

## Mechatronics Laboratory

### Rubik's Cube 3x3 Simulator User Guide

#### Overview

##### - Color Code

This Rubik's cube simulator enumerates the list of available colors in the following way:

Color	Code
White	0
Blue	1
Red	2
Green	3
Orange	4
Yellow	5

##### - Cube Movements code

This Rubik's cube simulator can perform up to 18 movements:

Movement	Description	Code
U	Up face (CW)	0
U2	Up face (CW double turn)	1
U'	Up face (CCW)	2
B	Back face (CW)	3
B2	Back face (CW double turn)	4
B'	Back face (CCW)	5
R	Right face (CW)	6
R2	Right face (CW double turn)	7
R'	Right face (CCW)	8
F	Front face (CW)	9
F2	Front face (CW double turn)	10
F'	Front face (CCW)	11
L	Left face (CW)	12
L2	Left face (CW double turn)	13
L'	Left face (CCW)	14
D	Down face (CW)	15
D2	Down face (CW double turn)	16
D'	Down face (CCW)	17

NOTE: This simulator assumes that green is the Front face and white is the Up face.

##### - Local Server

This Rubik's cube simulator internally leverages a local server, which may be accessed by using TCP/IP client.

Host	Port
"localhost" (127.0.0.1)	2500

## Commands

To send commands to the local server, the next packet format must be assembled:

CMD	PAYLOAD LEN	PAYLOAD
1 byte	1 byte	N bytes

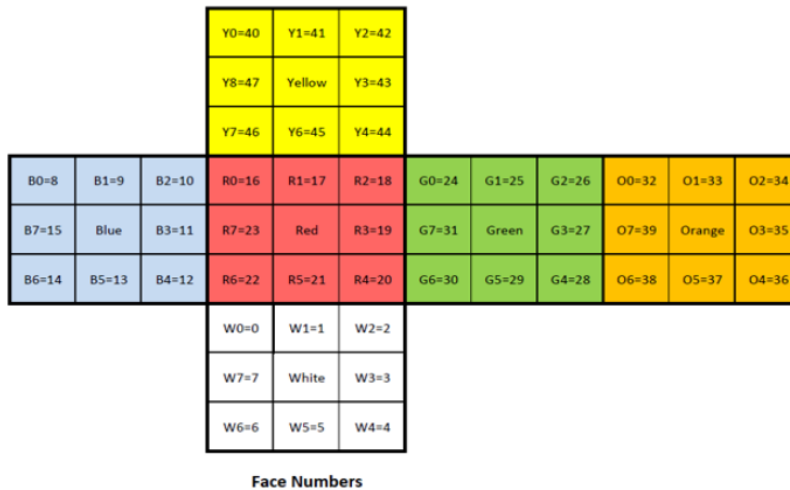
### - Set Cube State command

This command sets the initial state of the cube.

CMD	0xFA (hex)
PAYLOAD LENGTH	48
PAYLOAD	48 byte array

The cube has six sides. Each side has eight movable faces. In total there are 48 movable faces. The payload must contain an array of 48 bytes representing the movable faces.

Face numbers are 0 to 47. The diagram below shows all the face numbers.



### Code example (MATLAB)

```
1  command = 0xFA;    % Set cube state command
2  payloadLen = 48;    % Payload length
3  payload = uint8(zeros(payloadLen, 1)); %Payload
4
5  % Fill out payload
6  payload(1) = 5; % Paint face number W0 to yellow
7  payload(2) = 1; % Paint face number W1 to blue
8  payload(3) = 0; % Paint face number W2 to white
9  payload(4) = 2; % Paint face number W3 to red
10 ...
11 ...
12 payload(48) = 0; % Paint face number Y8 to white
13
14 % Assemble packet
15 packet = [command; payloadLen; payload];
```

**NOTE:** Use the enumeration from “Color Code” section to fill out the payload. The simulator will display an error if the cube state is not feasible.

See also: [setCubeState.m \(MATLAB\)](#), [setCubeState.py \(Python\)](#)

### - Get Cube State command

This command requests the state of the cube from the cube simulator.

CMD	0xFC (hex)
PAYLOAD LENGTH	N/A
PAYLOAD	N/A

**Response:** 48 bytes corresponding to the cube state (48 movable faces).

### Code example (MATLAB)

```
1  % Connect TCP/IP client to localhost in port 2500
2  client = tcpclient('localhost', 2500);
3
4  % Get Cube State command (just 1 byte)
5  command = 0xFC;
6
7  % Write Get Cube State command
8  write(client, command);
9  pause(0.5); % dummy wait for server to respond
10
11 % Read Cube State from cube simulator (48 bytes)
12 cubeState = read(client);
```

**NOTE:** The cube state response has the same format as the Face Numbers diagram in “Set Cube Command” section.

[See also:](#) [getCubeState.m \(MATLAB\)](#), [getCubeState.py \(Python\)](#)

### - Set Cube Moves command

This command sets a list of moves to perform in the cube simulator.

CMD	0xFB (hex)
PAYLOAD LENGTH	N
PAYLOAD	N byte array

### Code example (MATLAB)

```
1  command = 0xFB; % Set cube state command
2  payloadLen = 5; % Payload length (# of moves)
3  payload = uint8(zeros(payloadLen, 1)); %Payload
4
5  % Fill out payload
6  payload(1) = 0; % Perform U move
7  payload(2) = 9; % Perform F move
8  payload(3) = 7; % Perform R2 move
9  payload(4) = 17; % Perform D' move
10 payload(5) = 5; % Perform B' move
11
12 % Assemble packet
13 packet = [command; payloadLen; payload];
```

**NOTE:** Use the enumeration from “Cube Movements code” section to fill out the payload. Since the payload length must be 1 byte, it may be performed up to 255 moves per packet.

[See also:](#) [setCubeMoves.m \(MATLAB\)](#), [setCubeMoves.py \(Python\)](#)