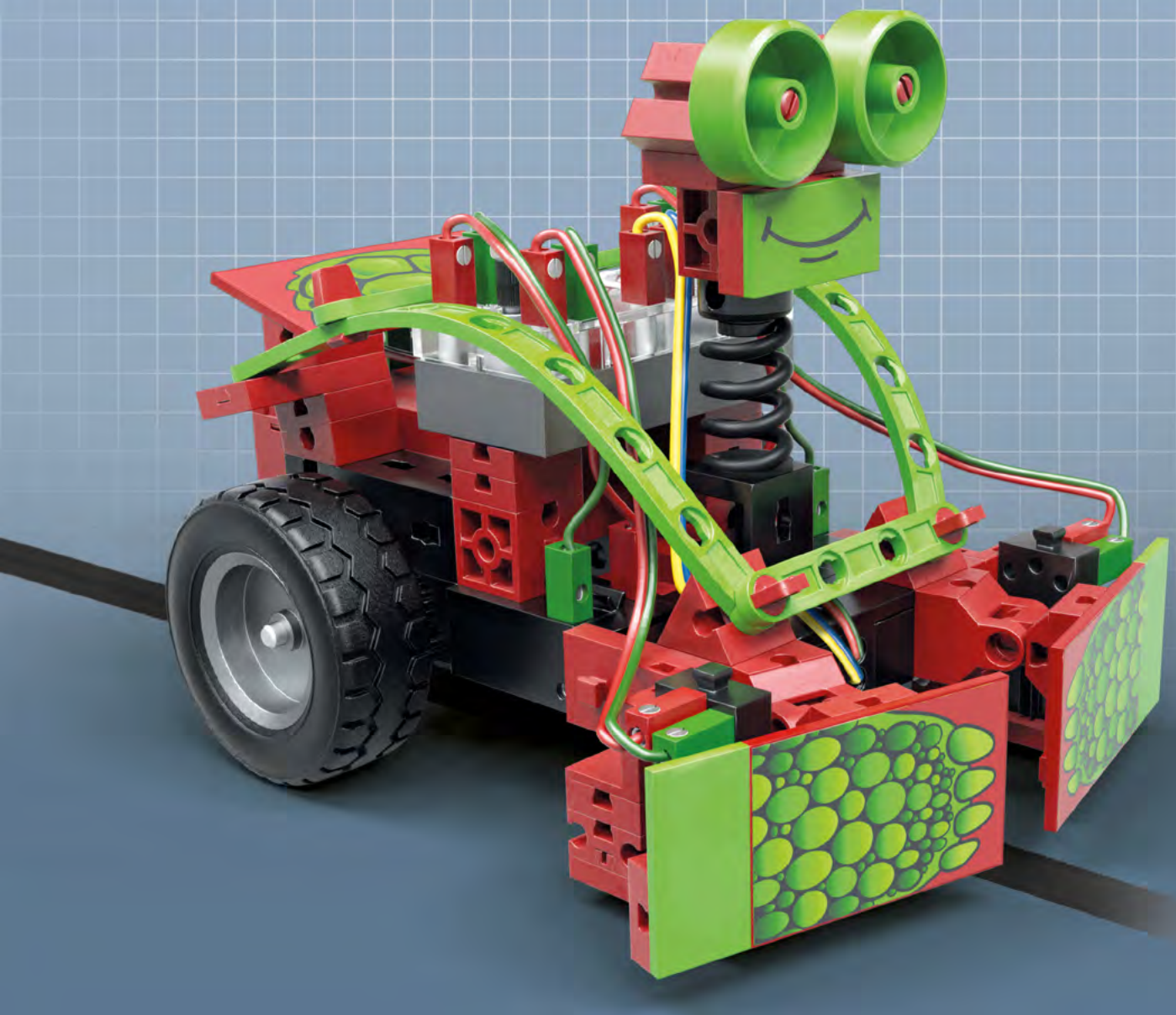


fischertechnik

ROBOTICS

Begleitheft
Activity booklet
Manual d'accompagnement
Begeleidend boekje
Cuaderno adjunto
Folheto
Libretto di istruzioni
Сопроводительная инструкция
附带说明书



Mini Bots

5 MODELS

Welcome to the world of fischertechnik's ROBOTICS line

Hello!

Congratulations on your purchase of the "ROBOTICS Mini Bots" Construction Set from fischertechnik. With this construction set you can build and control a number of interesting Mini Bots; our pet name for mobile robots.

Reading through this educational information and trying out the various Mini Bots will familiarize you step for step with the various applications for sensors.

Now we wish you a great deal of fun and success experimenting with your ROBOTICS Mini Bots.

Your team from

fischertechnik

Some General Information

Before we really get started with the construction set, you still need to know a few things. Even though the components we will work with are very robust, if you do not handle them properly, they can be damaged under certain circumstances.

Electricity

As you certainly know, a lot of the components in the ROBOTICS Mini Bots Set use electric power. And you know it is necessary to be particularly careful not to make any mistakes when working with electrical components. That is why you should always read the assembly instructions very carefully when wiring the electrical components.

Never connect the positive and negative poles directly to one another which would result in a short circuit. This can damage the ROBOTICS module.

The subjects of electricity and electronics are just as interesting as robotics (which is what this construction set is about) and there is a construction set from fischertechnik, which deals specifically with these subjects. If you are interested in this, you will also have

just as much fun with our "PROFI Electronics" construction set as with the ROBOTICS Mini Bots Set.

Robots, Artificial Humans?

What is your first thought when you hear the word "robot?" Have you ever seen a robot? In a movie or on television? Or perhaps a real one?

There are many different types of robots. Some robots look a bit like a human, while others have only one or more arms. So, what exactly makes a robot a robot?

The dictionary says: "Robots are stationary or mobile machines, which perform set tasks according to a certain program."

ROBOTICS, (Almost) Everything Automatic

Thus, robots are machines controlled by a program. And we call this control of machines (or in our case models) "ROBOTICS."

The "ROBOTICS Mini Bots" Set provides a great start for this subject, because the construction set contains everything you need to build and control various mobile robots.

Component Explanations

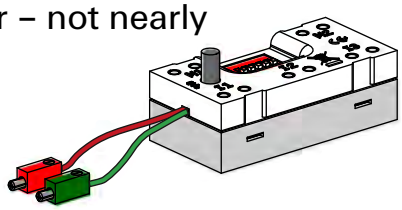
The construction set contains all of the following

First, it contains numerous fischertechnik building blocks, as well as motors and sensors and colored assembly instructions for building various models.

After you have unpacked all the building blocks, it is necessary to first assemble a few components such as installing plugs on the cables before you can really get started. Details are given in the assembly instructions under "Assembly Tips." It is best to do this first.

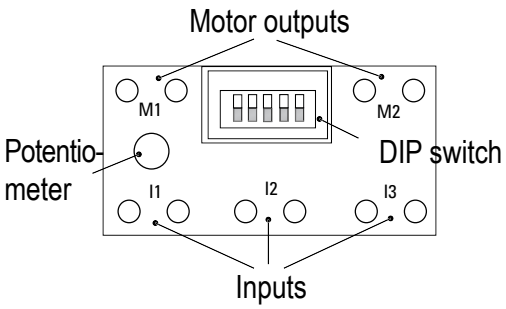
ROBOTICS Module

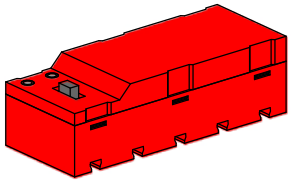
Your ROBOTICS Mini Bots Construction Set contains the ROBOTICS module. This corresponds to a small computer – not nearly as powerful as a PC, but fully sufficient for the following control experiments.



You cannot program the ROBOTICS module yourself. Various programs are already permanently stored in the module. The program from the "teach-in mobile robot" is an exception. This program allows you to create a short motion program using the two buttons. The small slide switches allow you to select and run the program for the model you want to control.

Power Supply

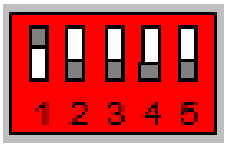




The ROBOTICS module works only when it is connected to a 9 V power supply. For this purpose use the battery tray with a 9 V block battery either as dry cell or rechargeable battery. When connecting ensure that the polarity is correct (red = positive). When the module is suppled with power correctly, the green LED illuminates.

Inputs I1 - I3:	Outputs Motor M1 and M2:
You can connect the fischertechnik sensors to these inputs. They provide information on the module. Two buttons and one trail sensor are available as sensors.	You can connect the XS motors to the two outputs.

Slide Switches (DIP Switches) 1-5



The position of the five slide switches, also known as a DIP switch, determines the function of the ROBOTICS module. The desired program can be set with these switches. Here it is necessary to ensure that the DIP switch is in the position required for the particular model. Each switch has two positions: "ON" (up) and "OFF" (down).

Important: The ROBOTICS module checks which programs is to be run when the power is switched on. Always set the desired program before switching on the power supply.

Actuators

Actuators are all components, which can perform some type of action. This means that they become "active" in some way when they are connected to electric power. In most cases you can see this directly. A motor runs, an indicator light illuminates and so forth.

XS Motor

The XS motor is an electric motor, exactly as long and high as a fischertechnik building block. In addition, it is very light. This means, you can install it at points too small for the big motors.

Both gearboxes included in the construction set fit perfectly on the XS motor.

The XS motor is designed for a supply voltage of 9 volts and a maximum current of 0.3 amperes.

Sensors

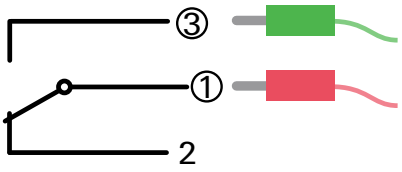
Sensors are so to speak the counterpart to the actuators. This is because they do not perform any actions, but react to certain situations and events. For example, a pushbutton reacts when pressed, allowing an electric current to flow or interrupting its flow.

Pushbutton Switch

The pushbutton could also be called a touch sensor. Pressing the red button actuates a switch mechanically allowing electricity to flow from contact 1 (middle contact) to contact 3. At the same time the circuit between contacts 1 and 2 is interrupted. So you can use the pushbutton in two different ways:

As a "Normally open switch" (NO or push-to-make switch)

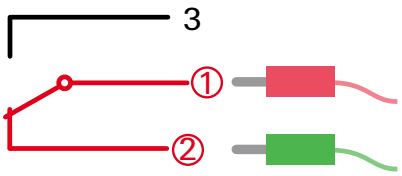
contacts 1 and 3 are connected.



Pushbutton is pressed: Electricity flows
When the pushbutton is not pressed:
Electricity does not flow

As a "normally closed switch" (NC or push-to-break switch)

contacts 1 and 2 are connected.



Pushbutton switch pressed: No electricity flows.
When the pushbutton is not pressed:
Electricity flows.

Trail Sensor

The infrared trail sensor is a digital sensor for identification of a black trail on a white background at a distance of 5 to 30 mm. It consists of two transmitter and receiver elements. For connection you need a digital input on the ROBOTICS module and the 9 Volt power supply (positive and negative poles) on the battery tray.

Mini Bots

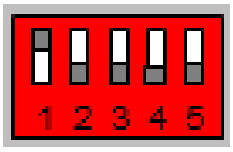
With the ROBOTICS Mini Bots Construction Set you can build one of the Mini Bot models: mobile robot, hindrance detector, trail searcher, hindrance detector with trail sensor or teach-in mobile robot.

The descriptions of the models below explain exactly what the models can do.

Important: The program setting is checked only when the ROBOTICS module is switched on. If you change the program after switching on, it is necessary to momentarily interrupt the power supply to activate the new program.

Mobile Robot

DIP switch setting:

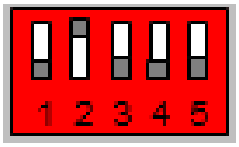


To help you get started the mobile robot model is not initially equipped with sensors. After setting the DIP switches for the mobile robot program as shown above, connecting the power supply on the battery tray and starting the ROBOTICS module program, the two drive motors start turning and the mobile robot moves forwards.

The potentiometer on the ROBOTICS module allows you to control the speed of the two drive motors. When the potentiometer is in the middle position (viewed from above, so that the DIP switch designation is easily legible) both drive motors turn at the same speed propelling the Mini Bot straight ahead. Turning the potentiometer to the left causes it to curve to the left while moving forwards. Turning the potentiometer to the right causes it to curve to the right while moving forwards.

Hindrance Detector

DIP switch setting:



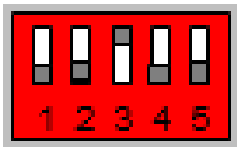
The Mini Bot hindrance detector is equipped with two mini-switches on the two bumpers which serve as sensors. After starting the program the Mini Bot moves straight ahead. It continues this until one of the bumpers touches an obstacle.

If, for example, the left bumper, as seen when facing in the direction of motion, hits against a hindrance, it moves back a short distance. During this maneuver it also deviates by turning to the right, and then continues to move forwards. This deviating motion helps the Mini Bot to move around an obstacle or out of a corner.

You can set the distance for this deviation on the potentiometer. When the potentiometer is set to the middle position, the deviation is identical in both directions. Turning the potentiometer to the left (viewed from above, so that the DIP switch designation is easily legible) increases the deviation to the left accordingly and reduces the deviation to the right by an equivalent amount.

Trail Searcher

DIP switch setting:



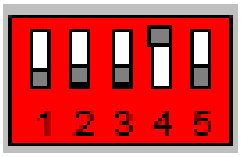
On the trail searcher model a further sensor, the trail sensor, is attached in addition to the two mini-switches acting as sensors on the two bumpers. With the aid of the trail sensor the Mini Bot trail searcher can follow a trail in the form of a black line.

The mini-switches as sensors on the two bumpers serve for recognition of hindrances located along the black trail. If one of the two mini-switches is tripped by hitting against an obstacle, the Mini Bot trail searcher moves back, makes a deviating motion and then continues to move forward again while it looks for the black trail.

An obstacle course is included in the construction set. A black trail is printed on it, which you can use for this model. For this purpose place the Mini Bot trail searcher in the middle of the obstacle course and switch on the power supply on the battery tray. The Mini Bot then moves forward in a spiral until it finds the black trail, which it then follows. However you can also draw a trail on a large sheet of white paper with a black marker. This black trail should be at least 20 mm wide for the trail sensor to work properly.

Hindrance Detector with Trail Sensor

DIP switch setting:



As the name of this Mini Bot suggests, it is an upgraded version of the hindrance detector model with a trail sensor.

The mini-switches on the two bumpers serve as sensors and the potentiometer has the same function as on the Mini Bot hindrance detector.

The trail sensor on this model is an additional sensor for recognition of hindrances in the form of a black line. If the trail sensor recognizes a black line, the Mini Bot also moves back, deviates by turning and then continues

to move forwards. The setting on the potentiometer also has an effect on the deviation caused by the trail sensor.

The trail sensor consists of two transmitter and receiver elements as described under sensors. With the aid of these two transmitter and receiver elements the trail sensor can recognize how the Mini Bot makes contact with the black line acting as a hindrance and deviates accordingly. When, for example, the transmitter and receiver elements on the left side detect a black line first, the Mini Bot moves back while deviating to the right. In this case the trail sensor activates the same action as the mini-switches acting as sensors on the bumper.

You can also use the obstacle course from the construction set for the hindrance detector model with trail sensor. For this purpose place the Mini Bot in the middle of the obstacle course and switch on the power supply on the battery tray. The Mini Bot then continues to move forward until it touches a hindrance with the bumper or recognizes a black line with the trail sensor.

Teach-in Mobile Robot

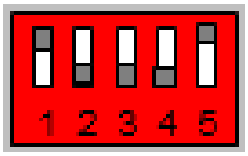
"Teach-in" is a concept from the world of robotics.

A wireless or cable type remote control is used to move the robot to the desired positions, which are then saved in a program. The robot then moves precisely to these positions with the aid of the program.

With the teach-in mobile robot you can program the motion path yourself using the cable remote control integrated into the model.

To program the teach-in mobile robot it is necessary to set DIP switches 1 and 5 to ON.

DIP switch setting for creating program:



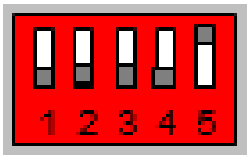
With the left button on the cable remote control you can switch on the drive motor on the left side of the Mini Bot when viewed facing in the direction of motion; the right drive motor can be actuated with the right button. The button pressed as well as the period of time it is held down is saved in the ROBOTICS module. This means that you can control your Mini Bot to move around hindrances with the cable remote control.

This path is recorded and saved in the ROBOTICS module during the teach-in operation. When you are finished teaching in your Mini Bot, it is necessary to set DIP switch 1 to OFF. This is the signal for the ROBOTICS module that the program is finished and that further entries will not be made with the cable remote control.

To run the program it is first necessary to switch on the power supply for the ROBOTICS module on the battery tray. There are now two possibilities for running the program:

Possibility 1: Run program once

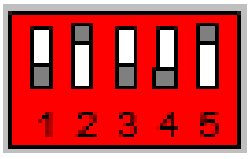
DIP switch setting for running program once:



After setting DIP switch 5 to ON and all others to OFF, you can switch on the power supply for the ROBOTICS module on the battery tray. The program last saved is then run through once. To run the program again, it is necessary to switch off the power supply to the ROBOTICS module and then switch it back on.

Possibility 2: Run program in endless loop

DIP switch setting for running program in endless loop:



Proceed as follows to have the Mini Bot teach-in mobile robot run along a path continuously. After setting DIP switches 2 and 5 to ON and all others to OFF, you can switch on the power supply for the ROBOTICS

module on the battery tray. The program last saved is then run through in an endless loop. This means that the program starts over again as soon as it is completed. The program continues to run in an endless loop until you switch off the power supply to the ROBOTICS module.

Note: The program last saved remains stored in the ROBOTICS module, even when the power supply is switched off. It remains stored until it is written over with a new program.

Programs and DIP Switch Positions

Important: The program setting is checked only when the ROBOTICS module is switched on. If you change the program after switching on, it is necessary to momentarily interrupt the power supply to activate the new program.

Program	DIP1	DIP2	DIP3	DIP4	DIP5
No program	0	0	0	0	0
Mobile robot	1	0	0	0	0
Hindrance detector	0	1	0	0	0
Trail searcher	0	0	1	0	0
Hindrance detector with trail sensor	0	0	0	1	0
Create program for teach-in mobile robot	1	0	0	0	1
Teach in mobile robot: start program in memory, run through once	0	0	0	0	1
Teach in mobile robot: start program in memory, run through as endless loop	0	1	0	0	1

Legend: 0 = "OFF", 1 = "ON"

LED	Description
LED illuminates continuously	• Power supply OK. • ROBOTICS module ready for operation
LED flashes once	• When power supply is switched on • Input to I1, I2 or I3 • At conclusion of programming teach-in mobile robot
LED does not illuminate after switching on power supply	• Power supply not OK (check 9 V block battery/rechargeable battery; a voltage of > 6.5 V is required) • Power supply polarity incorrect • ROBOTICS module defective (contact fischertechnik Service: info@fischertechnik.de)

More intelligent control - fischertechnik ROBOTICS

We hope you have had a lot of fun controlling the models from your ROBOTICS Mini Bots construction set.

Perhaps you can build a few new models yourself and control them with the ROBOTICS module. Sooner or later you are certain to reach a point, where the programs are no longer sufficient to control the models the way you want. Perhaps you would like to build a model with more than two motors and more or different sensors and realize a certain technical process. Then you are ready for the next stage in the ROBOTICS line.

The LT Controller (ROBOTICS LT Beginner Set) with two outputs for actuators (e.g. motors) and three inputs for sensors (e.g. mini-switches) serves as an introduction to ROBO Pro programming. The next stage is the TXT Controller (ROBOTICS TXT Discovery Set), which allows four motors to be controlled simultaneously. It also has eight inputs for sensors (e.g. mini-switches, phototransistors, reed contacts and much more). Moreover it has provisions for Bluetooth, WiFi and much more.