Application Note

MEMETIS SHAPE MEMORY ALLOY (SMA) BISTABLE MINIATURE VALVE EVALUATION KIT

Thank you very much for choosing the bistable valve evaluation kit. With the purchase, you have received a new generation of ultra-compact Shape Memory Alloy valves. With its size, it is suited even for complex fluidic systems with a multitude of fluidic components.

Important notes

Control: For testing purposes we recommend using the valves with the supplied electronic control unit (ECU-P2), otherwise there is a risk that the valve will be damaged due to overheating. For customer-specific electronic control and instructions please contact our customer support via support@memetis.com.

Storage: Avoid moisture and store in a dry place. Temperatures should stay between -10 °C and 90 °C.

Operation Temperature: 10 °C to 50 °C

Fluid Compatibility: In the standard configuration, the wetted materials are PEEK (housing) and Silicone (diaphragm). Please check the compatibility of the fluids used with the valve materials before use.
If required, valves can be provided with other materials (for example: PPS or PMMA for the housing and FKM, Nitrile or EPDM for the diaphragm).
Please contact us at support@memetis.com for further information.

Pressure range: 0.1 to 1 bar @input for air and water.

Do not attempt to open the valve housing, as this destroys the valve irreversibly!

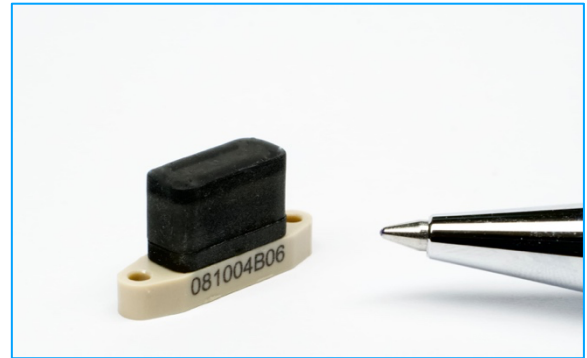Please check our data sheets for further information on the valve's properties.

Fig. 1: Bistable valve BV1101

Integration of the valve

memetis miniature valves have a flange-mount connection. Two M1.6 screws are required for integration on a flat backplane with sealing. The dimensions of the drilling holes for fixation on the backplane and the inlet and outlet of the fluid channels are shown in Fig. 2. Two O-rings are used as a sealing of the valves' openings against the backplane.

Our valve evaluation kits include a fluidic adapter, on which the valve is mounted using two M1.6 screws, to enable a quick connection to tubes. We offer the fluidic adapter with Male LUER fittings, fittings from IDEX for tubes with OD 1.6 mm and from FESTO for tubes with OD 4.0 mm. The inlet and outlet are marked on the fluidic adapter.

The correct orientation of the valve must be considered when mounting the valves onto the fluidic adapters. The fluidic inlet and outlet in the valve must match the fluid openings in the fluidic adapter. The central opening is for the fluidic inlet (see drawing).

If you prefer to manufacture your own fluidic backplane or integrate the valves directly into your fluidic system, you need to drill two holes for mounting and two holes for the fluid

to flow through with the dimensions shown in Fig. 2 and Fig.3.
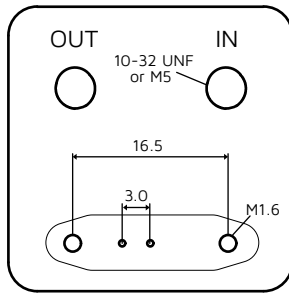
Fig. 2: Fluidic adapter with LUER fittings with indicated fluidic inlet and outlet. All units in mm.

The dimensions of the bistable valve can be seen in Fig. 3.
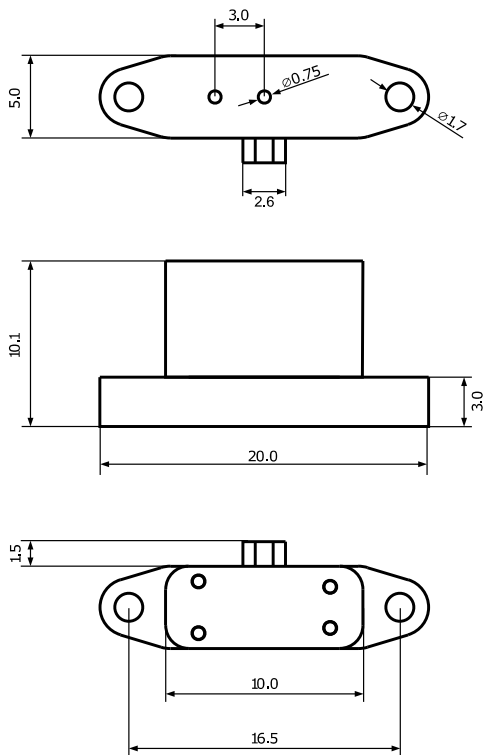
Fig. 3: Dimensions of the bistable valve BV1101. All units in mm.

Electronic control unit

memetis offers a pre-programmed electronic control unit (ECU-P2) to operate the valve intuitively and give you an easy start (Figure 4). You can find a data sheet and a troubleshooting guide on our download page: https://www.memetis.com/en/resources/

Fig. 4: Electronic control unit for controlling the bistable valve.

Powering the ECU

The ECU is powered via a micro USB cable. It can be connected to a PC or a 5 V USB plug. The maximum power that is available depends on the source the ECU is connected to. On a USB charger wall plug up to 1500 mA can be drawn, on a PC connection 100 mA/500 mA is the limit (depending on the USB host). In any case, the ECU will monitor the current that it consumes 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 using another power source. A USB charger with a 2 amp rating gives the highest output power.

Connecting a valve

Make sure you select an ECU configured for bistable valves. These units have a **black** front and back panel and are labeled on the underside with 'bistable'.

Connect the cables of the bistable valve to both channels of the ECU. The cable from the valve that is farther away from the fluidics connection controls the closing operation of the valve. The other cable controls opening the valve. The cables are labeled accordingly. Which ECU channel opens/closes the valve depends on the cable connection from the valve to the ECU.

Switching a valve

To open the valve, press the push button for the respective channel. Which channel that is depends on the cable connection to the valve. The valve will be powered for 300 ms (the blue LED will light up) at room temperature and then the output will automatically switch off. The valve will stay open. To close the valve, press the push button for the other channel.

If a blue LED starts flashing, one of the connections to the valve is broken and the ECU is unable to maintain the required output current.

In addition to the push buttons, the valve can be switched via the IO channels on the back side of the unit. The valve will be opened when the respective IO channel goes HIGH and closed when the other channel goes HIGH.

Using the IO interface

The IO interface on the back side of the unit can be used to enable the output channels with a range of input voltages.

The two inputs are electrically isolated (with opto-coupler). Any voltage from **1.8 V to 5 V** can be used as long as the **polarity** is correct. The positive and negative side of each input is labeled with + and - signs.

The input will draw 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 Raspberry Pi or Arduino GPIO pins. The positive input should be connected to the GPIO pin and the negative input to GND.

LEDs

The white LED on the front of the unit will light up after powering on the ECU.

If too much current is drawn from USB, this LED will flash.

The blue LEDs on the front will light up if the respective output is enabled and the output current is correct. These LEDs will flash if the ECU is unable to maintain output current regulation.

Data connection to the ECU

A digital interface to the ECU is available via USB (virtual COM port) and I2C.

The ECU implements a serial communication protocol to set the output current, enable/ disable output channels and set/ read various configuration parameters. In addition, the data connections allow reading back the momentary output current and voltage.

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

The I2C connector 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.

All in- and outputs of the ECU can be seen in Figure 5.
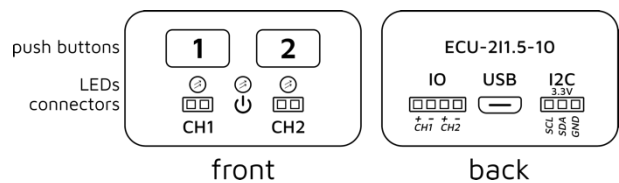
Fig. 5: Electronic control - Inputs, controls, and outputs.

If you have any problems with the electronic control unit or need support for set up of the evaluation kit, you can contact our customer support team at support@memetis.com.
Also, if you prefer a customized valve solution, please contact us.

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