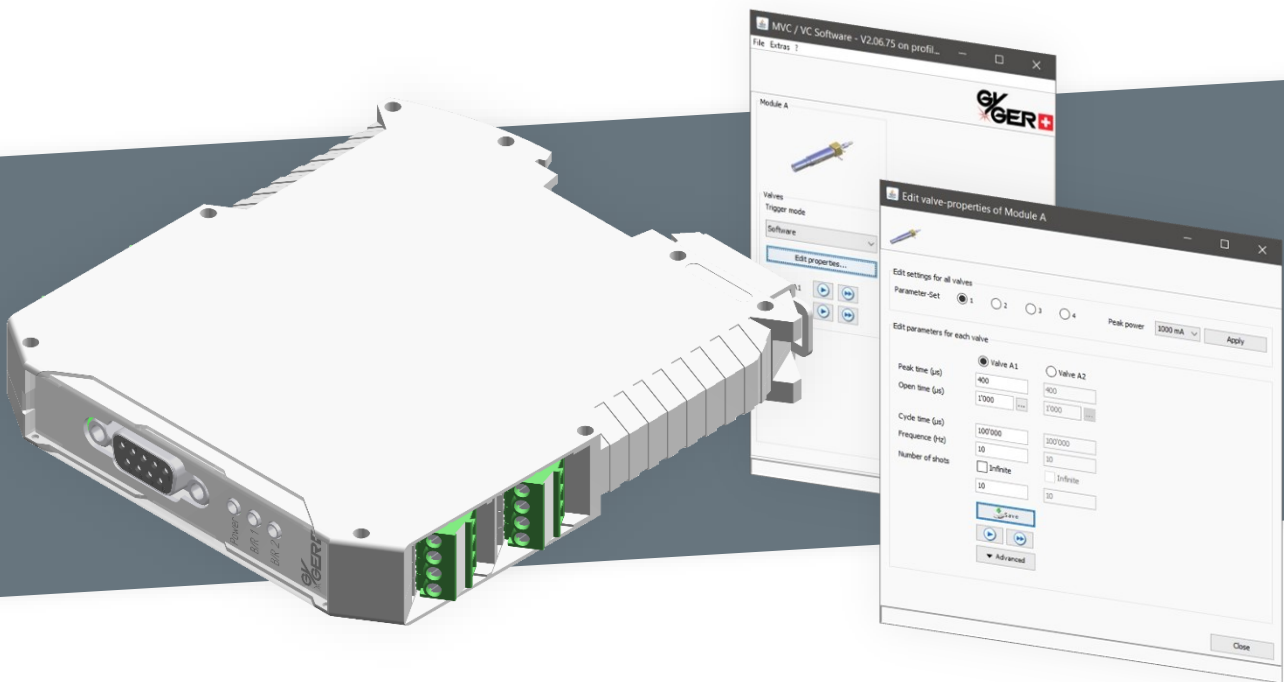


Valve Controller VC Mini

Operating manual for hardware and software.



Rev. 3.00

Valid for Software Version:
V2.06.75

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1 Proper usage

The valve controller VC Mini of Gyger provides a complete solution to control valves depending on the customer's dispensing applications. The VC Mini must be operated in a safe working environment.

An emergency stop circuit must be installed for the system. Operate the VC Mini only under the permitted ambient conditions. The VC Mini may only be used in industries, research and development institutions etc. If used in conjunction with additional commercially available components, such as sensors, valves, the specified maximum limits e.g. electrical data must be observed. Please comply with national and local safety laws and regulations.

1.1 Target group

This manual is aimed at technicians trained in control and automation technology, engineers, fitters etc. who are already familiar with drive controllers, but who are installing a drive controller like the VC Mini for the first time.

1.2 The aim of this manual

This manual will help you to carry out the first commissioning of the VC Mini successfully. In this manual you will find important information of both hardware and software. You acquire the basic knowledge necessary for operating the VC Mini correctly.

1.3 Safety instructions

WARNING

During installation, commissioning and maintenance you must observe the safety and accident prevention regulations valid for the specific application

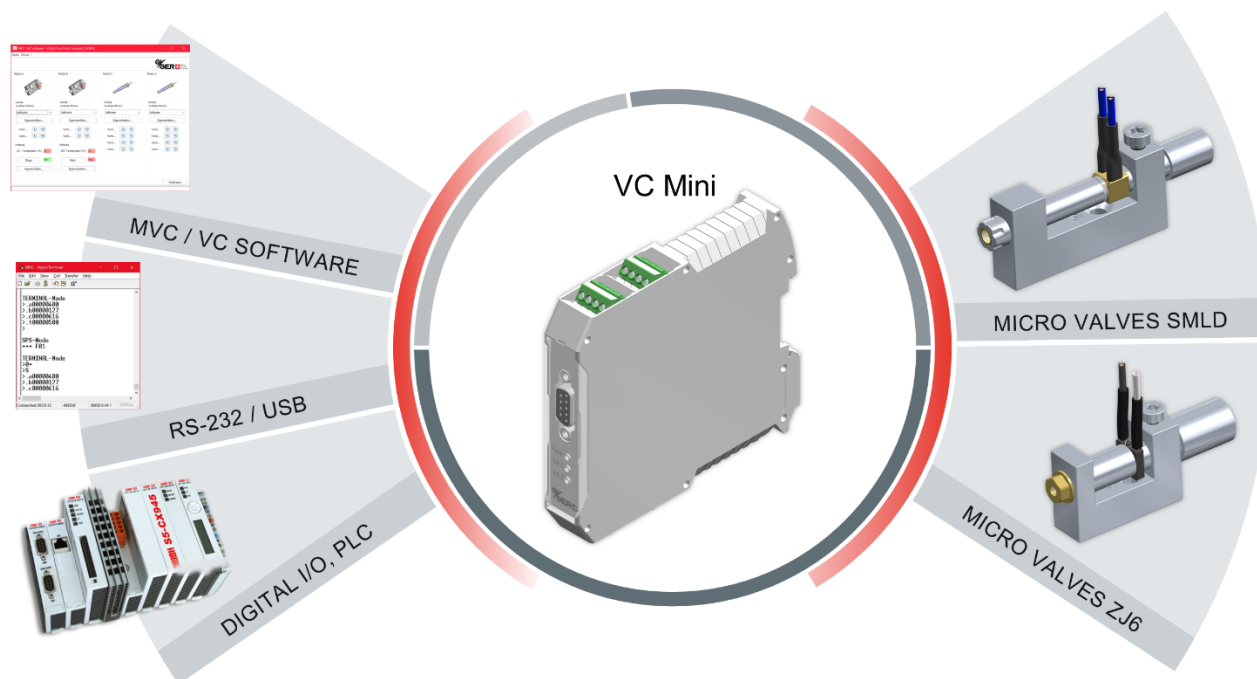
1.4 Installation and Mounting

Make sure that the VC Mini is installed and mounted correctly.

2 General information about the VC Mini controller

2.1 Complete integrated solution

The valve controller VC Mini of Gyger provides a complete lean solution to control valves on customer's dispensing applications. It is a fully-integrated control solution, providing hardware and software. The fundamental functions are to operate the SMLD valves of Gyger. This allows the customers, focused on the requirements of their applications, to integrate the VC Mini as an intelligent driver module in existing systems.



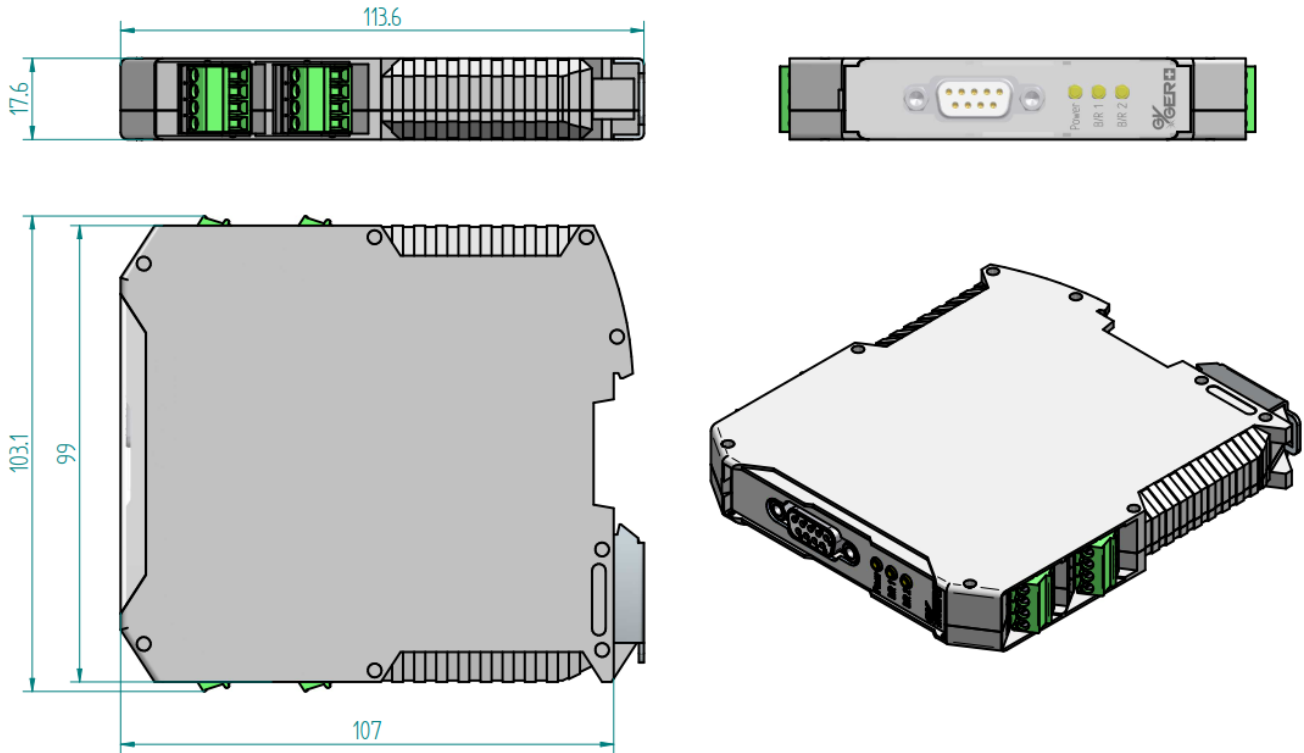
2.2 Structure

In contrast to the MVC-1 controller, which consists of one master module and up to four power modules with separate microcontrollers, the VC Mini only includes one single microcontroller in which all functions are combined.

A maximum of 2 SMLD micro valves can be controlled.

3 Hardware

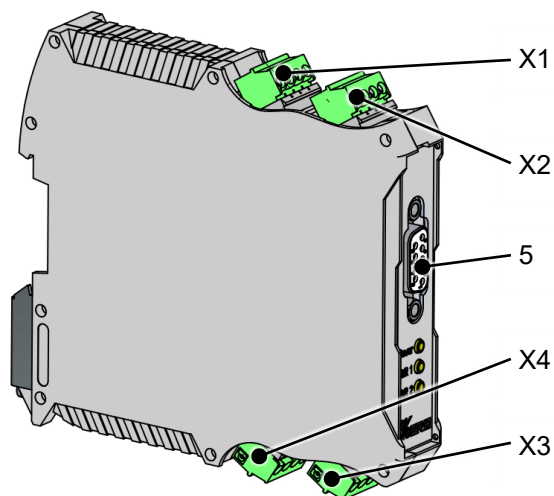
3.1 Physical Dimensions



The VC Mini is equipped with DIN rail assembly.
All units are in (mm). We reserve the right to change specifications without notice.

Weight: 0.1 kg

3.2 Electrical Connections overview



Nr.	Function	Connector
X1	Power supply 24 V DC, max. 1 A*	Phoenix Contact MC 1,5/ 4-ST-3,5
X2	Trigger inputs 12 V / 24 V	Phoenix Contact MC 1,5/ 4-ST-3,5
X3	Signal outputs 24 V DC	Phoenix Contact MC 1,5/ 4-ST-3,5
X4	Valve outputs	Phoenix Contact MC 1,5/ 4-ST-3,5
5	Serial interface RS 232	RS 232: D-Sub 9pol female USB: via RS232-USB-Converter

* The real power consumption depends on the connected loads and conditions (number of valves, heaters, etc.). The power consumption of the controller without connected loads is approx. 120 mA.

3.2.1 Specification Signal-Inputs (12-24 V)

Vin(low): max 5.0 V
 Vin(high): min 8.0 V
 Rin 5.6 kΩ

3.2.2 Specification of the 24 V Signal-Outputs

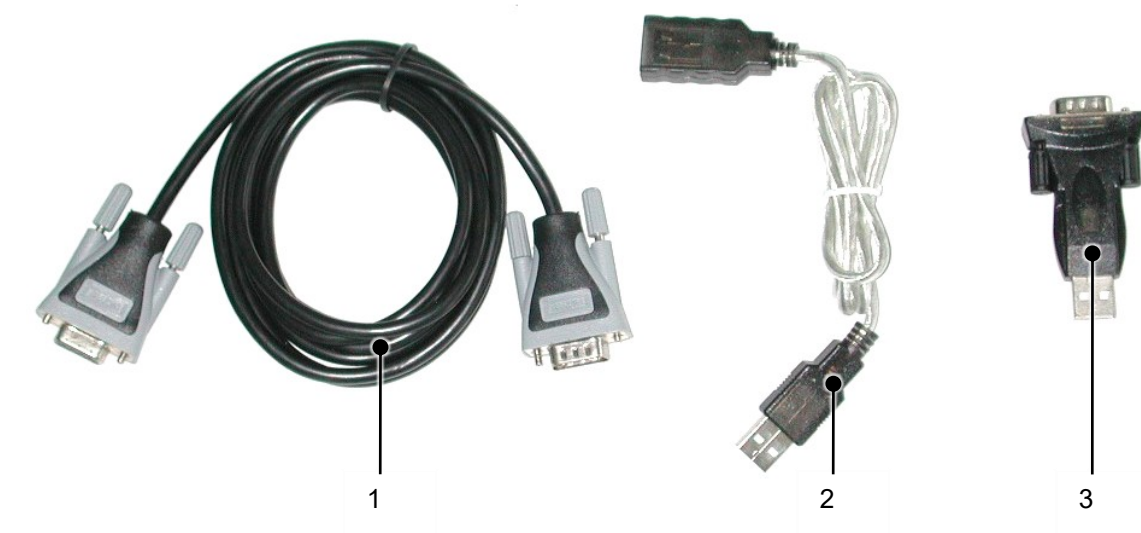
Load current: max 0.5 A
 Protection: Short circuit, Overcurrent, Overtemperature

3.2.3 Specification of the Driver-Outputs (D-Sub-Connectors, valve outputs)

Load: max. nominal current 0.85 A (100% ED)
 max. peak current 1.3 A (<10% ED)
 Protection: overcurrent, overtemperature, fast cutoff for inductive loads,
 limited short circuit protection

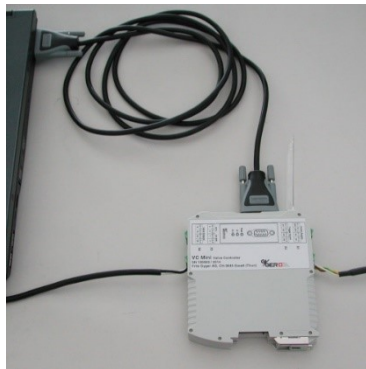
3.3 Interface RS232 / USB

With our cable set you can connect both, RS232 and USB.



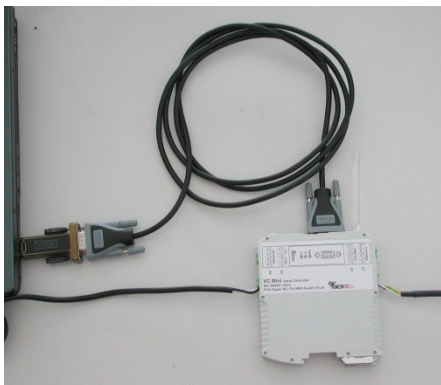
Nr.	Description	Connector type
1	RS232 connection cable 2 m	D-Sub 9 Pole male / female
2	USB extension cable 0.8 m	USB Type A male / USB Type A female
3	RS232 / USB Converter	D-Sub 9 Pol male, USB Type A male

3.3.1 Use RS232 directly



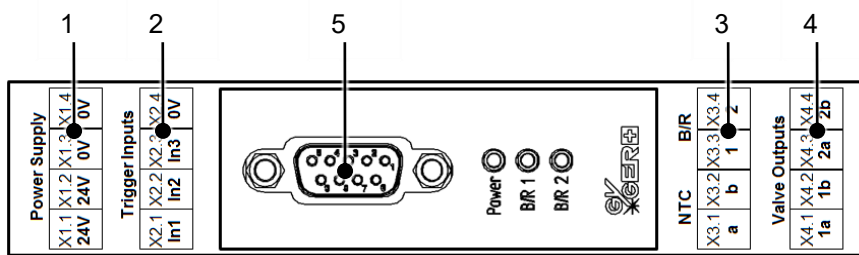
- Use the RS232 connection cable (1)
- No driver installation needed

3.3.2 Use via USB with converter



- Install previously the according driver (see chapter 4.2 Installing the USB-Driver)
- Connect the RS232 / USB-Converter (3) between PC and RS232 Connection cable (1). The Converter can be plugged also directly on the VC Mini. Use the USB extension cable (2) for connection with the PC in this case.

3.4 Pin Connections



Connector	Pin	Function
X1 Power-Connector	1	Power supply +24 V DC, 1 A
	2	Power supply +24 V DC, 1 A
	3	0 V GND
	4	0 V GND
X2 Trigger-Inputs	1	Trigger Valve 1*
	2	Trigger Valve 2*
	3	Trigger special functions
	4	0 V GND
X3 Signal-Outputs	1	-
	2	-
	3	Busy-Out Valve 1**
	4	Busy-Out Valve 2**
X4 Valve-Outputs	1+2	Valve 1
	3+4	Valve 2
5 RS-232-Connector	2	RXD (receive data) (data flow direction as seen from the remote terminal)
	3	TXD (send data) (data flow direction as seen from the remote terminal)
	5	GND

*Trigger-inputs are only active, when the corresponding trigger mode is set via software.

**Busy-Out generates a high-signal, as long as the valve is opened.

3.5 Electrical Control of the SMLD Micro Valves

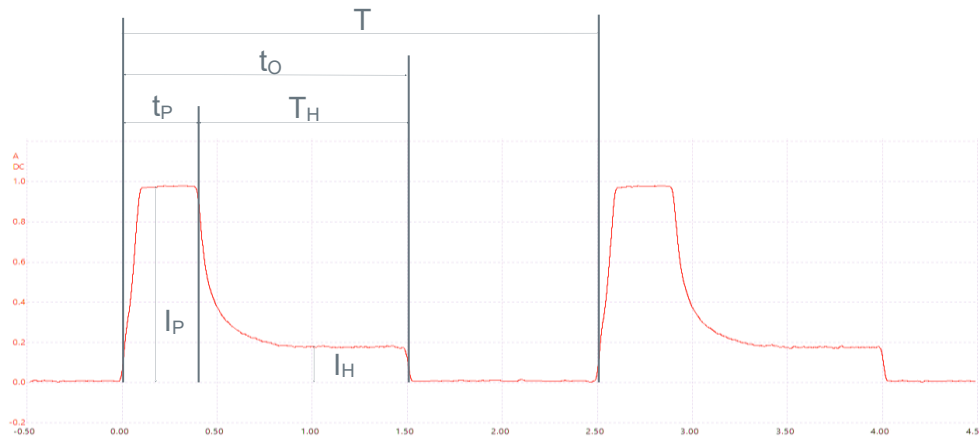
In order to achieve the shortest possible response times of the SMLD microvalves while at the same time minimizing heat generation, the control is preferably based on the peak and hold method

This involves using a short, increased peak current (e.g. $I_p = 1\text{ A}$) to achieve a fast and clearly defined opening of the valve. Once the valve is open, a lower holding current (e.g. $I_H = 200\text{ mA}$) is sufficient for the rest of the opening time.

When using our valve controller VC Mini, the current flow is optimally controlled. For this purpose, the 24 VDC supply voltage is timed with high precision by using the microprocessors. This also ensures optimal energy dissipation when the coil is switched off.

Example:

Valve control scheme for continuously repeated dispensing mode with following configuration: Frequency 400 Hz, valve opening time 1500 μs , peak time 400 μs , peak current 1 A, hold current 200 mA. Micro valve SMLD 300G.



Terms

- T Cycle to cycle period (1/frequency)
- t_o Valve opening time (controlling of volume in conclusion with fluid pressure)
- t_p Peak time (will be adjusted on the valve and application, normally 400 μs)
- t_H Holding time
- I_p Peak current (normally 1 A for the micro valves SMLD)
- I_H Holding current (100 – 200 mA recommended for minimal heat generation)
- t_R Valve closing time (not visible in graph). 200 – 400 μs for SMLD 300 / 300G. Depending on the operating parameters

The minimum opening time to achieve a complete opening of the valve corresponds:

$$t_{o\min} = t_p$$

The maximum opening time is a function of the cycle time and the response velocity of the valve:

$$t_{o\max} = T - t_R$$

WARNING

Wrong voltage / current-values can be burned the valve coil!
Observe the maximum allowable coil temperature is 100 °C

4 Installing the MVC / VC Software

4.1 System requirements

Please make sure your device meets the minimum system requirements:

- **Java runtime environment (JRE) Version 8 (Caution, 32 bit Version is needed!)**
If Java is not yet installed on your computer, install the Java environment as follows:

Oracle Java 8 (Please beware of the Oracle license terms!)

<http://www.java.com/en/download/> => use 32 bit Version!

or

Zulu OpenJDK Java 8 (Free alternative)

<https://www.azul.com/downloads/> => use 32 bit Version!

Links to both sources can also be found in the “Java” folder on the Gyger USB-Stick.

- **Operating System:** Windows XP SP3 / Vista SP2 / Windows 7, 8, 8.1, 10
- **Minimum RAM:** 128 MB (256 MB recommended)
- **Free Disk Space:** 140 MB (approx. 125 MB for Java JRE, 15 MB for MVC / VC Software)
- **Video Display:** 1024 x 768, 16-bit color or higher

4.2 Installing the USB-Driver

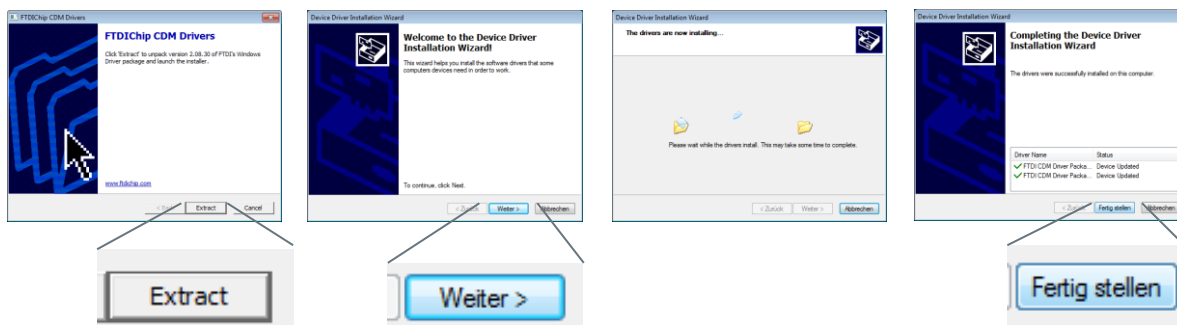
If the VC Mini is connected via the USB converter, the installation of a driver is necessary (RS232 to USB converter). If the operation is done via RS232, please continue with chapter “4.3 Installing the MVC / VC Software”.

Operating system Windows 7 and newer will download and install the driver automatically after plugging in the USB connector. This requires a working internet connection.

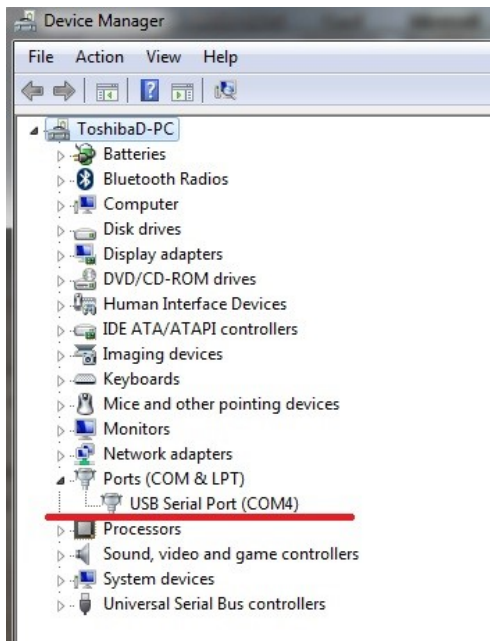
4.2.1 Manual installation

If automatic install does not work, install the driver from the Gyger data media (Folder USB-Driver), or download the newest driver from <http://www.ftdichip.com/Drivers/VCP.htm>

Driver installation: Double-click the executable file, in the following windows choose «Extract» and «Next». After that the driver will be installed. Click «finish». The controller is now installed.



The VC Mini controller will be visible now in the device manager as a virtual com port and your PC will now be able to recognize the controller whenever you connect it to the PC.



4.3 Installing the MVC / VC Software

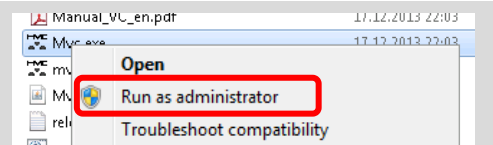
Copy the folder “MVC” and paste it in to a folder of your choice.

=>On operating system Windows 7 and newer **don't** copy the software in the windows program folder. There are special permissions that don't work with the MVC software.



With operating system Windows 7 and newer you have to start the software first time with administrator permissions (right click on the mvc.exe, run as administrator)

You need to do this only once after the installation.



5 Using the MVC / VC Software

5.1 Overview

The VC Mini controller can be configured via the serial interface (via RS232 or USB). Our MVC / VC software (Java-based) allows comfortable operation using a graphical user interface. All installed power modules and their functions are visualized in the software- The associated parameters (e.g. valve opening time, heating temperature) can be conveniently set and precisely adjusted to the dispensing application. The functions can be controlled directly from the software (e.g. triggering dispensing), additionally modes can be set which allow operation purely via the external hardware I/O signals. The complete configuration can be stored on the hard disk and reloaded later if required.

5.2 Starting the Software

To start the software, start the MVC.exe file in the MVC-Software directory.



Now the controller must be connected before the start of the application otherwise you will get error message.

5.2.1 Login / Permissions

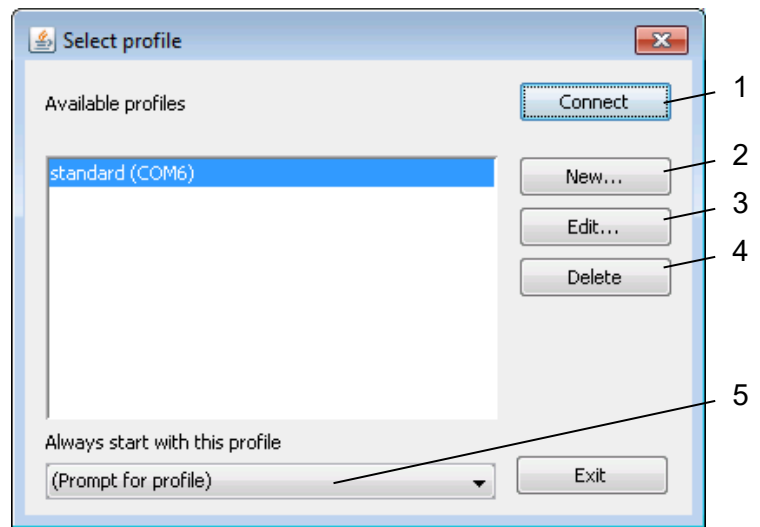
The program shows a login dialog immediately after startup. Select the appropriate user and enter the password.



- **Normal user (password 1234)**
The normal user has restricted permissions; the following settings are locked:
-Extras>Settings: Change user password
-Valve properties: Set peak time and peak current
-Heating properties: Advanced settings
- **Super-user (password 1234)**
The extended user has all permissions in the software.

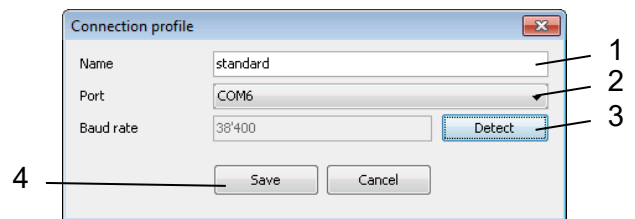
5.2.2 Selection window for the connection profiles

- 1 **Connect:** Connect with selected communication profile
- 2 **New:** Create new profile
- 3 **Edit:** Edit connection profile
- 4 **Delete:** Delete profile
- 5 **Always start with this profile:**
If a profile is selected here for the auto start, the start dialogue appears no longer, and the controller connects always automatically with the selected profile. The setting also can be changed from "Menu- Extras> Settings> Connection Profile again".



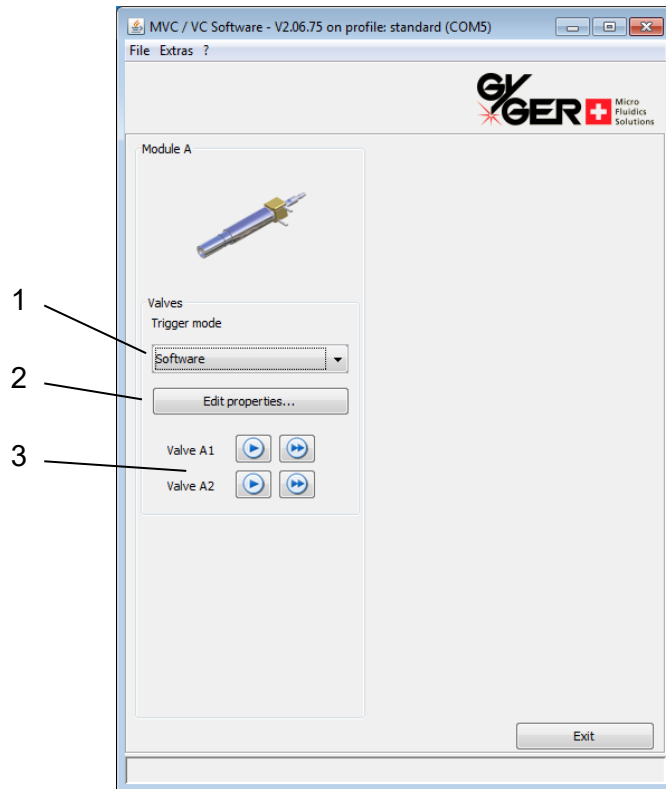
Edit dialog box „Connection profile“

- 1 **Name:** Enter a profile name. The name will later appear in the title of the main screen
- 2 **Port:** Select the corresponding Port
- 3 **Detect:** The correct baud rate can be detected automatic (Default: 38400)
- 4 **Save:** Save the settings here



5.3 Main menu window of the application

The main window shows an overview of the available functions.



Valves

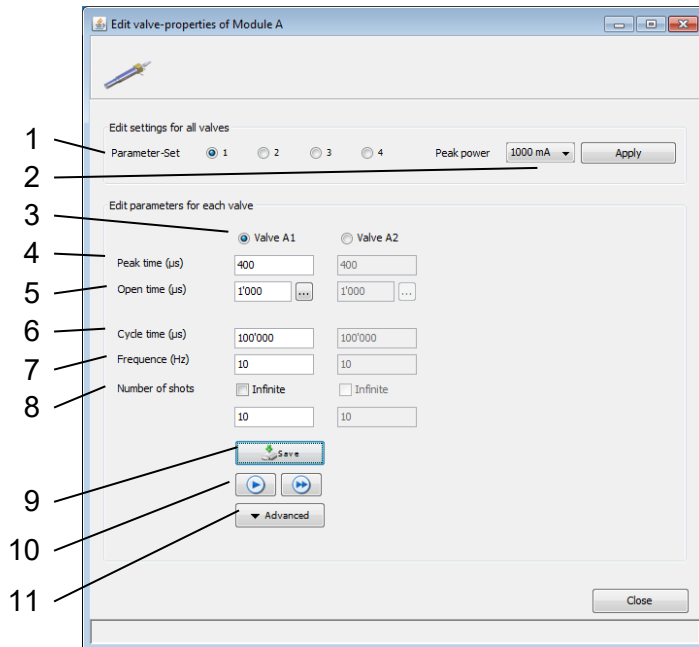
- 1 **Trigger mode:** Selection of trigger mode for module A
- 2 **Edit properties:** Edit valve properties of module A
- 3 single-shot and multiple-shot command for each valve, taking account of the parameters set



Wrong language? See section «[5.7.1 Menu Extras > Language](#)»

5.4 Edit valve properties

Click the “Edit properties” button in main menu window of module “A”. Edit valve-properties of module A window will appear.




The following operating parameters can be configured directly from the control software:

- 1 **Parameter set:** A maximum of four parameter sets can be assigned per valve. The values of the selected set are then displayed for each valve in the "Edit parameters for each valve" area. As a rule, only parameter set 1 is used. On set 2 e.g. a special rinsing cycle could be stored, and if necessary simply be activated by selecting the parameter set.
- 2 **Peak Power** (adjustable per module): Peak power of each module is adjustable, Default value is 1000 mA. Accessible for "Advanced User" only.
- 3 **Valve select:** Here, the desired valve can be selected to make changes to the parameters.
- 4 **Peak time:** Time for which the valve is driven with an increased current for a quick opening. Corresponds to the time taken for the valve to open fully. Default value is 400 µs. When dispensing high viscosity medium, it can help to increase this value (to 1000 µs and more).

WARNING

Longer peak times can destroy the coil in extreme cases! Particularly in combination with high dispensing frequencies. Note the max. permissible coil temperature of 100 °C!

- 5 **Open time:** Influences the valve opening time. This is the most important value and influences the dispensing volume. Values from **400 - 9'999'999 µs** are permissible (depending on the dispensing frequency). Experimentally, it is also allowed to go below 400 µs, the peak time is then cut. If the time is too short, the valve no longer opens cleanly.

➔ You can also enter the desired changes in %, by clicking on . Doing so will open a corresponding input window.

- 6 **Cycle time:** 1 / Frequency. Defines the shot-to-shot cycle time for the Shot Series command. The minimal **cycle time** must be larger than the adjusted **open time**.
- 7 **Frequency:** Dose frequency, see **Cycle Time**.



- 8 **Number of shots:** Amount of shots “series of Shots”, or via external Trigger control “**Infinite**” = endless operation.
- 9 **Save:** Saves the settings for the selected valve in the controller.
- 10 **Single Shot / Series of Shot:** When click on “Single Shot”, a single shot is released from the selected valve with the current parameter setting. With “series of Shot”, a series of shots are released. The parameter “**Numbers of Shots**” must be set before shot button press.
- 11 **Advanced:** Calling up the special functions for convenient transfer of values to other valves.

5.5 Activation of external trigger modes

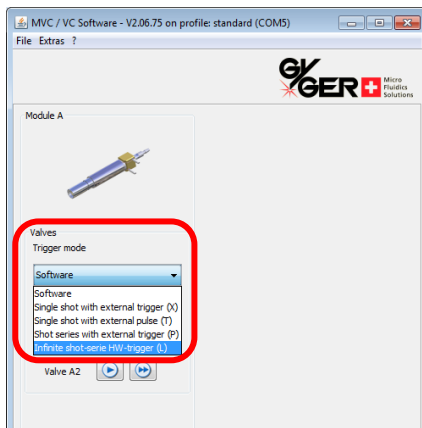
These features are especially useful when dispensing events are to be triggered by an external system.

You can set directly in the main window the corresponding trigger mode. The signal inputs X2.1 and X2.2 can then be used to trigger dispensing events in real time for the respective valve (for example, input X2.1 for valve 1).



If an external trigger mode is activated, the corresponding module is disabled for entries. By switching back to the trigger mode "software", the module is editable again.

5.5.1 Explanation of the different trigger modes

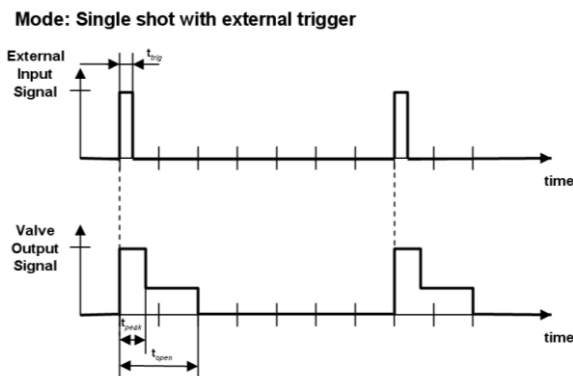


- **Software**

This mode is selected by default. It allows to change various parameters and release shots via software.

- **Single shot with external trigger**

A single shot of one valve could be released. When a rising edge signal is coming from input terminal e.g. Input X2.1 for valve 1.



Used valve parameters:
(of the currently active parameter set)

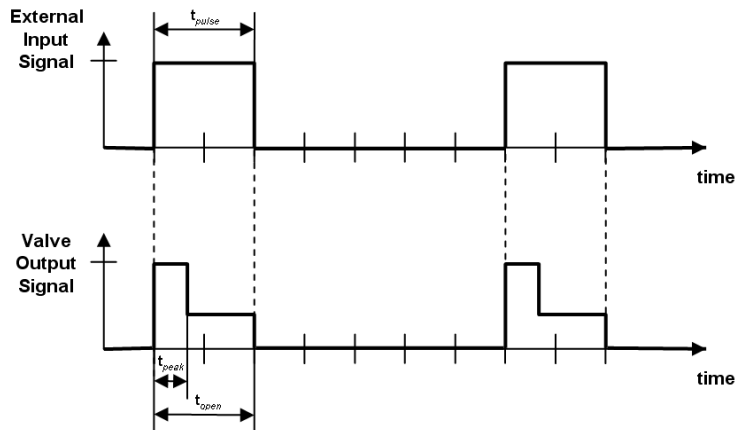
- Peak power
- Peak time
- Open time
- Cycle time => This parameter is used in the sense that no new clock pulse is processed before the cycle time has elapsed.

=> The other parameters are ignored

- **Single shot with external pulse**

As long as the corresponding signal input is "high", the associated valve is opened.

→ Positive edge: Opens the valve. Negative edge: Closes the valve again.



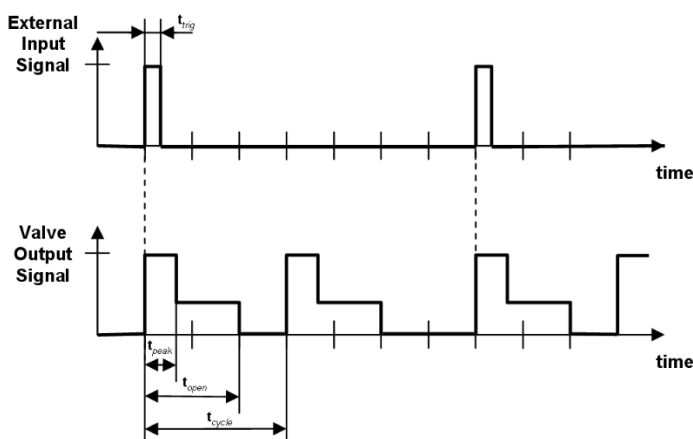
Used valve parameters:
(of the currently active parameter set)

- Peak power
- Peak time

=> The other parameters are ignored

- **Shot series with external trigger**

With a positive signal edge at the corresponding signal input, a shot series with the corresponding valve is triggered.

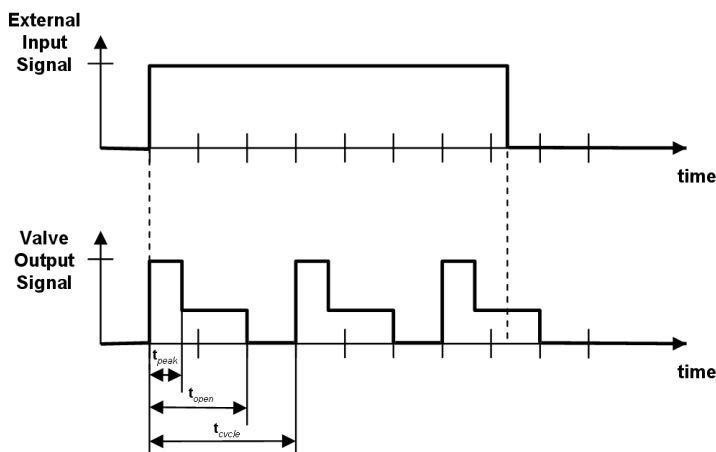


Used valve parameters:
(of the currently active parameter set)

- Peak power
- Peak time
- Open time
- Cycle time / Frequency
- Number of shots => Note: if the number of shots is infinitely defined, no shot will be released.

- **Infinite shot-series HW-trigger**

As long as the corresponding signal is high at input terminal, the valve dispenses continuously with predefined frequency and opening time.



Used valve parameters:
(of the currently active parameter set)

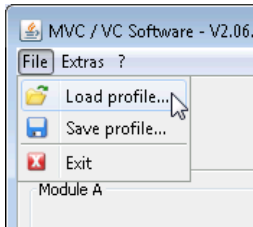
- Peak power
- Peak time
- Open time
- Cycle time / Frequency

=> The other parameters are ignored

5.6 Load and save parameters (menu file)

In the Menu "File", there are possibilities to save existing settings and load again.

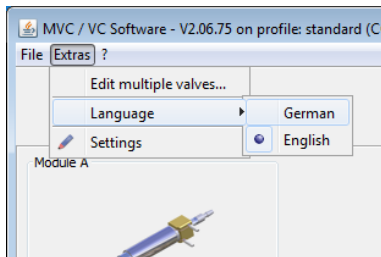
Load/save profile: all parameters, e.g. Dosing and heating configuration settings could be saved and loaded later on. To perform this operation click



5.7 Menu Extras

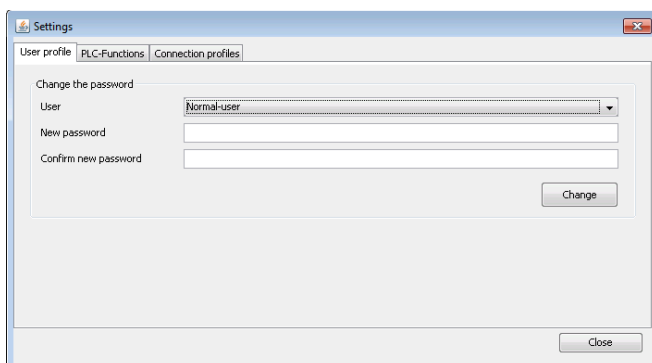
5.7.1 Menu Extras > Language

You can change the language of the user interface. Select the Menu>Extras - Language the appropriate language. After the change, a restart of the software is necessary for the change to take effect.



5.7.2 Menu Extras > Settings – User profile

Only available for "Super-user". Here the login passwords for the users can be changed.



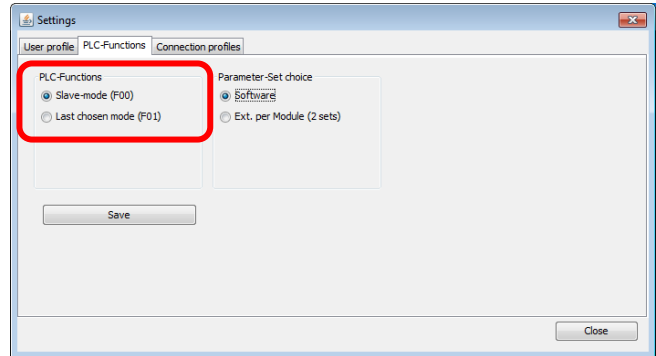
5.7.3 Menu Extras > Settings – PLC Functions

Only accessible for "Super-user". Basic operating modes of the control are set here.

PLC-Functions

- **Standard mode (F00):** Activated external trigger modes are cleared in every power on process again.
- **Last chosen mode (F01):** The controller starts power on always in that condition e.g. Trigger modes, which were adjusted before Power off.

The function type is stored permanently with the "Save" button in the control.

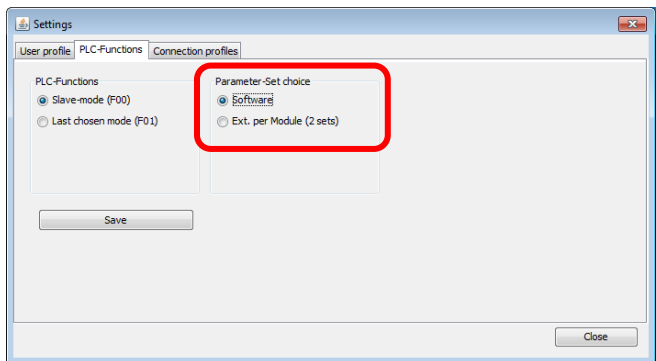


Parameter set selection

In the MVC / VC software 4 parameter sets can be stored directly in the controller.

By default, the selection / activation is done via the software (valve properties window).

The parameter sets 1 and 2 can be switched via external hardware signals when needed. The selection type is stored non-volatile with the "Save" button in the control.



=> For the detailed use of the parameter set selection via external inputs, see the separate chapter «[6 Working with parameter set selection by external signals](#)»

5.7.4 Menu Extras > Settings – Connection profiles

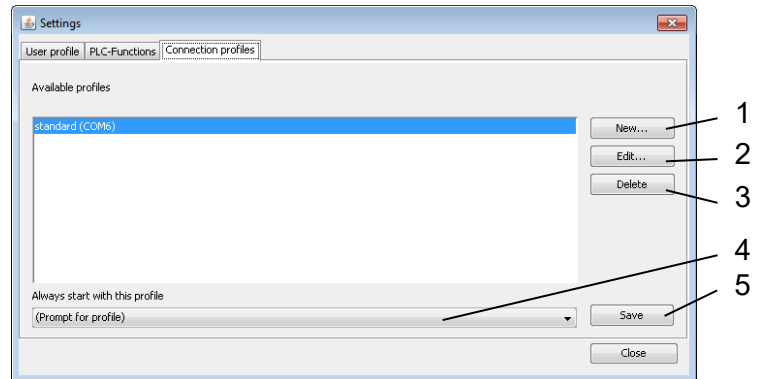
This is the same dialog as for logging in. Here the communication parameters can be set. The name of the connection profile is then also shown in the title bar of the main interface, so the controllers can be distinguished if more than one controller is connected to the PC.

1 **New:** Create new profile

2 **Edit:** Edit connection profile

3 **Delete:** Delete profile

4 **Always start with this profile:**
If a profile is selected here for the auto start, the start dialogue appears no longer, and the controller connects always automatically with the selected profile. If selected here "Prompt for Profile", a selection window will always appear at the start of the program.



5 **Save:** Save the settings here

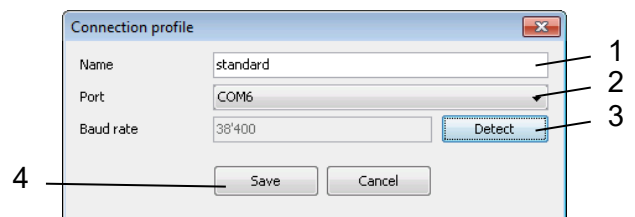
Edit dialog box „Connection profile“

1 **Name:** Enter a profile name. The name will later appear in the title of the main screen

2 **Port:** Select the corresponding COM-Port

3 **Detect:** The correct baud rate can be detected automatic (Default: 38400)

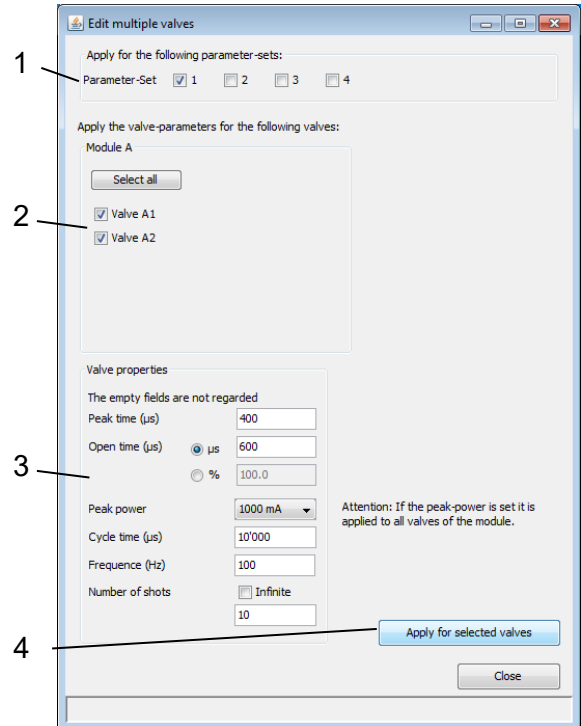
4 **Save:** Save the settings here



5.7.5 Menu Extras > Edit multiple valves

Here you can easily transfer values to multiple valves. The same menu is also accessible from the valve-edit-window by clicking "Advanced> Copy to other valves".

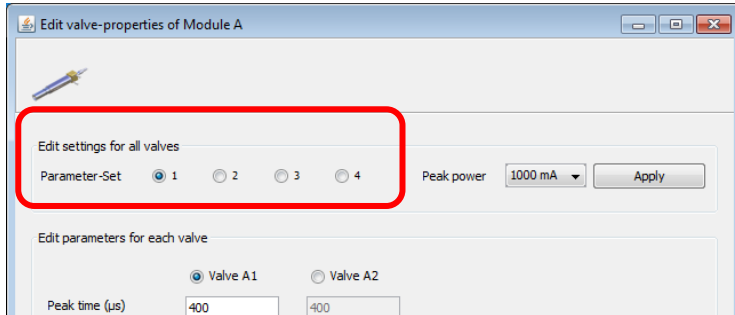
- 1 Select here to which parameter sets the values to be transferred.
- 2 Select here, on which valves the values to be transferred. With the "Select all" select all valves.
- 3 Specify here the values that you want to transfer to multiple valves. You need to fill in only the fields that shall be changed.
 ➔ If you choose % for the opening time, instead of μ s, then the opening times for each selected valve will be changed individually in percentage terms.
- 4 Here you perform the action. The entered values are applied to all selected valves.



6 Working with parameter set selection by external signals

In the MVC / VC software 4 parameter sets can be stored directly in the controller.

By default, the selection / activation is done by the software in the valve properties:



If necessary, the parameter sets 1 and 2 can be switched via external hardware signal (X2.3) when an external trigger mode is selected and the other needed settings are set appropriately.

6.1 Principle

The signal input X2.3 is used for parameter set selection

X2.3 low = parameter set 1

X2.3 high = parameter set 2



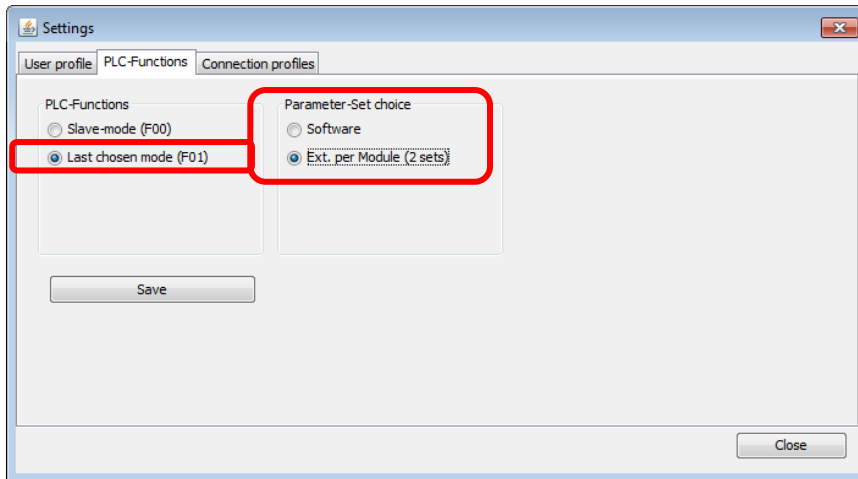
After a level change on the signal lines, the switching in the electronics needs max. 0.15 s!
During this time no shots are fired.

6.2 Software settings to use the external parameter set selection

1. Setting the parameter set selection

In the software is in the menu Extras>settings – PLC functions to set the following:

- Section PLC functions must be set to „Last chosen mode (F01)“
- Section parameter set choice must be set to „Ext. per module (2 sets)“



The selection is stored non-volatile with the "Save" button in the control.

2. Set an external trigger mode in the main menu

After step 1 one or all modules can be set in the main menu in an external trigger mode.

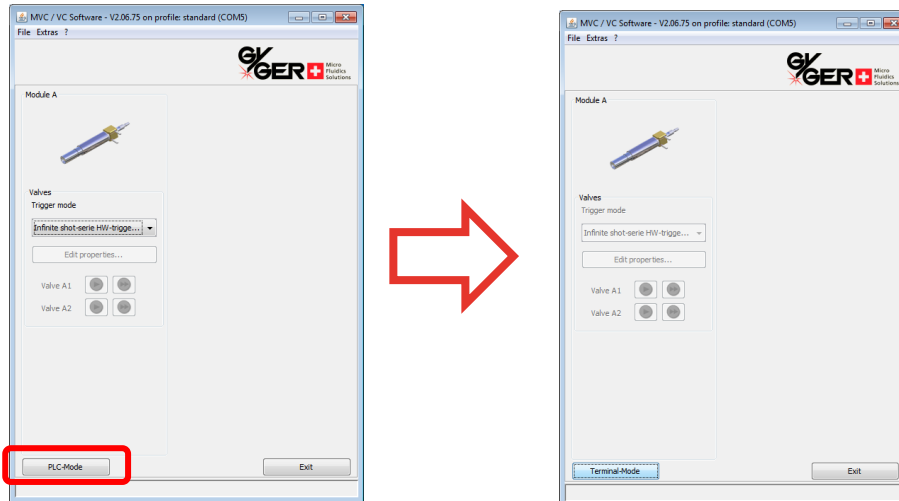
In this example „Infinite shot series HW trigger“



3. Switching the control in the PLC mode

Thus, the parameter set selection is active, the controller must be switched in the PLC mode.

For this, the button "PLC mode" is automatically displayed in the main menu as soon as the first two steps have been met.



Click on the button switches the controller to the PLC mode (text changes to "Terminal Mode")

The software can now be closed, and no longer needs to be active.

At power-up, the controller passes automatically to the last active mode.

To make again entries with the software, click on button "Terminal Mode".

Then, the ext. triggering modes can be terminated and the properties / valve parameters can be edited.



The parameter set selection via external signals only works if these conditions are all met:

- The PLC function F01 (last chosen mode) is selected
 - In the main menu, an external trigger mode is selected
 - The controller is in PLC mode (button shows text „Terminal mode“)
- =>This switching can also be performed in the main menu.

7 Technical data (Overview)

7.1 General specifications

Needed power supply	24 V DC, max. 1 A
Environment temperature	0 °C to 50 °C
Weight	0.1 kg
Dimensions	122 x 99 x 17.6 mm (L x B x H).
Mounting	Housing prepared for mounting on 35 mm DIN rail
Communication interface	Serial point-to-point connection (UART) via RS 232 or USB
User interface	<ul style="list-style-type: none"> - Windows graphical interface with Gyger MVC / VC software (Java-based) - Alternatively direct communication via command set via the interface (separate documentation)
Approvals	CE

7.2 Specifications of the power outputs (for valves)

Possible functions	2 valves
Output voltage	24 V DC, pulsed for peak + hold control
Current capacity	1.3 A short time, 0.85 A continuously

7.3 Specifications of the signal inputs / outputs

Digital Inputs	12-24 V DC, Rin 5.6 kΩ
Digital Outputs	24 V DC, max. 0.5 A