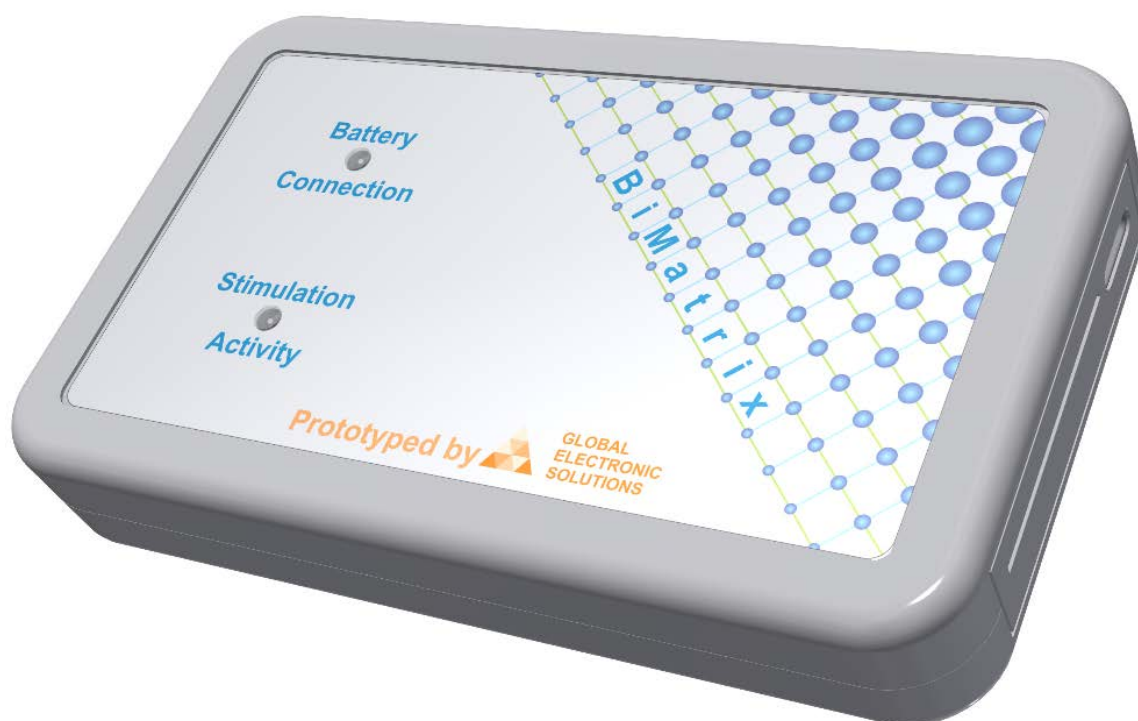


## **USER MANUAL FOR BiMatrix v1.0 RESEARCH PROTOTYPE**



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# 1 Information about the document

## 1.1 Document data

|               |  |
|---------------|--|
| Title         | User Manual for BiMatrix v1.0 Research Prototype |
| Document type | User manual                                      |
| Version       | 1.0  |

|                 |   |
|-----------------|---|
| <b>Warning!</b> | <b>This device is a prototype for research purposes only!</b><br><b>This is not a medical device!</b><br><b>Using this device is at your own risk!</b><br><b>Interconnection with any other device is prohibited!</b><br><b>For any nonspecific application contact manufacturer!</b> |
|-----------------|---|

## 1.2 Technical support

If you have technical problems or cannot find the required information in the provided documents, contact our Technical Support by e-mail using our dedicated e-mail address: [office@globalelectronic.rs](mailto:office@globalelectronic.rs). Your request will be processed as soon as possible.

## 2 Description

BiMatrix is a 24 channel current pulse generator controlled via Bluetooth or via USB interface. This prototype is developed for research and demonstration purposes at the research institutions according to their specification. The exact use of the BiMatrix prototype is a know-how which belongs to the research institutions and it is not disclosed to Global Electronic Solutions.

### Switch ON/OFF

BiMatrix is switched on when a connection to the host computer is established via USB or via Bluetooth interface, and switched off when the connection is aborted. Communication with the host computer is only possible through the communication interface which switched on the device. This means that switching to the other communication interface is not possible without first switching off the device.

### Operation and Operation modes

BiMatrix operates when a connection to the host computer is established. The host computer sends commands to BiMatrix in order to configure and control it. BiMatrix is on absolute control of the host computer via Bluetooth or USB interface. The list of commands is given in the document: [BiMatrix Communication Protocol.pdf](#)

BiMatrix device has two basic operation modes: Unipolar and Bipolar. A simplified diagram showing BiMatrix control circuits is given in the figure below.

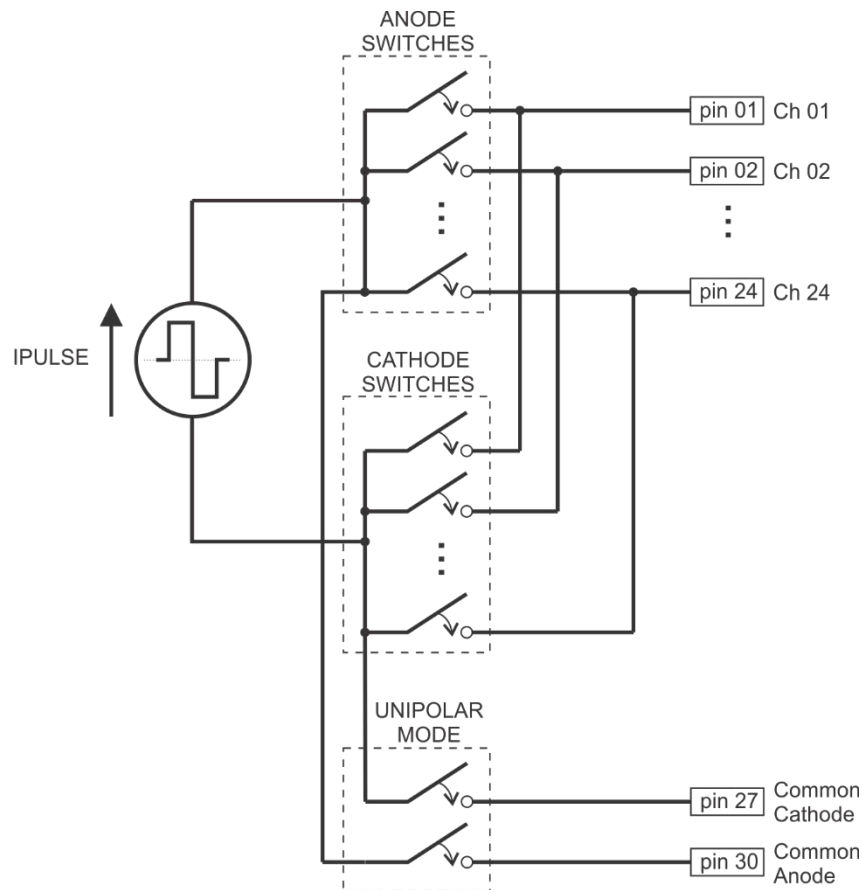


Figure 1. Simplified diagram of the BiMatrix

### Unipolar mode

In this mode the user can select a common anode and 24 cathodes or a common cathode and 24 anodes. Every pulse can be distributed through the common anode/cathode and one or more channels by sending the appropriate commands.

The common anode and 24 cathodes mean that the positive pulse flows from the common anode through the load and the selected cathodes.

The common cathode and 24 anodes mean that the positive pulse flows from the selected anodes through the load and the common cathode.

### Bipolar mode

In this mode the user cannot use the common anode and common cathode outputs. This mode is used in applications where the user wants to dynamically change anode/cathode pairs on the 24 channels. Pulses are distributed through one or more cathode switches and one or more anode switches. By sending the appropriate command, the user can select anode/cathode pairs on any of the 24 channels for every pulse.

### Battery charging

The integrated battery is charged via the BiMatrix USB port. The battery charging process is initiated when the USB wall outlet adapter is connected to the BiMatrix USB port. The device battery does not charge when connected to the host computer USB port.

### 3 Device specifications

Technical specification of the BiMatrix prototype is given in the table below.

| Parameter  | Value  | Unit |
|--|--|------|
| Dimension L x W x H  | 115 x 69 x 20  | mm   |
| Mass   | 145  | g    |
| <b>Battery and charging</b>  |  |      |
| Battery type   | 3,7V 2000mAh Li-Poly                                   |      |
| Battery autonomy   | > 5  | Hour |
| Charger power supply type  | USB wall outlet adapter                                |      |
| Charger input connector  | USB C  |      |
| Charger power supply voltage   | 5V <sub>DC</sub>                                       |      |
| Charger power supply current ratings   | 2A   |      |
| <b>Pulse generator properties</b>  |  |      |
| Number of channels   | 24   |      |
| Pulse waveform   | Biphasic charge compensated                            |      |
| Pulse type   | Current controlled pulses                              |      |
| Pulse intensity <ul style="list-style-type: none"> <li>High current mode</li> <li>Low current mode</li> </ul>  | 0 – 100      step    0.1<br>0 – 10        step    0.01 | mA   |
| Pulse duration   | 50 – 1000  | μs   |
| n-plet repetition rate <ul style="list-style-type: none"> <li>Long protocol</li> <li>Short protocol</li> </ul> | 1 – 400<br>1 - 255                                     | pps  |
| Pulse generator voltage  | 70 – 150   | V    |
| <b>Communication</b>   |  |      |
| Bluetooth  | Bluetooth 2.1+EDR                                      |      |
| USB  | USB 2.0  |      |
| USB isolation  | Yes  |      |

## 4 LED signalization

BiMatrix has two LED indicators related to battery, communication and pulse activities.

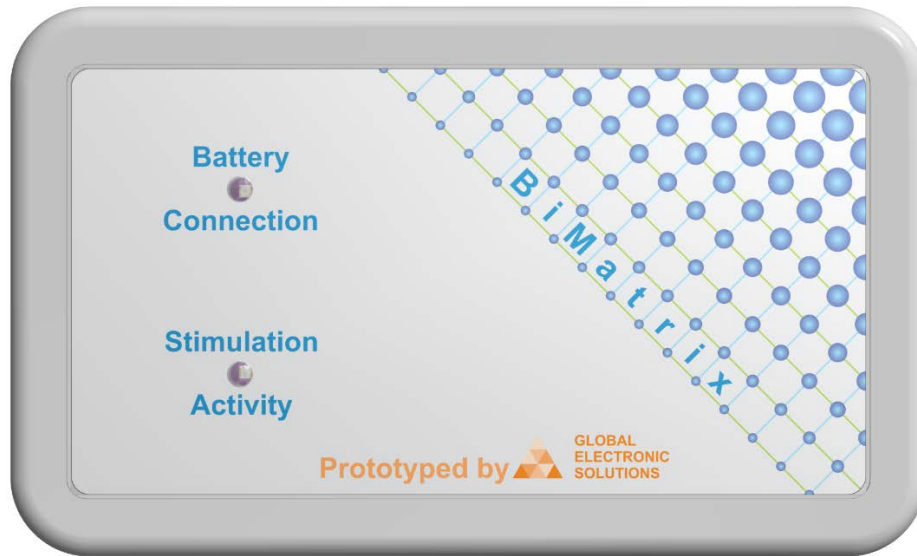


Figure 2. Position of the LED indicators

Description of the LED signalization is given in the table below.

| Battery and Connection LED                               |       |   |
|--|-------|---|
| Color  | State | Description   |
| Battery charger connected / Device switched off          |       |   |
| Red  | ON    | Battery charging in progress                        |
| Green  | ON    | Battery charging finished                           |
|  | OFF   | BiMatrix is removed from the charger                |
| Device switched on / Battery charger is connected or not |       |   |
| Green  | Blink | BiMatrix connected to the host device via USB       |
| Blue   | Blink | BiMatrix connected to the host device via Bluetooth |
| Red  | Blink | Battery state of charge is less than 10%            |
|  | OFF   | BiMatrix is switched off                            |

| Activity LED |       |  |
|--------------|-------|--|
| Color        | State | Description  |
| Red          | ON    | Pulse generation in progress<br>Pulse generator voltage is set between 121V – 150V |
| Blue         | ON    | Pulse generation in progress<br>Pulse generator voltage is set between 71V – 120V  |
| Green        | ON    | Pulse generation in progress<br>Pulse generator voltage is set to 70V              |
|              | OFF   | Pulse generation is not active   |

## 5 Communication

Communication between BiMatrix and PC can be established via USB or via Bluetooth communication interfaces. Only one communication interface can be used at a time.

For USB communication, driver needs to be installed. The driver can be downloaded from the link below:

<https://www.ftdichip.com/Drivers/VCP.htm> or <https://www.ftdichip.com/Drivers/D2XX.htm>

USB connection procedure:

1. Connect BiMatrix to the host's USB interface using a standard USB cable
2. When the driver recognizes the device, a COM port will be assigned for communication
3. Further communication is performed via the assigned COM port

Bluetooth communication interface uses SPP profile for communication with BiMatrix.

Bluetooth connection procedure:

1. BiMatrix needs to be found by the host computer's Bluetooth interface
2. BiMatrix needs to be paired with the host computer
3. A pairing pin is not used
4. After pairing, the host will assign a COM port for communication with BiMatrix
5. Further communication is performed via the assigned COM port

Communication parameters for both communication interfaces are listed in the table below.

| Baud rate  | Data bits | Parity | Stop bits | Flow control     |
|------------|-----------|--------|-----------|------------------|
| 921600 bps | 8         | No     | 1         | Hardware RTS/CTS |



## 6 Connections

BiMatrix has two connectors:

- USB C – USB communication / Battery charging port
- Output connector

The connector placement is given in the figure below.

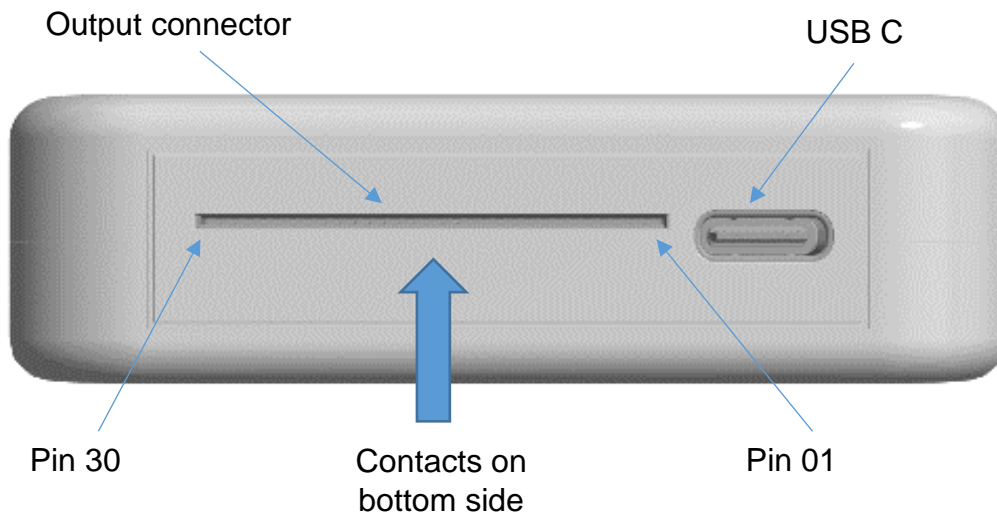


Figure 3. BiMatrix connector position

The output connector is a 30 pin FPC connector, 1mm pitch with contacts at the bottom side. Pin 1 is near the USB connector. The FPC connector pinout is given in the table below.

| Pin No. | Function   |
|---------|------------|
| 01      | Channel 01 |
| 02      | Channel 02 |
| 03      | Channel 03 |
| 04      | Channel 04 |
| 05      | Channel 05 |
| 06      | Channel 06 |
| 07      | Channel 07 |
| 08      | Channel 08 |
| 09      | Channel 09 |
| 10      | Channel 10 |
| 11      | Channel 11 |
| 12      | Channel 12 |
| 13      | Channel 13 |
| 14      | Channel 14 |
| 15      | Channel 15 |

| Pin No. | Function       |
|---------|----------------|
| 16      | Channel 16     |
| 17      | Channel 17     |
| 18      | Channel 18     |
| 19      | Channel 19     |
| 20      | Channel 20     |
| 21      | Channel 21     |
| 22      | Channel 22     |
| 23      | Channel 23     |
| 24      | Channel 24     |
| 25      | Not connected  |
| 26      | Not connected  |
| 27      | Common cathode |
| 28      | Not connected  |
| 29      | Not connected  |
| 30      | Common anode   |