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MAKEBLOCK RGB LINE FOLLOWER QUICK START MANUAL



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RGB Line Follower

1. Basic knowledge of RGB line follower

The RGB Line Follower module is designed for line patrol competitions. It contains 4 RGB fill lights and 4 photosensitive receiving tubes. The module has a learning button and an LED indicator on the front. The learning button is used to learn the background color and the track color of the arena. There are 6 fixable screws through holes at the installation position and a RJ25 base is at the tail. The module can be applied to dark background with light-colored tracks, or light-colored background with dark tracks. The RGB Line Follower needs to learn the arena through the learning button, so that it can adapt to external environments of different heights, light and other factors. The module port is marked with a blue and white label, which indicates dual-digital and I2C port that needs to be connected to the port with a blue-white mark on the main board, as shown in Figure 1.

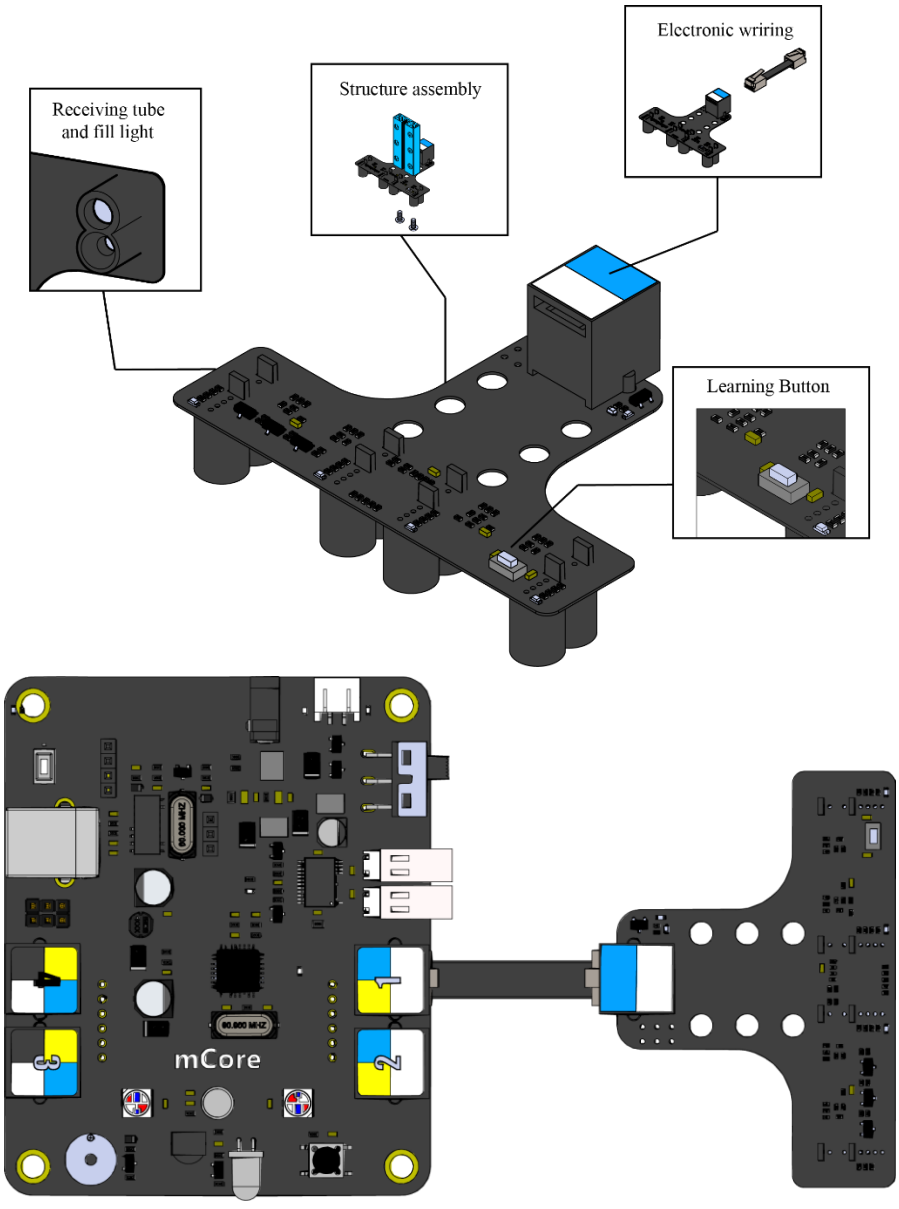


Figure 1. RGB Line Follower

2. Properties of RGB line follower

The RGB Line Follower contains 4 LED indicators for line following feedback and learning of new surroundings;

Learning button: recognize and record the color of the background and lane;

Supplement light: for now the RGB line follower supports three types of color: red, green and blue. By switching between these colors to find the best one, the line follower can learn the arena more easily. By pressing and hold the learning button, we can switch between these colors;

Adaptability of sensitivity;

Detection of the height: According to the material of the arena and lighting condition, we recommend to put the sensor at 5mm – 15mm high.

3. Principle Analysis

RGB Line Follower module has a total of four photosensitive receiving tubes, RGB1, RGB2, RGB3, and RGB4 from left to right, as shown in Figure 2.

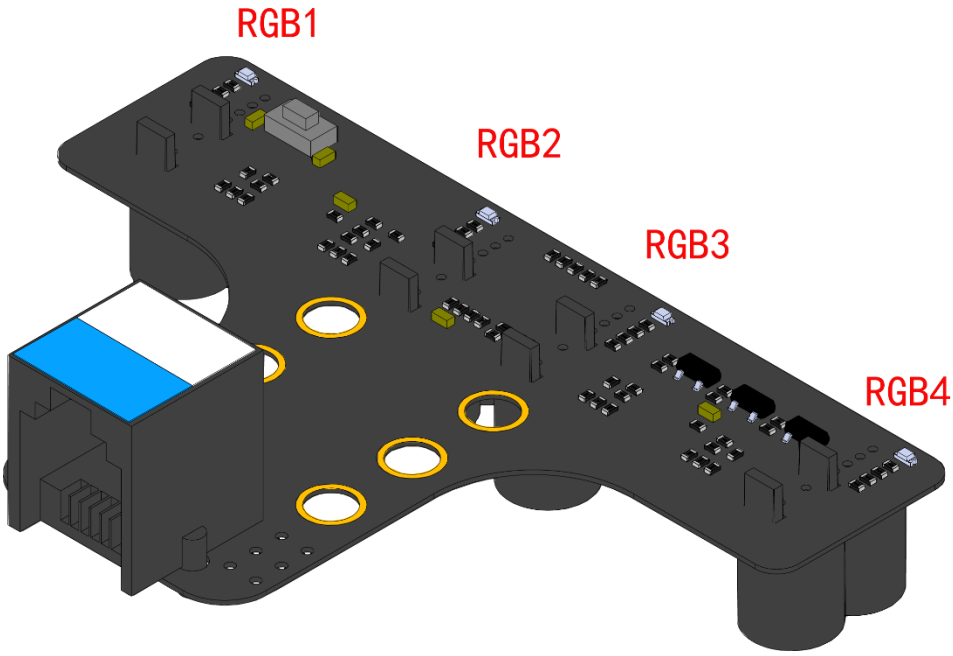


Figure 2: Order of Photosensitive Receiving Tubes

When the photosensitive receiving tubes pass through different colors, they will convert different optical information into electrical signals and output specific values from analog ports through the amplifier. The underlying software then uses the analog values of these four photosensitive receiving tubes to create a default line following algorithm. Eventually, it will output the offset value of RGB Line Follower module deviating from the track position. Users can use this offset to control the rotation speed of the left and right motors so as to realize the line following.

4. The learning process of RGB line follower

The RGB Line Follower needs to use RGB2 and RGB3 to determine the direction. If it does not learn the return values of the tracks and the background colors on the line following map, mBot still

cannot perform normal line following even though programming is completed. RGB Line Follower Learning Method is as follows:

- Adjusting the color of fill light: Long pressing the button to select the color of the fill light that is suitable for the current environment.
- Learning background color: Installing the RGB Line Follower module at the place to use it, so that all the 4 RGB lights directly face the background of the arena. Click the button, when the four indicators start to flash slowly, it indicates correct operation. After waiting for 2 to 3 seconds, the indicators stop flashing, it indicates the completion of background color learning.
- Learning track color: Installing the RGB Line Follower module at the place use it, so that all the 4 RGB lights directly face the track. Double-click the button, when the four indicators start to flash quickly, it indicates correct operation. After waiting for 2 to 3 seconds, the indicators stop flashing, it indicates the completion of track learning.
- Test Confirmation: Use the four probes to confirm that RGB Line Follower can correctly detect the color of background and track. When the background is detected, the LED corresponding to the probe turns on, and the corresponding LED turns off when the track is detected.
- Re-learning: Should any change in the arena, environment, RGB Line Follower installation location, etc., it is recommended to learn them again. The learning information will be saved in eeprom to prevent loss.

5. Programming tutorial

5.1 Installing RGB Line Follower plug-in

When using mBlock3 for the programming of RGB Line Follower, the RGB Line Follower plug-in must be installed. To install the plug-in, open the mBlock software → Extension → Extension Manager → Find RGB Line Follower → Download plug-in package.

The RGB Line Follower plug-in is based on the coding blocks that can be used by default line following algorithm. Its coding blocks are as shown in Figure 3.

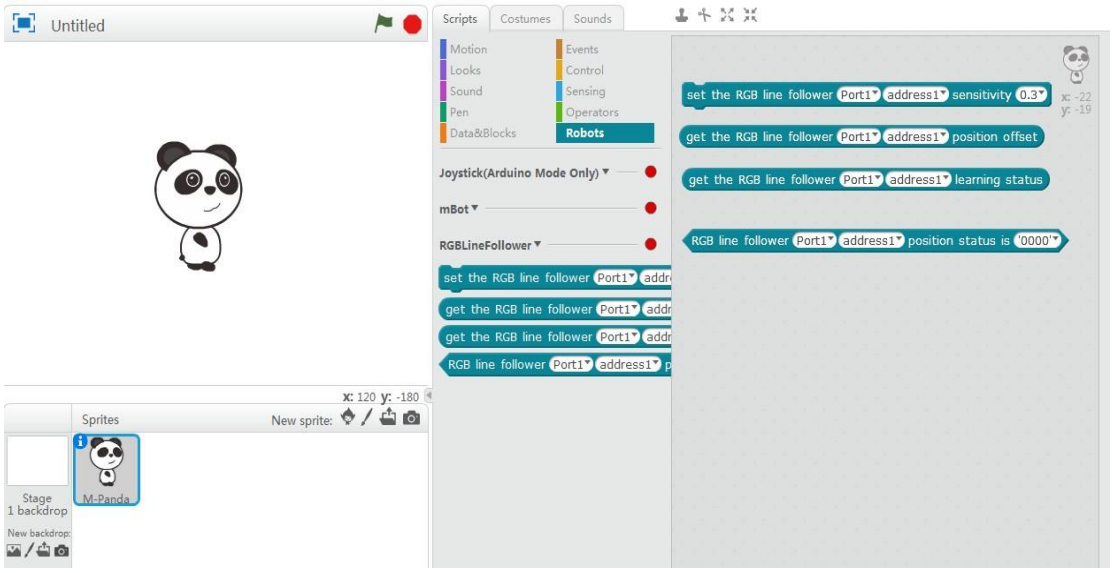


Figure3: RGB Line Follower plug-in statement blocks

(1) The meanings of the coding blocks in mBlock are as shown in Figure 4.

statement blocks	**Description**
	Parameter 1: the port of the main board connected to the RGB Line Follower;
	Parameter 2: channel, any one can be chosen when using one RGB Line Follower.
	Parameter 3: Line following sensitivity Kp, the sensitivity is used to adjust the response speed in line following. The greater the value, the more sensitive turning.
	Value blocks: The value blocks are used to assess deviations of the sensor from the racetrack, with a range of -512~512. A value above 0 indicates the sensor leans forward the left side while a value below 0 indicates the sensor leans forward the right side.
	Parameter 1: the port of the main board connected to the RGB Line Follower;
	Parameter 2: channel, any one can be chosen when using one RGB Line Follower.
	Parameter 1: the port of the main board connected to the RGB Line Follower;
	Parameter 2: channel, any one can be chosen when using one RGB Line Follower.
	Parameter 3: The feedback status of the four receiving tubes on the Line Follower. 0 indicates that the current receiving tube is on the track, 1 indicates that the current receiving tube is on the background color. There are a total of 16 free combined states for the four receiving tubes.
	Obtain the learning status of RGB

get the RGB line follower Port1 address1 learning status	Line Follower Sensor, 0-not learn, 1-learning background color, 2-learning track color
	Parameter 1: the port of the main board connected to the RGB Line Follower;
	Parameter 2: channel, any one can be chosen when using one RGB Line Follower.

Figure 4: Meanings of RGB Line Follower Plug-in Coding Blocks

(2) Based on the default line following policy model

- Left motor control value：left_motor_ctrl_value = car_speed + position_offset * Kp
- Right motor control value：right_motor_ctrl_value = car_speed - position_offset * Kp

The mBot line following example program can be obtained, as shown in Figure 5.

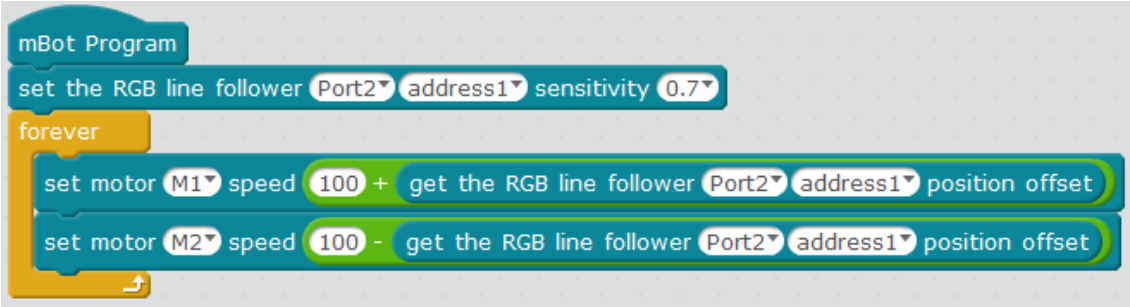


Figure 5: RGB Line Follower plug-in line following program

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