

# Instruction manual

## ECU-P2

### Abstract

The **E**lectronic **C**ontrol **U**nit (ECU) ensures an easy start with the memetis miniature valves. The ECU comes with every valve evaluation kit (some test kits contain an ECU-S1 instead) and offers a wide range of options for programming and customization as well as a **G**raphical **U**ser **I**nterface (GUI). The colour of the end caps defines for which kind of valve the ECU is designed, **blue** is used for monostable valves (nc/no) and **black** bistable valves.

### Information

Version: ECU-P2

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## ECU-P2

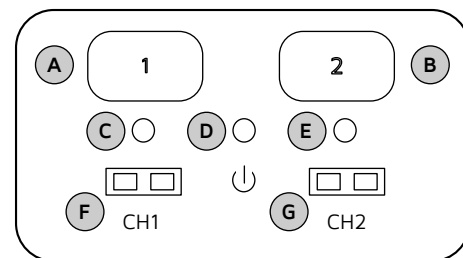


**Figure 1.** Electronic Control Units for monostable (blue cover) and bistable valves (black cover).

## 1. Operating the ECU-P2

### 1.1 Connection

The following figure shows the front view of the ECU-P2.



**Figure 2.** Front-side of the ECU.

- (A) In case of the **blue ECU** this button is for switching CH1 (toggle mode) and the corresponding valve (1.3.1). In case of the **black ECU** this button is for opening the bistable valve (1.3.2).
- (B) In case of the **blue ECU** this button is for switching CH2 (toggle mode) and the corresponding valve (1.3.1). In case of the **black ECU** this button is for closing the bistable valve (1.3.2).
- (C) This status LED indicates the state of CH1 (1.4.3).
- (D) This LED indicates the main ECU-P2 status (1.4.3).
- (E) This status LED indicates the state of CH2 (1.4.3).
- (F) In case of the **blue ECU** this female plug is for connecting an nc/no-valve to CH1.  
In case of the **black ECU** this female plug is for connecting the wires for the opening switch of a bistable valve.
- (G) In case of the **blue ECU** this female plug is for connecting a nc/no-valve to CH2.  
In case of the **black ECU** this female plug is to connect the wires for the closing switch of a bistable valve.

The following figure shows the back view of the ECU-P2.

- (H) IO interface to enable the output channel **CH1** or **CH2**.
- (I) Digital interface to the ECU-P2 via **I2C**.
- (J) **Powering** the ECU-P2 and digital interface via **USB** (virtual COM port).

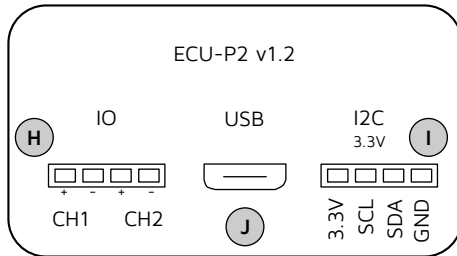


Figure 3. Back-side of the ECU-P2.

## 1.2 Powering

The ECU-P2 is connected to a 5 V power supply via a microUSB cable. It is advised to use the cable delivered with the ECU. It is strictly forbidden and dangerous to connect a power source with a higher electrical voltage! The maximum power that is available for actuation depends on the source the ECU-P2 is connected to:

- USB charger wall plug → up to 1500 mA
- PC connection is limited to 100 mA/500 mA (depending on the USB host)

In any case, the ECU-P2 will monitor the current drawn by connected actuators and detects if more power is consumed than allowed. If an over-current condition is detected, the outputs will be turned off immediately and cannot be turned back on for 2 s. The white LED will flash. If this happens, try to use another power source. A USB charger with a 2 A rating gives the highest output power.

## 1.3 Valve control

### 1.3.1 nc/no valve

**Connecting** For an nc/no-valve the **blue ECU-P2** has to be used! Connect the valve with the supplied cable to the output pin-connectors (**F** or **G**) on the front of the ECU-P2.

**Switching** After connecting the valves, they are switched as described below:

- **Button (A) marked with 1 → for switching CH1 (F)**
- **Button (B) marked with 2 → for switching CH2 (G)**

**Description** To switch the valve from its default state, press the push button on the front panel for the channel the valve is connected to. The valve stays powered with 500 mA until the push button is pressed again (toggle mode). In addition to the push button, the valve can be switched via the respective IO channel on the back side of the unit (1.4.1).

### 1.3.2 bistable valve

**Connecting** For the bistable valve the **black ECU-P2** has to be used! Connect the valve with the supplied cable to the output pin-connectors (**F** or **G**) on the front of the ECU-P2. It is recommended to connect the wires for the opening switch to the output pin-connectors (**F**) and the wires for the closing switch to the output pin-connectors (**G**).

**Switching** After connecting the valve, it is switched as described below:

- **Button (A) marked with 1 → for switching CH1 (F) and thus opening the bistable valve**
- **Button (B) marked with 2 → for switching CH2 (G) and thus closing the bistable valve**

**Description** To switch the valve from its current state, press the corresponding push button on the front panel. The valve will be powered with 500 mA for 300 ms. In addition to the push button, the valve can be switched via the respective IO channel on the back side of the unit (1.4.1).

## 1.4 Interfaces

### 1.4.1 IO

The IO interface on the back side (figure 3) of the unit can be used to enable the output channels. The two inputs are electrically isolated. A voltage from 1.8 V to 5 V can be used as long as the polarity is observed. The positive and negative side of each input is labeled with + and - signs. The input needs a current of around 2 mA with a 1.8 V signal and around 10 mA with a 5 V signal. The absolute maximum input current is 20 mA. The IO interface can directly be connected to RaspberryPi or Arduino GPIO pins as following:

- **(+) input connected to the GPIO pin**
- **(-) input connected to the GND pin**

### 1.4.2 Data connection / communication

A digital interface to the ECU-P2 is available via **USB** (virtual COM port) and **I2C**. The ECU-P2 implements a serial communication protocol to set:

- output current
- enable/disable output channels
- set/read various configuration parameters

In addition, the data connections allow reading back the momentary output current, voltage and resistance.

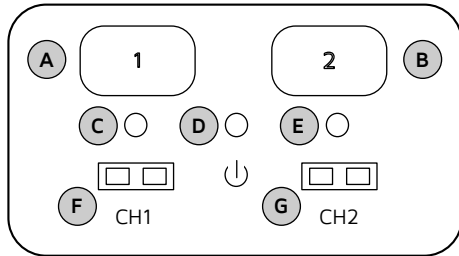
**USB interface** USB can be used to power the ECU-P2 and communicate at the same time. This allows the valves to be operated by a PC with a single connection.

**I2C connector** The I2C is directly connected (not isolated) to the internal circuit and has a strict 3.3 V requirement. **Do not** connect a 5 V Arduino I2C interface to the ECU-P2.

### 1.4.3 LEDs

The 3 LEDs (**C**, **D**, and **E**) on the front-side of the ECU-P2 have the following meaning:

- **D** (the LED in the center) will **light up white** after powering the ECU-P2.
- **D** (the LED in the center) will **flash white** if too much current is drawn from USB.
- **C** and/or **E** will **light up blue** if the respective output is enabled and the output current is correct.
- **C** and/or **E** will **flash** if the ECU-P2 is unable to maintain output current regulation.



**Figure 4.** Front-side of the ECU-P2.

## 2. General informationen

### 2.1 Content

In case of the **blue ECU-P2** you receive:

- the **blue ECU-P2**
- a USB cable
- connecting cables depending on the number of ordered valves

In case of the **black ECU-P2** you receive:

- the **black ECU-P2**
- a USB cable

### 2.2 Troubleshooting

**White LED does not light up** The ECU-P2 is not powered. The power over USB is supplied by PC/laptop. It requires 5 V with at least 500 mA current capability.

#### Cause

- the power supply might be broken, or the voltage output is too low
- the USB cable used to connect the ECU-P2 to the power supply might be broken
- the PC/laptop automatically disabled the USB port to save energy. This can happen when the PC/laptop is turned off or its battery is low

#### Solution

- try a different power supply or USB port on your PC/laptop
- try a different USB cable
- connect the battery charger and turn the PC/laptop on

**White LED flashes** The USB current exceeded the limit set by power supply. The ECU-P2 continuously monitors its power supply current and disables all outputs if this current is higher than allowed by the power supply/PC/laptop. It follows the specification set by the USB battery charging protocol.

#### Cause

- the USB cable used does not meet the USB specification. This leads to a USB current limit of 100 mA that is not enough to switch memetis valves.
- the power supply used does not support USB battery charging. The USB data lines are used to determine how much current can be drawn from the USB power supply.
- if the PC/laptop is in power saving mode it can limit the current drawn from its USB ports. This limit might not be enough to switch the valves.

#### Solution

- try a different USB cable
- try a different USB power supply
- try an external USB power supply

**Blue channel LED flashes** The output current is not in regulation. The ECU-P2 continuously measures the actual output current on each channel and compares it with the output setpoint.

#### Cause

- if the valve is not connected, no current will flow once a channel is enabled
- the valve connected to the ECU might be broken
- the cable used might be broken, and no current can flow

#### Solution

- connect a valve.
- try a different valve and/or cable and contact us via support@memetis.com.

**No ECU-P2 found by Python library when using USB.** The ECU-P2 uses the chip CP2102N from Silicon Labs. A driver is provided by SiLabs and needs to be installed to allow communication over USB from a PC/laptop.

#### Cause

- SiLabs VCP driver not installed.
- USB cable used that does not meet the USB specification.

#### Solution

- download and install the driver for your operating system from: "https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers."
- try a different USB cable.

