precision dots

VERMES MICRODISPENSING

USER MANUAL

15.07.2025 Rev. A

Microdispensing System MDS 3080-V

Microdispensing Systems with PX2 Technology

www.vermes.com

User Manual for Microdispensing Systems of the MDS 3080-V Series

System	Control Unit	Valve
MDS 3080-V	MDC 3090-V	MDV 3080-V

Tab. 1: Available products

1 Introduction

With a micro dispensing system of the MDS line from VERMES Microdispensing, you have bought a high quality product. Due to the longstanding experience of the team in regards to electronic devices and piezo controls, these products provide highest functionality and reliability.

Thank you very much for your trust in us.

We will now show you how to assemble and use the microdispensing system. In order not to impair the inherent safety concept of the system, you have to follow the procedures described in this manual consequently during installation and operation.

Read this manual before you start the assembly and always consult it during the use of the microdispensing system.

Start with the chapter “Safety Notes” (see chapter 2, page 8). This will help to prevent any problems for the user or the equipment. In the case of further questions, consult our Technical Support.

Technical Support	**VERMES Microdispensing GmbH** Rudolf-Diesel-Ring 2 83607 Holzkirchen Tel.: +49 (0) 80 24 6 44-26 Fax.: +49 (0) 80 24 6 44-19 support@vermes.com www.vermes.com

Service hours Monday - Friday 9.00 to 17.00 (CET). We recommend checking the relevant serial numbers (e.g. MDC and MDV) and the firmware revision before contacting the support.

The MDS 3000 Product Family

The MDS models are members of the MDS 3000 product family, specialized in most accurate dispensing and designed for flexible use with substances of low and medium viscosity (up to 8000 mPas). Applications can be found in the fields of SMT and in the production of electronics, semiconductors and photovoltaic modules and many more.

Each microdispensing system belonging to the MDS 3000 product family is composed of a high precision valve based on a piezoelectric element (MDV series), a control unit (MDC series) and an optional selectable supply unit.

Due to its compact modular design, the system can be integrated quickly into any existing production environment without major preparatory work. A change in the production line (e.g. a modification of the liquid to be processed) is easily possible, since all of the dispensing parameters are adjustable in a large range. Fine-tuning of the sequence is therefore possible at any time. The system allows for reproducible proportioning of hundreds of identical single dots or beads within a few seconds.

A comprehensive choice of accessories is available, e.g. nozzle inserts, tappets, seals and supply units, so that the system can easily be adapted to new challenges any time, without giving rise to major investment.

2 Safety Notes

This chapter summarizes the general safety aspects of the system. Further points to observe are emphasized in the corresponding subchapters.

2.1 Obligations and Liability

In order to protect the health of personnel and to avoid unnecessary damage, all of the recommendations of the manufacturer concerning safety must be explained to every member of the team taking part in installation, operation or maintenance of the system.

VERMES Microdispensing does not accept any liability for material damages or personal injury originating from inappropriate use, violation of safety prescriptions, or any procedure inconsistent with the instructions of this manual. The general rules for prevention of accidents as well as local environmental regulations must be in place and thoroughly followed by the personnel.

2.1.1 Obligations of the Customer

In view of a trouble-free operation of the microdispensing system, the customer has to select his personnel carefully:

- Unauthorized use must be prevented. Persons ignoring the fundamental requirements of industrial safety, environmental protection and prevention of accidents are not allowed to work with the system.
- New operators must correspondingly be instructed and trained, so that they can understand and put into practice the instructions of this manual. For certain measures, a particular qualification may be required.
- The manual must remain accessible at any time.

2.1.2 Obligations of the Operator

All persons in charge of the system must:

- Continuously respect the general rules for prevention of accidents.
- Be aware of the safety notes of this manual. This is necessary also for operators trained by the manufacturer or experienced in work with similar systems.
- Consult the manufacturer in any case of doubt. Applications beyond the scope of the specification and improvised repair work must be avoided.

2.2 Residual Risks

The drop volume system has been developed and designed with the common requirements of safety in mind, and corresponds to the current state of technology. In the delivered layout, it complies with the following regulations and directives:

- 2014/35/EU Low Voltage Directive
- 2014/30/EU Electromagnetic Compatibility
- EN 61010-1
- EN 61326-1
- EN 55011
- EN 61000-3-2
- EN 61000-3-3
- EN 61000-6-2

Despite this comprehensive inherent safety structure, the operation of the drop volume system DVS may entail danger

- For the health of the operator or a third party,
- For the system itself,
- Or give rise to another material damage.

Therefore, the use has strictly to be limited:

- To the intended application.
- To a state in which the technical safety of the system can be guaranteed (i.e. it is strictly forbidden to start or continue the operation whenever a defect has become obvious).

You have to solve problems immediately, if they have a potential to impair safety aspects. For this reason, it is imperative that this manual remains accessible any time without delay. In an emergency, a short reaction time may be crucial.

If you transmit the system to any other department or institution, this manual must accompany it.

2.3 Contracted Use

The systems of the MDS 308x series have been designed for ultra-precise contactless dispensing of fluids in a large range of viscosity (up to 8000 mPas), in unfilled or filled state (also with abrasive extenders), to be operated in a conveniently equipped industrial or laboratory environment.

Deviations from the instructions of this manual must explicitly be authorized by the manufacturer (in writing); otherwise his liability with regard to the guarantee becomes null and void.

This includes:

- Extensions and changes of design
- Modifications of the system, or spare parts not recommended by the manufacturer
- Inappropriate material selection (lack of compatibility between parts and dispensed fluids)
- Operation with damaged parts or after improvised repair
- Dispensing of fluids able to affect the functionality of the system (in case of doubt, consult manufacturer)
- Manipulation or absence of integrated safety devices or sealings
- Repair by persons or enterprises not authorized by the manufacturer
- Operation beyond the scope of the specification
- Auxiliary equipment not recommended by the manufacturer
- The system is not admitted for applications in hazardous locations (ATEX zones)

In no event shall we be liable under our guarantee or any other provision of the agreement for damages resulting from a violation of the instructions of this manual.

For further questions concerning current applications and modifications of the system with respect to new requirements, contact the manufacturer, the responsible sales partner or the Technical Support.

2.4 Specification and Technical Notes

- The system is designed for interior use only. Maximum altitude: 2000 m.
- The relative air humidity shall not surpass 80 % rH at 31 °C or 50 % rH at 50 °C (with a linear decline).
- Temperature: 10 °C till 50 °C
- Admissible mains voltage fluctuations: Within the range of ± 10 % of rated voltage.
- Transient overvoltage tolerated acc. to IEC 60364-4-443, max. degree of soiling: 2
- Mains cables must feature a protective conductor. In the case of cables not delivered by Vermes Microdispensing, the guarantee for the microdispensing system is valid only up from the interface.
- Power outlets must comply with common safety prescriptions.
- During the application, you must guarantee sufficient air circulation. For further details, refer to Installation chapter paragraph 6.3.1, page 46.

  For exact dispensing results, the temperature of the actuator system should stay below 80 °C. Therefore, you might need cooling. Cooling is achieved by compressed air, free of fine particles, dust, oil and condensate, quality classes 3, 4, 3 acc. to DIN/ISO 8573-1:2010.

- Solid particles: Quality class 3

  max. number of particles/m^3: 0.5 – 1 µm: < 90000, 1 – 5 µm: < 1000
- Water content: Quality class 4

  max. pressure dew point +3 °C
- Residual oil: Quality class 3

  1 mg/m^3 max.

2.5 Warnings

- Handle the mains cables correctly: Always seize the cable at the plug. Never touch it with wet hands.
- Under no circumstances connect a schuko-plug (type F, CEE 7/4) with a socket build for an unearthed plug (type C, CEE 7/17). The system would not be grounded.
- The cable should never be squeezed or kinked. Never place the instrumentation (or any other object) on the cable.
- Damaged cables may give rise to fire and danger caused by electricity. Inspect them visually in regular intervals. You should exchange damaged parts at once.
- In the case of a major disturbance, disconnect the equipment immediately from the mains.
- Spare parts not delivered or recommended by the manufacturer could affect the inherent safety of the system. The same problem arises, if the customer attempts to process substances not admitted for the dispensing system.
- Unqualified repair work often causes major damages, sometimes even personal injuries. Therefore, repair is reserved to our Technical Support and authorized subcontractors.
- Before removing the actuator and sensor cable, the system must be switched OFF.
- For longer interruptions, switch OFF the control unit.
- Before disconnecting the control unit from the mains, switch it OFF.
- Repeatedly switching ON and OFF the equipment may reduce the lifetime of the power unit.
- Before charging the fluid system with an aggressive, reactive or toxic substance, you have to verify that it is compatible with all of the contacting components inside the system.
- The supply pressure at the cartridge or in the pressure tank of 7 bar resp. 100 bar (according to the system configuration) should never be exceeded.

- If you use the valve with a heater for the nozzle unit, the temperature in that area can reach up to 180 °C. Do not touch it during operations and afterwards only once it had enough time to cool down.
- When cleaning the components in contact with the transported substance, you should place the device in a safe and stable position, without being subjected to vibrations.
- To clean the actuator, a cloth not fluffy and lightly moistened (e.g. by Isopropanol) is recommended. During the cleaning procedure, no liquid should penetrate into the actuator itself (e.g. through the plug).

2.6 Qualifications of Operators and Maintenance Personnel

The microdispensing system together with all attached accessories should only be used by competent personnel with an adequate qualification. They must know and understand the content of the manual. We do suppose that the department head is aware of possible dangers, and correspondingly assigns the tasks to persons able to execute their work in a responsible manner.

According to DIN VDE 0105 and IEC 364 qualified personnel refers to members of the team with a sufficient knowledge of relevant norms, directives and rules for prevention of accidents. They need the qualification and experience necessary, so that they are in a position to realize and to prevent possible dangers already at an early stage. Knowledge in First Aid and a direct contact to the local emergency units is required as well.

2.7 Protective Equipment and Safety Clothing

You should always wear suitable protective equipment, whenever handling or dispensing aggressive, reactive or toxic substances. The same is valid in the presence of a high supply pressure.

Safety Clothing	Safety Icon
Safety glasses	
Breathing apparatus	
Overall and gloves resistant to the corresponding chemical fluid	
When you work in the direct vicinity of the MDS for a prolonged period, you should also wear ear protection.	

Tab. 2: Protective Equipment and Safety Clothing

3 General Instructions

This chapter summarizes the content of this manual and contains general information for the user. Some pictures might differ slightly from the actual product.

3.1 How to Use this Manual

- Each step of installation, operation and maintenance has to be performed in accordance with this manual.
- You can find information about safety aspects and an efficient use of the system in the concerning chapters.
- This manual represents an integral part of the delivery and must be made available to every user working with this system. Always keep it in close vicinity.
- It must be preserved until the end of the lifetime of the system.

3.2 Legend

3.2.1 Danger Levels

Instruction	Possible Consequences
DANGER!	The damage is imminent! If the operating procedure is not strictly observed, this situation may result in death, considerable material damage or environmental contamination.
WARNING!	Warn of a potentially dangerous situation! The danger of death and serious injuring cannot be excluded.
CAUTION!	Cautions about a potential problem! Danger of minor or medium injuries.
IMPORTANT NOTE!	Warns about potential damage to the equipment! An operating procedure which, if not strictly observed, may result in damage to the equipment, unexpected interruptions or shutdown.
INFORMATION!	Supplementary recommendation for an economical and timesaving use of the equipment.

Tab. 3: Danger levels

3.2.2 Illustration Convention

Symbol	Explanation
Step 1: **Step 2:**	The sequence must be followed in correct order
–	Each step of this sequence is mandatory, none of them should be omitted
	Direction of movement
•	Lists
[...]	Symbol for a key on the keypad

Tab. 4: Illustration convention

3.2.3 Abbreviations

Abbr.	Full Name
BY	Bayonet
CTF	Ceramics Tappet Flat
CTK	Cleaning Tool Kit
FA	Fixed Adjust
FD	First Drop
MDC	Controller (MicroDispensingControl unit)
MDF	Fluid box (MicroDispensingFluid box)
MDS	MicroDispensingSystem
MDT	Tool (MicrodispensingTool)
MDV	Valve (MicroDispensingValve)
MDX	Supply unit
NFN	Nozzle Fixation Nut
NI	Nozzle Insert
NL	Needle Lift
PDTF	Poly Diamond Tappet Flat
PLC	Programmable Logic Controller
POD	Point of Dispensing
RTC	Real-time clock
TNL	True Needle Lift
TTF	Tungsten carbide Tappet Flat

Tab. 5: Abbreviations

3.3 Tools

The following tools are required to install and to operate the MDS:

- MDT 301 - Universal Tool (Order no. 1010208)
- MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)
- MDT 306 - Torque Wrench Tool VM black (Order no. 1015062)
- MDT 307 - Adjust Tool TA Hotmelt Handle (Order no. 1014143)
- MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)
- MDT 323 - Nozzle Insert – Squeezing Out Tool TA (Order no.1014283)
- MDT 324 - Nozzle Insert Cleaning Holder (Order no.1014310)
- MDT 327 - Multi-Function Tool (Order no.1014440)
- MDT 328 - Tappet Sealing Changing Tool (Order no.1014503)
- Hexagon Key Set (Order no. 1012993)

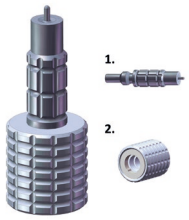
When you order tools, always specify the order number of the required item.

IMPORTANT NOTE

No foreign tools

Do not use auxiliary tools or foreign products, otherwise damages to the equipment might be possible.

3.3.1 MDT 301 - Universal Tool

The tool MDT 301 comprises two subcomponents screwed to each other: • "Sealmounter" with a mandrel to insert and to remove the tappet sealing (1.) • "Adjustment grip" with a receptacle for the adjust screw (2.)	
Intended Purpose: 1. Fixing of tappet sealing and tappet centering piece 2. It may also be used to execute the general adjust (alternatively to tool MDT 327)	

Tab. 6: MDT 301 - Universal Tool (Order no. 1010208)

3.3.2 MDT 303 - Nozzle Insert Changing Tool

The MDT 303 is required for the exchange of the nozzle insert. The 3 pins of the MDT 303 grip into the receptacle bores of the tappet centering screw in order to unscrew the tappet centering screw from the fluid box.	
Intended Purpose: 1. Screwing apart/together fluid box body and tappet centering screw	

Tab. 7: MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)

3.3.3 MDT 307 - Adjust Tool TA Hot Melt Handle

The MDT 307 can be used in combination with the bit BitVM-A Tightening Screw, magnetic (order no. 1014519) to perform the adjust with a valve capable of the top adjust function.	
Intended Purpose: 1. Performing the top adjust	

Tab. 8: MDT 307 - Adjust Tool TA Hot Melt Handle (Order no. 1014143)

3.3.4 MDT 316 - Nozzle Insert Cleaning Tool

The MDT 316 is used to clean clogged nozzle inserts made of carbide metal, ceramics or diamond (series N11 to N22). This is achieved by pumping a fat or grease with high pressure through the nozzle channel. Additional information is in the Quick Reference Guide MDT 316 Nozzle Insert Cleaning Tool. You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).	
Intended Purpose: 1. Cleaning of clogged nozzle inserts	

Tab. 9: MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)

3.3.5 MDT 323 - Nozzle Insert – Squeezing Out Tool TA

The MDT 323 has a thin and a wide end. Both are meant for different applications.	
Intended Purpose: 1. Detaching the nozzle insert from the fluid box (thin end) 2. Detaching the tappet sealing (wide end)	

Tab. 10: MDT 323 - Nozzle Insert – Squeezing Out Tool TA (Order no. 1014283)

3.3.6 MDT 324 - Nozzle Insert Cleaning Holder

The MDT 324 has a receptacle, in which the nozzle insert is placed to be held tight. Then you can clean the nozzle insert with compressed air without the danger of blowing it away accidently. Additional information is in the Quick Reference Guide “Nozzle Insert Cleaning Holder MDT 324”. You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).	
Intended Purpose: 1. For holding a nozzle insert during cleaning with compressed air	

Tab. 11: MDT 324 - Nozzle Insert Cleaning Holder (Order no. 1014310)

3.3.7 MDT 327 - Multi-Function Tool

The knobs of the MDT 327 grip into the slots of the adjust screw or into the slots of the tightening screw (gearing VM-A). The other end holds open-ended wrenches (size 7) and (size 8). They are needed for mounting the system.	
Intended Purpose: 1. Performing the adjust 2. Fixing the tightening screw to the fluid box 3. Fixing the Nozzle Fixation Nut 4. Opening/closing Luer-Lock connector 5. Picking up a nozzle insert	

Tab. 12: MDT 327 - Multi-Function Tool (Order no. 1014440)

3.3.8 MDT 328 - Tappet Sealing Changing Tool

The MDT 328 is used to mount and demount the tappet sealing and the tappet centering piece.	
Intended Purpose: 1. Squeezing out of the tappet sealing from the fluid box 2. Squeezing out of the tappet centering piece from the fluid box 3. Pushing the tappet sealing into the fluid box	

Tab. 13: MDT 328 - Tappet Sealing Changing Tool (Order no. 1014503)

3.3.9 Hexagon Key Set

The set includes three hexagon keys (sizes 2, 2.5 and 3) for hex-screws, with blades made of hardened steel and ergonomic grips.	
Intended Purpose: 1. Mounting and demounting the fluid box (2) 2. Mounting and demounting the tappet guard (2) 2. Mounting and demounting the isolation body (2) 4. Mounting and demounting the cartridge holder (2 or 2.5, depending on type) 5. Fixing of the valve, in-situ (3)	

Tab. 14: Hexagon Key Set (Order no. 1012993)

3.3.10 MDT 306 - Torque Wrench Tool VM black

The MDT 306 allows you to screw tight screws with an exactly set tightening torque. The value can be adjusted continuously at the torque wrench tool.
You can order the necessary bits separately or together with the torque wrench as a set in a tool box (MDTS 1 - Torque Wrench Tool Set TA, order no. 1013521). Additional information is in the Quick Reference Guide “Torque Wrench Tool VM MDT 306”. You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).

Intended Purpose:

1. Tightening screw
2. Tappet Centering Screw BY
3. Cartridge holder
4. Fluid box connector Luer-Lock
5. Nozzle Fixation Nut
6. MDC front panel
7. Valve screws

Tab. 15: MDT 306 - Torque Wrench Tool VM (Order no. 1015062)

3.3.11 Torques (in cN.m)

Element	Gearing Profile	Bit Order No.	Torque (cN.m)		Cross Reference
			Min.	Max.	
Nozzle Fixation Nut (hexagon screw, size 7)		1014204	150	180	Page 35
Screws for valve fixation (size M4, thread depth 5 mm)		1013373	150	180	Page 46
Screw for cartridge holder M 2 x 4 (hexagon socket, size 2)		1013294	25	30	Page 41
Connector BY (in mounting body PEEK; hexagon socket, size 2.5)		1016631	70	80	Page 41
Connector BY (in metal mounting body; hexagon socket, size 2.5)		1016631	120	140	Page 41
Tightening screw stainless steel (gearing VM-A)		1014519	120	140	Page 37
Tappet centering screw BY (gearing VM-B)		1014521	100	140	Page 41
Fluid box connector Luer-Lock (stainless steel; hexagon screw, size M8)		1013374	100	120	Page 41
Fluid box connector Luer-Lock (PEEK; hexagon screw, size M8)		1013374	40	60	Page 41

Tab. 16: Torques (in cN.m)

4 Control Unit MDC

This chapter contains relevant information about the control unit. It describes the menu structure, keypad and functions of the control unit.

4.1 Technical Data

	Value
Dimensions	128 mm H x 102 mm W x 173 mm D *(w/o Kabel)* *(see dimensional drawing,* Page 166*)* 3 RU x 20 HP
Weight	ca. 1500 g
Supply Voltage	110/230 V AC/DC
Supply Frequency	50/60 Hz
Current Consumption	Max. 900 mA During start-up, this value can increase by a factor of 5 (start-up peak). Recommended fuse: 16 A for 240 V resp. 110 V
Ambient Temperature	10 °C - 50 °C
Air Humidity	The relative humidity rH might not surpass 80% at 31 °C or 50% at 50 °C (connect linearly for other temperatures).
Casing Type	Plug-in case for 19“ rack
Color of Casing	Black
Ventilation	Convection
Internal Storage Locations:	10
Display Lines	2 lines with 16 characters each
Display Color	White with background lighting
Keypad	12 softkeys
Color of Keys	Blue, beige
Control Lamps (Front)	1x Heating circuit (red) 1x First Drop (“function”, red) 1x Adjust OK (green) 1x Adjust not OK (red)
Control Lamps (Back)	1x Illuminated power lamp
Plug Contacts (Back)	1x Mains plug (110/240 V AC) 1x 9 pin Sub-D RS-232C 1x 15 pin Sub-D PLC 1x AUX-socket 24V 1x Sensor socket 1x Actuator socket 1x Socket for heating 1x Thermocouple socket

4.2 Front Side

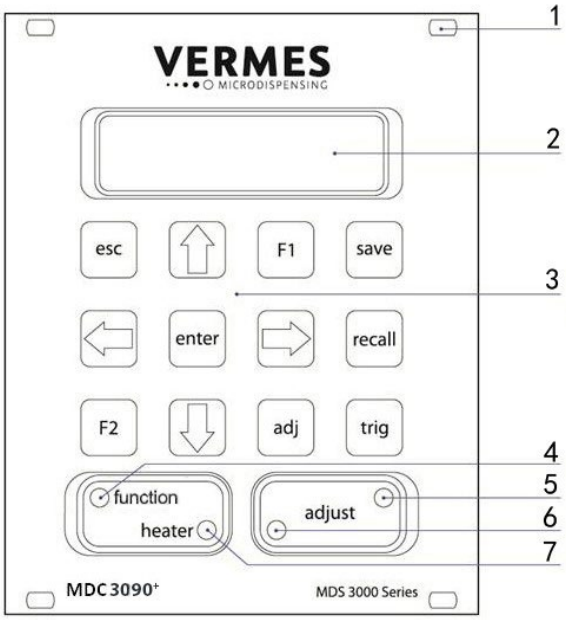


Fig. 1: Front Side

1 Mounting hole
2 LC display
3 Keypad with 12 soft keys
4 Control lamp for First Drop ("function") "red"
5 Control lamp for adjust "green"
6 Control lamp for adjust „red"
7 Control lamp for status of heating „red"

LC display:

Data, service intervals and menu options are shown in the two lines of the illuminated LC display (LCD = "liquid crystal display"). The current menu option appears in the upper line. The lower line contains the current parameter value for dispensing, according to numerical data to be modified.

Keypad with 12 softkeys:

Menu options to control the system are selected by means of these keys.

Details for changing parameters etc. are explained in a following chapter (see paragraph 4.4, page 25).

Control lamp for First Drop ("function"):

This red LED indicates, if there is a problem during the first drop adjust. It is also ON during the start-up of the MDC, while the power supply unit is initialized.

Control lamps for adjust ("green" and "red"):

During the adjust, these two control lamps indicates the adjust result that is internally monitored:

- Green: the adjust value is OK. Press **[Enter]**-key to confirm it.
- Red: the adjust value is too high. You have to lower it according to the instructions of this manual (see paragraph 6.5 "The Adjust Process", page 52).

You can de-/activate the control lamps for adjust. It makes no difference during the adjust (as above). But it affects the lamps outside of the adjust (as below).

Outside of the adjust: (if the control lamps for adjust are activated)

- Red: the MDC detects an error.
- Green: the valve detects that the adjust value falls inside the adjust range.

Outside of the adjust: (if the control lamps for adjust are deactivated)

- Red: the MDC detects an error (except for an adjust error).
- The green adjust-LED stays OFF.

To de-/activate the control lamps for adjust, enter the service code 1100 (see paragraph 4.5.6 "Submenu “Service-Option”", page 33). Alternatively, you can use the serial command SETADJLED:OFF/ON (see paragraph 8.1.2.2 "Explanations", page 88).

Control lamp for status of heating:

This red LED indicates the activity of the heating.

Heating activated – LED ON

Heating deactivated – LED OFF

Heat-up phase – LED flashes

4.3 Back Side

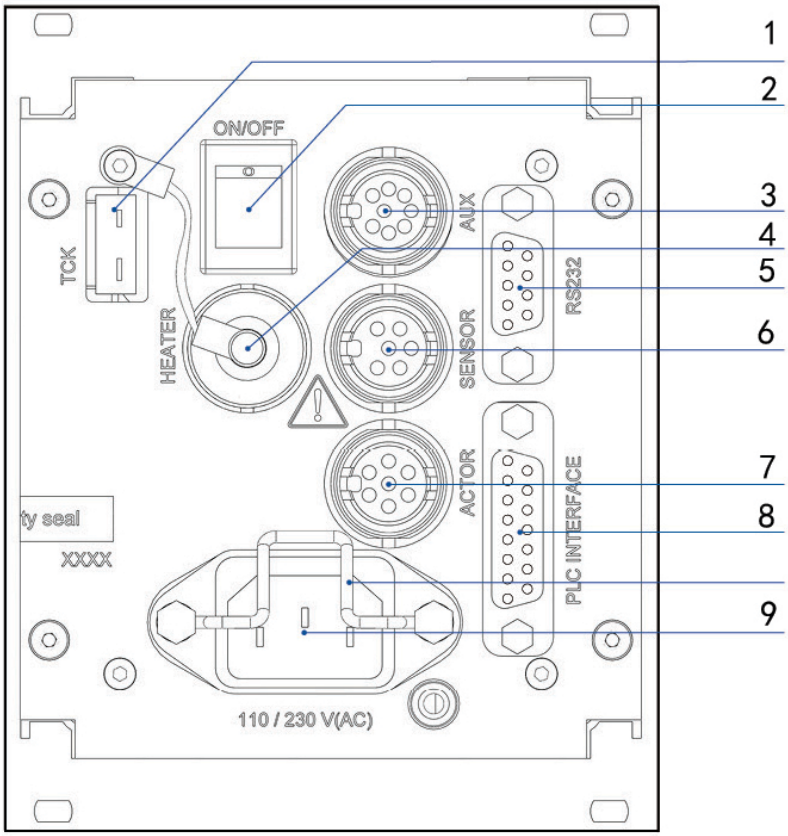


Fig. 2: Back side

1 Thermocouple „Type K“ socket
2 Mains switch
3 AUX socket
4 Socket for heating
5 RS-232C interface (9-pin)
6 Sensor socket
7 Actuator socket
8 PLC-interface (15-pin)
9 Mains connector

Thermocouple socket (TCK):

This element is intended for connection of thermocouples “Type K“.

Mains switch:

By means of this illuminated switch, the unit is switched ON and OFF.

AUX socket:

This connector can be used for supply of an external device (e.g. an optocoupler) or to control certain parameter setups or scenarios (see paragraph 7.9.3 "Scenario Selection with Select Pins", page 67). It is one of the three interfaces of the control unit (see paragraph 8.3, page 128 for the pin assignments).

Actuator socket:

For the connection of the actuator cable.

Sensor socket:

For the connection of the sensor cable.

Socket for heating:

The heater cable has to be connected here.

PLC-interface (15-pin):

Different inputs and outputs may be connected. For the communication protocol, refer to paragraph 8.1.1, page 83.

RS-232C interface (9-pin):

Since the system offers the possibility of external programming of dispensing parameters via PC, a local RS-232C is integrated to receive the data. For the communication protocol, refer to paragraph 8.2.1, page 119.

Mains connector:

Connects the control unit to power supply.

4.4 Function Keys

Function Key	Function
	Manual trigger key Pressing the **[trig]**-key instantaneously launches a dispensing procedure according to the selected parameter settings.
	The **[save]**-key opens the menu for storing current parameters. Ten storage locations are available for distinct configuration sets. Each set contains values for all pulse parameters. Select the desired storage location by means of arrow keys. Press **[enter]** to confirm. Press **[esc]** to cancel without saving the selection.
	Parameter sets saved in the internal memory can be retrieved any time with the **[recall]**-key. Here you can load the settings stored with **[save]**. Use the arrow keys to select one of the ten internal storage locations. Press **[enter]** to confirm the selection. Press **[esc]** to abort.
	The **[adj]**-key is used to start the adjust (see paragraph 6.5, page 52). It is required during each initial operation and after an exchange of the nozzle unit. With this procedure, the position of the nozzle insert with respect to the tappet is preselected.
	Pressing the **[enter]**-key confirms the menu selection and opens the corresponding submenu. or The entry of a value is confirmed. The screen changes to the next-higher menu level.
	Pressing the **[esc]**-key aborts the current action. Values just entered are deleted. The next-higher menu level opens. or Direct access to the next-higher menu level.
	**[↑]**-key Access to the next-higher menu level. or Increasing of a numerical value.
	**[↓]**-key Access to the next-lower menu level. or Reduction of a numerical value.

Function Key	Function
	[←]-key The screen moves one menu step back. or The cursor is shifted one position to the left. or A parameter is modified.
	[→]-key The screen moves one menu step ahead. or The cursor is shifted one position to the right. or A parameter is modified.
	The **[F1]**-key opens the valve, taking into consideration the current values for "Rising" and "Falling". The valve remains opened until the key is released. Maximum length: 2 min. Then the valve closes automatically in order to protect the actuator.
	If you start the control unit, while holding the **[F2]**-key, you have the option to format the EEPROM. With **[enter]** you agree, with **[esc**] you skip this point and reach the main menu just as normal. This function will only be necessary in exceptional cases. **Important Note!** Settings for Scenarios will **not** be reset back to the factory settings. That is only possible with the options "Scenario" and "Reset ALL" after entering the service code 1000 (see paragraph 4.5.6 "Submenu "Service-Option"", page 33). If the **[F2]**-key is pressed during operation and while in first drop mode (see paragraph 7.11, page 71), the first drop adjust starts (i.e. while the "FirstDrop" function is switched "ON" in the submenu "Status"). When "FirstDrop" is "OFF", then nothing happens when pressing **[F2]**. When the system is in fixed adjust mode, the same is true, since fixed adjust mode automatically includes first drop mode (see paragraph 7.12, page 76).

4.5 Menu Structure

The main menu of the control unit MDC 3090-V contains five submenus: “Pulse Parameters”, “Heater” (inapplicable to the MDS 3080-V), “Status”, “Scenario” and “Service-Option”. With the **[enter]**-key you can reach the level of the submenus. There you can switch around with the keys **[→]** and **[←]**. Another option from the main menu is to use **[→]** or **[←]**, which allows you to gather some information about the system, like maintenance situation or ID numbers. The items are “Date”, “MDC ID”, “Valve ID” and “Firmware Rev.”. “Firmware Rev.” will give you the current revision of the firmware on your MDC. “Date” gives the current date and time (as UTC), as the MDC has a real time clock (RTC). With **[↑]** you reach a level, where you can find information about the frequencies of your setups or scenario (depending on, if scenario is “ON” or “OFF”). Menu levels are always “wrap-around”, i.e. you can move on from the last item in a menu directly on to the first. With **[esc]** you can change from a submenu into the next higher menu level.

The information shown in the display differs, depending on the menu level (see paragraph 4.5.1 "Main Menu", page 28).

- Dispensing parameters for a particular process can be recalled and modified in the submenu “Pulse Parameters”.
- The submenu “Heater” is not used in the MDS 3080-V. Completely ignore it.
- You can use the submenu “Status” to switch the functions “FixedAdjust” (see paragraph 7.12, page 76) and “FirstDrop” (see paragraph 7.11, page 71) ON or OFF. The current number of cycles can be verified by the function “Cycle Counter”. Error messages concerning the system are shown with the function “Error”.
- In the submenu “Scenario” you can enter values for pre-defined scenarios. Here you can also set the option to work with these scenarios.
- The submenu “Service-Option” is used to enter service codes and to change the baud rate.

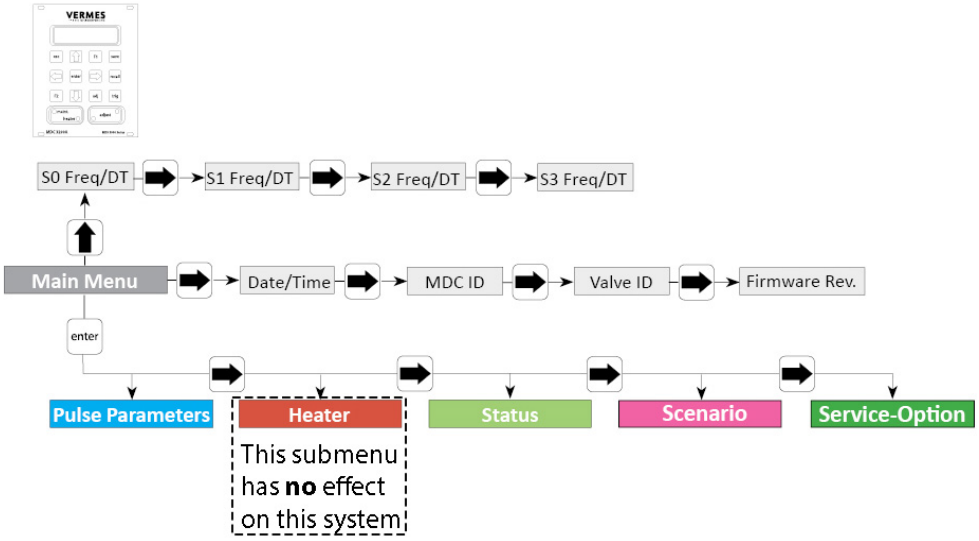


Fig. 3: Main menu

4.5.1 Main Menu

When you switch ON the MDC, you always start in the “Main Menu”. The display shows “3090+” (upper left). With [enter] or **[↓]** you can reach the submenus. For the information on the main level use **[→]** or **[←]**. With **[↑]** you can find information about the frequency and dispensing time (DT) of your scenarios or setups (depending on if scenario is “ON” or “OFF”). All levels are “wrap-around”, i.e. you can circle around between the items with both keys.

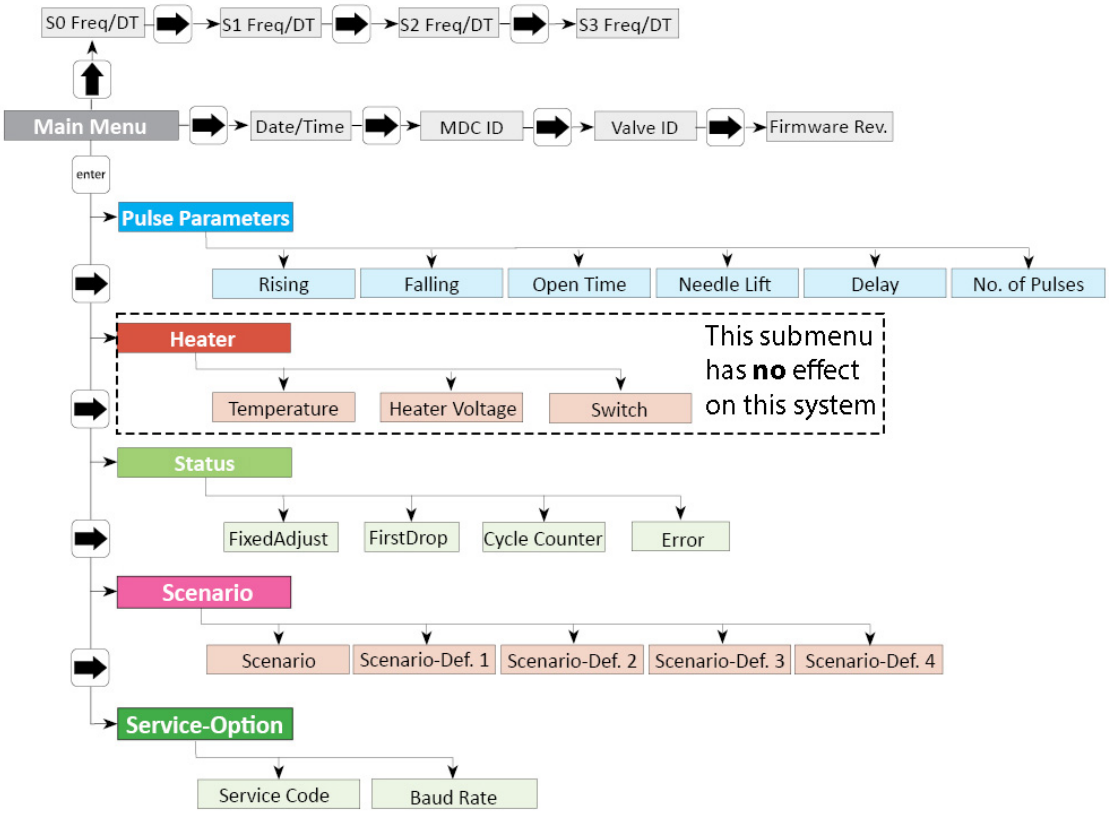


Fig. 4: Menu structure

INFORMATION

Automatic change back to the main menu

On this level, the display jumps automatically back to “3090+”, if you do not press any button for longer than about 10 sec. From the submenus, the display will jump back as well, if no buttons are pressed, but the wait is a bit longer.

In the upper right corner of the display a frequency is shown. This is the dispensing frequency resulting from your current parameter settings. While “Scenario” is “ON”, the word “Scenario” is shown instead (only while entering parameters in the submenu, the frequency is always shown). If you are in one of the submenus, instead of the frequency one or two letters show the submenu you are in (PP = Pulse Parameters, S = Status, Sc = Scenario, SO = Service-Option).

In case the system is in first drop mode (function “FirstDrop” in the submenu “Status” set to “ON”) or fixed adjust mode (function “FixedAdjust” in the submenu “Status” set to “ON”) the second line shows the current TNLmax.

4.5.2 Submenu “Pulse Parameters”

In the submenu “Pulse Parameters”, you can recall and modify dispensing parameters for a particular process. The limits for these parameters you can find in the diagram. For falling and rising, the lower limits depend on the needle lift. You cannot enter values outside these ranges. The dispensing frequency based on the current parameters is shown in the upper right of the display (as long as “Scenario” is switched “OFF” or always while entering parameters in the respective submenu).

INFORMATION

Fixed adjust and first drop mode

If either fixed adjust mode or first drop mode (see paragraph 7.12, page 76and paragraph 7.11, page 71) is “ON”, the parameter “True Needle Lift” is shown instead of “Needle Lift”. It can have a highest value of 80 % for the fixed adjust mode and of 70 % for the first drop mode. If the needle lift at the time of switching is higher than this limit, the value will be changed to this limit. You should not set the TNL to a value larger than the TNLmax. If you do, the red first drop LED (“function”) is “ON”.

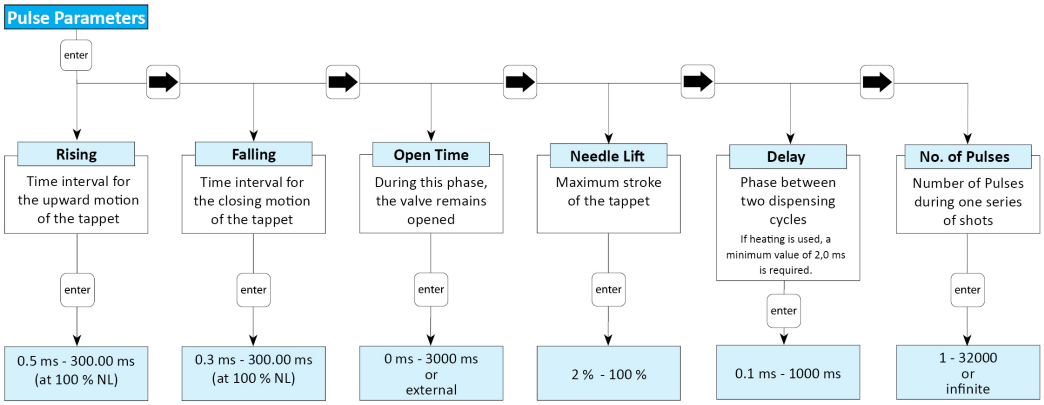


Fig. 5: Submenu „Pulse Parameters“

4.5.3 Submenu “Heater”

Completely ignore the submenu “Heater”! Since there is **no** 230 V heater from VERMES, which would be compatible with the valve MDV 3080-V.

The Microdispensing System MDS 3080-V can only be equipped with a 48 V heater (e.g. the heater MDH-48-BY, order no. 1014231). This heater cannot be controlled via the control unit MDC 3090-V. You will need an external heater controller (e.g. MFC 3000, order no. 1014981, or MHC 48-1, order no. 1014107). You can find more information in paragraph 7.14, page 77.

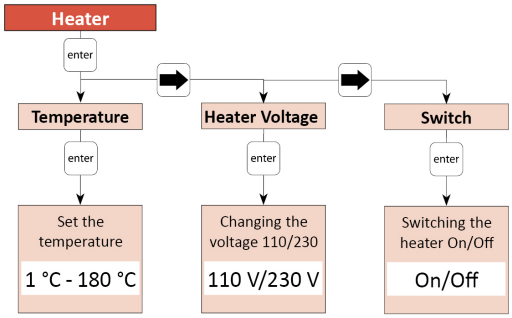


Fig. 6: Submenu “Heater” (inapplicable)

4.5.4 Submenu “Status”

You can use this submenu to switch “FixedAdjust” and “FirstDrop” ON or OFF (see paragraph 7.12, page 76 and paragraph 7.11, page 71). If you switch “ON” either of these modes, the red first drop LED shines until you have performed a successful first drop adjust. If you switch “ON” “FixedAdjust”, you also need to perform a normal adjust.

With “Cycle Counter”, you can check the cycle count of the dispensing cycles.

“Error” shows the latest error messages of the system (up to 50), depending on the system even with date and time (UTC). Help to solve error messages you will find in paragraph 11.2, page 151.

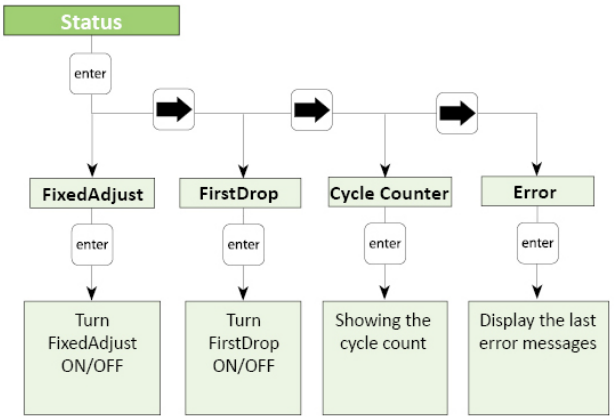


Fig. 7: Submenu „Status“

4.5.5 Submenu “Scenario”

In the submenu “Scenario” you decide if you want to work with scenarios (see paragraph 7.9.1 "Basics about Scenarios", page 66). You can also enter parameters for pre-defined scenarios. Each of the four potential scenarios has its own submenu, where you can set those parameters. The second diagram explains the structure of these submenus. Check there to find the possible limits for those parameters.

With **[→]** and **[←]** you can switch between the four scenarios.

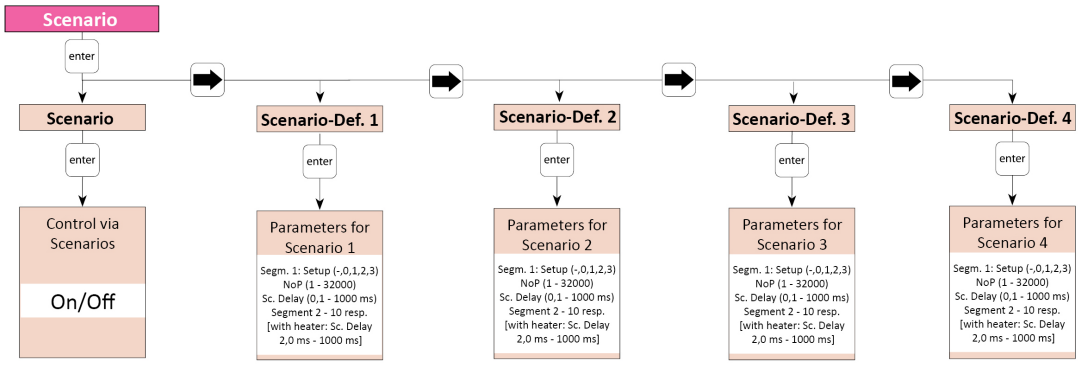


Fig. 8: Submenu “Scenario”

To enter the parameters for a scenario, press **[enter]** on the respective submenu “Scenario-Def.” The structure of these submenus is explained in the picture below (see Fig. 9, page 32).

In “Sc:1.1 Setup” you can enter “0”, “1”, “2” or “3” to select a setup or “-”, to decide that no further segment will follow. “0” is the working configuration, “1” to “3” are the parameters of the respective setups 1 to 3. Then the scenario will end with this segment and the menu will stop here as well. (If you later change the “-” to the number of a setup, the following segment will be unlocked again in the menu.) If you set the blank directly in the first segment, the system will simply use the working configuration instead of the scenario.

After entering a setup and **[→]**, you can select the Number of Pulses next. This NP replaces the one from the setup, which would be otherwise used. Another **[→]** gives the option to enter a scenario delay. Standard value is 10 ms. Just as with the normal delay, with a heater connected to the system the minimum scenario delay increases from 0.1 ms to 2.0 ms.

Another [→] brings you to the second segment in your scenario (“Sc:1.2 Setup”), where you have the same options as with the first. All in all, you can combine up to ten segments (though only four different setups, since only setups 0 to 3 are available), each with its own NP and scenario delay, unless you stop your scenario beforehand by selecting “-” instead of a setup. After the last segment, another [→] brings you the option to set the PLC-Stop “ON” or “OFF”. With “ON” a scenario always ends automatically, once the trigger signal drops to “low”. No further segments of the scenario will be performed. With the PLC-Stop “OFF”, the trigger signal only matters, if the NP in a setup is set as “infinite”. With these parameters will be dispensed until the trigger signal drops to “low”. If the trigger signal is already “low” when reaching the signal, only one pulse will be shot. Then the next segment of the scenario will follow after the scenario delay (unless, of course, it was already the last segment of the scenario).

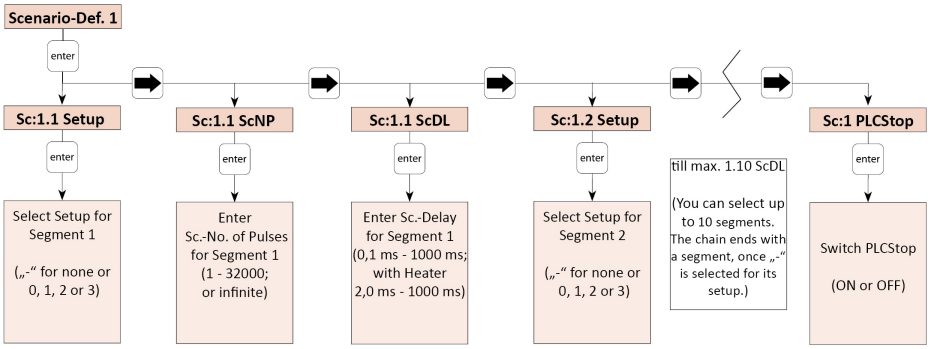


Fig. 9: Submenu “Scenario-Def. 1”

INFORMATION

Finding PLC-Stop quickly

If you just want to change the PLC-Stop setting, but not any of the segments in your scenario, it is quickest to use **[←]** once after entering the scenario, since this submenu is wrap-around, just like all other.

4.5.6 Submenu “Service-Option”

This menu has two sections. In “Service Code”, you can enter a service code. If you enter 2030, you switch ON/OFF the valve check during start-up of the MDC. If you enter 1100, you can switch ON/OFF the control lamps for adjust (see paragraph 4.2 "Front Side", page 21). If you enter 1000, you enter a further submenu containing the options listed in the table below.

“Baud Rate” is used to change the baud rate. There are five possible values: 9600, 19200, 38400, 57600 and 115200 (new MDCs are set to 9600).

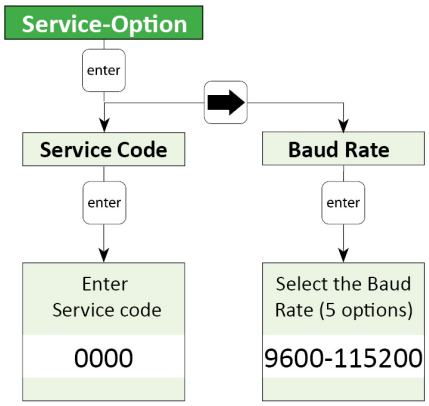


Fig. 10: Submenu „Service-Option“

Option	Explanation
SingleDosOK	You can select between the possibilities that the SingleDosOK signal is switched per pulse or per setup. (For the pin configuration of the PLC inter-face, see paragraph 8.2.1, page 119.)
DosOK with Delay	You can select, if before switching the signal DosOK there should be one delay executed at the end.
Auxiliary Mode	Here the auxiliary mode can be switched ON or OFF (see paragraph 7.13 "Auxiliary Mode", page 76).
Factory Settings	Here any parameters can be returned to the default factory settings (see paragraph 7.10 "Factory Settings", page 69). You have got four alternatives: • Setup 0 – 3 (the parameters of the working configuration and the setups 1 to 3 are returned to the factory settings) • Reset ALL (all parameters are returned, including the settings of the scenarios; also the heater will be turned OFF and the temperature set to 1°C) • Scenario (the parameters and settings of the scenarios are returned to the factory settings) • Setup ALL (the parameters of the working configuration and all setups are returned, setups 4 – 10 receive values of setup 0)

4.6 Memories of the MDC

The MDC contains several memories to save parameter setups.

The first one is the RAM (Random Access Memory). Here the parameters of the current dispense process will be saved. This memory will be erased when the controller is switched of or disconnected from power. When starting again, the MDC will load the first of eleven parameter memory sets saved on the EEPROM (Electrically Erasable Programmable Read Only Memory) into the RAM. This first parameter setup is also called the “EEPROM current working parameter configuration”, or short “working configuration” or “EEPROM working configuration”.

The parameter set in the EEPROM working configuration is usually the same as the parameter set saved in the RAM memory. When using the keypad to program the controller, the two memories will always have the same contents. The only way to create a difference in the parameter set saved in the RAM and in the EEPROM working configuration is by using some special commands through the RS-232C.

The remaining ten EEPROM memory sets can be used to save different parameter setups when programming the controller through the keypad interface (use the command **[Save]**).

In order to change the values saved in the EEPROM working configuration you may use the MDC keypad (enter the parameters in the menu “Pulse Parameters”, then press **[Enter]**).

Alternatively, you may use one of the following commands via RS-232C:

- TRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1
- TRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1
- STRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1
- STRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1

All values transmitted to the control unit by one of the following four commands will not be saved in the EEPROM working configuration.

- TRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>
- TRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>
- STRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>
- STRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>

Instead, it will remain in the RAM memory until erased by another RS-232C command, or when the control unit is switched OFF and the EEPROM is read out into the RAM during restart. The reason for having these two different types of commands (the distinction is the “1” at the end) is that it takes up to 1 sec to save the parameter set in the EEPROM.

On top of the working configuration and the ten parameter setups, there is another parameter setting saved in the software on the EEPROM. This is called the “factory setting”. You cannot change it. It may be loaded to the working configuration and the RAM memory after major disturbances of the system.

Additionally, there is the possibility to save combinations of setups, so called “Scenarios” (see paragraph 7.9 "Scenarios", page 66).

5 Microdispensing Valve

This chapter contains relevant information about the valve. It describes the structure and the hardware configuration.

5.1 Composition of the Valve

The Microdispensing valves of Vermes Microdispensing are modular. A valve is composed of seven different modules:

- Valve body (includes Electronics module and Actuator system) (1)
- Tappet (not visible) (2)
- Tappet sealing (not visible) (3)
- Nozzle insert (not visible) (4)
- Nozzle fixation nut (5)
- Fluid box (6)
- Media supply (7)

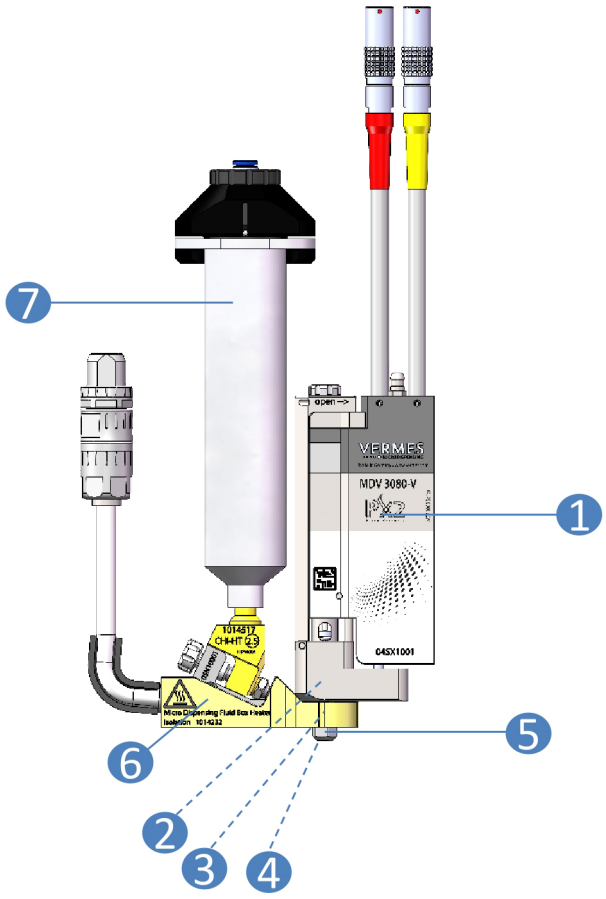


Fig. 11: Composition

The valve body (1) accommodates the electronics module, the actuator system and the adjust screw. The electronics module holds the electronics to receive the actuator and sensor signals. Here are the connectors for sensor cable and actuator cable integrated in the surface of the case; they have to be linked to the control unit. The electronics module is connected to the actuator system, representing the core of the microdispensing valve. The actuator system houses the

sensor, the piezoelectric element and the mechanics to drive the tappet. Actuator case and mechanics are sealed for protection against dust and contamination.

At the bottom of the valve is the inlet where the tappet (2) runs. You can exchange the tappet. Powered by the actuator the tappet moves with high speed back and forth. It hits the dispensing medium and presses it through the opening of the nozzle insert. Tappets can be made of ceramics or of carbide metal. They can have different forms or sizes. A tappet should be checked and cleaned regularly or exchanged if necessary (see paragraph 6.2 "First Assembling of the Valve", page 41). The adjust screw (8; see paragraph 5.2, page 37) is at the top end of the valve body.

The connection between valve body and fluid box is made up of the tappet sealing (3). There are different types of tappet sealings, e.g. the Tappet Sealings PE and PTFE. These tappet sealings have to be used together with a tappet centering piece.

A small but important module is the nozzle insert (4), which has to be considered as a wearing part. Thanks to the bayonet fluid box, it can easily be cleaned and exchanged in case of need. VERMES Microdispensing offers a large selection of different nozzle inserts to allow for optimum dispensing results, according to the current application. They can differ in form and material.

The nozzle fixation nut (5) contains the nozzle insert (NI).

The fluid box (6) contains the Fluid Box Body MDF 1500-BY-40 (order no. 1014538, see Fig. 12). Information how to assemble a fluid box you can find in paragraph 6.2, page 41.

The media supply (7) supplies the dispensing medium and is connected with the fluid box. VERMES Microdispensing has many different configurations available (see paragraph 13.4, page 160). For smaller amounts to be dispensed you can use a cartridge. They come in different sizes and types. For larger amounts, you can use a tube connector to connect a pressure tank with the fluid box.

Fig. 12: Fluid Box Body MDF 1500-BY-40

5.2 Explosion View Valve

The explosion view of an MDV 3080-V.

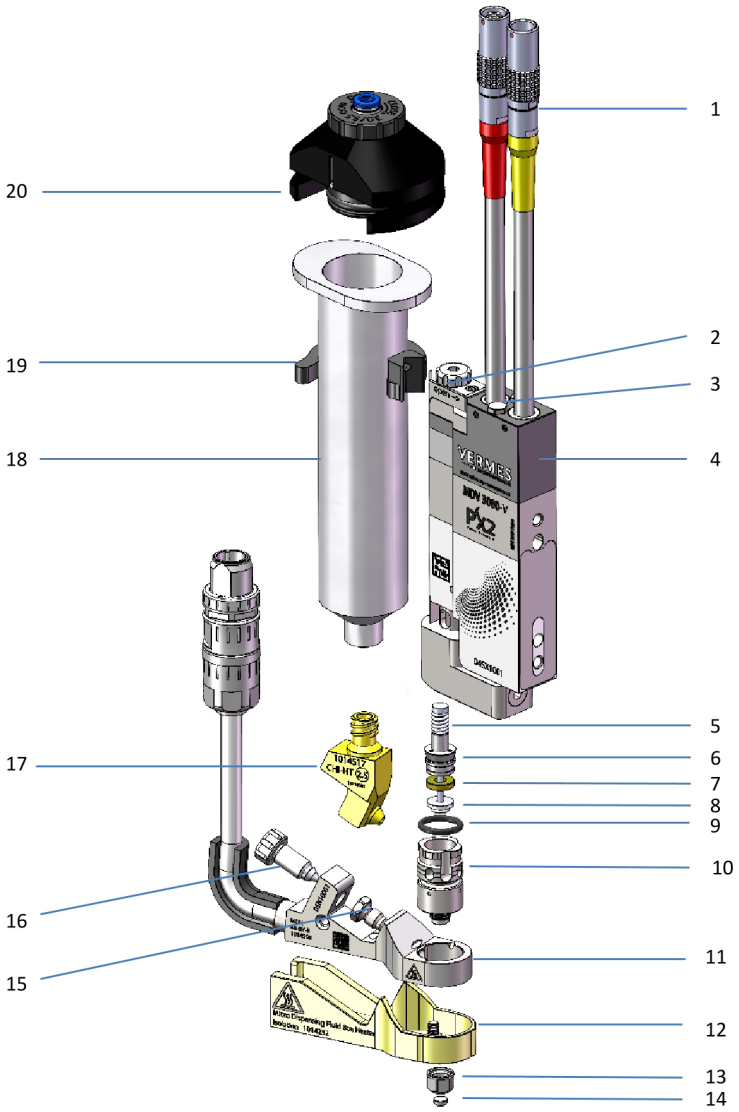


Fig. 13: Explosion view valve

1 Cable connections (red actuator, yellow sensor)
2 Adjust screw
3 Compressed air (in and out)
4 Valve MDV 3080-V
5 Tappet rod with tappet spring
6 Tappet centering screw BY
7 Tappet centering piece
8 Tappet sealing
9 O-ring BY
10 Fluid box body MDF 1500-BY
11 Heater MDH-48-BY
12 Isolation body
13 Nozzle fixation nut
14 Nozzle insert
15 Connector BY
16 Tightening screw
17 Cartridge base CHI
18 Cartridge
19 Cartridge holder
20 Adapter Safe for compressed air (connection for cartridge)

5.3 Technical Data

Parameter	Value
Dispensable Quantity	Minimum 3 nl per cycle
Inlet Pressure Range	Depending on the supply unit (e.g. cartridge or pressure tank)
Dynamic Viscosity of Fluids	Low to medium viscosity up to 8000 mPas
Response Time (PLC-interface)	ca. 96 µs
Dispensing Frequency (max.)	< 2 kHz
Dispensing Frequency (average)	450 Hz
Compatibility	all aqueous fluids, organic solvents, weak acids and bases
Dimensions (basic model)	103 mm x 44 mm x 15 mm
Weight	ca. 260 g (depending on configuration)
Position of Tappet in Absence of Voltage	closed

5.4 Special Features of the Valve

Normally Closed

In its not energized state, i.e. in absence of voltage, the valve remains in closed position, so that the channel of the nozzle insert is blocked by the tappet tip. The liquid in such a situation therefore cannot flow.

With Bayonet Fluid Box

Thanks to the bayonet system, you can remove the fluid box easily from the valve. There are no screws. This allows for a very quick exchange of nozzle fixation nut and nozzle insert or of the tappet for cleaning or maintenance purposes. Afterwards you have to carry out the adjust, in order to establish a convenient position of the nozzle insert with respect to the tappet. This way a reproducible process remains ensured.

Highest Flexibility

Due to the modular design of the series, nozzle units and fluid boxes can be exchanged easily. This allows at any time for a quick adaption of the system configuration to new applications. A comprehensive choice of accessories is also available for special circumstances.

These modifications can be performed in no time, avoiding downtimes for the process.

Functionality Independent of the Position

The functionality of the valves does not depend on the fitting position, considerably simplifying the integration into an existing process.

User-friendly Design

The control unit does not give rise to compatibility problems with respect to the other components of a complex process structure. Service is possible by keypad or, thanks to the integrated RS-232C, by remote PC.

Secure Wiring

The valves are equipped with high-quality Lemo connectors. Those can be connected and disconnected easily, but hold secure against any accidental opening.

Comprehensive Material Selection

Only the best materials are used for the production of Vermes Microdispensing valves.

- All parts in contact with the transported medium consist of high-alloy special steel, rust- and acid-resisting, or modifications of high-duty polymers of the PE (Polyethylene), PEEK (Polyetheretherketone) and PTFE (Polytetrafluoroethylene) family.
- Sealings can be made of different materials. You can find notes regarding heat resistance and chemical resistance in paragraph 9.2, page 130 and paragraph 9.3, page 131.
- For nozzle inserts, special steel, stainless steel and ceramics options are permanently in store, allowing for perfect tailoring of the configuration to the needs of the particular application. E.g. do we recommend using mounting bodies and tightening screws of stainless steel for very low viscosity media.

6 Initial Operation

6.1 Delivery

VERMES systems are shipped in carefully packed state. Transport damages however can never be totally excluded, and deadlines stated in insurance contracts should not be exceeded.

6.1.1 Unpacking

After receiving the merchandise:

– Check the package visually for any kind of damage.

If yes:

Detected damages must be notified to the carrier. As soon as the complaint has been confirmed in writing, contact the responsible forwarder and inform VERMES Microdispensing.

If no damage is detected:

– Open the package.

– Remove any contained subcomponents and parts of the microdispensing system from the package and check the delivery for completeness.

6.1.2 Content

According to the purchase order, the following components may be included; some of them are already preassembled:

1 Control unit MDC	8 MDT 327 – Multi-Function Tool
2 MicroDispensing Valve MDV	9 Mains cable (black)
3 Fluid box*	10 MDT 323 - Nozzle Insert – Squeezing Out Tool TA
4 Nozzle unit*	11 Actuator cable (red)*
5 Nozzle insert*	12 Sensor cable (yellow)*
6 MDT 303 - Nozzle Insert Changing Tool	13 MDT 329 – L-Shape Hexagon Key 2 mm
7 Tappet guard	

*These parts are included only, if ordered explicitly.

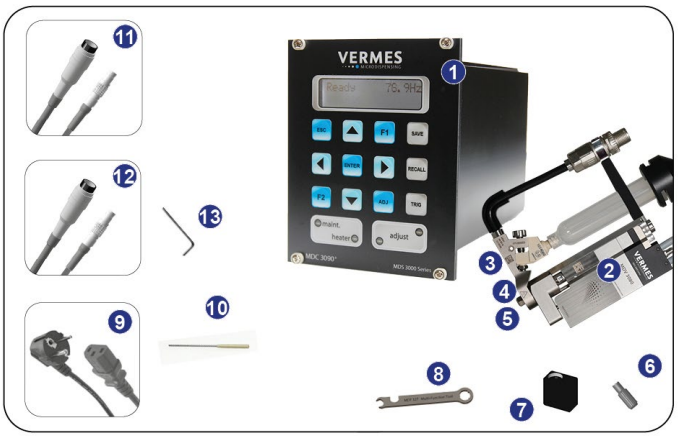


Fig. 14: Content

Options	Recommended options
Different models of fluid boxes Different fluid box connectors Nozzle heating	Cleaning set MDT 301 - Universal Tool MDT 324 – Nozzle Insert Cleaning Holder

If the intended application needs particular accessories (e.g. seals made of special material), consult our Technical Support at once (see Page 7). Do not start the system in incomplete state.

6.2 First Assembling of the Valve

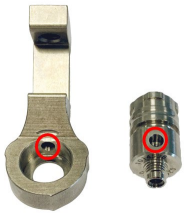
This chapter describes how to ready your microdispensing system for the first dispensing session. Always make sure all screw couplings sit tight (torque values in paragraph 3.3.11, page 19).

INFORMATION

Some parts preassembled

Some elements of the equipment are usually delivered in preassembled state. In those cases, you can omit the respective steps.

Proceed as follows:

Picture	Explanation
 	**Step 1 (fluid box body)** **Information!** This step will be optional, if you re-assemble the valve later, since usually you would not remove the Connector BY from the mounting body. Place the fluid box body on the receptacle of the mounting body. Align the bore on the fluid box body with the bore on the mounting body (see circles in the first picture). The fluid box body will sit in the mounting body.
	Push the Connector BY through the mounting body into the bore of the fluid box body. Screw the Connector BY tight (clockwise) by using an MDT 327 (for newer revisions of the Connector BY you can also use a hexagon key 2.5 or the MDT 306 - Torque Wrench Tool VM with the Bit Hexagon Key 2.5). Torques are depending on the material of the mounting body (stainless steel 120 – 140 cN.m, PEEK 70 – 80 cN.m). **Important Note!** Do **not** press the fluid box body while fastening the Connector BY. Otherwise, the Connector BY cannot correctly grip into the fluid box body.
	**Step 2 (O-ring)** Pull the O-Ring-BY over the fluid box body.

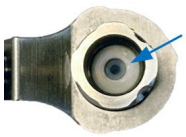
Step 3 (cartridge base)

Mount the cartridge base onto the fluid box. Use MDT 327 or the MDT 306 - Torque Wrench Tool VM with BitVM-A to fix the cartridge base with the tightening screw by screwing clockwise (torque 110 – 120 cN.m).

Important Note!
There are two types of cartridge base: Cartridge Base CH (without integrated luer lock) and Cartridge Base CHI (with integrated luer lock). If you use a Cartridge Base CH, you need to screw the Fluid Box Connector Luer Lock into the top bore of the cartridge base CH. Use the open-ended wrench of the MDT 327 (hexagon screw size M8, torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m).

Step 4 (tappet sealing)

Push the tappet sealing with the wider side down onto the pin of an MDT 328. Push the MDT 328 with the tappet sealing straight into the fluid box. When the tappet sealing sits tight, you will hear a light noise.



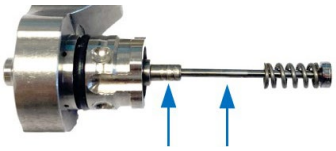
Step 5 (tappet centering piece)

Press the tappet centering piece into the fluid box body. Use the MDT 328 to make sure the tappet centering piece is lying straight on the tappet sealing.

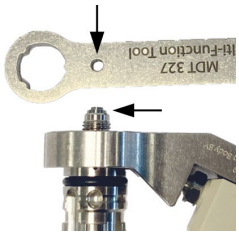
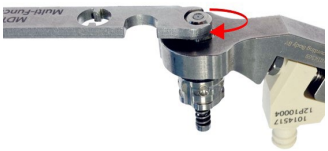
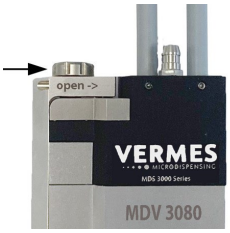
Important Note!
When using a 2G tappet rod, you do not need a tappet centering piece.

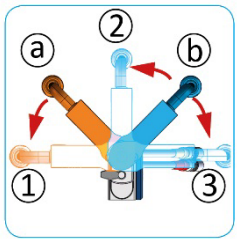
Step 6 (tappet and tappet centering screw)

Screw the Tappet Centering Screw BY into the fluid box. Do not screw it tight yet. Screw it only for two rotations.



Push the tappet rod with the tappet spring slightly into the tappet centering screw. Place a small droplet of Tappet Grease TF (Order no. 1014637; droplet size ca. 2 mm) on the tappet and another on the tappet centering screw (for placing see blue arrows in the picture). Make sure that the tappet tip is free of grease. Rotate the

 	tappet and pull it in and out for three times to spread the grease. Push the tappet spring onto the Tappet Centering Screw BY. Push the tappet rod through the tappet spring into the fluid box. Make sure the tappet goes through the tappet sealing.
	Screw the Tappet Centering Screw BY completely into the fluid box (torque 100 – 140 cN.m). Use MDT 303 - Nozzle Insert Changing Tool. The three small pins of MDT 303 have to fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 clockwise while pressing it down slightly to the fluid box. Combine the MDT 303 with MDT 327 for a better leverage. Alternatively, you can use the MDT 306 with BitVM-B.
	**Step 7 (nozzle insert)** Use tweezers to pick up the nozzle insert and to place it onto the fluid box body. Use the small hole of MDT 327 to press the nozzle insert to make sure the insert sits flat.
	**Step 8 (nozzle fixation nut)** Screw the nozzle fixation nut clockwise onto the fluid box using the MDT 327. Alternatively use the MDT 306 - Torque Wrench Tool VM with Bit Hexagon Socket (torque 150 – 180 cN.m).
	**Step 9 (adjust screw)** Turn the adjust screw completely in the direction “open” using the MDT 327.
	**Step 10 (fluid box)** Push the fluid box carefully in a 45° angle onto the valve. Make sure that the fluid box sits correctly inside the valve and touches the frame. There will be a resistance due to a spring inside the valve.
	Straighten the fluid box until it latches in.



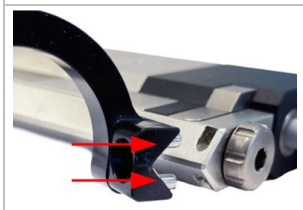
Optional positions

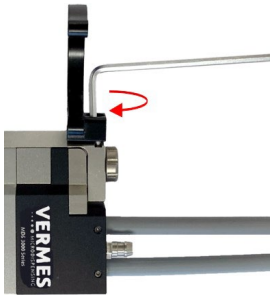
The bayonet fluid box has three locking positions (1: -90°, 2: 0°, 3: +90°) in which the valve can be operated. To fix in locking position 1, mount the fluid box at position a. To fix in locking position 2 or 3, mount the fluid box at position b. Currently, no cartridge holder is available for locking position 1 and 3.

Perform the adjust

You need to perform the adjust now. For details of the adjust process, see **paragraph 6.5, page 52**.

After the adjust is successfully completed, continue with the following steps.





Step 11 (cartridge holder)

Push the cartridge holder onto the top of the valve body, so that the two pins of the cartridge holders sit into the holes of the valve body.
To fix the cartridge holder, screw in the screw of the cartridge holder (torque 25 – 30 cN.m). You need the MDT 329 or a Hexagon Key 2 mm.
Depending on the size of the cartridge, you have to select the correct cartridge holder.

Step 12 (cartridge)

Push the cartridge into the cartridge holder and screw it onto the fluid box (clockwise).

Step 13 (Adapter for compressed air)

Screw the Adapter for Compressed Air onto the cartridge (clockwise).
Make sure it sits tightly.

	**Assembling completed** The completely assembled valve with the fluid box in straight position.

Tab. 17: First assembling of the valve

– Finally, connect the actuator and sensor cables as well as the compressed air. You can find more detailed information in paragraph 6.3, page 46.

6.3 Installation of the Microdispensing System

Prior to installation, verify the conditions in the intended location, with respect to the specification of the system and information detailed in this chapter.

The control unit and the valve have to be installed strictly in conformity with the procedures described below. The system requires:

- Power supply
- Pneumatic supply

INFORMATION

Read chapter "Safety Notes" first

The entire procedure of installation is reserved to persons reliably informed about the safety considerations (see chapter 2, page 8).

6.3.1 Installation of the Control Unit

The control unit is designed as a 19" plug-in module, which has to be fixed in the corresponding rack by means of four pan-head screws at the front side. Leave sufficient space around the unit to simplify service. Ventilation should be available. Recommended are cases complying with enclosures according to EN 61010-1 with regard to fire protection.

IMPORTANT NOTE

Potential damage to the control unit!

Do not close the four pan-head screws too tight; otherwise the front panel can be damaged (see torque table paragraph 3.3.11, page 19).

To avoid overheating and ensure the required ventilation, a minimum distance between the control unit and any other object should be maintained (at least 1.5 cm). Heat should neither be accumulated nor externally be introduced. Do not obstruct natural convection. Ventilation from the bottom side and air exhaust above is important. Minimum width of ventilation openings is 8 cm x 8 cm.

For high-duty applications (from ca. 300 Hz) or in the case of an air-cooled model (AC variants), a rack with separate ventilation is advisable, since in these situations an airflow of 30 m^3/h for each control unit is compulsory.

6.3.2 Installation of the Valve as Part of a Machine

Preferably, mount the valve on an automatic XYZ table or in a similar device (XYZ positioning system). Stable seat at the fixture of Z-axis is imperative, as the valve should not become loose during the dispensing process. For this purpose, insert two M4 hex screws to a depth of 4 mm, through the bores located at the narrow side of the valve. Their distance center to center amounts to 45 mm. To improve accuracy when positioning the valve on a receptacle, additionally use the alignment bore and the long hole, located on the narrow side of the valve as well.

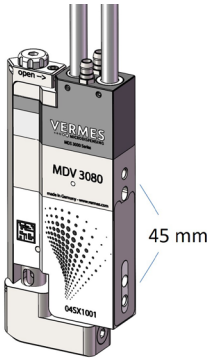


Fig. 15: Distance of the bores 45 mm

IMPORTANT NOTE

Corrosion!

In order to prevent corrosion, all parts used in connection with the valve (screws, fixing plates etc.) should consist of stainless steel, nonferrous metals or galvanized steel.

6.3.3 Wiring of the MDS

The valve is connected to the control unit by means of a four-pin actuator plug (red) and five-pin sensor plug (yellow). The plugs are protected by coding against interchanging by mistake.

⚠ WARNING

Switch off before removing plug

Never attempt to attach or remove one of these plugs, when the system is connected to mains.

⚠ CAUTION

Plan your cable connections carefully

Make sure to plan your cable run carefully, when considering the wiring, especially if the valve is included into a more complex system. Your cables cannot hang too loose, since then they might start to swing and be damaged, because of the vibrations of the valve. On the other hand, you need enough length in your cables, if the valve is moved in the z-axis.

IMPORTANT NOTE

Switch off for connection or disconnection

Before you disconnect the valve from the control unit or connect it to it, switch OFF the whole system.

6.3.3.1 Actuator Cable

Power to the piezo element is supplied by the actuator cable, which is wrapped with a red antikink sleeve. The voltage range is 0 V to 200 V.

Fig. 16: Connecting the actuator cable – step 1

– Step 1: Plug the cable into the correspondingly labeled connector on the rear side of the control unit and screw it in place.

Fig. 17: Connecting the actuator cable – step 2

– Step 2: The other end, equipped with a four-pin LEMO connector (corrugated sleeve), has to be connected to the red marked, looped cable attached to the valve.

INFORMATION

Connecting cables

Verify during the connecting procedure that the red dots on the plugs point towards each other.

INFORMATION

Release latch for disconnection

To secure the connectors there is a latch, which you have to release before disconnection. You have to grip the corrugated outhousing. Pull back the outhousing of the male connector to release the latch (see Fig. 18). Then pull both connectors apart without losing the grip and they will separate.

Do not pull at the cables!

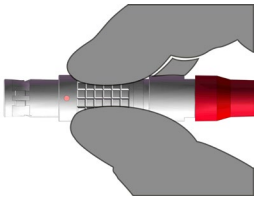


Fig. 18: Connector actuator cable - grip

6.3.3.2 Sensor Cable

This cable wrapped in yellow is provided to transfer data from the sensor integrated in the valve to the control unit. Connect it as described below.

Fig. 19: Connecting the sensor cable – step 1

– Step 1: First, fix the sensor cable to the corresponding socket on the rear side of the control unit.

Fig. 20: Connecting the sensor cable – step 2

– Step 2: The five-pin connector with a corrugated sleeve has to be connected to the yellow marked, looped cable attached to the valve.

INFORMATION

Connecting cables

Verify during the connecting procedure that the red dots on the plugs point towards each other.

INFORMATION

Release latch for disconnection

To secure the connectors there is a latch, which you have to release before disconnection. You have to grip the corrugated outhousing. Pull back the outhousing of the male connector to release the latch (see Fig. 21, page 50). Then pull both connectors apart without losing the grip and they will separate.

Do not pull at the cables!

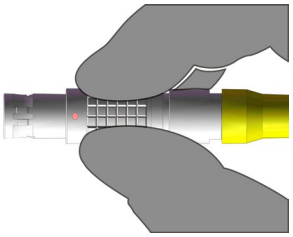


Fig. 21: Connector sensor cable - grip

6.3.3.3 Mains Cable

Power to the control unit is supplied by the black mains cable.

IMPORTANT NOTE

Type plate

Do not connect the system to the mains, before having checked the type plate of the model you want to install (mains voltage, 110 V AC or 230 V AC).

- Step 1: Plug the cable into the socket at the bottom of the rear side of the control unit.
- Step 2: Connect the cable to the power supply.
- Step 3: Press the ON/OFF button, located on the rear side of the control unit.

INFORMATION

Valve not connected

If the valve is not connected, an error message ("199 Valve Error – Escape for Auxi.") appears on the screen. Switch OFF the system, disconnect it from the mains and complete the installation before continuing. Alternatively, you can press the **[ESC]**-key. When confirming it with **[Enter]**, you change into the Auxiliary Mode (see paragraph 7.13, page 76).

6.4 Valves with Air cooling

If you want to air cool your valve with compressed air, you have to connect the air hoses to the compressed air supply after finishing the cable connections of the valve. Use hoses with an inner diameter of 4 mm.

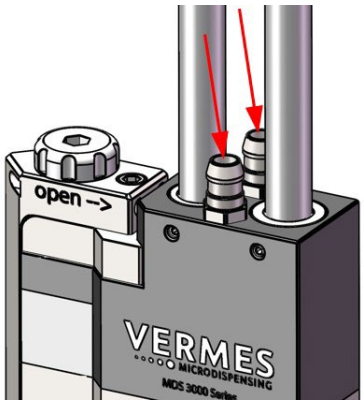


Abb. 22: Valve with air-cooling adapters

The air-cooling adapters are equal. Therefore, it does not matter which one you use as inlet, and which one as outlet. Push end of the hose onto the air inlet of the valve you chose. Connect the other end of the hose to the air supply.

The second connector represents the outlet, evacuating the heated compressed air from the valve. Push one end of the hose onto the connector. When running the hose away from the valve, take care not to impair functions of the system, or to disturb operators during their work.

For air-cooling, you should use a compressed-air pressure of about 2 bar. For a high temperature application, you should set the pressure higher, at up to 4 bar.

IMPORTANT NOTE

Quality of compressed air

Quality of compressed air should comply with DIN ISO 8573-1.

The pneumatic supply used for cooling of the valve should be free of fine dust and condensate and correspond to classes 1, 4, 2 according to DIN/ISO 8573-1.

- Solid particles: max. particle number/m^3: 0.1 – 0.5 µm: < 20000, 0.5 – 1 µm: < 400, 1 – 5 µm: < 10 = Quality class 1
- Water content: max. pressure dew point +3°C = Quality class 4
- Residual oil: max. 0.1mg/m^3 = Quality class 2

6.5 The Adjust Process

This chapter explains the adjust, which for a valve of the MDV 308x series is a top adjust. The adjust is necessary for all valves. A thoroughly performed adjust is the basis for clear and reproducible dispensing results.

This paragraph describes the normal adjust. You can also control the adjust via the serial interface as remote adjust (see paragraph 8.2.3 "Remote Adjust", page 123).

The microdispensing system is unable to perform a regular repeatable process, if the nozzle insert is not properly positioned relatively to the tappet prior to dispensing. Therefore, you have to perform the adjust during initial operation and after each exchange of the nozzle unit. This is especially important to avoid any leakage during dispensing.

IMPORTANT NOTE

Cleaning before adjust

The system has to be cleaned thoroughly before the adjust. The presence of dirt particles jammed between the tappet surface and the nozzle insert would compromise the results. Especially the O-ring-N around the tappet guidance has to be free of grease and dirt (for information regarding the cleaning see paragraph 9, page 129).

IMPORTANT NOTE

Heating and adjust

In case your application uses a nozzle heater, you have to activate the heater before you start the adjust. Make sure to wait long enough for the heater to reach stable temperature, since the adjust could lead to an incorrect result otherwise.

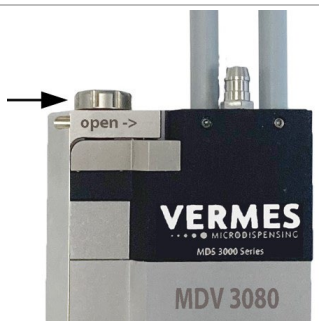
Wear heat-resistant gloves while working with the valve!

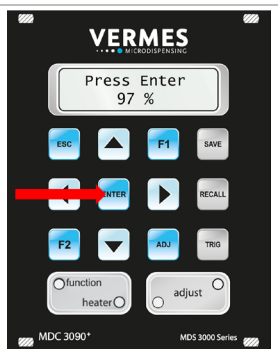
INFORMATION

Abort and end of procedure, fixed adjust mode

- The adjust can be aborted at almost any time by pressing **[esc]**. The exception is when the green adjust LED is ON.
- In fixed adjust mode (see paragraph 7.12, page 76) the range for the adjust is different (0 – 50 µm instead of 0 – 4 µm).
- The range, where the green adjust LED is ON, has for technical reasons a minimum size of 5.8 µm. This range can be expanded by using the serial command “ADJUST:TO:CHANGE:<range>” (see paragraph 14.8 "Changing the Adjust Range", page 174). This change is only recommended for selected applications in the fixed adjust mode. You should contact our technical support first, since sometimes widening the adjust range can lead to leakage despite a successful adjust.

Picture	Explanation

	Preparations for the adjust: 1 Turn the adjust screw by using the tool MDT 327 completely in the direction “open” (see arrow on the valve). Alternatively, you can use the MDT 306 - Torque Wrench Tool VM with Bit VM-A. 2 Mount the tappet. 3 Mount the complete fluid box and the nozzle fixation nut and screw it tight.
	You start the adjust by pressing **[adj]** on the keypad of the control unit.
	The message “Release NU ATT Fluid!!!!!!” appears in the display (NU = Nozzle Unit).
	Confirm by pressing **[enter]** that the adjust screw is completely open.
	The display now shows “Press Enter for 500 Shots”. These shots help to prepare the valve for the adjust. Confirm by pressing **[enter]**.

	The display shows “Calibration Please Wait”. This can take a few moments. Please wait.
	At the end of the calibration, the system tests the performance of the valve. If the performance is below 100 % and therefore unsatisfactory, the display shows for a moment the message “Max Needle Lift” together with a percentage value of the valve performance for the attached valve. In this case, you should send the valve to VERMES Microdispensing GmbH for maintenance. If the quality of the valve is okay, this message will not be shown.
	In the display, the message changes from “Max Needle Lift” to “Press Enter”. Press the **[enter]**-key. If the quality of the valve is okay, this message will **not** be shown. You will reach the next step without pressing **[enter]**.
	The display shows the starting value of the adjust.
	Now turn the adjust screw with the help of tool MDT 327 slowly in the direction “close”, until the green adjust LED is ON. The adjust is possible between 0 µm and 4 µm. (In fixed adjust mode, the adjust is possible between 0 µm and 50 µm.)

	Press the **[enter]**-key, if the green adjust LED is ON.
	If you screw in the adjust screw too far (5 µm or more shown), then the red adjust LED will be ON. Screw back a little bit, until the green adjust LED is ON, and further back, until both LEDs are OFF. Then screw forward again, until the green adjust LED is ON. An adjust can only be confirmed as successful with **[enter]**, while the green adjust LED is ON.
	Once you have completed the adjust successfully, the display returns to the message “3090+ xx Hz”. You are again in the main menu of the MDC. The system is now ready to be filled with the dispensing medium.

Tab. 18: The adjust

6.6 Initial Liquid Supply

- Step 1: If not using a prefilled cartridge, fill an empty one with the required fluid, till up to 80 % of its capacity.
- Step 2: Insert the cartridge into the corresponding holder and screw it onto the Luer-Lock connector, rotating clockwise.
- Step 3: Place the compressed-air adaptor onto the cartridge and rotate clockwise until it latches in place.
- Step 4: Connect the PVC hose with coupler plug KS4-CK-6 to air supply. A coupler socket type KD4-1/2-A is required.
- Step 5: After establishing a convenient dispensing pressure, activate the pneumatic supply.

IMPORTANT NOTE

Check for leakage

All of the parts must be installed correctly, and the entire configuration must be leak-tight – otherwise the dispensing fluid can trickle out in an uncontrolled manner.

Valves designed by VERMES Microdispensing can be operated at a relatively low supply pressure, in the range between 0 bar and 4 bar. This upper limit should not be exceeded in normal applications.

Standard values:

- Low-viscous fluids (e.g. water): 0.5 – 1.5 bar
- Medium viscosity (e.g. SMT-adhesives): 1.5 – 2.0 bar

IMPORTANT NOTE

Do not activate system without dispensing medium

Except for the adjust, do not activate the system “dry” (i.e. without dispensing medium). Otherwise, it might damage the system. For flushing the valve keep within the following limits:

- Needle Lift max. 80
- Falling min. 0.4

6.7 Removing Air Inclusions from the Fluid Box

Air must be removed from the fluid box, for instance after the exchange of a cartridge.

Save the current dispensing parameters beforehand (see paragraph 7.6, page 63).

Confirm the following parameter selection:

Rising 0.5, Open Time 1.5, Falling 0.4, Delay 5–30, Needle Lift 75, Number of Pulses 500–2000

Dispense a quantity of ca. 500 to 2000 shots by pressing **[trig]**.

When this measure is complete, retrieve the initial parameters stored beforehand (see paragraph 7.7, page 63) and start the dispensing process.

6.8 Parameter Input and Start

- Step 1: Enter the dispensing parameters (either recommended by the manufacturer or determined in your own experiments) into the submenu “Pulse Parameters” of the control unit (see paragraph 4.5.2, page 29).
- Step 2: Press **[enter]** to acknowledge the selection.
- Step 3: Return to the first level of the menu by pressing **[esc]** repeatedly.
- Step 4: Start the dispensing process by pressing **[trig]**.

INFORMATION

Starting the dispensing process

A dispensing process can only be initiated in the first menu level by all the usual methods. Starting it in the other menu levels is only possible with the key **[trig**].

7 Operation

7.1 Triggering a Dispense Sequence

There are three different options to trigger a dispense sequence:

- **via keypad on the control unit MDC**

  Press the **[trig]** button, a dispensing sequence with pre-set parameters will be triggered.
- **via RS-232C command**

  Use the command “VALVE:OPEN” (further commands in paragraph 8.1.2, page 84).
- **via PLC-signal**

  Real time triggering by direct I/O (recommended length of signal: between 0.0001 ms and 35 ms; not relevant for Infinite Mode and External Mode)

7.2 Dispensing and Positioning of Dots (Modes)

To combine a multitude of dots to a predefined structure (e.g. a line or a circle), use one of the following modes:

- Burst Mode

  A single trigger impulse by PLC signal causes a predefined number of dispense cycles.

  Number of Pulses: predefined value (e.g. 1–32000)
- Single-Shot Mode

  Each dispense point is triggered by an individual PLC signal. When dispensing a continuous feature (such as a straight line or a circle), the frequency of the dispense trigger signal should be proportional to the trajectory speed of the axis system. This is necessary to achieve a continuous line width.

  Number of Pulses: “1”
- Infinite Mode

– Continuous dispensing as long as the PLC trigger input is “logic 1”. Dispensing will stop when the signal is changed to “logic 0”

– Number of Pulses:

– “infinite” (when programmed through keypad)

– “0” (when programmed through RS-232C)

The parameters Rising, Falling, Delay, Needle Lift and Open Time use the values preset in the menu. Is the PLC trigger signal “logic 1”, the MDC sends dispensing impulses, until the signal changes to “logic 0”.

IMPORTANT NOTE

No dispending at high frequencies for too long

If the valve is used at high frequencies (hundreds of Hertz) for too long, there is a danger of overheating. For this reason, the system is switched OFF automatically after some time. Do not dispense for longer than 12 s without a break, when using these high frequencies.

- Scenario Mode

  A complex set of shots is defined via a scenario. This allows the dispensing even of very complex structures, since up to ten different segments, each with their own set of parameters, can be combined. Four different scenarios can be saved.

  The above mentioned methods for triggering are available.

- External Mode

  The “External Mode” will shift the responsibility of time control of the parameter “Open Time” to the higher-level machine control. (This may require a very precise time control of the higher level PLC.) As a result, the valve would function like a “Time-Pressure-Valve”.

  Activation of the control unit via RS-232C command by changing the pulse parameters. For the External Mode set the Open Time to “external”.

  Number of Pulses: Should be set to “1” (min delay still applies).

  Open Time calculates according to: Length trigger impulse – length Rising = length Open Time

  The parameters Rising, Falling and Needle Lift use the values preset in the menu. When the trigger signal is set to “logic 1”, the valve will open. It will remain open as long as the trigger signal remains on “logic 1”. It will start to close when the trigger signal is switched to “logic 0”. After the valve has completely closed, the controller is ready to receive the next trigger signal to start the process again.

7.3 Parameters for the Dispensing Process

The profile of the system behavior is illustrated below (Y axis = amplitude of the tappet).

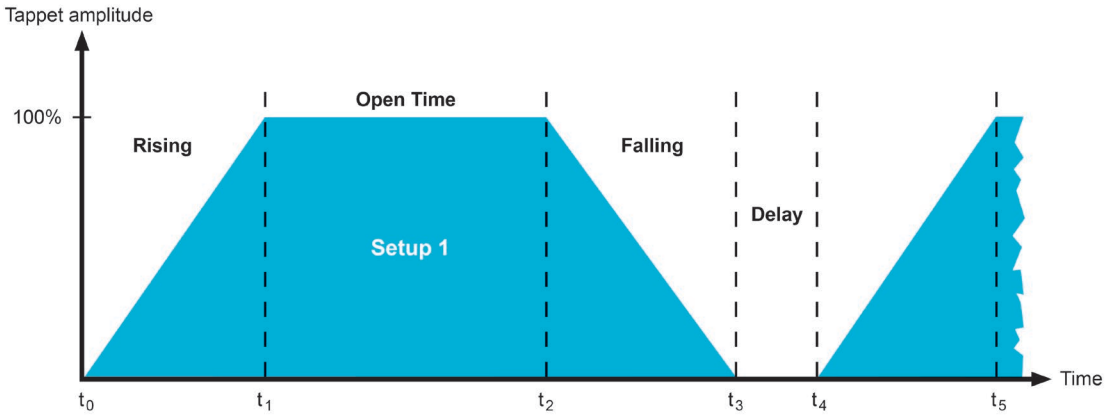


Fig. 23: System behavior

This diagram includes the following parameters.

Parameter	Description
Rising (RI)	This interval describes the time required until the valve is completely opened. It is adjustable in steps of 0.01 ms.
Open Time (OT)	During this phase, the valve remains in opened state. It is adjustable in steps of 0.1 ms. Max. open time = 3000 ms **CAUTION!** When working in External mode, the cycle is initiated with following properties: For rising, falling and needle lift, the values determined beforehand are used. Open time however remains active until the signal returns to the state “logic 0”.
Falling (FA)	The falling ramp of the curve illustrated above represents the time required for closing the valve. Residual fluid meanwhile is expulsed from the nozzle compression chamber (the cavity at the rear end of the nozzle insert). The interval is adjustable in steps of 0.01 ms.

Delay (DL)	This waiting phase between two cycles is adjustable in steps of 0.1 ms, but it is recommended to use at least 0.2 ms. **CAUTION!** For valves operated with connected heating systems, a minimum delay of 2.0 ms is necessary. Lower values can only be achieved, if the heater is operated via an external control unit.
Needle Lift (NL)	This parameter describes the stroke of the tappet, compared to its full value of 100 %.

Tab. 19: Parameters for dispensing

7.4 Minimum and Maximum Parameter Limits

Parameters	Min. Value	Max. Value	Transform. Factor (serial interface)
Rising	NL 2 % = RI 0.01 ms NL 10 % = RI 0.05 ms NL 20 % = RI 0.10 ms NL 30 % = RI 0.15 ms NL 40 % = RI 0.20 ms NL 50 % = RI 0.25 ms NL 60 % = RI 0.30 ms NL 70 % = RI 0.35 ms NL 80 % = RI 0.40 ms NL 90 % = RI 0.45 ms NL 100 % = RI 0.50 ms	300 ms	*10 or *100 e.g. RI = 0.5 ms ≙ 5 or RI = 0.05 ms ≙ 5 (Depends on the command. See the command description in paragraph 8.1.2.2, page 88.)
Falling	NL 2 % = FA 0.01 ms NL 10 % = FA 0.03 ms NL 20 % = FA 0.06 ms NL 30 % = FA 0.09 ms NL 40 % = FA 0.12 ms NL 50 % = FA 0.15 ms NL 60 % = FA 0.18 ms NL 70 % = FA 0.21 ms NL 80 % = FA 0.24 ms NL 90 % = FA 0.27 ms NL 100 % = FA 0.30 ms	300 ms	*10 or *100 e.g. FA = 0.8 ms ≙ 8 or FA = 0.08 ms ≙ 8 (Depends on the command. See the command description in paragraph 8.1.2.2, page 88.)
Open Time	0 ms	3000 ms	*10 e.g. OT = 2 ms ≙ 20
Needle Lift	2 %	100 %	*1 e.g. NL = 50 % ≙ 50
Number of Pulses (NP)	1 pulse	32000 pulses	*1 e.g. NP = 80 ≙ 80
Delay	0.1 ms (2 ms with heater)	1000 ms	*10 e.g. DL = 5 ms ≙ 50
Heater	Target temperature	180 °C	*1 e.g. Temp = 120 °C ≙ 120

Tab. 20: Minimum and maximum parameter limits

IMPORTANT NOTE

Minimum values for Fixed Adjust mode and First Drop mode

The minimum values for Falling and Rising in the table are only correct, if the system is not in fixed adjust mode (see paragraph 7.12, page 76) or first drop mode (see paragraph 7.11, page 71).

In fixed adjust mode, the minimum values for Falling (0.30 ms) and Rising (0.50 ms) are fixed and do not depend on the Needle Lift.

In first drop mode, the minimum values for Falling and Rising are determined by the following formulas:

Min. Falling = (Min. Falling at 100% NL) x (TNL + 30)/100

Min. Rising = (Min. Rising at 100% NL) x (TNL + 30)/100

If this formula results in a value, which cannot be used, it is rounded up to the next possible value (e.g. 0.201 ms would be rounded to 0.21 ms).

7.5 Input of Values

Modification of parameter values is simple. The name of the parameter appears in the upper, the assigned numerical value in the lower line of the screen. If the last digit before the decimal point is flashing, you can modify the value.

- Increase by one by using the **[↑]**-key.
- Correspondingly, the **[↓]**-key reduces the value by one.
- The **[→]**-key shifts the position of the active digit to the right.
- To shift the active position to the left, use the **[←]**-key.

Selection of other values (no numerical values) is performed similarly.

- Use the **[→]**-key or the **[←]**-key to change between ON and OFF.
- An input must be confirmed by [enter], to save the current selection. Then the control returns to the next-higher menu point.
- To cancel without saving the current selection, press **[esc]**. The screen returns to the next-higher menu level.

INFORMATION

Changing numbers

When modifying the first digit of a value from "1" to "0", the cursor automatically jumps one position to the right (if possible). The value in this position is set to 5, but you can modify it.

7.6 Saving Parameter Sets

Ten storage locations are available to save the pulse parameters from the menu.

– Step 1: Open the storage menu by pressing **[save]**.
– Step 2: Select the desired storage location with the arrow keys.
– Step 3: Confirm the selection by pressing **[enter]**.

INFORMATION

[esc] to abort

Pressing **[esc]** causes the saving procedure to be aborted. You can also use the submenu "Pulse Parameters" (see paragraph 4.5.2, page 29) to save parameters.

7.7 Retrieving Parameter Sets

Parameter combinations saved in the system can be recalled any time.

– Step 1: Press **[recall]** to activate the corresponding function.
– Step 2: Select the desired storage location with the arrow keys.
– Step 3: Confirm the selection by pressing **[enter]**.

INFORMATION

[esc] for interrupt

[esc] interrupts the procedure at once.

7.8 Select Pins

Setups can be directly controlled via the select pins of the AUX socket (see Fig. 24), if “Scenario” in the submenu “Scenario” is turned “OFF”. (In case “Scenario” is “ON” and you want to work with the scenarios, please refer to paragraph 7.9.3, page 67.) The select pins allow you to switch in real time between the setups 0 to 3.

INFORMATION

Setup 0 = working configuration

Please be aware that setup 0 is the working configuration and therefore is not programmed additionally.

With the pins Select_I (AUX socket Pin 5) and Select_II (AUX socket Pin 8) it is possible to switch rapidly between different sets of parameters. In their **blank state**, the select pins are on a high level (pull-ups to 24 V). You have to switch them to low (Gnd) to select a different setup (see Fig. 26, page 65 and see Tab. 21, page 65). For additional information regarding the AUX socket, see paragraph 8.3, page 128. You have to switch them before triggering.

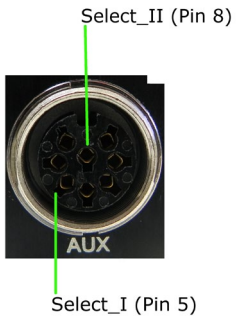


Fig. 24: Select Pins

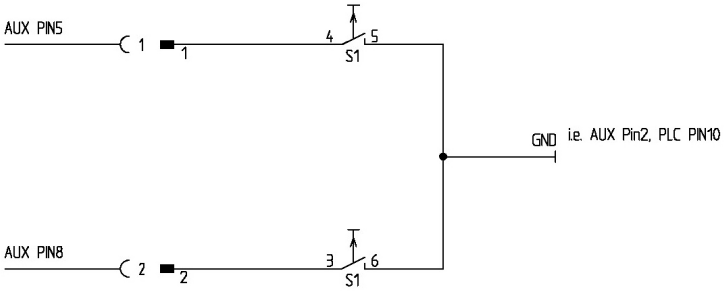


Fig. 25: Schematic of usage of select pins, example

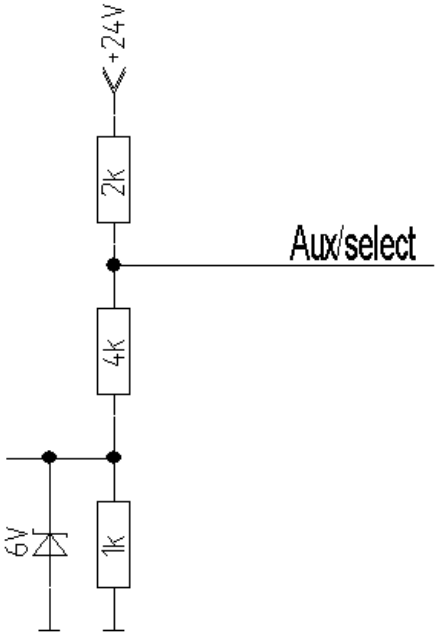


Fig. 26: Circuit diagram

INFORMATION

Select pins with other commands

Select pins will be checked for triggering via PLC interface, for the serial commands VALVE:OPEN, VALVE:AOPEN, SVALVE:OPEN and SVALVE:AOPEN (in the versions without parameters) and when pressing the [**trig**]-key.

Setup	Select_II (Pin 8)	Select_I (Pin 5)
Setup 0	High	High
Setup 1	Low	High
Setup 2	High	Low
Setup 3	Low	Low

Tab. 21: Select Pin settings for the setups

7.9 Scenarios

The MDC does not only allow you to save setups of parameters, but also to define combinations of setups, so called scenarios.

7.9.1 Basics about Scenarios

Each scenario consists of up to ten segments, each with a setup, a specific scenario delay and a Number of Pulses (see Fig. 27). You can define up to four scenarios. You can only choose between the setups 0, 1, 2 and 3. A maximum of ten segments can be chained together, consisting of any possible combination of the four potential setups 0, 1, 2 and 3. As soon as you enter "-" when selecting a segment, the chain ends. No further segments will be shown in the menu. This is possible even for the first segment you select. In that case, the working configuration (setup 0) would be executed instead of the scenario.

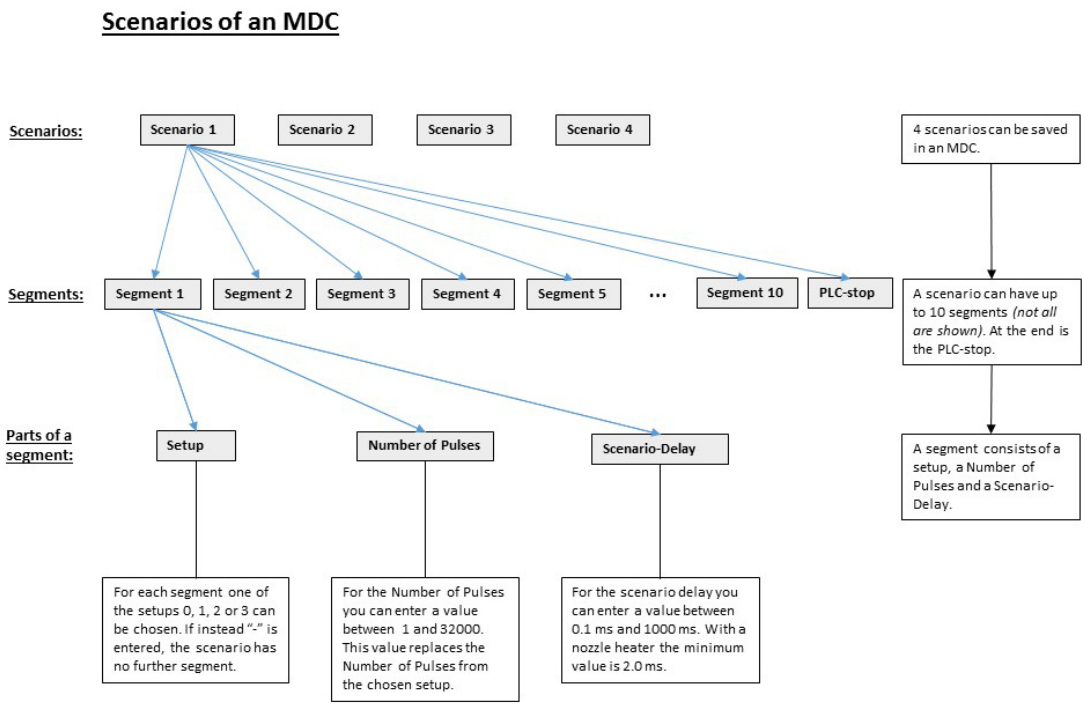


Fig. 27: Scenarios of an MDC

For each segment in a scenario, you can enter a Number of Pulses. For this segment, the number then replaces the Number of Pulses saved with the original setup. The value can be between 1 and 32,000 or "infinite". With "infinite", the trigger signal defines the end.

The scenario delay marks the time span between two segments. It can be set in the range of 0.1 ms and 1000 ms.

INFORMATION

Scenario delay with heater

With a nozzle heater in use, the minimum scenario delay is 2.0 ms, just like the normal delay.

Each scenario has a scenario PLC-stop, which is either "ON" or "OFF". If it is "ON", you can end the scenario prematurely. The moment the trigger switches to "low", the scenario ends. When it is

"OFF", the trigger only affects a segment on "infinite" number of pulses. In that case, once the trigger is switched to "low", the system moves on to the scenario delay, followed by any segments still to come. Unlike the "ON" situation, the scenario does not end immediately.

Scenarios can be controlled in two ways:

- via keypad (see next part)
- with remote commands via the serial interface RS-232C (see paragraph 8.1, page 82)

Scenarios can also be controlled directly via select pins (see paragraph 7.8, page 64). You have to set item "Scenario" of the submenu "Scenario" to "ON". While this is the case, the display shows "Scenario" where it usually shows the frequency.

7.9.2 Entering Scenarios

To enter the parameters for a scenario you have to go to the submenu "Scenario" (see paragraph 4.5.5, page 31). To do so, you have to press **[enter]** in the main menu and then **[←]** twice. Confirm with **[enter]** to reach the item "Scenario". Press **[enter]** and use either **[↑]** or **[↓]** to switch between "ON" and "OFF". Select "ON" and confirm your choice with **[enter]**.

Now you can select the desired scenario with **[→]** (also paragraph 4.5.5, page 31, the diagram for the submenu "Scenario-Def"). Press **[enter]**. Enter the first setup ("0", "1", "2", "3" or "-") and confirm with **[enter]**. With **[→]** you reach "ScNP", where you can enter the Number of Pulses. For the scenario, this value will replace the one saved within the setup. Values can be between 1 and 32,000 or "infinite". Confirm with **[enter]**. With another **[→]** you reach "ScDL", where you can set the scenario delay. Afterwards confirm with **[enter]**.

Repeat with the second segment, and so on, until you have entered all segments you need or until you reached the maximum of ten defined segments. When you want to end the chain, enter "-" instead of the number of a setup. No further segment will be shown in the menu. If you replace a "-" on a given segment with a correct number, it is unlocked. The system starts with the setup NP and 10 ms as Scenario-Delay, but you can change these values individually.

With **[→]** after the last segment you reach "PLCStop" (Scenario-PLC-Stop). After pressing **[enter]** you can switch between "ON" and "OFF" (using any arrow key). Confirm your choice with **[enter]**. (If PLCStop is your only goal in this submenu, it is faster to click **[←]** once on this level. Like all other menus, this is "wrap-around".)

This process you have to repeat for each of the up to four scenarios you want to define.

Scenarios are started with a trigger event. This can be a trigger via keypad, a PLC interrupt or the "Valve Open" command (without parameters) via the serial interface.

INFORMATION

When no scenario is triggered

Valve-Up/-Down via serial interface and the **[F1]** key cannot trigger a scenario.

7.9.3 Scenario Selection with Select Pins

Scenarios can be directly controlled via the select pins of the AUX socket (see Fig. 28, page 68), if "Scenario" in the submenu "Scenario" is turned "ON". If that is not the case, they switch between the setups 0 to 3 instead.

With the pins Select_I (AUX socket Pin 5) and Select_II (AUX socket Pin 8) it is possible to switch rapidly between different sets of parameters. In their blank state, the select pins are on a high level (pull-ups to 24 V). You have to switch one or both to low (Gnd) to select a different setup (see Tab. 22, page 68). You have to switch them before triggering.

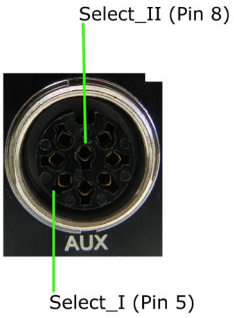


Fig. 28: Select Pins

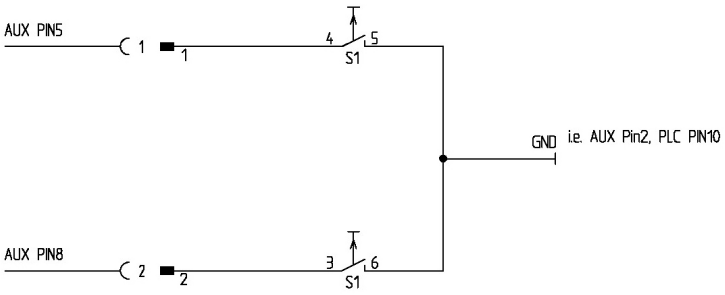


Fig. 29: Schematic of usage of select pins

INFORMATION

Select pins with other commands

Select pins will be checked for triggering via PLC interface, for the serial commands VALVE:OPEN, VALVE:AOPEN, SVALVE:OPEN and SVALVE:AOPEN (in the versions without parameters) and when pressing the key **[trig]**.

You can also simulate the select pin settings for these four commands by using the command extensions “S0”, “S1”, “S2” or “S3” (see paragraph 8.1.2.2 "Explanations", page 88).

Parameters	Select1	Select2	Scenario „OFF“	Scenario „ON“
S0	High	High	Setup 0 (working configuration)	Scenario 1
S1	Low	High	Setup 1	Scenario 2
S2	High	Low	Setup 2	Scenario 3
S3	Low	Low	Setup 3	Scenario 4

Tab. 22: Select Pin settings

7.10 Factory Settings

By recalling the factory settings (implemented by the manufacturer), you return to a predefined starting position. This is useful to start the input of a new parameter set.

These are the values contained in the factory settings:

RI = 0.50 ms, FA = 0.50 ms, OT = 2.0 ms, NL = 70 %, DL = 10.0 ms and NP = 1.

- Step 1: Press **[recall]**.
- Step 2: **[↓]** immediately opens this parameter set.
- Step 3: Confirm the selection with **[enter]**.

INFORMATION

Aborting the process

The working configuration (setup 0) is changed to the factory settings. Press **[esc]** to abort at any time.

The following table lists the factory settings of the setups.

	RI [ms]	OT [ms]	FA [ms]	NL [%]	NP	DL [ms]
Setup 0	0.50	2.0	0.5	70	1	10.0
Setup 1	10.0	4.0	1.4	70	1	10.0
Setup 2	5.0	2.0	2.0	70	10	10.0
Setup 3	4.0	0.6	1.6	70	1	10.0

Tab. 23: Factory settings of the setups

With Setup ALL (see paragraph 4.5.6 "Submenu “Service-Option”", page 33) Setup 4 – 10 get the same values as setup 0 (working configuration).

The factory settings for all four scenarios are the same. The PLCStop is “OFF”, the other parameters are shown in the following table.

Sc.-Segment	Setup used	ScNP	Sc.-Delay
Segment 1	0	as setup NP	10.0 ms
Segment 2	1	as setup NP	10.0 ms
Segment 3	2	as setup NP	10.0 ms
Segment 4	3	as setup NP	10.0 ms
Segment 5	0	as setup NP	10.0 ms
Segment 6	1	as setup NP	10.0 ms
Segment 7	2	as setup NP	10.0 ms
Segment 8	3	as setup NP	10.0 ms
Segment 9	0	as setup NP	10.0 ms
Segment 10	1	as setup NP	10.0 ms

Tab. 24: Factory settings of the scenarios

You can use the menu to reset changed parameters to their factory settings. Go to the submenu “Service-Option” and press **[enter]** at “Service Code“. You can enter the four-digit service code 1000. Confirm it with **[enter]**. Now you can use the keys **[←]** or **[→]** to choose be-tween four options. Go to “Factory Settings” and press **[enter]**. You can either reset the setups 0 – 3, all setups, all scenarios or every parameter (“Reset ALL”, will also turn OFF the heater). You can move

through the four options with the keys **[↑]** and **[↓]**. Confirm your choice with **[enter]** and confirm the whole process with another **[enter]**.

7.11 First Drop

The first drop mode is especially useful, if you want to work parallel with several systems. With the help of first drop you can make sure all values and parameters are comparable. With the first drop adjust you find the exact position, where the tappet does not completely close the nozzle and where you can see the “first drop”. This position depends mainly on the properties of the medium you want to dispense, especially its viscosity.

You can only use the first drop mode, if in the submenu “Status” the function “FirstDrop” is set to “ON” (see paragraph 4.5.4 "Submenu “Status”", page 31). If this is the case, the red first drop LED will be ON, until a successful first drop adjust has been completed.

Before the first drop adjust a normal adjust has to be performed.

IMPORTANT NOTE

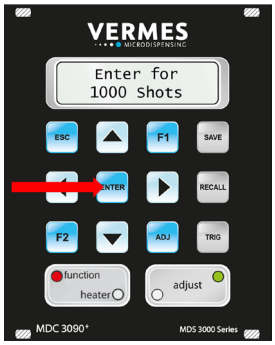
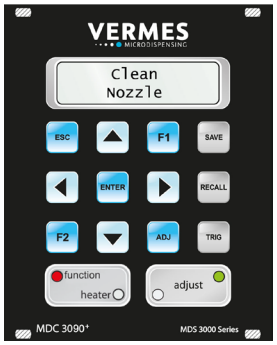
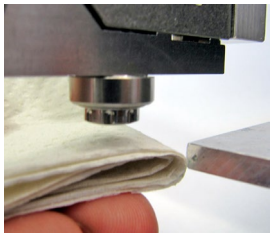
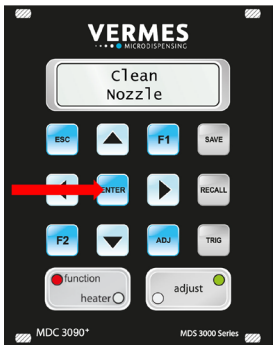
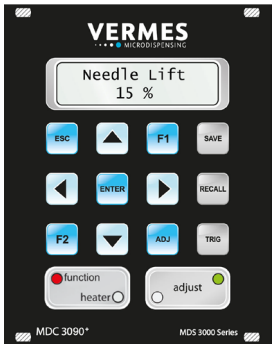
Cancelling the first drop adjust

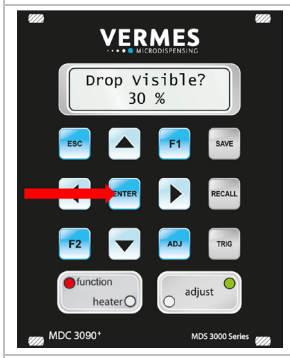
You can cancel the first drop adjust at any time by pressing the [**esc**]-key.

It is possible to alternatively perform the first drop adjust remotely via the serial interface (see paragraph 8.2.4, page 126).

Picture	Explanation
	Before you can start the first drop adjust, you have to switch “FirstDrop” to “ON” in the MDC submenu “Status”. The red LED “function” is now on. The current value of the Needle Lift is taken for the True Needle Lift (TNL). If the value of the Needle Lift is higher than 70 %, the TNL will be set to 70 %.
	You start the first drop adjust by pressing **[F2]** on the keypad of the control unit.
	The message “Fill up with Medium!!!!!” appears in the display.

	Mount the cartridge filled with your dispensing medium and set the required pressure (between 0.5 – 1.0 bar, depending on the medium and its viscosity).
	Confirm by pressing the **[enter]**-key.
	Next 1000 shots have to be dispensed to prepare the valve.
	Place a container of sufficient size below the valve to capture the dispensed medium.

	Confirm by pressing the **[enter]**-key.
	After the 1000 shots have been dispensed, the message “Clean Nozzle” appears. You have to clean the nozzle.
	Use a lintless rag and clean the nozzle. Make sure the lower surface is dry and that no drop appears again after cleaning.
	Confirm the cleaning by pressing the **[enter]**-key.
	The display shows the message “Needle Lift 15 %”. You want to find the position of the tappet, where the nozzle is no longer completely closed by it and a drop of dispense medium can flow out. As the starting value for the Needle Lift 15 % is set.

	You can change the starting value with the help of the arrow keys. The lowest possible value you could set is 2 %. For watery media the value for the first drop is roughly between 20 % and 35 % Needle Lift. You have to be careful. If your starting value is too high and the drop is already visible, you have to start again and select a lower starting value. You confirm the starting value by pressing **[enter]**.
	The display shows the message “Drop Visible?” and the starting value you have selected. Check if there is a drop visible at the lower surface of the nozzle. If yes, you have to re-start the process with a lower starting value. If not, press the **[adj]**-key. The value rises by 1 %. Check again, if there is a drop.
	Repeat these two actions (pressing **[adj]** and checking the nozzle) until there actually is a drop visible at the nozzle (see picture). This is the first drop position for your application.
	Confirm by pressing the **[enter]**-key.
	The display jumps back to the ready message (“3090+”). The second line now shows the TNLmax, the max value of the True Needle Lift. The value is calculated as (100 % - first drop value), but it is capped at 70 %. E.g., a first drop value of 35 % leads to a TNLmax of 65 %, but a first drop value of 25 % leads to a TNLmax of 70 %. In case you perform the first drop adjust in fixed adjust mode (see paragraph 7.12, page 76), the TNLmax will be set to 50 %. The red LED “function” has now been switched off.

Tab. 25: First Drop Adjust

While the system is in first drop mode, the display will always show the TNLmax on the main page. “Needle Lift” in the submenu “Pulse Parameters” will be exchanged for “True Needle Lift”. The True Needle Lift is capped at 70 %. In case the value of the Needle Lift is higher than 70 %, it will be lowered to a True Needle Lift of 70 % when switching to first drop mode.

In first drop mode, the minimum values for Falling and Rising are determined by the following formulas:

Min. Falling = (Min. Falling at 100% NL) x (TNL + 30)/100

Min. Rising = (Min. Rising at 100% NL) x (TNL + 30)/100

If this formula results in a value, which cannot be used, it is rounded up to the next possible value (e.g. 0.201 ms would be rounded to 0.21 ms).

7.12 Fixed Adjust

The fixed adjust is for special applications with media which react with air. A typical example would be cyanoacrylate.

You can only use the fixed adjust mode, if “FixedAdjust” is set to “ON” in the MDC submenu “Status” (see paragraph 4.5.4, page 31).

The fixed adjust is automatically coupled with the first drop mode. Therefore, you cannot select the submenu “FirstDrop ON/OFF”, while “FixedAdjust” is switched “ON”. Since the fixed adjust influences the normal adjust, you will be asked to perform an adjust every time the fixed adjust mode is switched “ON” or “OFF”. It is important to do this, since a correctly performed adjust is a requirement for good dispensing results.

In the fixed adjust mode some parameters for the adjust (see paragraph 6.5, page 52) and the first drop adjust (see paragraph 7.11, page 71) are slightly different. The adjust in fixed adjust mode can be confirmed in a range from 0 µm to 50 µm. For the first drop adjust in fixed adjust mode, TNLmax is set to 50 %. Otherwise, you can follow both processes as usual.

In fixed adjust mode, the function “Needle Lift” in the submenu “Pulse Parameters” is replaced by “True Needle Lift”, but normally keeps the same value. In fixed adjust mode the True Needle Lift is capped at 80 %. In case the value for the Needle Lift is higher than this limit, it will be changed into a True Needle Lift of 80 % when switching into fixed adjust mode.

IMPORTANT NOTE

Minimum values for Falling and Rising in fixed adjust mode

In fixed adjust mode, the minimum values for Falling (0.30 ms) and Rising (0.50 ms) are fixed and do not depend on the needle lift.

7.13 Auxiliary Mode

In this mode, you cannot dispense, since there is no internal communication with the valve. The valve might even be disconnected. But you can use all other functions of the MDC, e.g. check your parameters or control a heater. While in auxiliary mode, the display shows the message “Auxiliary Mode” in the bottom line. Auxiliary mode is automatically deactivated when you switch off the MDC.

You can enter the auxiliary mode through the menu. You have to enter service code “1000” in the submenu “Service Code” which is part of the menu “Service Option” (see paragraph 4.5.6, page 33).

After the error messages 101 (Incorr. Valve) and 199 (Valve Error), you also get the chance to switch to the auxiliary mode. This allows you to keep control of the information and most of the functions of the MDC in such a situation (see chapter 11, page 149).

When an auxiliary mode is activated, it will automatically be deactivated during the start-up of the MDC, if a compatible microdispensing valve is connected.

7.14 Dispensing with a Heater

With a heater, you can control the dynamical viscosity of the fluid to be dispensed. For some liquids, dispensing without heating is impossible. Heating may also be required to ensure a constant process temperature, or when the dispensing has to take place above room temperature.

The Microdispensing System MDS 3080-V can be optionally equipped either with the nozzle heater MDH-48-BY (order no. 1014231) or with the nozzle heater MDH-48-BY-BH (order no. 1015224). For this heater you need an external control unit, for example the Multifunctional controller MFC 3000 (order no. 1014981), which can also control cooling valves, or the MHC 48-1 (order no. 1014107). You can find detailed information about these control units in their respective user manuals.

IMPORTANT NOTE

Turn ON channel at MFC before starting MDC

In case you use an MFC to control a cooling valve, you have to turn ON the respective channel at the MFC, **before** you switch on the MDC.

INFORMATION

MDC 3090-V cannot control MDH-48-BY/MDH-48-BY-BH

With the control unit MDC 3090-V you cannot control a heater of the MDH-48-BY Series. Completely ignore the submenu “Heater” of the MDC and the serial commands for heaters.

⚠ CAUTION

High temperatures, danger of burns

The nozzle heater can reach temperatures of up to 180 °C. Do not touch this area during operation, since there is the danger of severe burns. Afterwards only touch it once it has cooled down and use heat resistant gloves.

7.14.1 The Adjust with Heater

The adjust is necessary to position the nozzle insert to the tappet before beginning with the dispensing process itself. Please perform the adjust for every initial startup and after every disassembly of the nozzle fixation nut. The adjust is especially important to avoid any leakage during dispensing (see also paragraph 6.5, page 52).

IMPORTANT NOTE

Heating and adjust

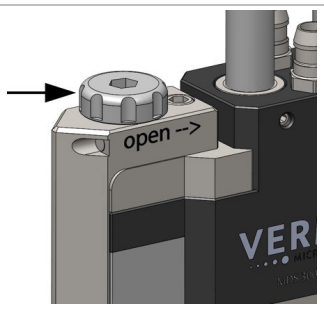
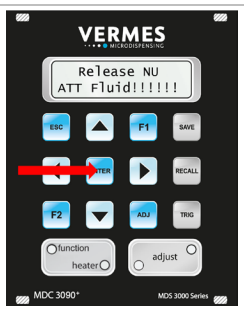
In case your application uses a nozzle heater, you have to activate the heater before you start the adjust. Make sure to wait long enough for the heater to reach stable temperature, since the adjust could lead to an incorrect result otherwise.

Wear heat-resistant gloves while working with the valve!

IMPORTANT NOTE

Adjust only with cleaned system

Make sure the system is always cleaned before you start an adjust. The presence of dirt particles jammed between the tappet surface and the nozzle insert would compromise the results.

Preparation for the Adjust Turn the adjust screw completely in the direction “open” (see arrow on the valve). Screw the nozzle fixation nut absolutely tight (torque for screwing it tight at least 150 cN.m). Turn on the heater and bring the heater to the desired temperature. Wait a few moments for the system to settle in this temperature.	
Step 1 (Starting the adjust) Start the adjust by pressing the **[adj]** -key on the keypad of the control unit.	
The message “Release NU ATT Fluid!!!!!!” appears in the display (NU = Nozzle Unit). Confirm it by pressing the **[enter]**-key.	
The display shows the message “500 Shots – Please Wait”. These shots help to prepare the valve for the adjust. Confirm it by pressing the **[enter]**-key.	
The display shows “Calibration Please Wait”. This can take a few moments. Please wait. If the quality of the valve is okay, you will reach the next step without pressing **[enter]**.	

Information! If the performance of the valve is unsatisfactory. In the display, the message “Max Needle Lift” is shown together with a percentage value in the display. Once the message changes to “Press Enter”, press the **[enter]**-key. In this case, you should send the valve to VERMES Microdispensing GmbH for maintenance.	
Step 2 (turn in the adjust screw) The display shows the starting value of the adjust.	
Now turn the adjust screw with the help of tool MDT 327 slowly in the direction “close”, until the green adjust LED is ON. The adjust is possible between 0 µm and 4 µm. (In fixed adjust mode, the adjust is possible between 0 µm and 50 µm.)	
Step 3 (Find adjust value and confirm it) Press the **[enter]**-key, if the green adjust LED is ON.	
Once you have completed the adjust successfully, the display returns to the message “3090+ xx Hz”. You are again in the main menu of the MDC. The system is now ready to be filled with the dispensing medium.	
Information! If you screw in the adjust screw too far (5 µm or more shown), then the red adjust LED will be ON. Screw back a little bit. An adjust can only be confirmed as successful with **[enter]**, while the green adjust LED is ON.	

IMPORTANT NOTE

Confirming adjust while green LED is ON

Confirming the successful adjust by pressing **[enter]** is only possible, if the green LED is on.

INFORMATION

Further adjust information

- You can always leave the adjust by pressing the **[esc]**-key.
- After the successful adjust, the green LED will go off after approx. 3 s.

7.15 Switching OFF the Microdispensing System

- Step 1: The current dispensing cycle must be completed, so that the valve is in home position.
- Step 2: Lower the supply pressure to atmospheric pressure (because in initial position, the valve is still opened). Disengage the pneumatic supply. If required, close the cartridge by using locking pin MDT 309.
- Step 3: Switch OFF the control unit (ON/OFF button at the rear end). After switching OFF the control unit, please wait a few seconds.
- Step 4: Disconnect the valve from fluid supply.
- Step 5: Remove all cables from the valve.
- Step 6: Unscrew the screws used for fixing the valve in place.

After working with self-curing substances, immediate cleaning is advisable in order to avoid clogging. This concerns the valve itself and all parts in contact with the fluid. The valve and its subcomponents have to be dismantled and cleaned (see chapter 9, page 129).

8 Communication Interfaces

The control unit has three communication interfaces. There is a 9-pin serial interface, RS-232C, a 15-pin PLC-interface and an AUX socket.

8.1 Serial Interface RS-232C: 9-Pin Sub-D

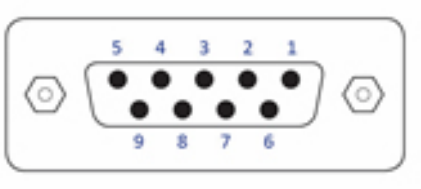


Fig. 30: Serial interface

The local interface is structured according to SCPI Standard.

These “Standard Commands for Programmable Instruments” represent a standardized set of instructions used for control and programming, transmitted in form of ASCII text. They can be generated by any selectable programming language in any environment. The serial interface operates by means of software handshake. The hardware handshake communications are not in use.

INFORMATION

Communication while triggering

Do not send instructions through this interface in the course of a running dispensing cycle. Communication is only possible between distinct sequences (signal DosOK on “high”). This is especially important during start-up of a heater.

After sending data or parameters to the control unit, you have to wait for the “OK” signal before you can start further actions. You only can send data while the MDC is in the main menu.

8.1.1 Pin Functions

PIN	Characteristics	Level	Function
1	Reserved	_____	_____
2	Output	TX	Serial transmission signal
3	Input	RX	Serial reception signal
4			Connected to PIN 6
5	Ground		Ground
6			Connected to PIN 4
7	Reserved	_____	_____
8	Reserved	_____	_____
9	Reserved	_____	_____

The RS-232C log of the control unit uses RS-232C standard and is designed for communication via a serial cable, connected 1:1, with a Sub-D nine pin connector.

The following parameter configuration is used for the communication with the control unit:

- Synchronous mode: Half-duplex
- Bits/s: 9600 – 115200 (5 different options available, see paragraph 4.5.6, page 33)
- Start bit: 1
- String length: 8 bit (ASCII)
- Parity: None
- Stop bit: 1
- Log: None

8.1.2 RS-232C Commands

The available commands are listed below. They are explained on the following pages, together with short examples. This list is according to firmware revision 4071LU1-G.

Each command has to be followed by a line feed (LF, \n, 0x0a) and then a carriage return (CR, \r, 0x0d). It is important to keep to this order!

INFORMATION

Response to commands

The control unit gives a response to every command send to her. Possible answers are:

- A value or set of value, asked for in the command
- OK, to acknowledge a command sent
- NAK ("not acknowledged"), if command sent was incorrect (e.g. incomplete set of values or a value outside the range)
- "NO HEATER", if you send the command "HEATER:1:ON", but there is no heater present.
- "Auxiliary Mode", if you send the command "SYSTEM:SHOW:VALVEID" while the system is in the auxiliary mode.

If there is no response to a command, either the connection is interrupted (e.g. malfunctioning cable or interface) or the command did not end in a carriage return (0x0d).

You can find the reaction times for the commands in the table in the next chapter. The values are noted for the highest and lowest baud rate, since these have a great influence on the times. The length of a response is also influential. There it makes e.g. a big difference with the ESR commands, if there are only a few errors reported or many of them. Please be aware that your hardware also influences the reaction times. Therefore, the given times are only guidelines.

8.1.2.1 Overview

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
1. *ESR? (e.g. 0 errors)	980	640
2. *ESR2? (e.g. 0 errors)	1590	640
3. *IDN?	80	70
4. *OPC?	50	40
5. ADJUST:?	50	40
6. ADJUST:START	400	340
7. ADJUST:TO:CHANGE:<adjust range>	210	190
8. ADJUST:VAL:FA:?	90	70
9. ADJ:VALUES:?	80	70
10. HEATER:?	inapplicable to the system	
11. HEATER:1:OFF	inapplicable to the system	
12. HEATER:1:ON	inapplicable to the system	
13. HEATER:110V	inapplicable to the system	
14. HEATER:230V	inapplicable to the system	
15. KEY:ENTER	60	40
16. KEY:ESCAPE	60	40
17. KEY:ADJUST	60	40
18. HELP	1890	640
19. LCD?	390	340
20. SETADJLED:OFF	90	80
21. SETADJLED:ON	90	80
22. SYSTEM:KLOCK:OFF	50	40
23. SYSTEM:KLOCK:ON	50	40
24. SYSTEM:SHOW:CYCLES	50	40
25. SYSTEM:SHOW:VALVEID	90	70
26. SYSTEM:SHOW:CONTROLLERID	90	70
27. SYSTEM:SHOW:STATUS	690	340
28. SYSTEM:FIRSTDROP:OFF	340	320
29. SYSTEM:FIRSTDROP:ON	200	190
30. SYSTEM:FIRSTDROP:ADJUST:<starting value>	90	70
31. SYSTEM:FIXEDADJUST:OFF	380	380
32. SYSTEM:FIXEDADJUST:ON	380	380
33. SYSTEM:DOSOKDELAY:OFF	80	70
34. SYSTEM:DOSOKDELAY:ON	80	60

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
35. SYSTEM:SINGLEDOSOK:SETUP	80	70
36. SYSTEM:SINGLEDOSOK:PULSE	80	60
37. SYSTEM:PASSWORD:<your password>	60	40
38. SYSTEM:PASSWORD:OFF	80	60
39. SYSTEM:PASSWORD:ON	80	60
40. SYSTEM:PASSWORD:SET:<your password>	80	70
41. SYSTEM:AUXILIARYMODE:ON	130	110
42. TEMP:?	inapplicable to the system	
43. TEMP:<set point in °C>	inapplicable to the system	
44. TRIGGER:SET:?	90	70
45. TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	60	60
46. TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	90	80
47. TRIGGER:ASET:?	380	340
48. TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	70	50
49. TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	100	80
50. STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	100	90
51. STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	130	110
52. STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	400	350
53. STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	430	380
54. VALVE:UP	60	40
55. VALVE:DOWN	60	40
56. VALVE:CHECK:OFF	120	110
57. VALVE:CHECK:ON	120	110
58. VALVE:CHECK:<value>	50	40
59. VALVE:OPEN	60	40
60. VALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	70	50
61. VALVE:OPENS<setup no.>	60	40
62. VALVE:AOPEN	60	40
63. VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	60	50
64. VALVE:AOPENS<setup no.>	60	40
65. SVALVE:OPEN	90	90
66. SVALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	90	80
67. SVALVE:OPENS<setup no.>	90	340
68. SVALVE:AOPEN	390	340
69. SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	400	350
70. SVALVE:AOPENS<setup no.>	80	340

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
71. WRITE:LCD:<text>	60	40
72. SCENARIO:STATUS	680	340
73. SCENARIO:OFF	90	70
74. SCENARIO:ON	80	70
75. SCENARIO:PLCSTOP:1:OFF	100	90
76. SCENARIO:PLCSTOP:1:ON	100	80
77. SCENARIO:SAVE:<scenario no.>:<values>	100	90
78. SCENARIO:READ:<scenario no.>	680	340
79. SETUP:SAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	90	80
80. SETUP:ASAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	90	70
81. SETUP:READ:<setup no.>	100	70
82. SETUP:AREAD:<setup no.>	400	340
83. BAUDRATE:0/1/2/3/4	60	40
84. GETTD	90	70
85. MDC:RESTART	210	190

8.1.2.2 Explanations

1	***ESR?**	**ESR? = Event Status Register Query**	
	Description:	This command shows the latest error codes created by the system, starting with the latest event. At the most 50 error messages will be shown. Each error messages also includes the valve ID (if known) and a time and date stamp. If the RTC of the MDC is defect, the value will be given as "00:00:00 2014-01-01".	
	Example:	Input:	*ESR?
		Result:	List of the (up to 50) latest error messages
		Return:	8 199 VALVE ERROR 08FU04 09:16:38 2018-01-21 9 104 INCORR. VALVE 08FU04 09:16:21 2018-01-21

2	***ESR2?**	**ESR2? = Event Status Register Query 2**	
	Description:	This command shows the latest error codes created by the system, starting with the latest event. There will be shown a max of 50 error messages. Each error messages also includes the valve ID (if known) and a time and date stamp. If the RTC of the MDC is defect, the value will be given as "00:00:00 2014-01-01". Additionally the parameters of setups 0 to 3 before the error are listed.	
	Example:	Input:	*ESR2?
		Result:	List of the (up to 50) latest error messages with parameters
		Return:	20 199 VALVE ERROR 000000 09:16:38 2018-01-21 0, 0, 0, 0, 0, 0 0, 0, 0, 0, 0, 0 0, 0, 0, 0, 0, 0 0, 0, 0, 0, 0, 0 27 104 INCORR. VALVE 08FU04 09:16:21 2018-01-21 30, 5, 30, 80, 1, 20 50, 20, 20, 80, 1, 100 50, 20, 20, 80, 1, 100 50, 20, 20, 80, 1, 100

3	***IDN?**	**IDN? = Identification Query**	
	Description:	Device specific information, formatted as follows: type (hv, or lv), software version. Important for contact with our Technical Support.	
	Example:	Input:	*IDN?
		Result:	Micro Dispenser LV, 4071LU1-D
		Return:	Micro Dispenser LV, 4071LU1-D

4	***OPC?**	**OPC? = Operation Complete Query**	
	Description:	Monitoring the last trigger impulses. After this, the counter is cleared to zero.	
	Example:	Input:	*OPC?
		Result:	Number of the last pulses. Clears the counter to zero.
		Return:	6699

5	**ADJUST:?**		
	Description:	This command is used to verify the success of the adjust. The result consists in one of the following options: • Unknown state (Result: 0) The system is not able to interpret the question and has to be switched OFF and ON again. The adjust must be repeated. This event however is an exception. • The nozzle unit is too far down (Result: 1) You have to screw the adjust screw in the direction “Close”. An adjust is required (or must be repeated). • The adjust was successful (Result: 2) The position of the nozzle insert relatively to the tappet is OK. • The nozzle unit is too far up (Result: 3) You have to screw the adjust screw in the direction “Open”. The adjust must be performed (or repeated).	
	Example:	Input:	ADJUST:?
		Result:	The system informs about the current nozzle position.
		Return:	2 The nozzle is correctly adjusted. Adjust was successful.

6	**ADJUST:START**		
	Description:	Sending this command causes the adjust to be executed at once. This procedure checks on the position of the nozzle insert with respect to the tappet. It is required during each initial start-up and after replacing the nozzle unit. For further information read paragraph 8.2.3, page 123.	
	Example:	Input:	ADJUST:START
		Result:	The adjust is initiated.
		Return:	Release NU Attention Fluid!!!!!

7	**ADJUST:TO:CHANGE:<adjust range>**		
	Description:	This command changes the size of the adjust range, where you can confirm an adjust. The value entered is ten times the value in micrometers. E.g. entering 142 will set the adjust range to 14.2 µm. You can only enter values between 58 and 300 (i.e. 5.8 µm and 30.0 µm). For further information read paragraph 14.8, page 174. **Important Note!** Widening the range too much can lead to a valve leaking even after the adjust. Use the command carefully. It is mostly meant for applications which use the fixed adjust.	
	Example:	Input:	ADJUST:TO:CHANGE:142
		Result:	The adjust range is set to 14.2 µm.
		Return:	OK

8	**ADJUST:VAL:FA:?**		
	Description:	This command gives you the status of the fixed adjust. The two parameters have the following meaning. • Fixed adjust activated? (0 = FA off, 1 = FA on) • Has valve been adjusted with a fixed adjust (0 = not adjusted with fixed adjust, 1 = adjusted with fixed adjust) For further information read paragraph 7.12, page 76.	
	Example:	Input:	ADJUST:VAL:FA?
		Result:	The command gives you the status of the fixed adjust (here: fixed adjust is activated and the last adjust with this valve has been performed as a fixed adjust).
		Return:	1,1

9	**ADJ:VALUES:?**		
	Description:	This command gives you the parameters for the adjust range, where you can confirm the adjust. The five parameters have the following meaning. • Setting in regards to FA/FD (0 = normal, 1 = FA, 2 = FA + FD, 3 = FD) • Adjust values in µm (range 0 – 4 for normal adjust, 0 – 50 for fixed adjust, set during the adjust) • Deviation from the adjust value in µm * 10 (e.g. 23 = deviation by 2.3 µm) • Range where the green adjust LED is ON in µm * 10 (e.g. 82 = 8.2 * 10, meaning a range from +/- 4.1 µm) • LED status (1 = OFF, 2 = green, 3 = red) For further information read paragraph 14.8, page 174.	
	Example:	Input:	ADJ:VALUES:?
		Result:	The command gives you the adjust parameters.
		Return:	2,45,23,142,2

10	**HEATER:?**	
	Description:	Ignore this command since it is inapplicable to this system.

11	**HEATER:1:OFF**	
	Description:	Ignore this command since it is inapplicable to this system.

12	**HEATER:1:ON**	
	Description:	Ignore this command since it is inapplicable to this system.

13	**HEATER:110V**	
	Description:	Ignore this command since it is inapplicable to this system.

14	**HEATER:230V**	
	Description:	Ignore this command since it is inapplicable to this system.

15	**KEY:ENTER**		
	Description:	The acknowledgement signal is transferred to the control unit. This option is only usable in case of errors, which produce a message on the display of the MDC. You can respond with a serial command. Then the function is identical to pressing the **[enter]**-key on the keypad.	
	Example:	Input:	KEY:ENTER
		Result:	The ENTER signal is send.
		Return:	OK (no other reaction of the MDC)

16	**KEY:ESCAPE**		
	Description:	The ESCAPE signal is transferred to the control unit. This option is only usable in case of errors, which produce a message on the display of the MDC. You can respond with a serial command. Then the function is identical to pressing the **[esc]**-key on the keypad.	
	Example:	Input:	KEY:ESCAPE
		Result:	The ESCAPE signal is send.
		Return:	OK (no other reaction of the MDC)

17	**KEY:ADJUST**		
	Description:	The adjust signal is transferred to the control unit. The function is identical to pressing the **[adj]**-key on the keypad. For the remote first drop adjust, this command has the same effect as pressing the **[adj]**-key of the MDC during the F2 adjust.	
	Example:	Input:	KEY:ADJUST
		Result:	The first drop position is increased by 1 %.
		Return:	OK

18	**HELP**		
	Description:	Shows a list with all RS-232C commands. **Information!** The listed commands for heaters do **not** work with this system. Please ignore them!	
	Example:	Input:	HELP
		Result:	List with all RS-232C commands.
		Return:	List with all commands

19	**LCD?**	**LCD? = Liquid-Crystal Display Query**	
	Description:	Use this command to externally inspect the current content of the screen.	
	Example:	Input:	LCD?
		Result:	When sending this command the information on the display will be returned. E.g. immediately after switching the MDC ON, the content of the screen could be “3090+ 200 Hz“.
		Return:	“3090+ 200 Hz”

20	**SETADJLED:OFF**		
	Description:	This command deactivates the control lamps for adjust. This affects the lamps outside of the adjust: • The red adjust-LED is ON, if the MDC detects an error (except for an adjust error) • The green adjust-LED stays OFF During the adjust, the adjust-LEDs work as always. Alternatively, you can deactivate the control lamps for adjust by means of the service code 1100 (see paragraph 4.5.6 "Submenu “Service-Option”", page 33).	
	Example:	Input:	SETADJLED:OFF
		Result:	The control lamps for adjust are deactivated.
		Return:	OK

21	**SETADJLED:ON**		
	Description:	This command activates the control lamps for adjust. This affects the lamps outside of the adjust: • Red: if the MDC detects an error • Green: the valve detects that the adjust value falls inside the adjust range. During the adjust, the adjust-LEDs work as always. Alternatively, you can activate the control lamps for adjust by means of the service code 1100 (see paragraph 4.5.6 "Submenu “Service-Option”", page 33).	
	Example:	Input:	SETADJLED:ON
		Result:	The control lamps for adjust are activated.
		Return:	OK

22	**SYSTEM:KLOCK:OFF (KLOCK = Key Lock)**		
	Description:	Access to keypad is permitted, the locking function disabled.	
	Example:	Input:	SYSTEM:KLOCK:OFF
		Result:	The keypad of the control unit can be used.
		Return:	OK

23	**SYSTEM:KLOCK:ON (KLOCK = Key Lock)**		
	Description:	This command locks the keypad of the control unit. This way, unauthorized modification of parameters can be prevented.	
	Example:	Input:	SYSTEM:KLOCK:ON
		Result:	The keypad is locked.
		Return:	OK

24	**SYSTEM:SHOW:CYCLES**		
	Description:	The current value of the cycle counter is indicated.	
	Example:	Input:	SYSTEM:SHOW:CYCLES
		Result:	Current value of the cycle counter.
		Return:	1235000

25	**SYSTEM:SHOW:VALVEID**		
	Description:	The valve ID is displayed. In case the system is in auxiliary mode, the return is “Auxiliary Mode”.	
	Example:	Input:	SYSTEM:SHOW:VALVEID
		Result:	ID of the connected valve.
		Return:	Valve ID: 10PEA001

26	**SYSTEM:SHOW:CONTROLLERID**		
	Description:	The ID of the control unit is displayed.	
	Example:	Input:	SYSTEM:SHOW:CONTROLLERID
		Result:	ID of the control unit.
		Return:	Controller ID: 12060

27	**SYSTEM:SHOW:STATUS**		
	Description:	This command sends the current status of KeyLock, First Drop, Fixed Adjust, DosOK with Delay, SingleDosOK and Auxiliary Mode. If the status for First Drop or Fixed Adjust is ON, the system sends some extra information like TNL or adjust value.	
	Example:	Input:	SYSTEM:SHOW:STATUS
		Result:	Settings of the above listed items
		Return:	KeyLock: OFF FirstDrop: OFF FixedAdjust: OFF DosOK with Delay: OFF SingleDosOK: per pulse Auxiliary Mode: OFF

28	SYSTEM:FIRSTDROP:OFF		
	Description:	This command deactivates the first drop function.	
	Example:	Input:	SYSTEM:FIRSTDROP:OFF
		Result:	The first drop mode is deactivated.
		Return:	OK

29	SYSTEM:FIRSTDROP:ON		
	Description:	This command activates the first drop function.	
	Example:	Input:	SYSTEM:FIRSTDROP:ON
		Result:	The first drop mode is activated.
		Return:	OK

30	SYSTEM:FIRSTDROP:ADJUST:<starting value>		
	Description:	This command starts the first drop adjust. The starting value is between 2 and 50. Further control of the first drop adjust is done via the commands “KEY:ENTER”, “KEY:ESCAPE” and “KEY:ADJUST”. Details you will find in paragraph 8.2.4, page 126.	
	Example:	Input:	SYSTEM:FIRSTDROP:ADJUST:10
		Result:	The first drop adjust is started.
		Return:	Fill up with Medium!!!!!

31	SYSTEM:FIXEDADJUST:OFF		
	Description:	This command deactivates the fixed adjust function.	
	Example:	Input:	SYSTEM:FIXEDADJUST:OFF
		Result:	The fixed adjust mode is deactivated.
		Return:	OK

32	SYSTEM:FIXEDADJUST:ON		
	Description:	This command activates the fixed adjust function.	
	Example:	Input:	SYSTEM:FIXEDADJUST:ON
		Result:	The fixed adjust mode is activated.
		Return:	OK

33	**SYSTEM:DOSOKDELAY:OFF**		
	Description:	This command deactivates the DOSOK-Delay. When this is true, the length of a delay is not added to the length of the DOSOK signal. (Default setting is “delay OFF”.)	
	Example:	Input:	SYSTEM:DOSOKDELAY:OFF
		Result:	Deactivates the DOSOK-delay.
		Return:	OK

34	**SYSTEM:DOSOKAYDELAY:ON**		
	Description:	This command activates the DOSOK-Delay. When this is true, the length of a delay is added to the length of the DOSOK signal. (Default setting is “delay OFF”.)	
	Example:	Input:	SYSTEM:DOSOKDELAY:ON
		Result:	Activates the DOSOK-delay.
		Return:	OK

35	**SYSTEM:SINGLEDOSOK:SETUP**		
	Description:	This command sets the Single-DOSOK signal to “Setup”. The length of the Single-DOSOK signal is that of the setup. (Default setting is “Pulse”.)	
	Example:	Input:	SYSTEM:SINGLEDOSOK:SETUP
		Result:	The Single-DOSOK is set to “setup”.
		Return:	OK

36	**SYSTEM:SINGLEDOSOK:PULSE**		
	Description:	This command sets the Single-DOSOK signal to “Pulse”. The length of the Single-DOSOK signal is that of a pulse. (Default setting is “Pulse”.)	
	Example:	Input:	SYSTEM:SINGLEDOSOK:PULSE
		Result:	The Single-DOSOK is set to “pulse”.
		Return:	OK

37	**SYSTEM:PASSWORD:<Your password>**		
	Description:	This command sends the 6-digit password to unlock the keypad after a PLC-trigger. Each digit can be either of 1, 2, 3 or 4 (representing the keys "**[**←**]**", "**[**↑**]**", "**[**↓**]**" and "**[**→**]**" resp.)	
	Example:	Input:	SYSTEM:PASSWORD:111111
		Result:	The keypad is unlocked.
		Return:	OK

38	**SYSTEM:PASSWORD:OFF**		
	Description:	This command deactivates the password, which unlocks the keypad after a PLC-trigger.	
	Example:	Input:	SYSTEM:PASSWORD:OFF
		Result:	The password is deactivated.
		Return:	OK

39	**SYSTEM:PASSWORD:ON**		
	Description:	This command activates the password, which unlocks the keypad after a PLC-trigger.	
	Example:	Input:	SYSTEM:PASSWORD:ON
		Result:	The password is activated.
		Return:	OK

40	**SYSTEM:PASSWORD:SET:<Your password>**		
	Description:	This command sets the 6-digit password, which can unlock the keypad after a PLC-trigger. The password is 6-digit, with each digit either of 1, 2, 3 or 4 (representing the keys "**[**←**]**", "**[**↑**]**", "**[**↓**]**" and "**[**→**]**" resp.). The password has to be **exactly** six digits long; anything else would lead to an error.	
	Example:	Input:	SYSTEM:PASSWORD:SET:111111
		Result:	The 6-digit password is set.
		Return:	OK

41	**SYSTEM:AUXILIARYMODE:ON**		
	Description:	This command activates the auxiliary mode. In auxiliary mode, the valve is disconnected. All other functionalities of the MDC can be used and tested. To turn the auxiliary mode OFF, use service code 1000 (see paragraph 4.5.6, page 33) or re-start the MDC with the command MDC:RESTART.	
	Example:	Input:	SYSTEM:AUXILIARYMODE:ON
		Result:	The auxiliary mode is activated.
		Return:	OK

42	**TEMP:?**	**TEMP = temperature**
	Description:	Ignore this command since it is inapplicable to this system.

43	**TEMP:<Set point in °C> (TEMP = temperature)**	
	Description:	Ignore this command since it is inapplicable to this system.

44	**TRIGGER:SET:?**		
	Description:	The pulse parameter set currently present in the RAM is displayed in the following order: Rising, Open Time, Falling, Needle Lift, Number of Pulses, Delay. Parameters relating to time are indicated in 1/10 ms. If the valve is currently operated in external mode, the value for "Open Time" is "EXTERNAL". In infinite mode, the number of pulses is always "0". This command cannot show Falling or Rising values with two decimal places. In those cases the relevant value is rounded to one decimal place. E.g. 0.66 ms is rounded to 0.7 ms (i.e. in the answer the value is given as 7).	
	Example:	Input:	TRIGGER:SET:?
		Result:	Information is given about the current cycle parameters. Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,90,20,8

45	**TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify cycle parameters. Parameters relating to time have to be specified in 1/10 ms. Values lower than "1" are not admissible. The minimum Falling and Rising values depend on the Needle Lift (see paragraph 7.4, page 61). Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command "VALVE:OPEN". **Information:** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the "1" at the end.)	
	Example:	Input:	TRIGGER:SET:10,10,15,90,20,8
		Result:	This assigns the following values to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

46	**TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	This command is used to modify cycle parameters and to save them in the EEPROM in the control unit (reaction time: 200 ms). The entered set thus remains available for future use. (That marks the difference to the command before this one. It is shown in the command line with the "1" at the end.) A trigger signal is not launched, but can be initiated by means of the command "VALVE:OPEN", so that a dispensing cycle with this parameter set immediately starts. Parameters relating to time have to be specified in 1/10 ms. Values lower than "1" are not admissible. The minimum Falling and Rising values depend on the Needle Lift (see paragraph 7.4, page 61). Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value.	
	Example:	Input:	TRIGGER:SET:10,10,15,90,20,8,1
		Result:	The following values are assigned to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

47	**TRIGGER:ASET:?**		
	Description:	This command gives the values for the pulse parameters currently saved in the RAM. The correct order of the values is: Rising, Open Time, Falling, Needle Lift, Number of Pulses, Delay. Parameters relating to time are indicated in 1/10 ms, except for "Falling" and "Rising" which are given in 1/100 ms. If the valve is currently operated in external mode, the value for "Open Time" is "EXTERNAL". In infinite mode, the number of pulses is always "0".	
	Example:	Input:	TRIGGER:ASET:?
		Result:	Information is given about the current cycle parameters. Rising: 55 ≙ 0.55 ms (ms = milliseconds) Open Time: 10 ≙ 1.0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 ≙ 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	55,10,8,80,20,8

48	**TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify pulse parameters without transmitting the trigger signal. The values for both of the parameters “Falling” and “Rising” are specified in steps of 0.01 ms. The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4, page 61). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:AOPEN”. **Information:** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the “1” at the end.)	
	Example:	Input:	TRIGGER:ASET:100,10,150,80,20,8
		Result:	The following values are assigned to the dispensing parameters: Rising: 100 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 150 ≙ 1.5 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

49	**TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	As described pulse parameters can be modified and saved in EEPROM in the control unit (reaction time: 200 ms). (The latter marks the difference to the command before this one. It is shown in the command line with the “1” at the end.) It does not transmit a trigger signal. In this case, both of the parameters “Falling” and “Rising” are specified in steps of 0.01 ms. The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4, page 61). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:AOPEN”.	
	Example:	Input:	TRIGGER:ASET:100,10,150,80,20,8,1
		Result:	The following values are assigned: Rising: 100 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 150 ≙ 1.5 ms Needle Lift: 80 ≙ 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

50	**STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify cycle parameters. If you intend to save this configuration in the EEPROM, refer to the command described next. Parameters relating to time have to be specified in 1/10 ms. Values lower than "1" are not admissible. The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4, page 61). Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command "VALVE:OPEN". This command works just like its "TRIGGER" variant. Only the MDC does not answer with "OK", but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly. **Information:** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the "1" at the end.)	
	Example:	Input:	STRIGGER:SET:10,10,15,90,20,8
		Result:	This assigns the following values to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,90,20,8

51	**STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	This command is used to modify cycle parameters and to save them in the EEPROM in the control unit (reaction time: 200 ms). The entered set thus remains available for future use. (That marks the difference to the command before this one. It is shown in the command line with the "1" at the end.) A trigger command is not launched, but can be initiated by means of the command "VALVE:OPEN", so that a dispensing cycle with this parameter set immediately starts. Parameters relating to time have to be specified in 1/10 ms. Values lower than "1" are not admissible. The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4, page 61). Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. This command works just like its "TRIGGER" variant. Only the MDC does not answer with "OK", but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly.	
	Example:	Input:	STRIGGER:SET:10,10,15,90,20,8,1
		Result:	The following values are assigned to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,90,20,8

52	**STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify pulse parameters without transmitting the trigger signal. The values for both of the parameters “Falling” and “Rising” are specified in steps of 0.01 ms. The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4, page 61). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:AOPEN”. This command works just like its “TRIGGER” variant. Only the MDC does not answer with “OK”, but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly. **Information:** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the “1” at the end.)	
	Example:	Input:	STRIGGER:ASET:55,10,150,80,20,8
		Result:	The following values are assigned to the dispensing parameters: Rising: 55 ≙ 0.55 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 150 ≙ 1.5 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	55,10,150,80,20,8

53	**STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	As described pulse parameters can be modified and saved in EEPROM in the control unit (reaction time: 200 ms). (The latter marks the difference to the command before this one. It is shown in the command line with the "1" at the end.) It does not transmit a trigger command. Both of the parameters "Falling" and "Rising" are specified in steps of 0.01 ms. The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4, page 61). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. The start of a dispensing cycle with the selected parameter configuration is initiated by the command "VALVE:AOPEN". This command works just like its "TRIGGER" variant. Only the MDC does not answer with "OK", but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly.	
	Example:	Input:	STRIGGER:ASET:55,10,150,80,20,8,1
		Result:	The following values are assigned: Rising: 55 ≙ 0.55 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 150 ≙ 1.5 ms Needle Lift: 80 ≙ 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	55,10,150,80,20,8

54	**VALVE:UP**		
	Description:	The valve is opened until it receives the command "VALVE:DOWN" or closes automatically after 2 min. During this phase, other commands are ignored in order to protect the valve.	
	Example:	Input:	VALVE:UP
		Result:	The valve opens.
		Return:	OK

55	**VALVE:DOWN**		
	Description:	This command closes the valve. It is the only command accepted in a "VALVE:UP" phase. In other situations, it has no effect.	
	Example:	Input:	VALVE:DOWN
		Result:	The valve closes.
		Return:	OK

56	**VALVE:CHECK:OFF**		
	Description:	This command deactivates the valve check at the start-up of the MDC, during which the valve is opened very shortly. The default setting for the valve check is “ON”. **Information:** Even if the valve check is set to “OFF”, you can perform an immediate valve check with the command VALVE:CHECK:<value>.	
	Example:	Input:	VALVE:CHECK:OFF
		Result:	The valve check will not be performed at the start-up of the MDC.
		Return:	OK

57	**VALVE:CHECK:ON**		
	Description:	This command activates the valve check at the start-up of the MDC, during which the valve is opened very shortly. The default setting for the valve check is “ON”.	
	Example:	Input:	VALVE:CHECK:ON
		Result:	The valve check will be performed at the start-up of the MDC.
		Return:	OK

58	**VALVE:CHECK:<value>**		
	Description:	This command causes an immediate valve check, during which the valve is opened very shortly. As parameter you enter the Needle Lift to use for the check. You can enter a value between 1 and 100. This value will correspond directly to the Needle Lift. In case you enter a value above 100, the response will be “NAK”. In case the command is send correctly, but the valve check cannot be performed for technical reasons, the response is “NOT OK”. **Information:** Even if the valve check is set to “OFF”, you can perform an immediate valve check with the command VALVE:CHECK:<value>.	
	Example:	Input:	VALVE:CHECK:30
		Result:	The system immediately starts a valve check with a Needle Lift of 30.
		Return:	OK

59	**VALVE:OPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated (see paragraph 7.8, page 64), the setup (or scenario) is determined by them. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:OPEN
		Result:	The system launches a dispensing cycle, using the parameters given by the working configuration, scenario 1 or the select pins, respectively (for further information about scenarios and the select pins, see paragraph 7.9, page 66). Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated, the setup (or scenario) is determined by them.
		Return:	OK

60	**VALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Time parameters have to be specified in 1/10th ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. Parameters previously entered by “TRIGGER:SET” are not erased. The values entered by “VALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>”, are valid only until the end of the dispensing cycle. If you intend to use the combination several times, the complete command has to be repeated at the beginning of each single cycle. In such a situation it would be more practical to use the “TRIGGER:SET” command instead, since the cycle in this case can be reactivated simply by “VALVE:OPEN”. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:OPEN: 30,10,15,90,20,8
		Result:	The dispensing cycle contains the following values: Rising: 30 ≙ 3.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

61	**VALVE:OPENS<setup no.>**		
	Description:	This command initiates a dispensing cycle with the parameter combination of the setup (or scenario) indicated in the command. You decide to dispense with the parameters of a specified setup (or scenario, if SCENARIO is "ON"), by using one of the following command extensions: • S0 - uses parameters of setup 0 (or scenario 1 with SCENARIO „ON") • S1 - uses parameters of setup 1 (or scenario 2 with SCENARIO „ON") • S2 - uses parameters of setup 2 (or scenario 3 with SCENARIO „ON") • S3 - uses parameters of setup 3 (or scenario 4 with SCENARIO „ON") These parameters are used even with activated select pins. As an example, to dispense with the parameters of setup 2 you have to enter the following command: VALVE:OPENS2 For this example, SCENARIO has to be "OFF" in the menu. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:OPENS2
		Result:	The system launches a dispensing cycle, using the parameters given by the selected setup (or scenario; for further information about scenarios and the select pins see paragraph 7.9, page 66).
		Return:	OK

62	**VALVE:AOPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated (see paragraph 7.8, page 64), the setup (or scenario) is determined by them. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:AOPEN
		Result:	The system launches a dispensing cycle, using the parameters given by the working configuration, scenario 1 or the select pins, respectively (for further information about scenarios and the select pins, see paragraph 7.9, page 66). Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated, the setup (or scenario) is determined by them.
		Return:	OK

63	**VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	With this command, both of the parameters “Rising” and “Falling” are specified in steps of 1/100 ms, in contrast to the other time parameters (1/10 ms). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. Parameters previously entered by “TRIGGER:SET” or “TRIGGER:ASET” are not erased, but the combination remains in the system only until the end of the cycle. If you do not wish to reenter the entire command several times, the “TRIGGER:ASET” command is advantageous. This way the cycle can be reactivated simply by “VALVE:AOPEN”. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:AOPEN: 30,10,15,80,20,15
		Result:	The dispensing cycle contains the following values: Rising: 30 ≙ 0.3 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	OK

64	**VALVE:AOPENS<setup no.>**		
	Description:	This command initiates a dispensing cycle with the parameter combination of the setup (or scenario) indicated in the command. You decide to dispense with the parameters of a specified setup (or scenario, if SCENARIO is “ON”), by using one of the following command extensions: • S0 - uses parameters of setup 0 (or scenario 1 with SCENARIO „ON“) • S1 - uses parameters of setup 1 (or scenario 2 with SCENARIO „ON“) • S2 - uses parameters of setup 2 (or scenario 3 with SCENARIO „ON“) • S3 - uses parameters of setup 3 (or scenario 4 with SCENARIO „ON“) These parameters are used even with activated select pins. As an example, to dispense with the parameters of setup 2 you have to enter the following command: VALVE:AOPENS2 For this example, SCENARIO has to be “OFF” in the menu. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:AOPENS2
		Result:	The system launches a dispensing cycle, using the parameters given by the selected setup (or scenario; for further information about scenarios and the select pins, see paragraph 7.9, page 66).
		Return:	OK

65	**SVALVE:OPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated (see paragraph 7.8, page 64), the setup (or scenario) is determined by them. This command works just like its "VALVE" variant. Only the MDC does not answer with "OK", but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:OPEN
		Result:	The system launches a dispensing cycle, using the parameters given by the working configuration, scenario 1 or the select pins, respectively (for further information about scenarios and the select pins, see paragraph 7.9, page 66). Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated the setup (or scenario) is determined by them.
		Return:	30,10,15,80,20,8

66	**SVALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Time parameters have to be specified in 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. You have to include all six setup parameters. Parameters previously entered by "TRIGGER:SET" are not erased. The values entered by "SVALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>", are valid only until the end of the dispensing cycle. If you intend to use the combination several times, the complete command has to be repeated at the beginning of each single cycle. In such a situation it would be more practical to use the "TRIGGER:SET" command instead, since the cycle in this case can be reactivated simply by "SVALVE:OPEN". This command works just like its "VALVE" variant. Only the MDC does not answer with "OK", but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:OPEN: 30,10,15,90,20,8
		Result:	The dispensing cycle contains the following values: Rising: 30 ≙ 3.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms

		Return:	30,10,15,90,20,8

67	**SVALVE:OPENS<setup no.>**		
	Description:	This command initiates a dispensing cycle with the parameter combination of the setup (or scenario) indicated in the command. You decide to dispense with the parameters of a specified setup (or scenario, if SCENARIO is "ON"), by using one of the following command extensions: • S0 - uses parameters of setup 0 (or scenario 1 with SCENARIO „ON") • S1 - uses parameters of setup 1 (or scenario 2 with SCENARIO „ON") • S2 - uses parameters of setup 2 (or scenario 3 with SCENARIO „ON") • S3 - uses parameters of setup 3 (or scenario 4 with SCENARIO „ON") These parameters are used even with activated select pins. As an example, to dispense with the parameters of setup 2 you have to enter the following command: SVALVE:OPENS2 For this example, SCENARIO has to be "OFF" in the menu. This command works just like its "VALVE" variant. Only the MDC does not answer with "OK", but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:OPENS2
		Result:	The system launches a dispensing cycle, using the parameters given by the selected setup (or scenario; for further information about scenarios and the select pins, see paragraph 7.9, page 66).
		Return:	50,20,20,80,1,10

68	**SVALVE:AOPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated (see paragraph 7.8, page 64), the setup (or scenario) is determined by them. This command works just like its "VALVE" variant. Only the MDC does not answer with "OK", but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:AOPEN

		Result:	The system launches a dispensing cycle, using the parameters given by the working configuration, scenario 1 or the select pins, respectively (for further information about scenarios and the select pins, see paragraph 7.9, page 66). Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 31), then the parameters of scenario 1 are chosen. If the select pins are activated, the setup (or scenario) is determined by them.
		Return:	30,10,15,80,20,15

69	**SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	With this command, both of the parameters “Rising” and “Falling” are specified in steps of 1/100 ms, in contrast to the other time parameters (1/10 ms). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. Parameters previously entered by “TRIGGER:SET” or “TRIGGER:ASET” are not erased, but the combination remains in the system only until the end of the cycle. If you do not wish to reenter the entire command several times, the “TRIGGER:ASET” command is advantageous. This way the cycle can be reactivated simply by “SVALVE:AOPEN”. This command works just like its “VALVE” variant. Only the MDC does not answer with “OK”, but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:AOPEN: 30,10,15,90,20,8
		Result:	The dispensing cycle contains the following values: Rising: 30 ≙ 0,3 ms (ms = Millisecond) Open Time: 10 ≙ 1,0 ms Falling: 15 ≙ 0,15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	30,10,15,90,20,8

70	**SVALVE:AOPENS<setup no.>**		
	Description:	This command initiates a dispensing cycle with the parameter combination of the setup (or scenario) indicated in the command. You decide to dispense with the parameters of a specified setup (or scenario, if SCENARIO is "ON"), by using one of the following command extensions: • S0 - uses parameters of setup 0 (or scenario 1 with SCENARIO „ON") • S1 - uses parameters of setup 1 (or scenario 2 with SCENARIO „ON") • S2 - uses parameters of setup 2 (or scenario 3 with SCENARIO „ON") • S3 - uses parameters of setup 3 (or scenario 4 with SCENARIO „ON") These parameters are used even with activated select pins. As an example, to dispense with the parameters of setup 2 you have to enter the following command: SVALVE:AOPENS2 For this example, SCENARIO has to be "OFF" in the menu. This command works just like its "VALVE" variant. Only the MDC does not answer with "OK", but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:AOPENS2
		Result:	The system launches a dispensing cycle, using the parameters given by the selected setup (or scenario; for further information about scenarios and the select pins, see paragraph 7.9, page 66).
		Return:	50,20,20,80,1,10

71	**WRITE:LCD:<text> (LCD = Liquid-crystal display)**		
	Description:	With this command, an ASCII text including up to 32 characters can be written on the screen. All the letters appear in form of capital letters.	
	Example:	Input:	WRITE:LCD:Hello World
		Result:	The display shows: HELLO WORLD
		Return:	OK

72	**SCENARIO:STATUS**		
	Description:	This command tells if scenarios are “ON” or “OFF”. It also gives this information for the four PLC-Stops.	
	Example:	Input:	SCENARIO:STATUS
		Result:	Gives the ON/OFF status for scenarios and the four PLC-Stops.
		Return:	Scenario: OFF PLCSTOP Scenario 1: OFF PLCSTOP Scenario 2: OFF PLCSTOP Scenario 3: OFF PLCSTOP Scenario 4: OFF

73	**SCENARIO:OFF**		
	Description:	This command deactivates the use of scenarios.	
	Example:	Input:	SCENARIO:OFF
		Result:	Use of scenarios is deactivated.
		Return:	OK

74	**SCENARIO:ON**		
	Description:	This command activates the use of scenarios.	
	Example:	Input:	SCENARIO:ON
		Result:	Use of scenarios is activated.
		Return:	OK

75	**SCENARIO:PLCSTOP:<Scenario no.>:OFF**		
	Description:	This command deactivates the PLC-Stop. The number of the scenario can be either 1, 2, 3 or 4.	
	Example:	Input:	SCENARIO:PLCSTOP:1:OFF
		Result:	PLC-Stop for scenario 1 is deactivated.
		Return:	OK

76	**SCENARIO:PLCSTOP:<Scenario no.>:ON**		
	Description:	This command activates the PLC-Stop. The number of the scenario can be either 1, 2, 3 or 4.	
	Example:	Input:	SCENARIO:PLCSTOP:1:ON
		Result:	PLC-Stop for scenario 1 is activated.
		Return:	OK

77	**SCENARIO:SAVE:<Scenario no.>:<Segment 1 Setup, Segment 1 Number of Pulses, Segment 1 Scenario-Delay, Sg. 2 Setup, Sg. 2 NP, Sg. 2 Dl., Sg. 3 Setup, Sg. 3 NP, Sg. 3 Dl., Sg. 4 Setup, Sg. 4 NP, Sg. 4 Dl., Sg. 5 Setup, Sg. 5 NP, Sg. 5 Dl., Sg. 6 Setup, Sg. 6 NP, Sg. 6 Dl., Sg. 7 Setup, Sg. 7 NP, Sg. 7 Dl., Sg. 8 Setup, Sg. 8 NP, Sg. 8 Dl., Sg. 9 Setup, Sg. 9 NP, Sg. 9 Dl., Sg. 10 Setup, Sg. 10 NP, Sg. 10 Dl.>**		
	Description:	This command saves the parameters of the given scenario. You only have to enter parameters for the segments actually used. For every such segment, you have to give the setup number, the number of pulses and the scenario delay. The parameters will be checked. Not enough parameters or illegal ones will result in cancellation. Therefore, you always have to enter complete segments with setup number, NP and Sc. delay. You can enter a maximum of ten segments. The scenario number can be 1, 2, 3 or 4, a setup number 0, 1, 2 or 3. The NP can be between 1 and 32000 or 0, which would mean "infinite". The scenario delay will be given in 1/10 ms, i.e. 5 means 0.5 ms. The max delay is 1000.0 ms, min delay is 0.1 ms (with heater 2.0 ms). To delete a scenario use the version "**SCENARIO:SAVE:<scenario no.>:-**".	
	Example:	Input:	SCENARIO:SAVE:1:0,1,5,1,2,5,2,3,5,3,4,5,0,5,5,1,6,50,2,7,50,3,8,50,0,9,50,1,10,50
		Result:	The scenario parameters of scenario 1 are saved.
		Return:	OK

78	**SCENARIO:READ:<scenario no.>**		
	Description:	This command gives you the scenario parameters of the named scenario via the serial interface. The response follows the scheme "setup no. of segment 1, number of pulses of segment 1, scenario delay of segment 1, setup no. of segment 2, NP of segment 2, sc. delay of segment 2, …, sc. delay of segment 10". The scenario delay is given in 1/10 ms. The value 50 e.g. represents 5 ms. Only the used segments of the scenario are given, the others are left out in the output.	
	Example:	Input:	SCENARIO:READ:1
		Result:	Gives the scenario parameters of scenario 1.
		Return:	0,1,5,1,2,5,2,3,5,3,4,5,0,5,5,1,6,50,2,7,50,3,8,50,0,9,50,1,10, 50

79	**SETUP:SAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command saves the given parameters in a setup. You always have to provide the number of the setup and all six setup parameters. All parameters will be checked. Not enough parameters, delay too short with activated heater or incorrect values will lead to cancellation. Parameters relating to time have to be specified in 1/10 ms. Values lower than "1" are not admissible, only the open time can be "0". The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 61). Specified values must be integer and positive.	
	Example:	Input:	SETUP:SAVE:1: 30,10,15,90,20,8
		Result:	The parameters will be saved in the given setup and checked.
		Return:	OK

80	**SETUP:ASAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command saves the given parameters in a setup. You always have to provide the number of the setup and all six setup parameters. All parameters will be checked. Not enough parameters, delay too short with activated heater or incorrect values will lead to cancellation. Parameters relating to time have to be specified in 1/10 ms, except for "Falling" and "Rising", which have to be entered in 1/100 ms. Values lower than "1" are not admissible, only the open time can be "0". The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 61). Specified values must be integer and positive	
	Example:	Input:	SETUP:ASAVE:1: 30,10,15,90,20,8
		Result:	The parameters will be saved in the given setup and checked.
		Return:	OK

81	**SETUP:READ:<setup no.>**		
	Description:	This command reads the parameters of a given setup. As value you have to enter its number. All values relating to time are given in 1/10 ms (i.e. 10 ≙ 1.0 ms). The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 61).	
	Example:	Input:	SETUP:READ:1
		Result:	Displays the parameters of the given setup. Rising: 30 ≙ 3.0 ms (ms = Milliseconds) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 1.5 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	30,10,15,90,20,8

82	**SETUP:AREAD:<setup no.>**		
	Description:	This command reads the parameters of a given setup. As value you have to enter its number. All values relating to time, except “Falling” and “Rising”, are given in 1/10 ms (i.e. 10 ≙ 1 ms). Falling and rising are given in 1/100 ms (i.e. 100 ≙ 1.00 ms). The minimum values for Falling and Rising depend on the Needle Lift (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 61).	
	Example:	Input:	SETUP:AREAD:1
		Result:	Displays the parameters of the given setup. Rising: 30 ≙ 0.3 ms (ms = Milliseconds) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	30,10,15,90,20,8

83	**BAUDRATE:0/1/2/3/4**		
	Description:	This command changes the baud rate of the serial interface. There are five possible baud rates (9600, 19200, 38400, 57600 and 115200), corresponding with the parameters in this order (0, 1, 2, 3 or 4). **Important Note!** After reading the “OK”, the sender has to switch his baud rate as well; otherwise, the communication will break down.	
	Example:	Input:	BAUDRATE:1
		Result:	The baud rate is switched to 19200.
		Return:	OK

84	**GETTD**	**GETTD = Get time and date**	
	Description:	This command tells you the current time (UTC) and date in the format “hour, minute, second, year, month, day”.	
	Example:	Input:	GETTD
		Result:	The time (UTC) is given, including the date.
		Return:	10,07,00,2019,02,17 or No Clock (if the RTC of the MDC is defect)

85	**MDC:RESTART**		
	Description:	This command tells the MDC to shut down (without shutting down the power) and then to restart.	
	Example:	Input:	MDC:RESTART
		Result:	The MDC is shut down and then restarts.
		Return:	OK

8.2 PLC-Interface: 15-pin, Sub-D

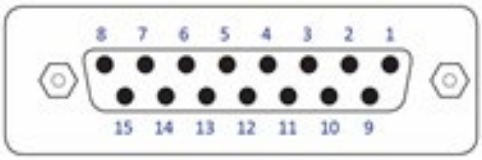


Fig. 31: PLC Interface: 15-pin, Sub-D

The PLC interface (illustrated above) works on digital basis without a particular syntax. It allows for controlling a machine or device by means of a remote master device. Transmission of data is possible in either direction. The trigger delay of this interface amounts to 96 µs.

Access is possible to:

- Status bits
- Values of voltage and current
- Set-Trigger signals initiating dispensing cycles (pulses) or complete packages of pulses (bursts)

INFORMATION

Do not use keypad during PLC triggered dispensing

When a PLC-trigger is send, the keypad is locked at the same time. This lock can be lifted by pressing the **[enter]**-key. But make sure not to do it during dispensing, since it also activates a delay, which could affect your dispensing result. On the other hand, a trigger does not work, if the MDC is not switched to the main menu. Additionally do not send a trigger, while the heater is starting.

8.2.1 Pin Functions

PIN	Characteristics	Level	Function
1	Output	0 / +24 V, R_a=2.2 kΩ (valid for 0 V)	SingleDosOK
2	Input	0 / +24 V R_i=1.3 kΩ	Trigger Voltage Input 0 ... +5 V "Valve closed" +12 V ... +30 V "Valve opened" Positive edge triggering
3	Input	0/ +5 V R_i=400 Ω	Trigger Voltage Input 0 ... +0.8 V "Valve closed" +3 V ... +5 V "Valve opened" Positive edge triggering
4	Ground	_____	Ground
5	Output	0 / +24 V, R_a=2.2 kΩ (valid for 0 V)	Set point Heating OK
6	Output	0 / +24 V, R_a=2.2 kΩ (valid for 0 V)	Nozzle unit "adjusted" OK (means green adjust LED)
7	Output	0 / +24 V, R_a=2.2 kΩ (valid for 0 V)	Mains voltage OK
8	Output	0 … +5 V, R_a=20 kΩ	U-Needle – sensor signal (needle lift)
9	Output	24 V/50 mA	Power supply to external trigger
10	Ground	_____	Ground
11	Input	0 / 20 mA, R_i=500 Ω	Trigger Current Input
12	Reserved	_____	_____
13	Output	0 / +24 V, R_a=2.2 kΩ (valid for 0 V)	For adjust: adjust failed. Nozzle unit screwed in too deep or not enough. Outside adjust: general error (24 V = error)
14	Output	0 / +24 V, R_a=2.2 kΩ (valid for 0 V)	DosOK – Ready for dispensing (in the case of a pulse package, at the end of the entire burst)
15	Input	_____	Trigger Abort, connection to ground, to interrupt dispensing cycle

8.2.2 PLC-Signals

The following graphs show you the different PLC-signals Trigger, DosOK and SingleDosOK and their behavior in various dispensing modes. The last paragraph then shows the effect of scenarios. It also shows the differences for the variants of DosOK (Delay ON and Delay OFF) and SingleDosOK (pulse and setup).

DosOK

The signal DosOK shows the length of a dispensing burst. During the pulsing burst, the signal is "low".

SingleDosOK

The signal SingleDosOK shows, that a single shot is being dispensed. When the signal changes to "low", a single shot is started. When the signal jumps back to "high", it shows that the Open Time has ended and the valve is closed.

8.2.2.1 Single-Shot Mode

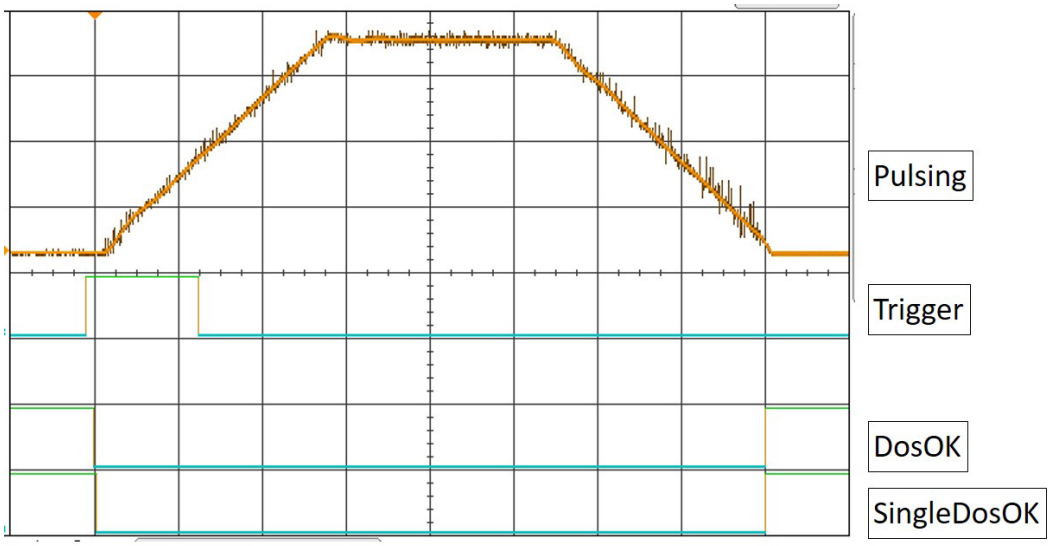


Fig. 32: Single-Shot Mode

8.2.2.2 Burst Mode (Example with Three Shots)

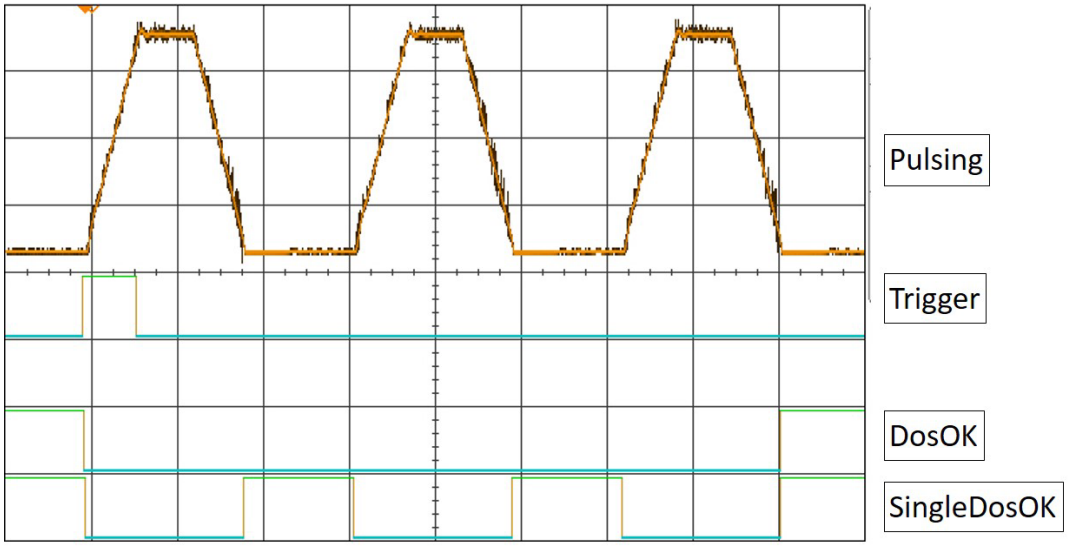


Fig. 33: Burst Mode (Example with Three Shots)

8.2.2.3 External Mode

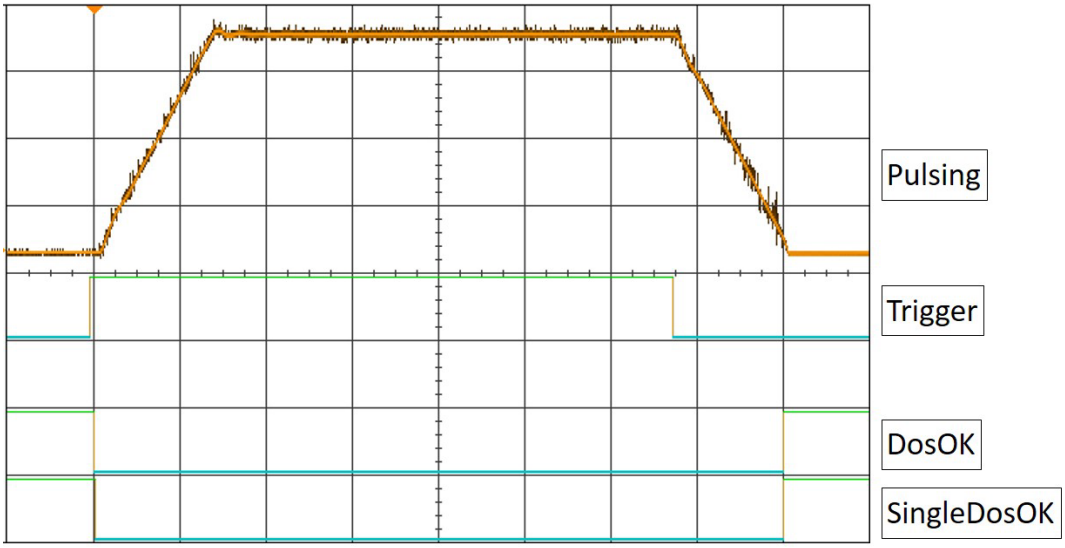


Fig. 34: External Mode

8.2.2.4 Infinite Mode

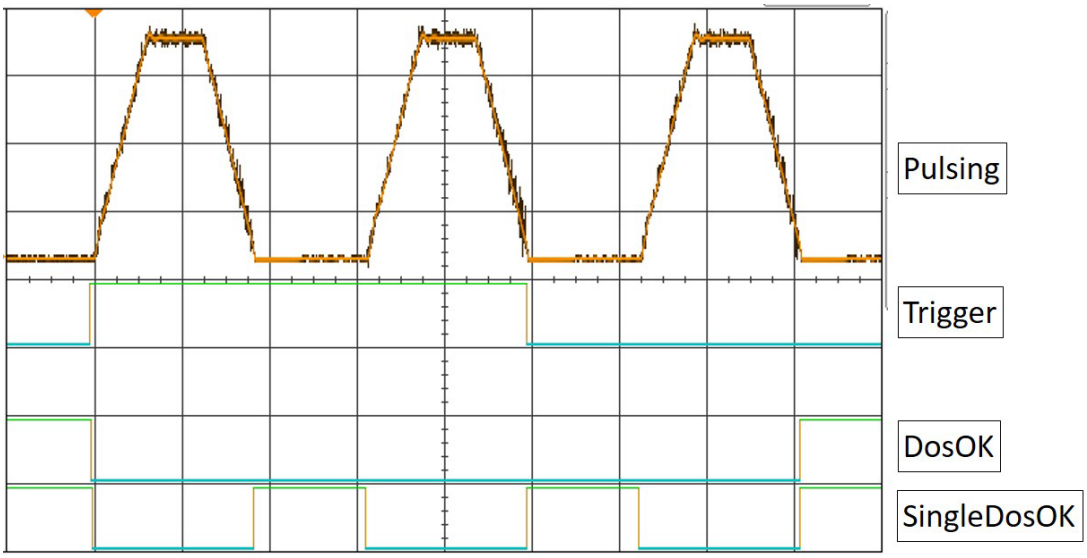


Fig. 35: Infinite Mode

8.2.2.5 Comparison of the signals DosOK and SingleDosOK for Scenario ON and Scenario OFF

The following two figures show the signals DosOK and SingleDosOK in relation to the tappet movement. In the first figure, scenarios are off, in the second figure, scenarios are ON.

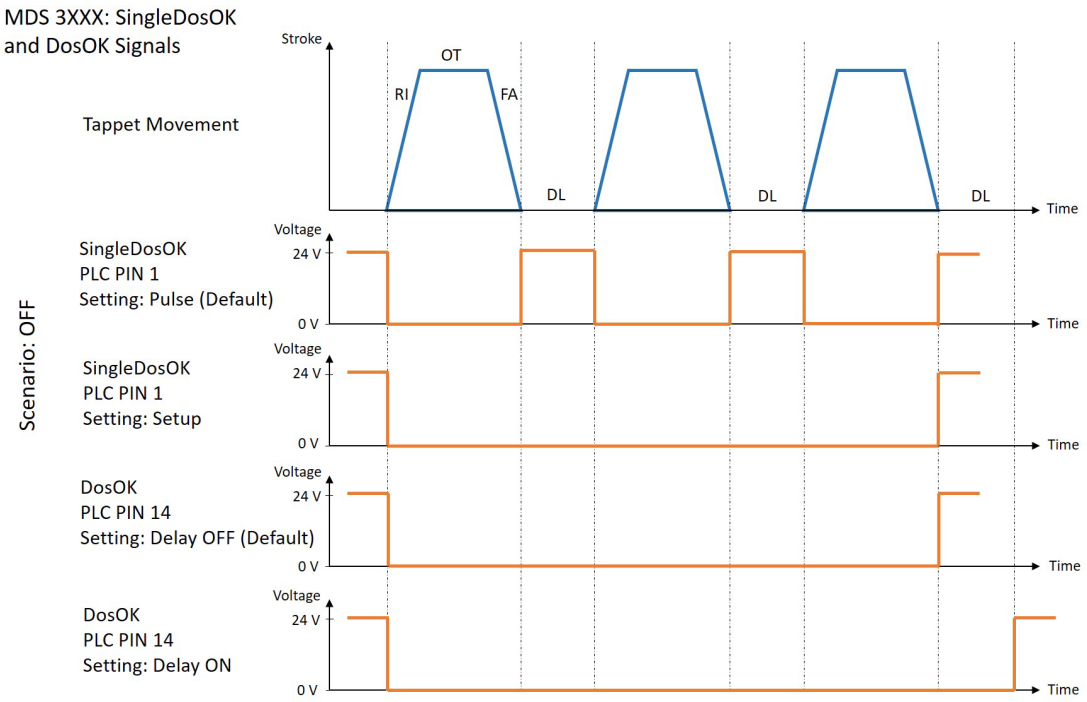


Fig. 36: PLC signals with Scenario OFF

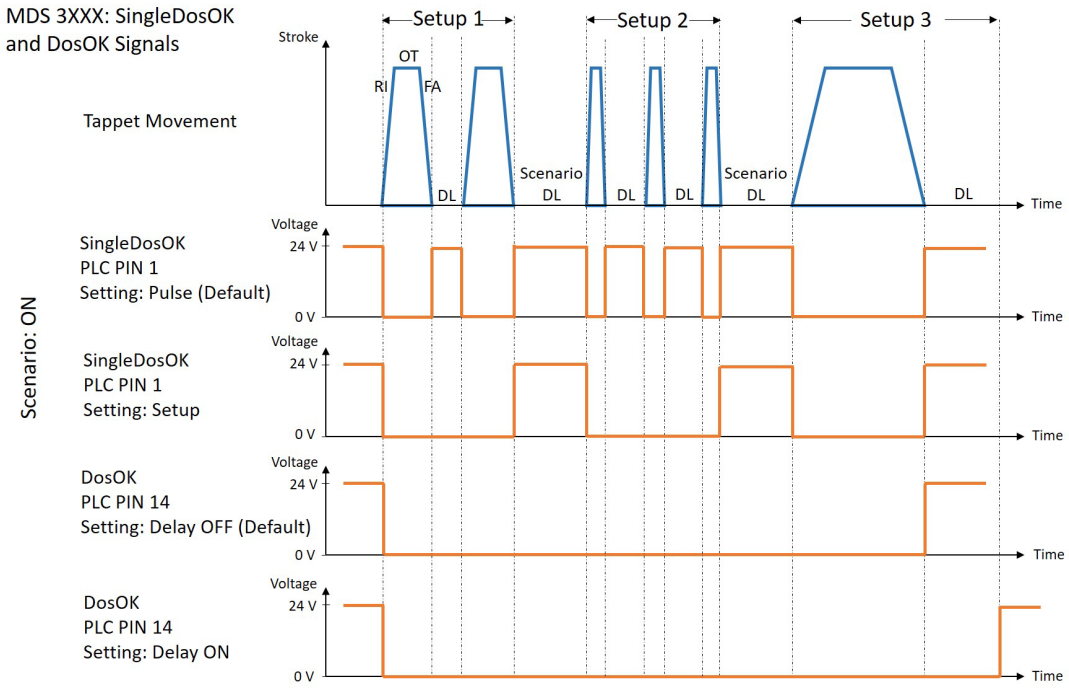


Fig. 37: PLC signals with Scenario ON

8.2.3 Remote Adjust

8.2.3.1 What is the Remote Adjust?

A remote adjust is similar to a normal adjust (see paragraph 6.5, page 52), but the system is operated from a master device (e.g. a PC or an XY machine) by means of interfaces (PLC, RS-232C). The function itself is identical.

Instead of the **[enter]**-key a short trigger signal is used and instead of the **[esc]**-key a long trigger signal.

Short Trigger signal:

5 V or 24 V (PIN3 + PIN4 or PIN2 + PIN4 Input signal of MDC via 15 pin Sub-D)

Signal length: 500 µs – 80 ms

Long Trigger signal:

5 V or 24 V (PIN3 + PIN4 or PIN2 + PIN4 Input signal of MDC via 15 pin Sub-D)

Signal length: 110 ms – 200 ms

8.2.3.2 Advantages

The remote adjust allows for total control of a control unit integrated in a machine, since dispensing parameters can be monitored by the software of this machine. The control unit can be built in with permanent key lock. Thus, the modification of parameters without authorization can be prevented in the machine software.

8.2.3.3 Procedure

The remote adjust has to be performed according to the following instructions:

IMPORTANT NOTE

Heating and remote adjust

In case your application uses a nozzle heater, you have to activate the heater before you start the remote adjust. Make sure to wait long enough for the heater to reach stable temperature, since the remote adjust could lead to an incorrect result otherwise.

Wear heat-resistant gloves while working with the valve!

INFORMATION

Displaying remote adjust

- In the course of the entire procedure, both adjust LEDs are lit simultaneously.
- The display shows “Remote Adjust is running!”
- For transmission of the orders between PC and control unit, both of the interfaces (RS-232C as well as PLC-interface) are used.
- The parameters may not be in infinite mode.
- The baud rate of the serial interface should be set to 115200 or at least as high as possible.

1. Preparation for the adjust: Use the tool MDT 327 to turn the adjust screw completely in the direction “open” (see arrow on the valve, see Fig. 38, page 124, torque for screwing it open is approx. 50 – 60 cN.m). Mount the tappet. Mount the complete fluid box and the nozzle fixation nut. Screw the nozzle fixation nut absolutely tight by using the tool MDT 327 (torque at least 150 cN.m).

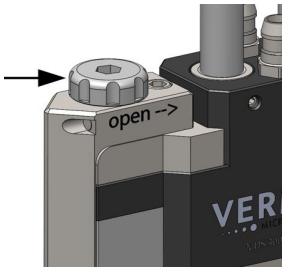


Fig. 38: Screw open the adjust screw completely

2. Send the command “ADJUST:START” to the control unit via RS-232C. The system returns the message “Release NU Attention fluid!!!!!“.
3. In order to confirm step 2, send a short trigger signal (500µs – 80 ms) to the control unit via PLC interface.
4. The next message from the system is “Enter for 500 Shots”. Send a short trigger signal via PLC-interface as confirmation.
5. The system then dispenses 500 shots, to clear the valve for the adjust. The next message “Calibration Please Wait” appears. The calibration will take a few moments, before it is finished. In case there is a problem with the calibration, the message “Adjust failed” appears.
6. If the calibration is successful and the valve is okay, move on to step 7. If the performance of the valve is below 100 %, the message “max. Needle Lift = xx %” is returned. You should exchange the valve and send it in for maintenance. Confirm the message with a short trigger signal.
7. At first the message “Enter if Green” is send. This message is followed by the current adjust value (e.g. -26 µm) and either:

   1 (value too low, i.e. below 0 µm)

   2 (value ok, i.e. between 0 µm and 4 µm)

   3 (value too high, i.e. above 4 µm)

   Adjust value and adjust answer are repeated in short intervals while you slowly screw the adjust screw in the direction “close” by using the MDT 327, e.g.:

   Enter if Green

   -26 µm

   1

   -15 µm

   1

   0 µm

   2
8. In order to confirm step 7, send a short trigger signal (500µs – 80 ms) to the control unit via PLC-interface. This will only be accepted, if the value is okay. After the confirmation, the system then returns the following response via RS-232C:

   “Adjust LED Green”

   The adjust has been completed successfully and the green LED is lit.

INFORMATION

Values out of range cannot be confirmed

Beyond the tolerance range of 0–4 µm (resp. 0–50 µm in fixed adjust mode) it is impossible to confirm the values.

Outside the adjust range, the adjust can only be interrupted by sending a long trigger signal (110 ms – 200 ms) to the control unit via PLC- interface. The system returns the message “adjust failed” to the PC.

8.2.4 Remote First Drop

Performing the first drop adjust (see paragraph 7.11, page 71) is also possible remotely via the RS-232C serial interface. In this chapter, the necessary steps are explained.

IMPORTANT NOTE

Display, cancelling the first drop adjust

- During the remote first drop adjust the message “Remote FirstDrop is running” is shown in the display.
- You can cancel the remote first drop by sending the command “KEY:ESC”, unless the system is working at that moment (e.g. during dispensing the 1000 shots).

Step	Explanation	Result
Send the command “SYSTEM:FIRSTDROP:ON”.	To perform the first drop adjust, you switch the system into first drop mode.	Response of the system: “OK” The red first drop LED is ON.
Send the command “SYSTEM:FIRSTDROP:ADJUST:<value>”. For “value” use the starting value, e.g. 15 %.	With this command you start the first drop adjust. The starting value for the first drop has to be between 2 % and 50 %. From this value, you will slowly increase the needle lift to find the exact position at which the first drop of the medium appears. For watery fluids, the value usually lies between 20 % and 35 %. You should not start with a too high value, since if there is a drop visible right away, then you will have to repeat the first drop adjust from the beginning with a lower starting value. Make sure you have inserted a filled cartridge with your dispensing medium. Set the dispensing pressure at 0.5 – 1.0 bar (depending on medium).	Response of the system: “Fill up with Medium!!!!!!” The display shows: “Remote FirstDrop is running!”
Confirm the message with the command “KEY:ENTER”.	Now 1000 shots have to be dispensed. This will prepare the valve. Place a container of sufficient size be-low the valve to capture the dispended medium.	Response of the system: “Press Enter for 1000 Shots”
Confirm the message with the command “KEY:ENTER”.	After the 1000 shots have been dispensed, you have to clean the nozzle. Use a lintless rag. Make sure the lower surface is dry and that no drop appears after cleaning.	Response of the system: “OK” “Clean Nozzle”
Confirm the message with the command “KEY:ENTER”.	With this command, you confirm that you have cleaned the nozzle. Check, if there is a drop visible at the nozzle. **Yes**: You have to repeat the first drop adjust with a lower starting value. **No**: Move on to the next step.	Response of the system: “OK” “Drop Visible” “15 %”
Send the command “KEY:ADJUST”.	With this command, you increase the needle lift by 1 %. Check again, if there is now a drop visible at the nozzle. **Yes**: Move on to the next step. **No**: Repeat this step and send the command “KEY:ADJUST” again.	Response of the system: “OK” “Drop Visible?” “16 %”

	(You might have to repeat this step several times.)	
Confirm your settings with the command “KEY:ENTER”.	With this command, you confirm the first drop value. The first drop adjust is completed. The display jumps back to the “3090+” message. The shown max value of the True Needle Lift (TNLmax) depends on your first drop value. If the first drop value is smaller than 30 %, the TNLmax is 70 %. If the first drop value is bigger than 30 %, the TNLmax is calculated as: (100 % minus first drop value) [Example: With a first drop value of 40 %, the TNLmax is 60 %.]	Response of the system: “OK” “Ready” The red first drop LED is OFF. The display shows: “3090+ xx Hz TNLmax = yy %”

Tab. 26: Remote First Drop

8.3 AUX socket

The AUX socket can be used for the supply of an external device (e.g. an optocoupler) or to control certain setups (see paragraph 7.8, page 64) or scenarios (see paragraph 7.9.3, page 67). The pin assignments are shown below (see Fig. 39). In case the select pins are activated, the maximum current is 12 mA. The other pins are used internally and cannot be used otherwise. The socket is a Lumberg SV81 8P.

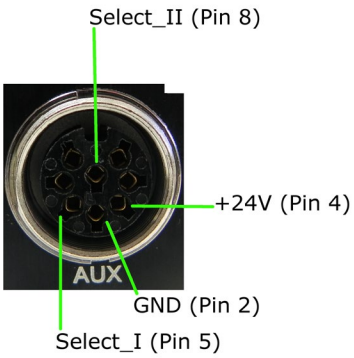


Fig. 39: AUX socket

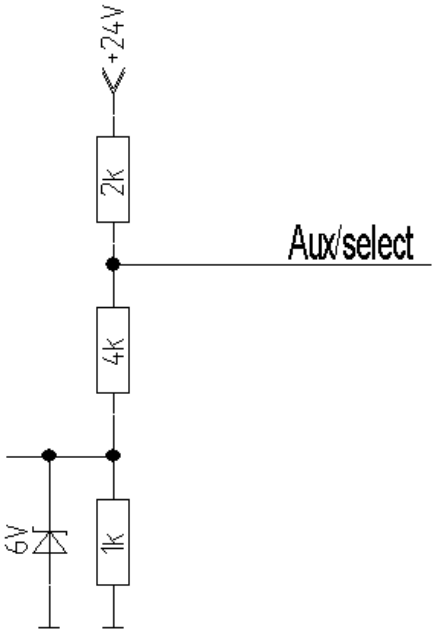


Fig. 40: Circuit diagram

9 Cleaning

After every dispensing process involving aggressive or self-curing substances, a cleaning procedure is recommended. It should involve the valve and all other surfaces in contact with the fluid. Different methods of cleaning are described in the following chapter. The proper choice depends on the degree of contamination and the dispense medium used.

9.1 Preliminary Notes

IMPORTANT NOTE

Prepare cleaning in advance

It is recommended to prepare the cleaning procedure in advance. Do not drop the device or its subcomponents.

⚠ CAUTION

Liquid spurts possible

Residual liquids may spurt when handling components during the cleaning process. Therefore, protective clothes are recommended:

- Safety goggles
- Gloves (chemical resistant)
- Overall (chemical resistant)
- Surgical mask

Remember that the surface of the valve is sensitive to abrasion, so do not use wire brushes and other inappropriate tools. A specially developed cleaning tool kit (CTK 2.5) is available upon request (order no. 1014632), which is of particular interest for all surfaces in direct contact with the fluid.

⚠ WARNING

Potential chemical reaction!

The dispensed medium and the cleaning agent must be compatible to each other. Otherwise, they might cause unwanted chemical reactions, toxic vapor, increase of temperature etc. Consult the manufacturer in case of doubt.

Before introducing aggressive purifying agents or solvents to the system, verify compatibility with the material of all adjacent parts. Refer to the list in paragraph 9.3, page 131.

In case of materials you cannot find on the list, please consult the manufacturer or the Technical Support of VERMES Microdispensing (see Page 7).

⚠ CAUTION

Keep actuator clean

No liquid may penetrate into the actuator (e.g. through the plug); otherwise the whole element could be damaged.

9.2 Heat Resistance of Sealing Materials

The following table shows the maximum temperature to which the respective sealing materials may be exposed.

Material	Max. Temperature [in °C]
PE	80
PTFE	230
NBR	100
EPDM	140
Silicone	200
Viton	220
CeTeDur	250

Tab. 27: Heat Resistance of Sealing Materials

9.3 Compatibility between Sealing Materials and Selected Media

	NBR	EPDM	VITON	SILICONE	PE	PTFE	CeTeDur
Acetone	---	+++	---	- +	+++	+++	+++
Ammonia	---	---	---	+++	+++	+++	+++
Chloroform	---	---	+++	---	+++	+++	+++
Cyclohexane	+++	---	+++	---	+++	+++	+++
Cyclohexanol	+++	---	+++	- +	+++	+++	+++
Cyclohexanone	---	---	---	---	---	+++	+++
Dimethylformamide	---	+++	---	- +	+++	+++	+++
Acetic acid	---	---	---	- +	+++	+++	+++
Ethanol	+++	+++	---	+++	+++	+++	+++
Heptane	+++	---	+++	---	- +	+++	+++
Hexane	+++	---	+++	---	- +	+++	+++
Isopropanol	- +	+++	+++	+++	+++	+++	+++
Methylene Chloride	---	---	- +	---	---	+++	+++
Nitromethane	---	- +	---	---	+++	+++	+++
Pentane	+++	---	+++	---	---	+++	+++
Mercury	+++	+++	+++	+++	+++	+++	+++
Silicone Oil	+++	+++	+++	- +	+++	+++	+++
Toluene	---	---	---	---	- +	+++	+++
Water	+++	+++	+++	+++	+++	+++	+++
Xylene	---	---	+++	---	- +	+++	+++

Legend	
Excellent compatibility **+++**	No or only a marginal influence on the component.
Moderate compatibility **- +**	Limited contact and sporadic exposure to the media will allow some usability, but long term it will lead to malfunctions of the component. If possible, use materials with a higher compatibility.
No compatibility **---**	Usage is not recommended.

Tab. 28: Compatibility between Sealing Material and Selected Media

9.4 Cleaning Methods

The following methods are available:

- Pre-purifying
- Rinsing with a purifying agent
- Total disassembly of the valve, followed by fine purification

For a thorough cleaning process, you need:

- A cleaning tool kit CTK 2.5
- Nozzle insert cleaning wires (of the correct size)
- A lint-free cloth
- An ultrasonic bath
- A beaker with a compatible cleaning liquid (e.g. Isopropanol)
- A pointed pair of tweezers
- The necessary tools for mounting and demounting as recommended by VERMES (see paragraph 3.3, page 15).

9.4.1 Pre-purifying

Pre-purifying consists in purging the system with compressed air.

⚠ CAUTION

Potential liquid spurts

During this procedure, liquid droplets may be expulsed!

Users must protect themselves correspondingly (protective clothing, safety goggles).

Step 1:

– Complete the dispensing process. The valve is in closed position.
  Do NOT switch OFF the control unit.

Step 2:

– Separate the compressed-air connection.
– Reduce the pressure to 0 bar.
– Disconnect the PP adapter fitting from the cartridge.

Step 3:

– Replace the used cartridge by a new one.

Step 4:

– Reinstall the compressed-air connection as follows.
– Place the PP adapter fitting on the cartridge. Rotate clockwise, until it latches in place.
– Connect the PVC hose with the KS4-CK-6 coupler plug to a compressed-air supply. For this purpose, you require a KD4-1/2-A coupler socket.
– Activate the compressed-air supply.

Step 5:

– Place a container underneath the valve, to collect any liquid dripping out.

Step 6:

– Initiate the purging procedure by pressing **[F1]**.
– Keep the **[F1]**-key pressed until the procedure is complete and no more liquid flows out through the nozzle unit.

INFORMATION

Automatic closing

After ca. 2 min the valve closes automatically, in order to protect the actuator.

Alternatively, the procedure can be performed by the RS-232C interface. Use the commands VALVE:UP and VALVE:DOWN for this purpose.

Step 7:

– Separate the compressed-air connection and remove the cartridge.

Step 8:

– Make sure the collected liquid in the container is disposed of according to local regulation.

9.4.2 Rinsing with a purifying agent

After pre-purification by compressed air, residual liquid may still be present inside the fluid system (particularly when dispensing high-viscous substances). It can only be removed by a flushing procedure. For this purpose, the following examples may be suitable agents:

- Distilled water
- Ethanol
- Isopropanol (IPA)
- Acetone

⚠ WARNING

Potential chemical reactions

Before the start of the procedure, carefully read the safety data sheet of the dispensed substance. Ensure compatibility with the cleaning agent.

The cleaning agent itself should not react with any part in contact with the fluid.

Consult the manufacturer in case of need, especially if you intend to use aggressive material.

Step 1:

– Complete the dispensing process. The valve is in closed position. Do NOT switch OFF the control unit.

Step 2:

– Separate the compressed-air connection.
– The pressure must be reduced to 0 bar.
– Disconnect the PP adapter fitting from the cartridge.

Step 3:

– Replace the used cartridge by a new one.
– The purifying agent can be supplied.

⚠ CAUTION

Check for leaks

All of the connectors must be installed and leak-tight.

Step 4:

– Reinstall the compressed-air connection as follows.
– Place the PP adapter fitting on the cartridge. Rotate clockwise, until it latches in place.
– Connect the PVC hose with the KS4-CK-6 coupler plug to a compressed-air supply. For this purpose, you require a KD4-1/2-A coupler socket.
– Activate the compressed-air supply.

Step 5:

– Place a container underneath the valve, to collect any liquid dripping out. The container needs sufficient capacity to contain the purifying agent together with the solved residual liquid.

Step 6:

– Initiate the purging procedure by pressing **[F1]**.
– Keep the **[F1]**-key pressed until the procedure is complete and no more liquid flows out through the nozzle unit.

INFORMATION

Automatic closing

After ca. 2 min the valve closes automatically, in order to protect the actuator.

Alternatively, the procedure can be performed by the RS-232C interface. Use the commands VALVE:UP and VALVE:DOWN for this purpose.

Step 7:

– Separate the compressed-air connection and remove the cartridge.

Step 8:

– Make sure the collected liquid in the container is disposed of according to local regulation.

9.4.3 Disassembling of the Valve

⚠ CAUTION

No dispensing medium residues

Before demounting the fluid box from the valve, make sure that no dispensing medium is left inside the system.

Preliminary steps:

- The dispensing process must be completed. The valve is in closed position.
- Deactivate the compressed air supply and remove the Adapter for Compressed Air.
- Switch OFF the control unit and disconnect it from the mains.
- Remove the actuator cable and sensor cable from the valve.
- Detach the valve with fluid box from dispensing robot.

⚠ CAUTION

High temperatures, danger of burns

Be careful if you have used the heater with your application. A nozzle heater can reach temperatures of up to 180 °C. Do not touch this area before it has cooled, since there is the danger of severe burns. Use heat resistant gloves.

Disassemble the valve as follows.

	**Step 1 (Adapter for compressed air)** Unscrew and remove the Adapter for Compressed Air from the cartridge. First, unscrew the connection counter-clockwise; then pull it off. **Important Note!** Make sure that no medium spills into the machine.
	**Step 2 (fluid box)** Remove the fluid box with the cartridge from the valve. Turn the fluid box by 45° and pull it off from the valve.

Step 3 (cartridge)

Unscrew the cartridge counter-clockwise and remove it from the fluid box. If necessary, use the MDT 309 - Cartridge locking pin.

Important Note!

Make sure that no medium spills into the machine.

Step 4 (tappet)

Pull the tappet from the fluid box. Pull the tappet spring from the tappet rod.

Step 5 (nozzle fixation nut)

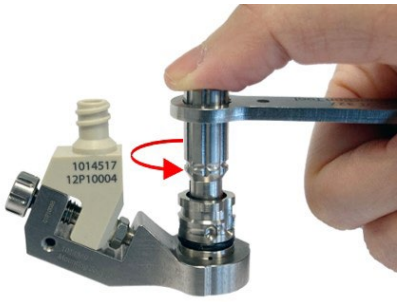
Remove the nozzle fixation nut by screwing counter-clockwise. Use the MDT 327 - Multi-Function Tool.

Step 6 (nozzle insert)

Use the thin end of MDT 323 - Nozzle Insert – Squeezing Out Tool TA, to push out the nozzle insert from the fluid box.

Important Note!

Immediately use a cleaning wire to push through the channel of the nozzle insert, to avoid hardening of residue medium.



Step 7 (tappet centering screw)

Unscrew the Tappet Centering Screw BY from the fluid box (counter-clockwise). Use the MDT 303 - Nozzle Insert Changing Tool.
The three pins of MDT 303 have to fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 counter-clockwise while pressing it down slightly to the fluid box. Combine the MDT 303 with MDT 327 for a better leverage.

Step 8 (tappet sealing and tappet centering piece)

Disengage the tappet centering piece and tappet sealing from the fluid box. Use the thicker side of tool MDT 323 (as shown) or the thicker end of the MDT 328.

Important Note!

When using a 2G Tappet rod, you do not need a tappet centering piece.

	**Step 9 (cartridge base)** Unscrew the tightening screw with the help of the MDT 327, rotating counter-clockwise. Remove the tightening screw and the cartridge base from the fluid box. **Important Note!** There are two types of cartridge bases: Cartridge Base CH (without integrated luer lock) and Cartridge Base CHI (with integrated luer lock). If you use a Cartridge Base CH, you need to screw off the fluid box connector Luer Lock. Unscrew it (counter-clockwise) with the open-ended wrench of the MDT 327 (hexagon screw size M8).
	
	**Step 10 (O-ring)** Remove the O-ring from the fluid box body. Pull it off carefully with a pair of tweezers. Be careful not to damage the O-ring. **Caution!** You could omit this step, only if the solvent you use is compatible with the material of the O-ring.
	**Unusual (connector BY)** Usually you will **not** remove the Connector BY from the fluid box body. In case the connector is clogged, use MDT 327 to screw it out (counter-clockwise; for newer revisions of the Connector BY you can also use a hexagon key 2.5).

Tab. 29: Disassembling of the valve

⚠ CAUTION

Damaged tappet sealing

Only use the tools recommended by VERMES. Do **not** use a sharp tool to press the tappet sealing from the fluid box. It could cause damage to the tappet sealing, which might lead to a leakage.

9.4.4 Fine Purification

Preliminary steps:

– Push a cleaning rod or a fluidic brush through the media carrying channels of all the components.

First, clean the single components in an ultrasonic bath.

– Place a beaker in the ultrasonic bath. Make sure it is large enough.
– Place the nozzle insert, tappet sealing, tappet centering piece, cartridge base, tightening screw, nozzle fixation nut and the fluid box body in the beaker.

CAUTION

Damage of O-ring/tappet sealing

Unless the compatibility between the O-ring/tappet sealing and the solvent is excellent, do not insert the O-ring/tappet sealing into the solvent.

CAUTION

Damage of components

Place tipped nozzle inserts (e.g. J-, C-, N27-type) in a separate beaker. To avoid damage, do not place tipped nozzle inserts together with other components in one beaker.

– Fill the beaker with an appropriate solvent (e.g. Isopropanol), until all of the parts are covered.
– Leave the components for ca. 15 min inside.

WARNING

High temperature, danger of burns

Be aware of your dispensing medium when setting the temperature, if the dispensing medium is inflammable. Otherwise, with too high temperatures deflagration might occur. Set the temperature as low as possible within the effective range.

– Take the beaker with the components out of the ultrasonic bath. Then use tweezers to take the components out of the beaker.

Next, clean all components by hand.

– For fine purification, you have to clean all components by hand. In general, you should take special care about those places, which get in contact with the medium or where two different parts fit together. First, you should clean the nozzle insert, since hardening would cause most problems here.

INFORMATION

Simpler cleaning

For some uncomplicated media it is possible to clean the parts just by using a fluid like ethanol and compressed air, which can simplify the cleaning process. Before you try it, you should always contact our Technical Support.

INFORMATION

Nozzle inserts with small inner channel

If a nozzle insert with inner channel smaller than 100 µm (except for nozzle inserts with long dispensing channels, namely J-/C-series, N-27 and N-28) happens to be still clogged after

cleaning, please clean it with MDT 316 - Nozzle Insert Cleaning Tool. For operating the MDT 316 please refer to the “Quick Reference Guide – MDT 316 - Nozzle Insert Cleaning Tool”.

Step 1 (nozzle insert)

Start with the nozzle insert. For the bore use a nozzle insert cleaning wire. These come with different sizes. They are not part of the cleaning toolkit CTK and have to be ordered separately.

Important Note!

Use the MDT 324 - Nozzle Insert Cleaning Holder with all Vermes nozzle inserts. With it, you can safely keep the nozzle insert in place during cleaning and drying with compressed air.

Clean the surface of the inner channel using a fluidic brush. Clean it thoroughly from above and below with a cleaning rod.

Step 2 (nozzle fixation nut)

Clean the nozzle fixation nut. Use a cleaning rod to clean the inside/outside of the nozzle fixation nut. Pay special attention to sharp corners and edges.

Push a fluid box cleaner through the opening of the nozzle fixation nut to remove persistent residues.

Clean the bore of the nozzle fixation nut using a fluidic brush.

Step 3 (fluid box body)

With the fluid box, clean all bores and threads with a fluidic brush first.

Afterwards, use a fluid box cleaner. Check all bores as well and then clean the rest of the fluid box body.

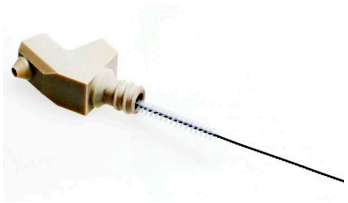
Step 4 (tappet centering screw)

Push the fluidic brush through the bore of the tappet centering screw first.

Keep using the fluidic brush to clean the threads of the tappet centering screw.

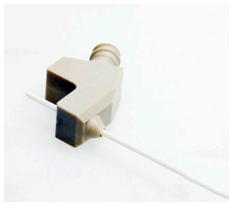
Afterwards, use a cleaning rod to clean the inner rim of the tappet centering screw.

Important note!
You need to perform a two finger seesaw test (see Tab. 31, page 142), to check if the tappet rod runs smoothly through the tappet centering screw. Otherwise, the parts have to be cleaned again.



Step 5 (cartridge base)

For the cartridge base, start with the fluidic brush to clean all bores and openings of the cartridge base.



Next clear the bore with a cleaning rod.
Finally use a fluid box cleaner to clean the wide opening of the bore.

Important Note!
There are two types of cartridge bases: Cartridge Base CH (without integrated luer lock) and Cartridge Base CHl (with integrated luer lock). If you use a cartridge base CH, you need to clean the Fluid Box Connector Luer Lock as follows. Otherwise, you can continue with the next step.

Push a cleaning rod through the bore of the Fluid Box Connector Luer Lock several times to remove any residues of the medium.

Clean the center bore of the Fluid Box Connector Luer Lock using a fluidic brush.

Cleaning the openings and thread of the Fluid Box Connector Luer Lock using a fluid box cleaner. Use it for the outside and the end of the bore.

Step 6 (tappet sealing and tappet centering piece)

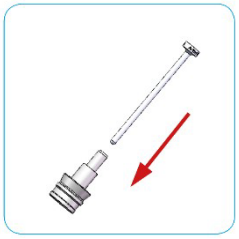
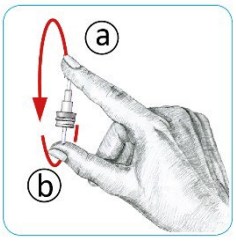
For the tappet sealing, clean the bore of the tappet sealing carefully with a fluidic brush.

	Afterwards, clean the outside of the tappet sealing. Keep using the fluidic brush, especially for the outer edge.
	Then clean the inner rim of the tappet sealing with a cleaning rod.
	Clean the outside of the tappet centering piece first with a lint-free cloth.
	Use a fluidic brush for the bore of the tappet centering piece. **Important Note!** There is no tappet centering piece, if you use a 2G tappet rod.
	**Step 7 (valve body)** Clean the valve with a lint-free cloth.
	**Step 8 (O-ring)** Clean all O-rings with a lint-free cloth.

Tab. 30: Clean all components by hand

– Dry all the components in the air or with compressed air. For nozzle inserts, we recommend to use the MDT 324 Nozzle Insert Cleaning Holder.

– A two finger seesaw test is necessary to check if the tappet rod runs smoothly through the Tappet Centering Screw BY. Otherwise, the parts have to be cleaned again. The table explains how to perform a two finger seesaw test.

	**Step 1:** Push the Tappet Centering Screw BY onto the tappet.
	**Step 2:** Hold the tappet with the Tappet Centering Screw BY between the index finger and the thumb. Swivel the tappet half-circularly between a and b. The Tappet Centering Screw BY must slide smoothly on the tappet in between the ends. Remove the Tappet Centering Screw BY from the tappet after the test.

Tab. 31: Two-Finger-Seesaw-Test

In case you still have parts, which are not completely clean after the fine purification, repeat the corresponding cleaning steps for those components several times, if necessary. If that is still not helping, contact our Technical Support.

9.4.5 Assembling of the Valve

Re-assemble the valve and its components as follows.

Unusual (connector BY)

In the exceptional case that you removed the connector BY as well, you have to mount it first.

Place the fluid box body on the receptacle of the mounting body. Align the bore on the fluid box body with the bore on the mounting body (see circles). The fluid box body will fit into the mounting body, if the mounting direction is correct.

Push the Connector BY through the mounting body into the bore of the fluid box body. Screw the Connector BY tight (clockwise) by using an MDT 327 (for newer revisions of the Connector BY you can also use a hexagon key 2.5 or the Torque Wrench Tool VM with the Bit Hexagon Key 2.5). Torques are depending on the material of the mounting body (stainless steel 120 – 140 cN.m, PEEK 70 – 80 cN.m).

Important Note!

Do **not** press the fluid box body while fastening the Connector BY, otherwise, it cannot correctly grip into the fluid box body.

Step 1 (O-ring)

In case that you removed the O-ring, you have to mount it onto the fluid box body.
Pull the O-Ring-BY over the fluid box body with a pair of tweezers.

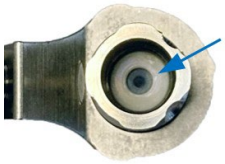
Step 2 (cartridge base)

Mount the cartridge base onto the fluid box. Use MDT 327 or the MDT 306 - Torque Wrench Tool VM with BitVM-A (torque 110 – 120 cN.m) to fix the cartridge base with the tightening screw by screwing clockwise.

Important Note!
There are two types of cartridge bases: Cartridge Base CH (without integrated luer lock) and Cartridge Base CHI (with integrated luer lock). If you use a cartridge base without integrated luer lock, you need to screw the Fluid Box Connector Luer Lock into the top bore of the cartridge base. Use the open-ended wrench of the MDT 327 (hexagon screw size M8, torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m).

Step 3 (tappet sealing)

Push the Tappet Sealing PE/PTFE/HT with the wider side down onto the pin of an MDT 328 - Tappet Sealing Changing Tool. Push the MDT 328 with the tappet sealing straight into the fluid box. When the tappet sealing sits tight, you will hear a light noise.



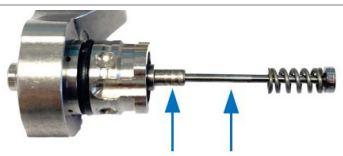
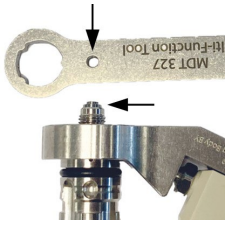
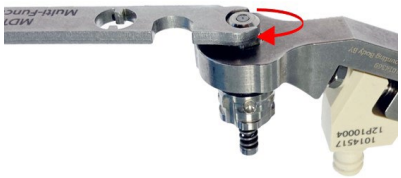
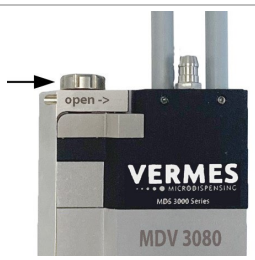
Step 4 (tappet centering piece)

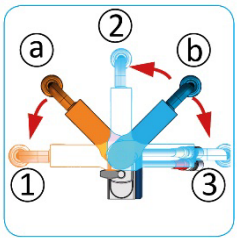
Press the tappet centering piece into the fluid box body. Use the MDT 328 to make sure the tappet centering piece rests flat on the tappet sealing.

Important Note!
When using a 2G Tappet rod, you do not need a tappet centering piece.

Step 5 (tappet and tappet centering screw)

Screw the Tappet Centering Screw BY into the fluid box. Do not screw it tight yet. Screw it only for two rotations.

	Push the tappet rod with the tappet spring slightly into the tappet centering screw. Place a small droplet of Tappet Grease TF (order no. 1014637; droplet size ca. 2 mm) on the tappet and another on the tappet centering screw (for placing see blue arrows in the picture). Make sure that the tappet tip is free of grease. Rotate the tappet and pull it in and out for three times to spread the grease.
 	Push the tappet spring onto the Tappet Centering Screw BY. Push the tappet rod through the tappet spring into the fluid box. Make sure the tappet goes through the tappet sealing.
	Screw the Tappet Centering Screw BY completely into the fluid box (torque 100 – 140 cN.m). Use MDT 303 - Nozzle Insert Changing Tool. The three small pins of MDT 303 have to fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 clockwise while pressing it down slightly to the fluid box. Combine the MDT 303 with MDT 327 for a better leverage. Alternatively, you can use the MDT 306 with BitVM-B.
	**Step 6 (nozzle insert)** Pick up the nozzle insert with tweezers, clip it into the fluid box. Use the small hole of MDT 327 to press the nozzle insert to make sure that it sits flat.
	**Step 7 (nozzle fixation nut)** Screw the nozzle fixation nut clockwise onto the fluid box. Use the MDT 327 - Multi-Function Tool. Alternatively, use the MDT 306 - Torque Wrench Tool VM with Bit Hexagon Socket (torque 150 – 180 cN.m).
	**Step 8 (adjust screw)** Turn the adjust screw completely in the direction “open” using the MDT 327.
 	**Step 9 (fluid box)** Push the fluid box carefully in a 45° angle onto the valve. Make sure that the fluid box sits correctly inside the valve and touches the frame. There will be a resistance due to a spring inside the valve.

	Straighten the fluid box until it latches in.
	**Optional positions** The bayonet fluid box has three locking positions (1: -90°, 2: 0°, 3: +90°) in which the valve can be operated. To fix in locking position 1, mount the fluid box at position a. To fix in locking position 2 or 3, mount the fluid box at position b. Currently, no cartridge holder is available for locking position 1 and 3.
	Perform the adjust You need to perform the adjust now. For details of the adjust process, see paragraph 6.5, page 52. After the adjust is successfully completed, continue with the following steps.
	**Step 10 (cartridge)** Push the cartridge into the cartridge holder and screw it onto the fluid box (clockwise).
	**Step 11 (Adapter for compressed air)** Screw the Adapter for Compressed Air onto the cartridge (clockwise). Make sure it sits tight.
	**Assembling completed** The completely assembled valve with the fluid box in straight position.

Tab. 32: Re-assembling of the valve

– Finally, connect the actuator and sensor cables as well as the compressed air. You can find more detailed information in paragraph 6.2, page 41 and paragraph 6.3, page 46.

10 Maintenance

We suggest to clean and to maintain your system regularly, especially for wearing parts such as tappets, tappet sealings and nozzle inserts. This chapter gives you an overview of the wearing parts that require high attention. You can check the cycle count of the dispensing cycles, which is shown at the MDC (see paragraph 4.5.4, page 31). To learn how to demount, clean and remount each part, see the chapter “Cleaning” (see chapter 9, page 129).

10.1 Maintenance of Tappet, Tappet Sealing and Nozzle Insert

As the tappet, the tappet sealing and the nozzle insert belong to the wearing parts of the system, they need to be cleaned and exchanged regularly.

10.1.1 Maintenance of the Tappet

The tappet has to be cleaned and exchanged in regular intervals (at least every 40 million shots) or in the case of problems (as soon as it starts to move in a sluggish way). Please be aware that the lifespan of the tappet not only varies by the material and size, but also depends on your application. Ceramics (CTF, SNTF), tungsten carbide (TTF) and diamond (PDTF) items are available. The tappet consists of the tappet rod and the tappet spring.

Fig. 41: Example - TTF Tappet (consists of tappet rod and tappet spring)

10.1.2 Maintenance of the Tappet Sealing

For replacement of tappet sealings a particular counter is not provided, as the necessity depends on current applications, substances to be dispensed etc. Caused by the tappet movement, some materials tend to penetrate between tappet and tappet sealing, giving rise to abrasion. Therefore, you have to inspect the tappet sealing from time to time. To continue working with a damaged tappet sealing inevitably entails unexpected interruptions, loss of material and an increased need of cleaning.

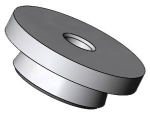


Fig. 42: Example - Tappet Sealing PE

10.1.3 Maintenance of the Nozzle Insert

The nozzle insert has to be cleaned and exchanged in regular intervals or in the case of problems. Please be aware that the lifespan of the nozzle insert depends on your application. After disassembling the nozzle insert, immediately use a cleaning wire to push through the channel of the nozzle insert, to avoid hardening of residue medium. Do not use a clogged nozzle insert, since it would strongly compromise your dispensing results. Exchange the nozzle insert as soon as it is worn out, since otherwise it can cause a leakage problem.

Fig. 43: Example - Nozzle Insert N11

10.1.4 Exchange of the Tappet, the Tappet Sealing and the Nozzle Insert

For the necessary steps of de-/mounting the tappet/tappet sealing/nozzle insert, please see the cleaning chapter (see chapter 9, page 129). Before disassembling the system, perform the cleaning procedure explained in the same chapter. There you will also find the necessary information of how to clean the tappet/tappet sealing/nozzle insert.

11 Error Messages

The following pages list all the error messages you could encounter when using this system. The table in paragraph 11.1, page 150 will give you a quick overview. In paragraph 11.2, page 151 every error message is explained in detail.

In case of an error, an error message is shown in the display and the red adjust LED is switched “ON”. This information can also be obtained via pin 13 of the PLC interface (see paragraph 8.2.1 "Pin Functions", page 119). Press **[enter]** to clear the display. If this does not work, switch “OFF” the control unit. Check the system for potential problems (e.g. loose cables) and re-start the system.

If the error still occurs, please contact the Technical Support at VERMES Microdispensing or your local supplier (see Page 7).

INFORMATION

Storing error messages

After the re-start, the error message can only be found in the submenu “Error” (see paragraph 4.5.4 "Submenu “Status”", page 31).

11.1 Table of Error Messages

The following table lists all error messages with their error code and when they might appear.

Error Code	Error Message	Related to	When?
104	104 Sensor Communication Error	Valve	Start-up, Operation
190	190 Incorrect Valve Data	Valve	Start-up, Operation
193	193 Autorange Error pr. Enter	Valve	Operation
199	199 Valve Error Escape for Auxi.	Valve	Start-up
301	301 No Valve Present Error	Valve	Start-up
302	302 Actuator Connection Error	Valve	Operation
501	501 Valve Defect Error	Valve	Start-up
601	601 USART Buffer Overflow	RS-232C	Operation
700	700 MDC Calibr. Wrong pr. Enter	MDC	Start-up
702	702 Watchdog TimeOut pr. Enter	MDC	Start-up, Operation
800	800 wrong H calib pr. Enter	Heater	Start-up
801	801 No Heater! Press Enter	Heater	Start-up, Operation
901	901 RAM Data Error pr. Enter	MDC Data	Start-up, Operation
902	902 EEPROM not formatted Enter	MDC Data	Start-up, Operation
903	903 EEPROM Write Error pr. Enter	MDC Data	Operation
904	904 Setup Save Error pr. Enter	MDC Data	Operation
905	905 Setup Load Error pr. Enter	MDC Data	Operation
999	999 Error in Errorlist	MDC Data	Operation

11.2 Explanations of Error Messages

104	**104 Sensor Communication Error**	
	This error message appears, when there is a problem with the sensor cable.	
	Error code display:	104 Sensor Communication Error
	Error code status menu:	104 Sensor Communication Error
	Error handling:	• Press **[enter]**-key to acknowledge error message. • The sensor connection has not been plugged in correctly. Switch OFF MDC and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • If the cables are not the cause of the error, you have to send back the valve to VERMES Microdispensing or to your supplier.

190	**190 Incorrect Valve Data**	
	This error message appears, if a checksum error occurs while writing the Cycle Counter. **Note:** The most common cause for this error is to unplug the valve before switching OFF the MDC or before the MDC has completely shut down.	
	Error code display:	190 Incorrect Valve Data (Press Enter)
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge error message. • If error happens repeatedly, switch OFF MDC and inspect the connection. If necessary, exchange the cable and/or valve.

193	**193 Autorange Error**	
	This error message appears, when there is a problem during the adjust, which prevents a range calibration.	
	Error code display:	193 Autorange Error pr. Enter
	Error code status menu:	193 Autorange Error
	Error handling:	• Press **[enter]** key to acknowledge error message. • Contact the Technical Support.

199	**199 Valve Error**	
	General valve data error (Sensor connection). When the checksum of the valve EEPROM is compared to software data during startup, mismatch is notified by this message. This error message appears with the start-up of the MDC. At this point, you have the opportunity to switch to Auxiliary Mode.	
	Error code display:	199 Valve Error Escape for Auxi.
	Error code status menu:	199 Valve Error
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF MDC and inspect the sensor cable and its connection. • Send valve to VERMES Microdispensing or to your supplier

301	**301 No Valve Present Error**	
	The control unit does not recognize the valve during startup.	
	Error code display:	301 No Valve Present Error
	Error code status menu:	301 No Valve Present Error
	Error handling:	• The actuator connection has not been plugged in correctly. Switch OFF MDC and inspect the actuator cable and its connection. If the actuator cable is damaged, it must be exchanged before restarting. • Check MDC • Send valve and/or MDC to VERMES Microdispensing or to your supplier

302	**302 Actuator Connection Error**	
	With system in operation, the connection between valve (actuator) and MDC is disrupted.	
	Error code display:	302 Actuator Connection Error
	Error code status menu:	302 Actuator Connection Error
	Error handling:	• The actuator connection has not been plugged in correctly. Switch OFF MDC and inspect the actuator cable and its connection. If the actuator cable is damaged, it must be ex-changed before restarting. • Check MDC • Send valve to VERMES Microdispensing or to your supplier

501	**501 Valve Defect Error**	
	The valve fails during operation, e.g. due to a damaged piezoelectric element. **Important note!** If there is a valve error, while a maintenance is needed (according to warranty and maintenance document), the message “Maintenance needed” is shown in the display.	
	Error code display:	501 Valve Defect Error *or* Maintenance needed
	Error code status menu:	501 Valve Defect Error
	Error handling:	• Switch off the MDC, remove the valve and send it to VERMES Microdispensing or to your supplier (regular maintenance is advisable)

601	**601 USART Buffer Overflow**	
	This problem sometimes occurs during data transmission via serial interface. The buffer is full and the MDC is unable to handle more inflowing data. The message “601 USART Buffer Overflow” is returned via serial interface. LEDs are not lit.	
	Error code display:	No error message
	Error code status menu:	601 USART Buffer Overflow
	Error message monitor:	601 USART Buffer Overflow
	Error handling:	• Interrupt data transmission • Send data again

700	**700 MDC Calibr. wrong**	
	This error message appears, if the calibration values are incorrect at the start-up of the MDC. The values will be overwritten with the factory settings. There will be no entry in the error list.	
	Error code display:	700 MDC Calibr. wrong pr. Enter
	Error code status menu:	700 MDC Calibr. wrong
	Error handling:	• Press **[enter]** key to acknowledge error message. • Send the MDC back to VERMES Microdispensing or to your supplier.

702	**702 Watchdog TimeOut**	
	Abnormal end (crash) of the MDC.	
	Error code display:	702 Watchdog TimeOut pr. Enter
	Error code status menu:	702 Watchdog TimeOut
	Error handling:	• Press **[enter]** key to acknowledge error message. The MDC restarts

800	**800 Heat. Calib. wrong**	
	The error message “800 Heat. Calib. wrong pr. Enter” appears, if the calibration values of the heater are incorrect at the start-up of the MDC. The values will be overwritten with the factory settings. There will be no entry in the error list. The heater should be recalibrated or contact our technical support.	
	Error code display:	800 Heat. Calib. wrong pr. Enter
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge error message. • For further information, contact the Technical Support (see Page 7).

801	**801 No Heater!**	
	Even though the heater option has been activated in the Heater Menu, this element is not detected.	
	Error code display:	801 No Heater! Press Enter
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge error message. Heater status will be switched “OFF” in the submenu “Heater”. • Inspect the heater cable connection. Worn, kinked or charred cables must be exchanged. • Heater defect – change the heater

901	**901 RAM Data Error**	
	During the check of RAM data, a problem arises. The message has to be acknowledged by the **[enter]** key. The system reformats the EEPROM, replacing current values with the factory settings. In case the error appears during start-up of the MDC, all setups will be reset to the factory settings after pressing **[enter]**. In case the error appears after the RECALL of a specific setup, the will be no automatic correction. Therefore, enter the parameters of the working configuration for this setup and save them by pressing **[save]**.	
	Error code display:	901 RAM Data Error pr. Enter
	Error code status menu:	901 RAM Data Error
	Error handling:	• Press **[enter]** key to acknowledge error message. • Reenter the working configuration.

902	**902 EEPROM not formatted**	
	A corrupted memory area becomes obvious when reading the EEPROM.	
	Error code display:	902 EEPROM not formatted Enter
	Error code status menu:	902 EEPROM not Formatted
	Error handling:	• Press **[enter]** key to acknowledge error message – the factory settings will be loaded • You have to reenter your dispensing parameters • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier

903	**903 EEPROM Write Error**	
	The problem can occur when writing data to the EEPROM.	
	Error code display:	903 EEPROM Write Error pr. Enter
	Error code status menu:	903 EEPROM Write Error
	Error handling:	• Press [enter] key to acknowledge error message. • If the problem arises when modifying program parameters, the new values are not saved in the EEPROM. After restart of the MDC, the former values of the EEPROM will be loaded. • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier

904	**904 Setup Save Error**	
	The storing procedure for a setup, initiated by **[save]** key, fails.	
	Error code display:	904 Setup Save Error pr. Enter
	Error code status menu:	904 Setup Save Error
	Error handling:	• Press **[enter]** key to acknowledge error message. After restart of the MDC, the factory settings will not be loaded. • You have to reenter your dispensing parameters. • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier.

905	**905 Setup Load Error**	
	This problem may arise during the retrieval of a setup by **[recall]** key.	
	Error code display:	905 Setup Load Error pr. Enter
	Error code status menu:	905 Setup Load Error
	Error handling:	• Press **[enter]** key to acknowledge error message • Repeat the procedure. If the problem persists, you have to enter new data to the corresponding memory position. • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier

999	**999 Error in Errorlist**	
	The problem cannot be assigned to any other error code from the list. This error only appears while browsing through the error list in the status menu.	
	Error code display:	999 Error in Errorlist
	Error code status menu:	999 Error in Errorlist
	Error handling:	• Move on in the error list or leave the submenu “Error”.

12 Transport, Storage and Disposal

12.1 Transport

For shipment, the system is packed in an appropriate case. Preserve it for further transport procedures in the future. The necessity can never be excluded, e.g. for purposes of maintenance. Observe the following measures.

- If the original packaging is no longer available, select a suitable material for the package.
- Pack in a way that protects the delivery against shock and vibrations.
- Fill empty spaces with appropriate material (e.g. paper, insulating air cushion, Styrofoam).
- Decontaminate the system completely before shipping it.
- Fill out the corresponding form completely (see paragraph 14.9, page 176). Attach it, clearly visible, at the exterior of the package.

⚠ CAUTION

Decontamination

The customer is liable for all consequences resulting from insufficient decontamination of the system (health of transport personnel)!

12.2 Storage

The environmental conditions in the room intended for storage should fulfill the requirements of the system.

Observe the following storage conditions.

- The room should be sufficiently ventilated and free of dust
- Admissible temperature: Between +5 °C and +30 °C
- Rel. humidity < 50 %
- The system should not be stored together with fuel, solvents, lubricants, acids and other chemicals able to develop vapors, which may aggress to the surface of the components.

Air-tight foil sheathing with included desiccants may be useful.

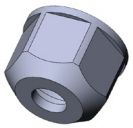
12.3 Recycling and Disposal

	The entire packaging consists of 100 % recyclable material.
	At the end of its lifetime, the product itself should be discarded in conformity with local regulations. Prescriptions with respect to handling of electrical scrap have to be observed.

13 Spare Parts and Tools

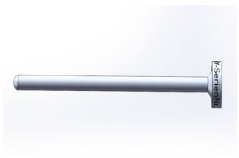
Here are some of the most important spare and extra parts as well as tools. For the latest and complete list, please check our homepage at www.vermes.com.

13.1 Nozzle Fixation Nuts

		
Nozzle Fixation Nut NFN-TA-HC Order no. 1014181	**Double Channel Nozzle Fixation Nut NFN-TA** Order no. 1016198	**Nozzle Fixation Nut NFN-TA-IB** Order no. 1014494 **Nozzle Fixation Nut NFN-TA-HC-IB** Order no. 1014493
		
Nozzle Fixation Nut NFN-TA-HC+10mm Order no. 1015451		

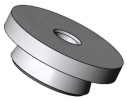
Tab. 33: Nozzle Fixation Nuts

13.2 Tappets

		
Tappet rod CTF CTF 0 Order no. 1016089 CTF 4 Order no. 1013126 CTF 7 Order no. 1013125 CTF10 Order no. 1013124 CTF15 Order no. 1012884	**Tappet rod TTF** TTF 0 Order no. 1015963 TTF 4 Order no. 1012892 TTF 7 Order no. 1012891 TTF10 Order no. 1012890 TTF15 Order no. 1012889 TTF20 Order no. 1013185 TTF23.5 Order no. 1015125 TTF30 Order no. 1016497	**Tappet rod SNTF** SNTF 0 Order no. 1018090 SNTF 4 Order no. 1014240 SNTF 7 Order no. 1014243 SNTF10 Order no. 1014244 SNTF15 Order no. 1014245 SNTF 23.5 Order no. 1015752
		
Tappet rod 2G CTF 2G CTF 4 Order no. 1015241 2G CTF 7 Order no. 1015242 2G CTF10 Order no. 1015243 2G CTF15 Order no. 1015244	**Tappet rod 2G TTF** 2G TTF 4 Order no. 1015235 2G TTF 7 Order no. 1015236 2G TTF10 Order no. 1015218 2G TTF15 Order no. 1015217	**Tappet rod 2G SNTF** 2G SNTF 4 Order no. 1015253 2G SNTF 7 Order no. 1015254 2G SNTF10 Order no. 1015255 2G SNTF15 Order no. 1015256
		
Tappet rod 2G CTF + 10 mm 2G CTF 4 +10 mm Order no. 1015644 2G CTF 7 +10 mm Order no. 1015645 2G CTF 10 +10 mm Order no. 1015646 2G CTF 15 +10 mm Order no. 1015647 (only compatible with 1015316)	**Tappet rod 2G TTF + 10 mm** 2G TTF 4 +10 mm Order no. 1015639 2G TTF 7 +10 mm Order no. 1015640 2G TTF 10 +10 mm Order no. 1015641 2G TTF 15 +10 mm Order no. 1015642 (only compatible with 1015316)	**Tappet rod 2G SNTF + 10 mm** 2G SNTF 4 +10 mm Order no. 1015648 2G SNTF 7 +10 mm Order no. 1015649 2G SNTF 10 +10 mm Order no. 1015650 2G SNTF 15 +10 mm Order no. 1015651 (only compatible with 1015316)
		
Tappet spring TF-PR Order no. 1014620 SN Order no. 1017165 SB Order no. 1014748 (blue)	**Tappet centering screw** BY (stainless steel) Order no. 1014228 HM-BY (carbide) Order no. 1014679 23.5 BY Order no. 1014709 2G BY Order no. 1015221	**Tappet Grease TF** 1 ml Order no. 1014637 10 ml Order no. 1014636 310 ml Order no. 1014635
		
Tappet centering screw 2G BY +10 mm Order no. 1015316		

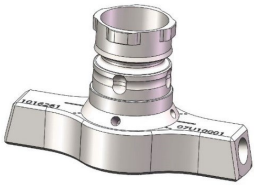
Tab. 34: Tappets

13.3 Sealings

		
Tappet sealing PE Order no. 1007067 PTFE Order no. 1010247	**Tappet Centering Piece PEEK** Order no. 1009419	**Tappet sealing HT** Order no. 1015823
		
O-Ring-BY NBR Order no. 1014226 (black) EPDM Order no. 1017525 (black) Viton Order no. 1014385 (green) *Large:* EPDM Order no. 1017526 (black)	**O-Ring-Safe – EPDM** 3 ccm Order no. 1017353 5 ccm Order no. 1017354 10 ccm Order no. 1017355 30/55ccm Order no. 1017356 *(black)*	**O-Ring-Safe – NBR** 3 ccm Order no. 1015892 5 ccm Order no. 1015895 10 ccm Order no. 1015897 30/55ccm Order no. 1015899 *(10 pieces, black)*

Tab. 35: Sealings

13.4 Supply Unit

		
Cartridge 3 ccm Order no. 1007091 5 ccm Order no. 1012914 10 ccm Order no. 1008361 30 ccm Order no. 1007087 (also available nontransparent for light or UV light) 30 ccm Order no. 1015697 (metal cartridge for hot melt applications)	**Cartridge Holder 30xx-TA** 30/55 ccm Order no. 1017137 5 ccm Order no. 1017136	**Fluid Box Connector CH-HO** Order no. 1014352
		
Connector BY Order no. 1014234	**Cartridge Base CHI-HT** Order no. 1014517	**Cartridge Base CHI** Order no. 1014060
		
Heater MDH-48-BY-BH Order no. 1015224	**Fluid Box Body MDF 1500-BY** 1500-BY-40 Order no. 1014538 1500-BY-40+10mm Order no. 1015127	**Mounting Body** BY Order no. 1014369 PEEK-BY Order no. 1014537
		
Double Channel Fluid Box Body MDF 3078-BY Order no. 1016261	**Adapter Safe for compressed air** 3 ccm Order no. 1014953 5 ccm Order no. 1014952 10 ccm Order no. 1014951 30/55 ccm Order no. 1014950	**Tightening Screw** PEEK Order no. 1013487 PEEK (with insert) Order no. 1013139 Stainless Steel Order no. 1010027
		
Fluid box connector Luer-Lock Stainless Steel Order no. 1007060 PEEK Order no. 1012826	**Cartridge Base CH** Order no. 1015638	

Tab. 36: Supply unit

13.5 Heater Controllers

		
MFC 3000 Order no. 1014981	**Heater Controller MHC 48-2** Order no. 1015680	**Heater Controller MHC 48-1** Order no. 1014107

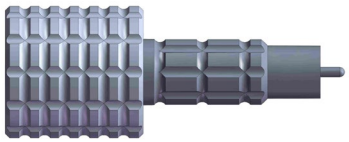
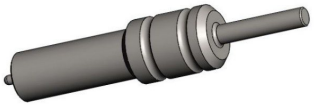
Tab. 37: Heaters Controllers

13.6 Cleaning Tools

		
CTK – Cleaning Tool Kit 2.5 Order no. 1014632 consists of: 25 pcs. Fluid Box Cleaners (P: 1013266) 20 pcs. Cleaning Rods 2.5 (P: 1014631) 20 pcs. Fluidic Brushes 2.5 (P: 1014422) (P = Order no. for only these parts)	**Nozzle Insert Cleaning Wires** size 100 (blue) Order no. 1011208 size 120 (white) Order no. 1011488 size 150 (green) Order no. 1010380 size 200 (orange) Order no. 1010379 size 300 (yellow) Order no. 1012208 size 400 (red) Order no. 1012209 size 500 (gray) Order no. 1015396	**Set – NI Cleaning Reamers** Order no. 1014627 (6 pcs.)
		
MDT 316 - Nozzle Insert Cleaning Tool Order no. 1013324	**MDT 324 - Nozzle Insert Cleaning Holder** Order no. 1014310 (PEEK) Order no. 1017320 (Stainless Steel)	

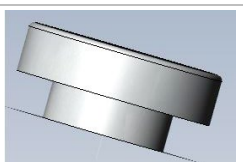
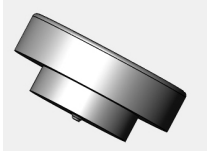
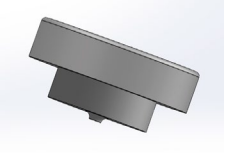
Tab. 38: Cleaning Tools

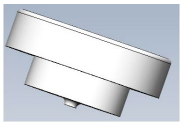
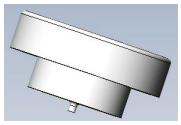
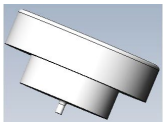
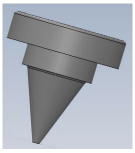
13.7 Tools

		
MDT 301 - Universal Tool Order no. 1010208	**MDT 303 - Nozzle Insert Changing Tool** Order no. 1007083	**MDT 306 - Torque Wrench Tool VM** Order no. 1015062 BitVM Set Order no. 1013398
		
MDT 307 - Adjust Tool TA Hot Melt Handle Order no. 1014143	**MDT 323 - Nozzle Insert - Squeezing Out Tool TA** Order no. 1014283	**Hexagon Key Set** Order no. 1012993 (can be ordered separately)
		
MDT 327 - Multi-Function Tool Order no. 1014440	**MDT 328 - Tappet Sealing Changing Tool** Order no. 1014503	**MDT 333 - Double Channel Tappet Sealing Changing Tool** Order no. 1016243

Tab. 39: Tools

13.8 Nozzle Inserts

		
Nozzle Insert N11 N11- 70 Order no. 1010343 N11- 90 Order no. 1013129 N11-100 Order no. 1009837 N11-120 Order no. 1010344 N11-150 Order no. 1009838 N11-200 Order no. 1009839 N11-300 Order no. 1013024 N11-400 Order no. 1013025	**Nozzle Insert N13** N13- 30 Order no. 1013444 N13- 40 Order no. 1013443 N13- 50 Order no. 1012846 N13- 60 Order no. 1013393 N13- 70 Order no. 1013344 N13- 75 Order no. 1011781 N13- 80 Order no. 1013345	**Nozzle Insert N14** N14- 70 Order no. 1015070 N14- 250 Order no. 1013055 N14- 300 Order no. 1012097 N14- 400 Order no. 1012098 N14- 600 Order no. 1014532 N14-1200 Order no. 1012901
		
Nozzle Insert N16 N16-150 Order no. 1012950 N16-200 Order no. 1012951 N16-500 Order no. 1012218 N16-600 Order no. 1012219 N16-700 Order no. 1012220 N16-800 Order no. 1012843 N16-900 Order no. 1012844 N16-1000 Order no. 1012845	**Nozzle Insert N17** N17- 70 Order no. 1013155 N17- 100 Order no. 1013959 N17- 150 Order no. 1013136 N17- 200 Order no. 1012780	**Nozzle Insert N21** N21-100 Order no. 1013045
		
Nozzle Insert N25 N25- 30 Order no.: 1015233 N25- 40 Order no.: 1015234 N25- 50 Order no.: 1015175 N25- 60 Order no.: 1015866 N25- 70 Order no.: 1015174 N25- 80 Order no.: 1015886 N25-100 Order no.: 1013427 N25-120 Order no.: 1014535 N25-150 Order no.: 1013426 N25-180 Order no.: 1014660 N25-250 Order no.: 1014659 N25-500 Order no.: 1013428	**Nozzle Insert N27** N27- 50 Order no.: 1015173 N27-200 Order no.: 1015207	**Nozzle Insert N30** N30-100 Order no.: 1016770
		
Nozzle Insert N34 N34- 30 Order no.: 1017094 N34- 40 Order no.: 1016787 N34- 50 Order no.: 1015452 N34- 70 Order no.: 1015453 N34- 80 Order no.: 1017146 N34- 90 Order no.: 1017147	**Nozzle Insert N43** N43-150 Order no.: 1014457	**Nozzle Insert N64** N64- 50 Order no.: 1016131 N64- 80 Order no.: 1015971 N64- 90 Order no.: 1016132 N64-100 Order no.: 1015025 N64-120 Order no.: 1015026 N64-180 Order no.: 1015027

N34-100 Order no.: 1015231 N34-120 Order no.: 1015454 N34-150 Order no.: 1015455 N34-200 Order no.: 1015230 N34-250 Order no.: 1015456 N34-300 Order no.: 1015228 N34-350 Order no.: 1015696 N34-400 Order no.: 1015229		
		
Nozzle Insert N80 N80-100 Order no.: 1016693	**Nozzle Insert N85** N85- 70 Order no.: 1016976 N85-150 Order no.: 1017444	**Nozzle Insert N90** N90- 70 Order no.: 1017271
		
Nozzle Insert N92 N92-100 Order no.: 1017315		
		
Nozzle Insert J01 J01-100 Order no.: 1011463 J01-120 Order no.: 1012997 J01-150 Order no.: 1013016 J01-200 Order no.: 1012863 J01-300 Order no.: 1014838 J01-400 Order no.: 1012883	**Nozzle Insert J02** J02-50 Order no.: 1013032 J02-70 Order no.: 1012878	**Nozzle Insert J03** J03- 200 Order no.: 1012885
		
Nozzle Insert J04 J04-200 Order no.: 1012936 J04-300 Order no.: 1015149 J04-400 Order no.: 1014613 J04-500 Order no.: 1014614 J04-600 Order no.: 1014629	**Nozzle Insert J17** J17-100 Order no.: 1014340	**Nozzle Insert J28** J28- 150 Order no.: 1016936
		
Nozzle Insert N10 N10- 70 Order no. 1007053 N10-100 Order no. 1007055 N10-150 Order no. 1007057 N10-170 Order no. 1014309 N10-200 Order no. 1007058 N10-300 Order no. 1011900 N10-400 Order no. 1011924	**Nozzle Insert C15** C15- 70 Order no. 1012784 C15-120 Order no. 1012236 C15-165 Order no. 1013452 C15-200 Order no. 1012818 C15-240 Order no. 1012813 C15-300 Order no. 1012814 C15-400 Order no. 1012833	**Nozzle Insert C04** C04- 150 Order no.: 1007051

Tab. 40: Nozzle Inserts

14 Attachments

14.1 EU Declaration of Conformity

EU Declaration of Conformity

EU Declaration of Conformity according to European directives
In Accordance with DIN EN ISO/IEC 17050-1:2018-08

Company Name: **VERMES Microdispensing GmbH**

Address: Rudolf-Diesel-Ring 2
83607 Holzkirchen

Product Name: **Microdispensing Systems (MDS 3080-V)**

Model Number:

System	Control Unit	Valve
MDS 3080-V	MDC 3090-V	MDV 3080-V

We declare that these products are specified to the relevant EC Guidelines.

The Conformity is approved by the following guidelines and harmonized standards:

Directive 2014/35/EU	Low Voltage Directive (LVD)
Directive 2014/30/EU	Electromagnetic Compatibility Directive (EMC)
Directive 2011/65/EU (with EU 2015/863)	Restriction of Hazardous Substances (RoHS 2) (with amendment)
EN 61326-1	
EN 55011	
EN 61000-3-2	
EN 61000-3-3	
EN 61000-6-2	
EN 61010-1	

Holzkirch, 10/7/25
Place and date of issue

Stefan Hirte
Managing Director

VTK-GF-VT-078e-1

Page
1 / 1

Fig. 44: EU Declaration of Conformity

14.2 Dimensional Drawing MDC 3090-V

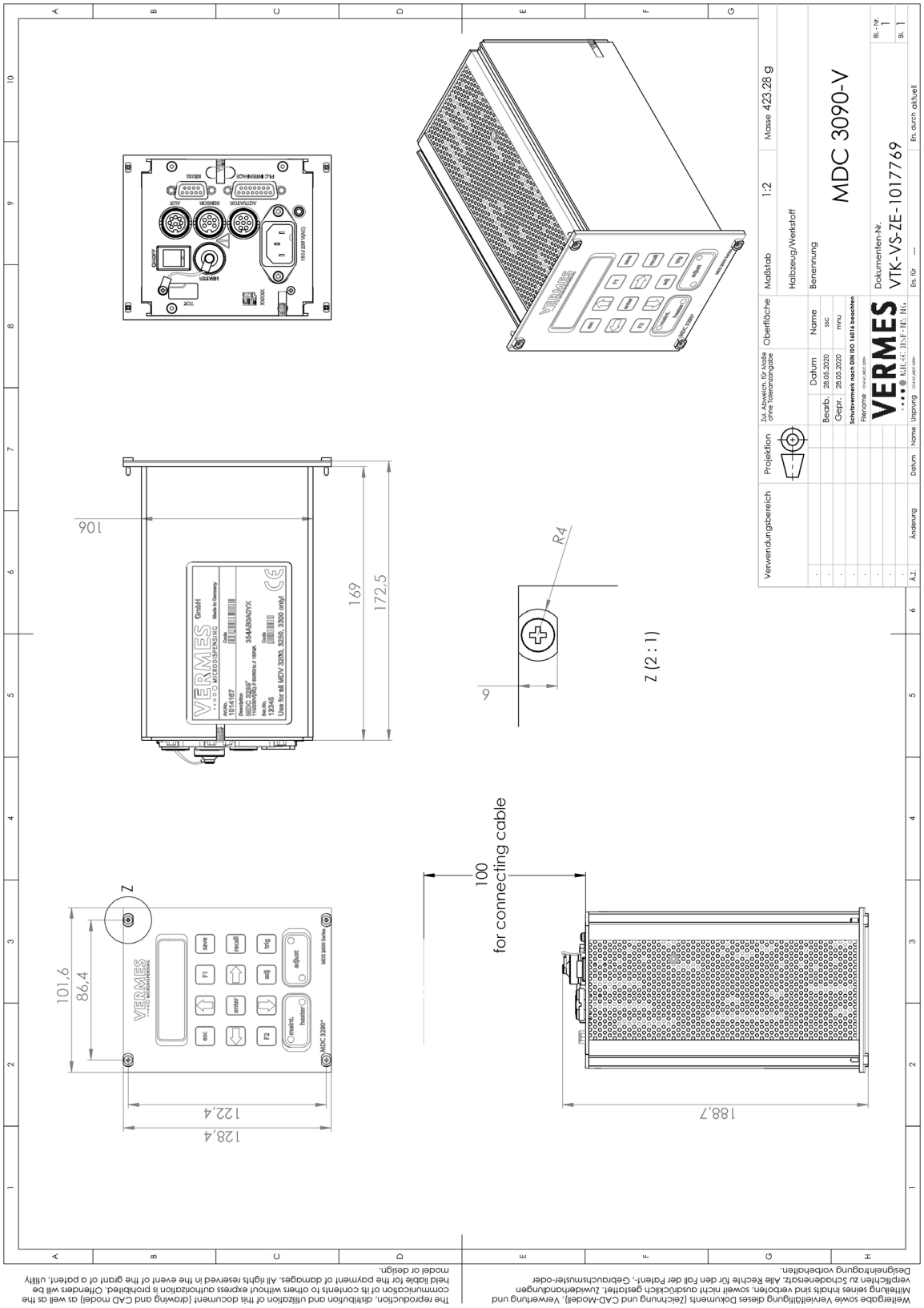


Fig. 45: Dimensional Drawing MDC 3090-V

14.3 Dimensional Drawing MDV 3080-V

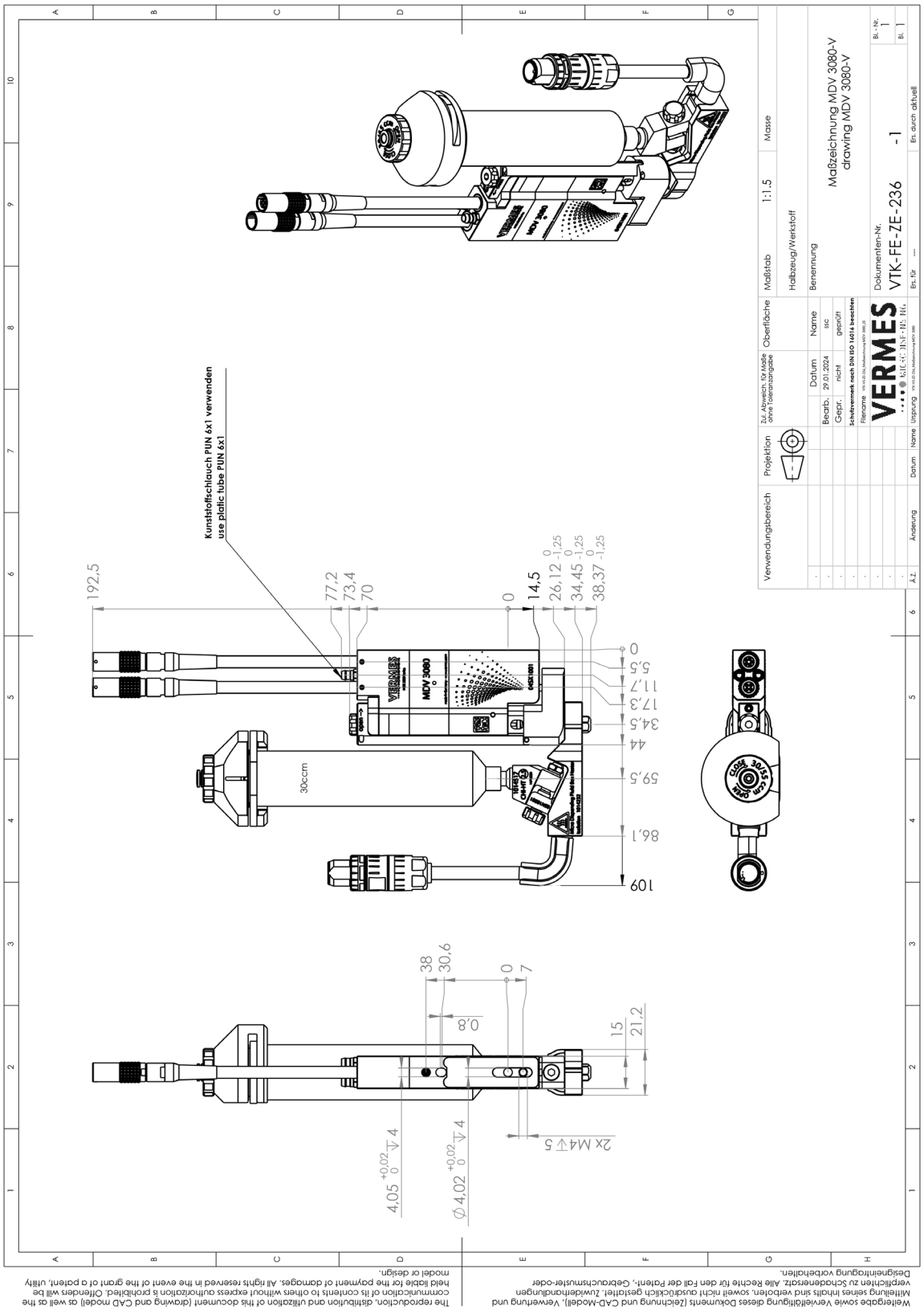


Fig. 46: Dimensional Drawing MDV 3080-V

14.4 Connection Diagram PLC-interface

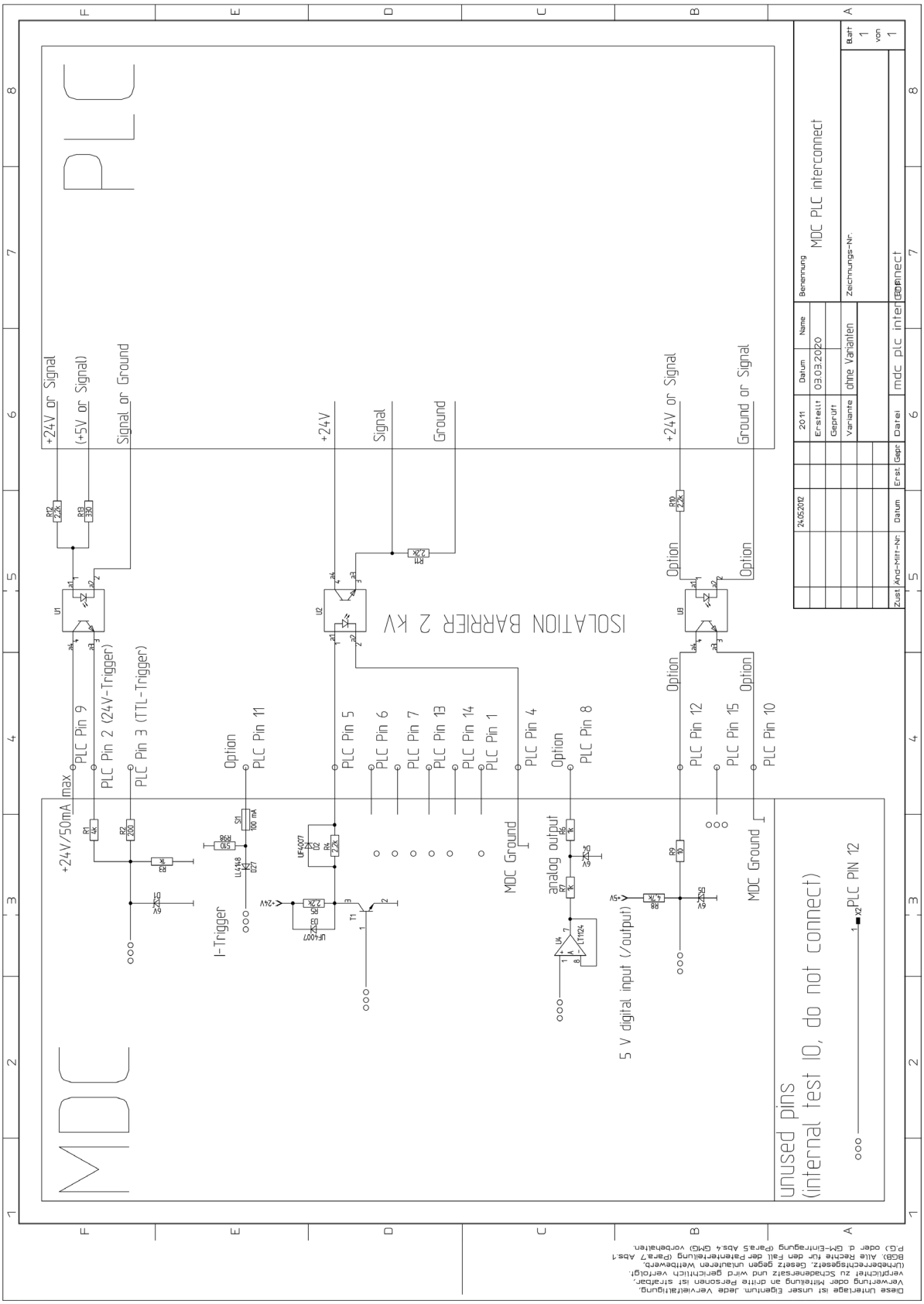


Fig. 47: Connection Diagram PLC-interface

14.5 Connection Diagram MDS 3080-V

This diagram shows the connections of an MDS 3080-V.

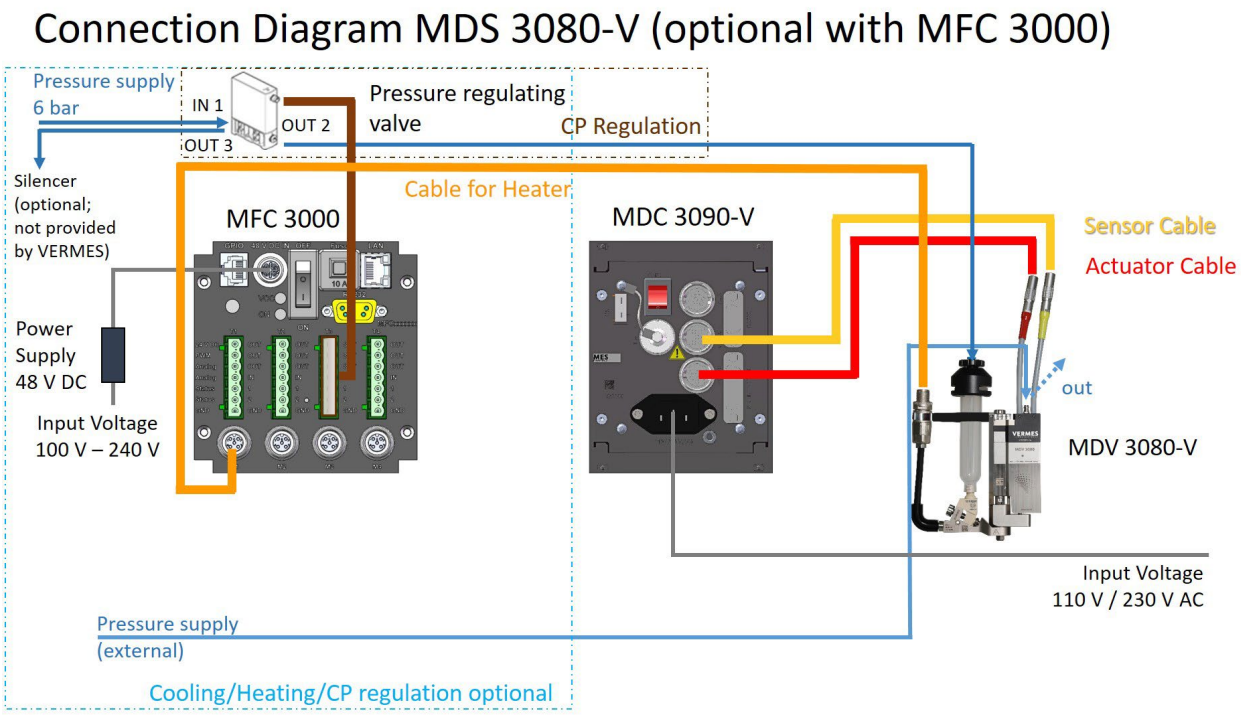


Fig. 48: Connection Diagram MDS 3080-V

14.6 Overview of the MDC Menu

For a more detailed description of the (sub-) menus, see paragraph 4.5, page 27.

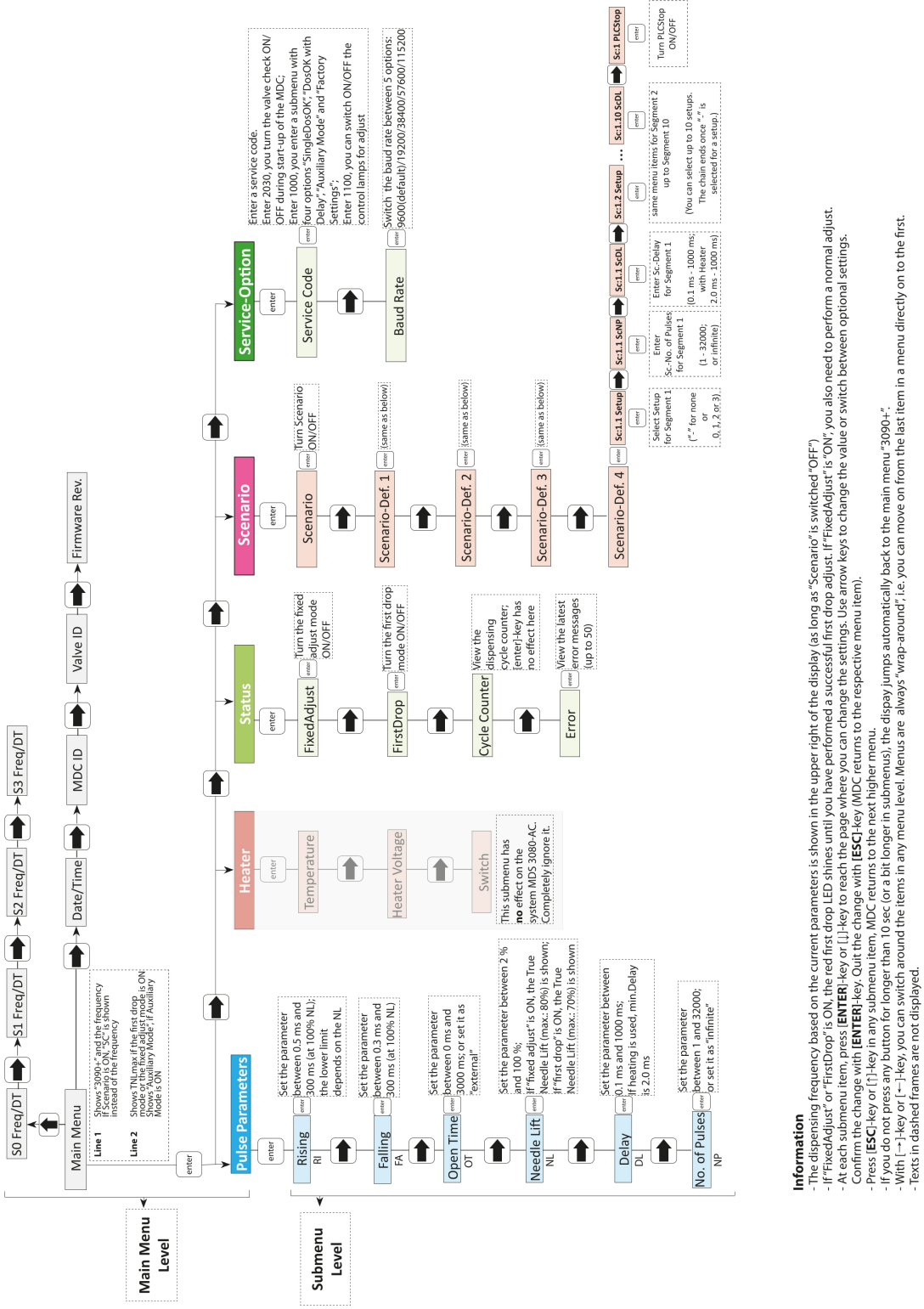


Fig. 49: Overview – Menu of MDC 3090-V (using the MDV 3080-V)

14.7 Overview of the Command Functions

Details of the commands listed below are explained in paragraph 8.1.2.2, page 88.

	RS-232C commands	Functions
1	*ESR? (e.g. 0 errors)	Check the latest error codes
2	*ESR2? (e.g. 0 errors)	Check the latest error codes with parameters
3	*IDN?	Check device information
4	*OPC?	Check the last trigger impulses
5	ADJUST:?	Check the adjust status
6	ADJUST:START	Initiate the adjust
7	ADJUST:TO:CHANGE:<adjust range>	Change the parameters for the adjust range
8	ADJUST:VAL:FA:?	Check the status of the fixed adjust
9	ADJ:VALUES:?	Check the adjust range
10	HEATER:?	This command does not work in the MDS 3080-V
11	HEATER:1:OFF	This command does not work in the MDS 3080-V
12	HEATER:1:ON	This command does not work in the MDS 3080-V
13	HEATER:110V	This command does not work in the MDS 3080-V
14	HEATER:230V	This command does not work in the MDS 3080-V
15	KEY:ENTER	Send ENTER signal to confirm error(s)
16	KEY:ESCAPE	Send ESCAPE signal
17	KEY:ADJUST	Send the adjust signal
18	HELP	Check all RS-232C commands
19	LCD?	Check current content of the screen
20	SETADJLED:OFF	Deactivate the control lamps for adjust
21	SETADJLED:ON	Activate the control lamps for adjust
22	SYSTEM:KLOCK:OFF	Unlock the keypad
23	SYSTEM:KLOCK:ON	Lock the keypad
24	SYSTEM:SHOW:CYCLES	Check the current cycle counter
25	SYSTEM:SHOW:VALVEID	Check the valve ID
26	SYSTEM:SHOW:CONTROLLERID	Check the MDC ID
27	SYSTEM:SHOW:STATUS	Check the status of KeyLock, First Drop, Fixed Adjust, DosOK with Delay, SingleDosOK and Auxiliary Mode
28	SYSTEM:FIRSTDROP:OFF	Deactivate the first drop function
29	SYSTEM:FIRSTDROP:ON	Activate the first drop function
30	SYSTEM:FIRSTDROP:ADJUST:<starting value>	Starts the first drop adjust
31	SYSTEM:FIXEDADJUST:OFF	Deactivate the fixed adjust function
32	SYSTEM:FIXEDADJUST:ON	Activate the fixed adjust function
33	SYSTEM:DOSOKDELAY:OFF	Deactivate the DOSOK-Delay
34	SYSTEM:DOSOKDELAY:ON	Activate the DOSOK-Delay
35	SYSTEM:SINGLEDOSOK:SETUP	Set the Single-DOSOK signal to “Setup”
36	SYSTEM:SINGLEDOSOK:PULSE	Set the Single-DOSOK signal to “Pulse”
37	SYSTEM:PASSWORD:<your password>	Send the password for unlocking the keypad

	RS-232C commands	Functions
38	SYSTEM:PASSWORD:OFF	Deactivate the password for unlocking the keypad
39	SYSTEM:PASSWORD:ON	Activate the password for unlocking the keypad
40	SYSTEM:PASSWORD:SET:<your password>	Set the password for unlocking the keypad
41	SYSTEM:AUXILIARYMODE:ON	Activate the auxiliary mode
42	TEMP:?	This command does not work in the MDS 3080-V
43	TEMP:<set point in °C>	This command does not work in the MDS 3080-V
44	TRIGGER:SET:?	Check the current pulse parameters
45	TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM ("Rising": 1/10 ms)
46	TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM ("Rising": 1/10 ms)
47	TRIGGER:ASET:?	Check the pulse parameters in the RAM
48	TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM ("Rising": 1/100 ms) (MDC returns "OK")
49	TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM ("Rising": 1/100 ms) (MDC returns "OK")
50	STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM ("Rising": 1/10 ms) (MDC returns the saved parameters)
51	STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM ("Rising": 1/10 ms) (MDC returns the saved parameters)
52	STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM ("Rising": 1/100 ms) (MDC returns the saved parameters)
53	STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM ("Rising": 1/100 ms) (MDC returns the saved parameters)
54	VALVE:UP	Open the valve
55	VALVE:DOWN	Close the valve
56	VALVE:CHECK:OFF	Deactivate the valve check at the start-up of the MDC
57	VALVE:CHECK:ON	Activate the valve check at the start-up of the MDC
58	VALVE:CHECK:<value>	Starts a valve check with the given Needle Lift
59	VALVE:OPEN	Initiate a dispensing cycle with current parameters ("Rising": 1/10 ms) (MDC returns "OK")
60	VALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Initiate a dispensing cycle with given parameters ("Rising": 1/10 ms) (MDC returns "OK")
61	VALVE:OPENS<setup no.>	Initiate a dispensing cycle with selected setup ("Rising": 1/10 ms) (MDC returns "OK")
62	VALVE:AOPEN	Initiate a dispensing cycle with current parameters ("Rising": 1/100 ms) (MDC returns "OK")
63	VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Initiate a dispensing cycle with given parameters ("Rising": 1/100 ms) (MDC returns "OK")
64	VALVE:AOPENS<setup no.>	Initiate a dispensing cycle with selected setup ("Rising": 1/100 ms) (MDC returns "OK")
65	SVALVE:OPEN	Initiate a dispensing cycle with current parameters ("Rising": 1/10 ms) (MDC returns the saved parameters)

	RS-232C commands	Functions
66	SVALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Initiate a dispensing cycle with given parameters (“Rising”: 1/10 ms) (MDC returns the saved parameters)
67	SVALVE:OPENS<setup no.>	Initiate a dispensing cycle with selected setup (“Rising”: 1/10 ms) (MDC returns the saved parameters)
68	SVALVE:AOPEN	Initiate a dispensing cycle with current parameters (“Rising”: 1/100 ms) (MDC returns the saved parameters)
69	SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Initiate a dispensing cycle with given parameters (“Rising”: 1/100 ms) (MDC returns the saved parameters)
70	SVALVE:AOPENS<setup no.>	Initiate a dispensing cycle with selected setup (“Rising”: 1/100 ms) (MDC returns the saved parameters)
71	WRITE:LCD:<text>	Write an ASCII text on the display
72	SCENARIO:STATUS	Check the status of scenarios and PLCstops
73	SCENARIO:OFF	Deactivate the use of scenarios
74	SCENARIO:ON	Activate the use of scenarios
75	SCENARIO:PLCSTOP:1:OFF	Deactivate the PLC-Stop
76	SCENARIO:PLCSTOP:1:ON	Activate the PLC-Stop
77	SCENARIO:SAVE:<scenario no.>:<values>	Save the parameters for selected scenario
78	SCENARIO:READ:<scenario no.>	Check the parameters of selected scenario
79	SETUP:SAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Save parameters in a setup (“Rising”: 1/10 ms)
80	SETUP:ASAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Save parameters in a setup (“Rising”: 1/100 ms)
81	SETUP:READ:<setup no.>	Check the parameters of a setup (“Rising”: 1/10 ms)
82	SETUP:AREAD:<setup no.>	Check the parameters of a setup (“Rising”: 1/100 ms)
83	BAUDRATE:0/1/2/3/4	Change the baud rate
84	GETTD	Check the current time and date
85	MDC:RESTART	Restart the MDC

14.8 Changing the Adjust Range

The range where the green adjust LED is ON has for technical reasons a minimum size of 5.8 µm. This range can be expanded by using the serial command “ADJUST:TO:CHANGE:<range>” (see paragraph 8.1.2.2 "Explanations", page 88). This attachment explains the details.

IMPORTANT INFORMATION

Changing the adjust range can lead to leakages

Changing the adjust range is only recommended for selected applications in the fixed adjust mode. You should contact our technical support first, since sometimes widening the adjust range can lead to leakage despite a successful adjust.

The adjust range has the setpoint ADJ2 (the “SHOULD-value”) in its center (see Fig. 50). When the current position of the adjust (the “IS-value”) is within the adjust range, the green adjust-LED is ON. Is the current position beyond the adjust range the red adjust-LED is ON. In case the value for the current position is smaller than the value where the adjust range begins both adjust-LEDS are OFF.

With the serial command ADJ:VALUES:?, the MDC shows you the setpoint ADJ2 as well as the deviation of the current position from the setpoint (see paragraph 8.1.2.2, page 88).

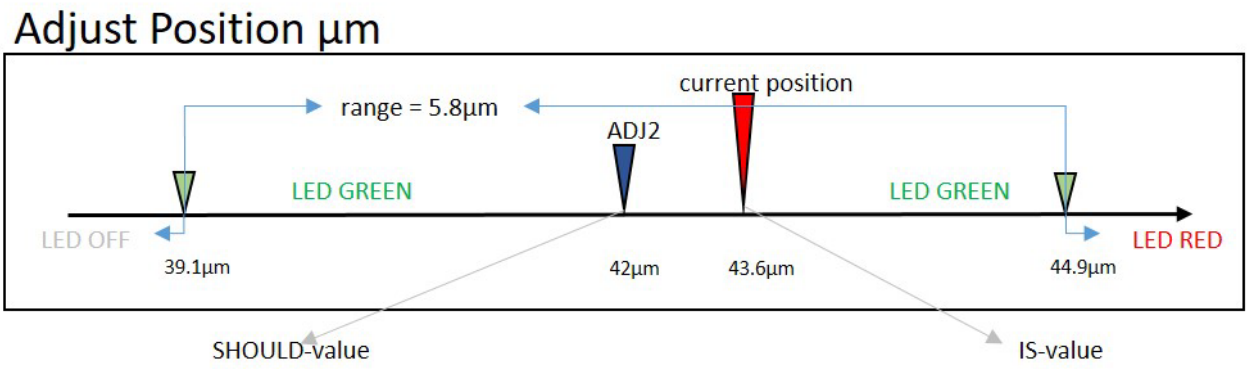


Fig. 50: Adjust position with unchanged adjust range

To widen the adjust range, use the serial command ADJUST:TO:CHANGE:<adjust range>. As parameter for the range, enter ten times the value in micrometer. E.g. to change the adjust range to 8.4 µm, enter 84 as value for the parameter. The new adjust range is again centered around the setpoint ADJ2. The following figure shows an example, where the adjust range is set to 14.2 µm (see Fig. 51). The range is then at 45 µm +/- 7.1 µm. In this example, the command would be ADJUST:TO:CHANGE:142.

You can only enter integer values between 58 and 300 as parameters (i.e. between 5.8 µm and 30.0 µm).

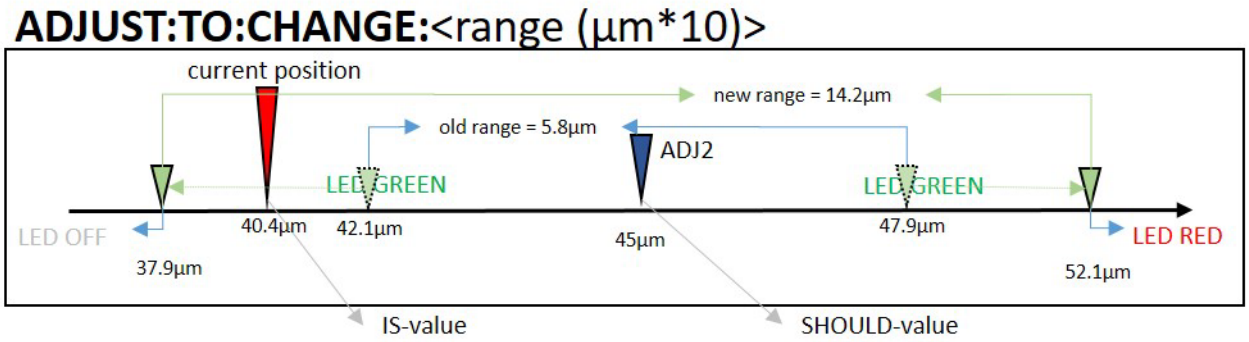


Fig. 51: Adjust position with adjust range changed with command ADJUST:TO:CHANGE

14.9 Declaration Concerning Decontamination of Shipped Equipment

Before returning Microdispensing Systems for purposes of inspection, maintenance and repair, be sure that the equipment is in a completely decontaminated state. You have to fill out the following form correctly; otherwise, the order will not be processed. Upon request, VERMES Microdispensing performs the required decontamination after receipt of the corresponding safety data sheet. This work will be calculated separately.

Only authorized and responsible personnel may fill out and sign this declaration!

1 Designation of the System	
Serial No.:	MDV SN# _____
	MDV SN# _____

2 Legally Binding Declaration	
The signer declares that the microdispensing system is free of any substances harmful to health. The decontaminated system is shipped according to legal prescriptions.	
Company: _____	
Address: _____ _____	
Name: _____	
Phone: _____	Fax:_____
E-Mail: _____	
Date: _____	Signature: _____
Company Stamp:	

3 Note for Shipment
In order to prevent damage to the equipment, the manufacturer recommends using the original packaging material for return. Instructions about transport have to be observed (see paragraph 12.1, page 156). The manufacturer is not liable for any damage resulting from inadequate packaging or transport.

15 List of Figures

16 List of tables

17 Index