the wheel robot.

The FoXee Robot Module includes:

- 1 x Battery pack: Li-ion 20V 2000mA-40Wh + charger 230V/20V
- 1 x Battery holder DC/DC power supply for FoXee
- 1 x Front bumper
- 1 x Rear bumper
- 2 x Driver wheels
- 2 x Directional wheel
- 2 x DC motor holder
- 2 x 12 V DC motor with encoder
- 2 x Ultrasonic Analog Sensor
- 1x Connection cable for DC motor

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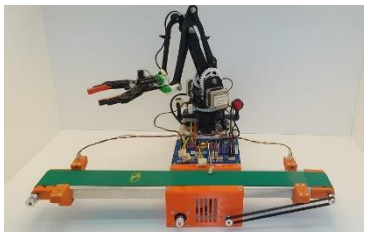
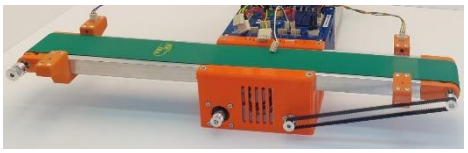
III. FoXee Factory On The Table:

With the Belt Conveyor and Manipulator modules built for 3D printing and controlled by the FoXee Basic set it is possible to assemble and simulate basic tasks of robotics and mechatronics and Industry 4.0 automation.





i. Belt Conveyor Module:



Using the Belt Conveyor Module (FoXee Belt Conveyor), the FoXee Basic set can be converted into a real-life conveyor with a stepper and DC motors, including an encoder.

It offers the student an overview and knowledge concerning the real direction and movement of basic stepper motors and DC motors. Students learn how to drive the engine speed, work with pulses and motor control accuracy as well as its reversing. The conveyor is fitted with 2 optical gates.

The construction of the kit is a combination of aluminum profiles, 3D - printing and mechanical parts.

The Belt Conveyor module includes:

- 1 x set of aluminum profiles and connecting as well as mechanical parts
- 1 x Conveyor Belt
- 4 x Belt pulleys
- 1 x Toothed belt
- 2 x Optical Latch
- 1 x Stepper motor including driver
- 1 x 12 V DC motor with encoder

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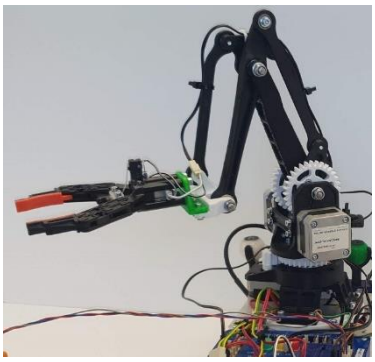
ii. Manipulator Module:



The Manipulator Module (FoXee 3 Axes Manipulator enables the transformation of the FoXee Basic set into a real-mode manipulator with stepper motors moving along the x, y, z axes.

Students gain the necessary knowledge of the real direction and movement of stepper motors. This model helps students understand multiple engines operations and their synchronizing. Students are familiarized with the basics of G-code, sequencing, and behavior of the model in a real-life environment, for example, when transferring objects from one place to another to ensure repeatability and movement accuracy.

The construction kit is a combination of 3D printing and mechanical parts.

The Manipulator module includes:

- 1 x Joint set and mechanical parts
- 1 x Gripping Pliers
- 3 x End position sensor
- 3 x Stepper motor including driver

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