



Operating manual for the mp-Multiboard



Content

General Description	3
Declaration of conformity.....	3
Description of functions.....	3
Proper use.....	4
Intended purpose.....	4
Misuse.....	4
Staff selection and qualification.	4
Saftey Notice.....	4
Overview	5
Setup instructions.....	6
Electrical Characteristics.....	6
Pump drivers.....	7
Auxiliary connectors.....	8
USB-driver.....	8
Multiboard App.....	8
Package Dimensions.....	11



General Description

The mp-Multiboard is an evaluation board that allows to control up to four mp6 micropumps simultaneously with various waveforms, frequencies ranging from 8 Hz up to 800 Hz and amplitudes from 0 Vpp to 250 Vpp.

The mp-Multiboard has a pump driver and an Arduino compatible microcontroller onboard. Both can be fully configured by the user to fit the required application demands. The pump driver outputs are wired to four Molex flex cable connectors so that Bartels Mikrotechnik micropumps (mp6) can be directly attached. The pump driver is connected to the microcontroller through the I²C bus. Additionally there are multiple auxiliary connectors on board for future use to connect a flowsensor, pressure sensor and active valves. Some of the microcontroller I/O pins are externally connectable through a pin header for use in custom user projects. A micro-USB connector on the microcontroller can be used to supply power, upload software and for serial communication. An external power

Declaration of conformity.

Bartels Mikrotechnik GmbH declares that the products are compliant to the RoHS directive 2011/65/EU. The controller comply with the requirements of EMV 2014/30/EU and CE markings have been affixed to the devices. Additionally, the controllers are also compliant to the EU Low Voltage Directive 2014/35/EU.

Description of functions.

The micropumps have been developed for the transport of gases or liquids. The controllers have been developed for operating the micropumps. Bartels Mikrotechnik can assume no liability for damages resulting from the pump media. This applies especially for hazardous fluids.

The pumps must be operated with Bartels Mikrotechnik electronics. Bartels Mikrotechnik GmbH cannot guarantee the proper work of the units with customer specific electronics. If other controllers than the ones from Bartels Mikrotechnik are used, Bartels Mikrotechnik disclaims any warranty.

Moreover, please note that components of the controller and pump are operating with high-voltage. Therefore, persons wearing pacemakers are recommended to avoid the operating system.

Bartels Mikrotechnik assumes no liability for abnormal handling, improper or negligent use of the micropump and the controller that is not conform to the specified purpose of the system. This applies especially for micropump controllers, components and systems of other manufacturers, which have not been certified by Bartels Mikrotechnik.

We guarantee that the micropumps comply with the actual state of scientific and technical knowledge and due to this, the operational risks are limited to a minimum.

Do not open the housing of the micropump and the controllers. In those cases, Bartels Mikrotechnik cannot issue a guaranty anymore. Please keep this manual safe and give a copy to all users.



Proper use

Intended purpose.

The mp-Multiboard in combination with the mp-Highdriver4¹ is designed as a next step from the mp6-QuadEVA board to control up to four micropumps for gas pumping, i.e. four pieces of mp6-gas micropumps. Nevertheless, it is also possible to pump liquids, with all our mp6 micropumps; though the higher frequencies will not result in a performance boost.

If liquids should be pumped, please regard the following:

The micropump is intended for pumping liquids or gases with varying flow rates controlled by the electronics. The mp-Highdriver4 is intended as a pump driver for the mp6.

Any other use of the micropump or controller unit is deemed improper.

Do not make any modifications or extensions to the pump or controller without the prior written consent of the manufacturer. Such modifications may impair the safety of the unit and are prohibited! Bartels Mikrotechnik GmbH rejects any responsibility for damage to the unit caused by unauthorized modifications to the pump and risk and liability are automatically transferred to the operator.

Other drivers which can be used with the mp-Multiboard are the mp-Lowdriver and the mp-Highdriver which are both for the use of one single mp6 micropump. For more detailed description of the single drivers please check it in the relevant manuals.

¹ mp-Highdriver4 was formerly known as mp6-QuadOEM

Misuse.

The use of liquids, which may alone or in combination create explosive or otherwise health-endangering conditions (including vapors) is not permitted.

Staff selection and qualification.

All work in connection with the installation, assembly, commissioning/decommissioning, disassembly, operation, servicing, cleaning and repairing of the pump and the controller must be carried out by qualified, suitably trained and instructed personnel. Work on electrical components and assemblies must be carried out by personnel with the necessary qualifications and skills.

Safety Notice.

The mp Highdriver4 generates voltages of up to 250 Vpp. All parts of the controller can carry voltages in this range. Therefore, the board should only be used by qualified personnel. Although the output power of the module is very low, proper insulation according to the application conditions needs to be considered by the customer. This especially applies to the bottom side of the PCB. Contact with water or other liquids needs to be prevented. The pump must not be unplugged while the board is active.

 **DANGER**

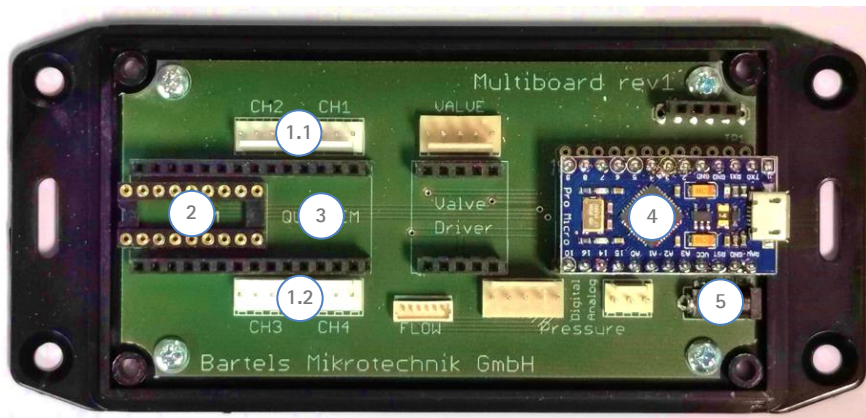
THE DEVICE CAN CARRY HIGH VOLTAGE!
BE CAREFUL, WHILE CONNECTING AND HANDLING THE BOARD!



Overview

The mp-Multiboard is available in different combinations and has the following standard components included:

- mp-Multiboard board
- micropump mp6
- Micro-USB cable
- selective: pump driver mp-Lowdriver, mp-Highdriver, mp-Highdriver4



The figure above shows the following components:

- | | | |
|--|----------------------------|------------------------------------|
| 1.1 & 1.2 Pump cable harness connector | 3. mp-Highdriver4 socket | 5. Power supply terminal connector |
| 2. mp-Lowdriver / Highdriver socket | 4. Arduino microcontroller | |



Setup instructions

Make sure pump driver, pump cable harness and pumps are plugged in correctly; Install Micro-USB driver; connect Multiboard via USB cable to the computer; start App

Do not disconnect pumps or driver while Multiboard is powered (via USB or otherwise)!

Electrical Characteristics

The Multiboard is powered via USB connection of the microcontroller. It does comply with the USB standard and does not require more than 500mA to operate under normal conditions. If in any case more current is needed on the board, an external power supply can be connected to the power supply connector labeled "POWER".



The power supply connector is directly wired to the RAW and GND pins of the microcontroller and tied to its onboard voltage regulator. Recommended input voltage for this connector is 7,5-12V. The mate plug should have an outer diameter of 3,5 mm and an inner diameter to be able to accept the 1 mm pin. See Figure 2 for connector polarity. A suited power supply is available in our store.

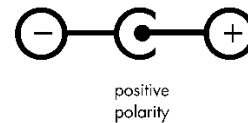


Figure 1: Connector Polarity

For all other characteristics of the microcontroller or the pump driver please refer to the corresponding manual or datasheet.

Information about the pump drivers and the mp6 micropumps is available on our download-page:

<https://www.bartels-mikrotechnik.de/downloads/>



Pump drivers

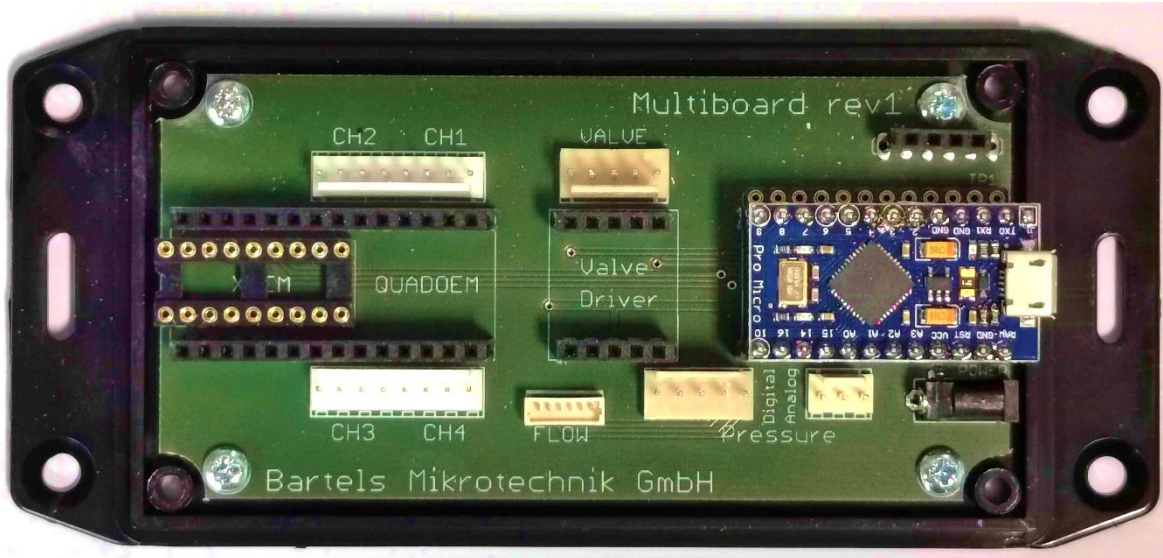
The Multiboard is compatible to our mp-Lowdriver, mp-Highdriver and mp-Highdriver4. Depending on the driver attached to the Multiboard, capabilities and ranges of amplitude and frequency can change. Please refer to the according manual for details. When attaching the pump driver make sure to follow the correct orientation as shown in the pictures below (notice the white dot always pointing outwards).



Use caution when removing the pump driver from the board in order to not bend the pins of the chip. IC pliers are recommended to be used for extraction.



Auxiliary connectors



The Multiboard has multiple auxiliary connectors available. Most of these are not in use at the moment and will be documented in this manual once fully implemented. Nevertheless here is a list of the connectors and their (future) use:

CH2 / CH1, CH3 / CH4	Two 8-pin connectors for pump cable harness. Each cable harness has two FFC connectors on the other end to connect to the micropump flex cable
Valve	5-pin connector for two active valves
TP1	12-pin header for custom purposes
Flow	6-pin connector for an I ² C flow-sensor
Pressure digital	5-pin connector for an I ² C pressure-sensor
Pressure analog	3-pin connector for an analog pressure-sensor
Power	Barrel power supply connector

USB-driver

The most current USB-driver is commonly installed with the Arduino IDE. If you don't want to install the whole IDE and just need the driver, you can download the IDE including the driver as ZIP archive from the Arduino download site (<https://www.arduino.cc/en/software>) and install just the USB driver.

A driver-package is also included in the Multiboard App download.

Multiboard App

The following code shows the setup routine implemented in the demo sketch delivered with the mp-Multiboard. Also enabling/disabling pumps and changing the frequency is shown and demonstrates the ease of controlling the mp-Highdriver4 with just a few commands.

After executing the app, the following screen opens up:

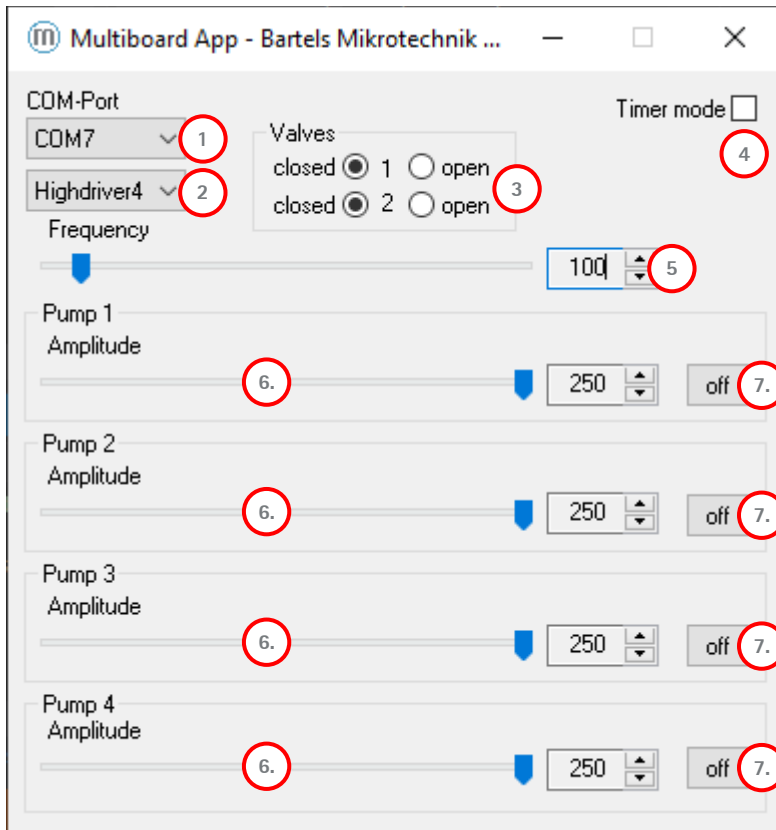


Figure 2: Multiboard App GUI

Select the COM-Port of your Multiboard in the list-box (1), followed by the pump driver currently inserted on the Multiboard in the list-box below (2).

Now you are able to adjust each pump's amplitude separately (6.1 - 6.4), switch every pump on and off (7.1 - 7.4) and change the frequency for all pumps globally (5).

The radio-buttons labelled "Valves" (3) can be used to open and close active valves connected to the Multiboard, when a valve driver is plugged onto the Multiboard.

By ticking the "Timer mode" checkbox (4) the timer mode is activated and user interface expands, now showing settings to setup a timed on/off cycle of each pump:

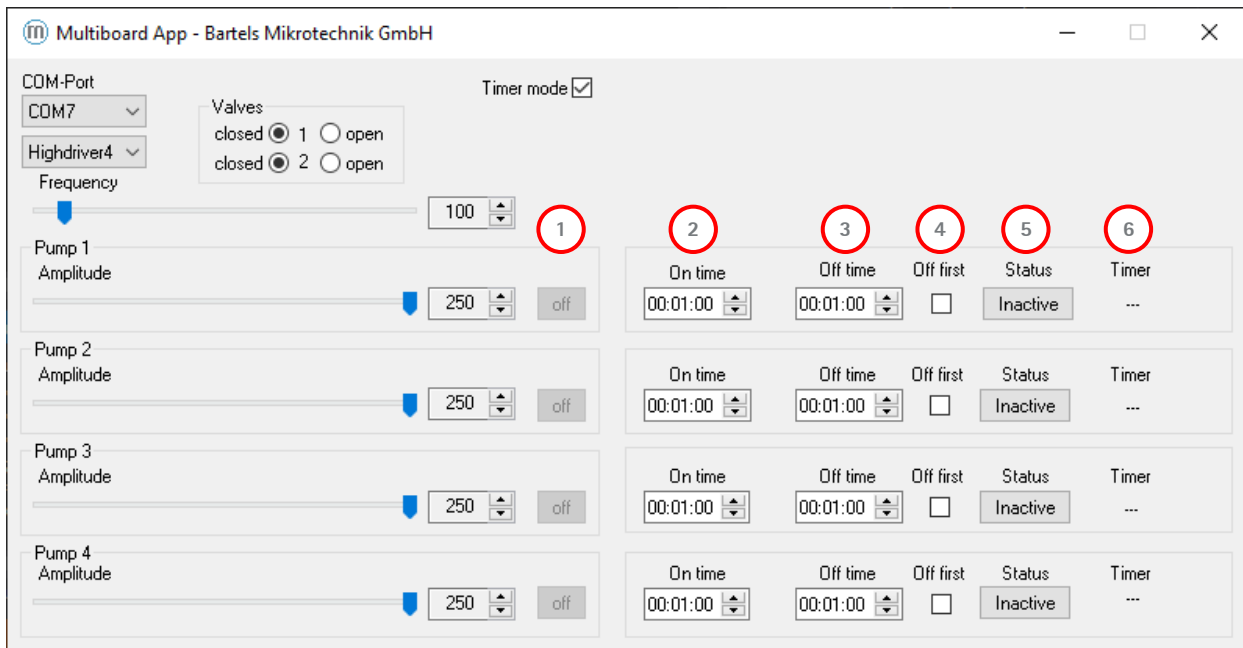


Figure 3: Multiboard App GUI in "Timer mode"

The "On time" (2) defines how long the pump is to stay activated (pumping), while the "Off time" (3) defines how long the pump is to stay deactivated before starting a new cycle. When "Off first" (4) is ticked, the cycle starts with the pump deactivated. By pressing the "Status" button (5) this periodic pumping can be activated/deactivated for each pump. The indicator "Timer" (6) shows the current state of the pump (on/off) and the time remaining for this part of the cycle.

The current state of each pump can also be seen on the on/off button (1). The button is disabled and greyed while timer mode is active. The frequency and amplitude controls are not disabled since they still take effect on the pumps in timer mode.

Package Dimensions

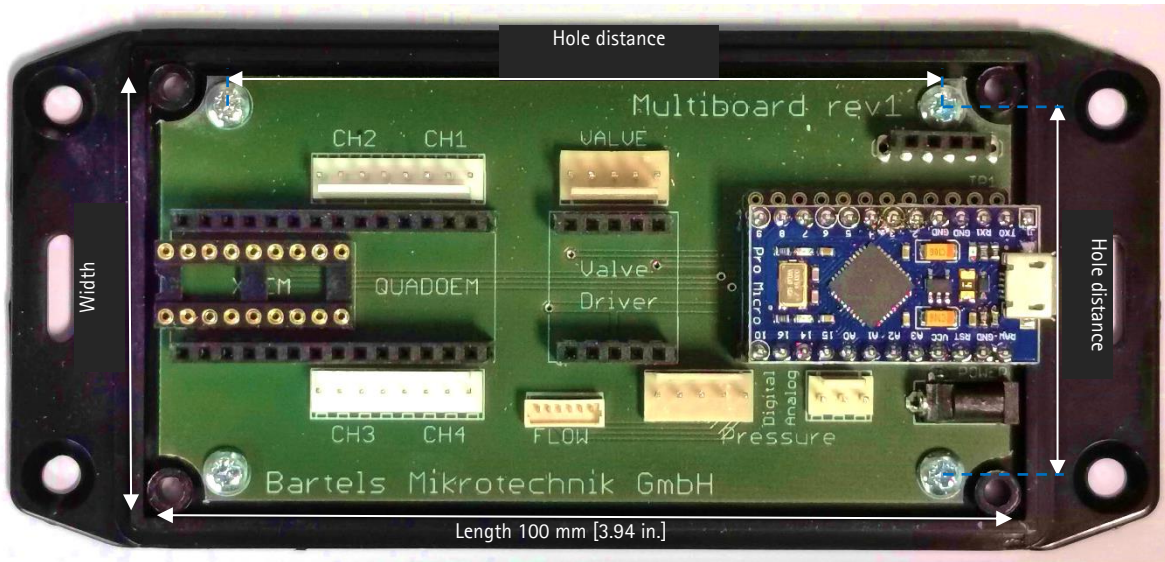


Figure 4: Package Dimensions



All values are approximate and no guarantee of specific technical properties.

Changes in the course of technical progress are possible without notice.

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