precision dots

VERMES MICRODISPENSING

USER MANUAL

15.03.2022 Rev. B

Microdispensing System MDS 3200j

User Manual for Microdispensing Systems of the MDS 3200j Series

System	Control Unit	Valve*
MDS 3200j	MDC 3200j	MDV 3200j
MDS 3200j-HM	MDC 3200j	MDV 3200j-HM

Tab. 1: Available products

*For explanations of the different valve types, see paragraph 5.4, page 36.

INFORMATION

Manual only preliminary for MDS 3200j-HM

For a system MDS 3200j-HM, this user manual has to be seen as a preliminary manual. For MDS 3200j-HM, the needle lift is limited at 80 % (see paragraph 4.5.2, page 28 and paragraph 7.4, page 57).

1 Introduction

With a micro dispensing system of the MDS 3000 line from VERMES Microdispensing you have bought a high quality product. Due to the long-standing 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” 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 micro dispensing system MDS 3200j is a member of the MDS 3000 product family, specialized in most accurate dispensing and designed for flexible use with substances of low, medium and high viscosity (up to 2000000 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 (1 nl up to > 200 µl) 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.

Valves compatible with MDC 3200j

The base of each Microdispensing System of the MDS 3200j series is the control unit MDC 3200j, which is then combined with a valve of the MDV 3200j or MDV 3200-HM series.

Valve	Order no.	Valve	Order no.
MDV 3200j	1013119	MDV 3200A-HM	1014151

Tab. 2: Valves compatible with MDC 3200j

2 Safety Notes

This chapter summarizes the general safety aspects of this VERMES Microdispensing system. Further points to be observed 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 under-stand 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 microdispensing 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 microdispensing system MDS 3200j series 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 system MDS 3200j has been designed for ultra-precise contactless dispensing of fluids in a large range of viscosity (up to 2000000 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 (see paragraph 6.3.1 "Installation of the Control Unit", page 42).
- For exact dispensing results, the temperature of the actuator system should stay below 80 °C and the temperature at the outside of the valve body should stay below 39 °C. Therefore, you might need cooling. Cooling is achieved by compressed air, free of fine particles, dust, oil and condensate, quality classes 1, 4, 2 acc. to DIN/ISO 8573-1:2010.

- Solid particles: Quality class 1

  max. number of particles/m^3: 0.1 – 0.5 µm: < 20000, 0.5 – 1 µm: < 400, 1 – 5 µm: < 10
- Water content: Quality class 4

  max. pressure dew point +3 °C
- Residual oil: Quality class 2

  0.1 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. Damaged parts should be exchanged 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, it must be verified 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, the device should be placed 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).
- The valve is designed according to the Normally Open principle. Therefore the valve is normally open and the transported liquid can flow. Before switching OFF the microdispensing system, do not forget to lower the supply pressure to atmospheric pressure.

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. 3: 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. 4: 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. 5: Illustration convention

3.2.3 Abbreviations

Abbr.	Full Name
CTF	Ceramics Tappet Flat
CTK	Cleaning Tool Kit
NI	Nozzle Insert
NU	Nozzle Unit
NU-fix	Nozzle Unit with fixation
NAN	Nozzle Adjustment Nut
NAN-fix	Nozzle Adjustment Nut with fixation
MDC	Controller (MicroDispensingControl unit)
MDF	Fluid box (MicroDispensingFluid box)
MDS	MicroDispensingSystem
MDV	Valve (MicroDispensingValve)
MDX	Supply unit
POD	Point of Dispensing
RTC	Real-time clock
TG	Tappet Guidance
PLC	Programmable Logic Controller
TTF	Tungsten carbide Tappet Flat

Tab. 6: Abbreviations

3.3 Tools

The following tools are required to install and to operate the MDS 3200j:

- MDT 301 - Universal Tool (Order no. 1010208)
- MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)
- MDT 304 - Nozzle Insert – Squeezing Out Tool (Order no. 1007085)
- MDT 306 - Torque Wrench Tool VM black with Bit-Adapter (Order no. 1015062)
- MDT 310 - Tappet Changing Tool (Order no. 1008344)
- MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)
- MDT 324 - Nozzle Insert Cleaning Holder (Order no.1014310)
- MDT 327 - Multi-Function Tool (Order no.1014440)
- Hexagon Socket Key Set (Order no. 1012993)

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

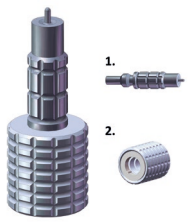
IMPORTANT NOTE

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 seal (1.) • "Adjustment grip" with a receptacle for the nozzle adjusting nut (2.)
Intended Purpose: 1. Fixing and removing of tappet sealing and tappet centering piece 2. Holding nozzle insert to place it in the tappet guidance (sealmounter) 3. It may also be used to execute the general adjust (alternatively to tool MDT 327)



Tab. 7: 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 guidance in order to unscrew the tappet guidance from the nozzle adjustment nut. The other end is used when mounting LX sealings.
Intended Purpose: 1. Screwing apart nozzle adjusting nut and tappet guidance when changing the nozzle insert 2. Mounting LX sealings

Tab. 8: MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)

3.3.3 MDT 304 – Nozzle Insert – Squeezing Out Tool

The diameters of the end pieces of tool MDT 304 are not identical, as each of them is used for a different purpose.	
Intended Purpose: 1. Squeezing out of the tappet sealing between fluid box and actuator (1.) 2. Detaching the nozzle insert from the tappet guidance (2.)	

Tab. 9: MDT 304 – Nozzle Insert – Squeezing Out Tool (Order no. 1007085)

3.3.4 MDT 310 – Tappet Changing Tool

The MDT 310 features a bore with two studs, serving as a receptacle for the tappet. When exchanging the tappet, carefully push it into this bore until the studs latch into the grooves of the tappet centering screw. Then the centering screw can be inserted or removed by rotating the tool (while applying a light constant pressure). The other end has been changed to be used for an adjust screw (VERMES gearing VM-A).	
Intended Purpose: 1. Removing the present tappet and fixing a new one 2. Performing the top adjust (alternatively to tool MDT 307)	

Tab. 10: MDT 310 - Tappet Changing Tool (Order no. 1008344)

3.3.5 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 find it on the manual DVD.	
Intended Purpose: 1. Cleaning of clogged nozzle inserts	

Tab. 11: MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)

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 find it on the manual DVD.	
Intended Purpose: 1. For holding a nozzle insert during cleaning with compressed air	

Tab. 12: 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 nozzle adjustment nut or into the slots of the tightening screw (gearing VM-A). Other end 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. Changing of tappet guidance (in combination with MDT 303)	

Tab. 13: MDT 327 – Multi-Function Tool (Order no. 1014440)

3.3.8 Hexagon Socket Key Set

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

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

3.3.9 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 as a set (BitVM Set for MDT 306 Torque Wrench Tool, order no. 1013398). Additional information is in the Quick Reference Guide “Torque Wrench Tool VM MDT 306”. You can find it on the manual DVD.

Intended Purpose:

1. Screws for fluid box
2. Tappet guidance
3. Tightening screw
4. Fluid box connector Luer-Lock
5. MDC front panel
6. Nozzle Fixation Nut

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

3.3.10 Torques (in cN.m)

Element	Gearing Profile	Bit Order No.	Torque (cN.m)		Cross Reference
			Min.	Max.	
Screws for MDC front panel (cross recess screw, size M3)		1013373	30	40	Page 42
Screws for fluid box M 2.5 x 8 (hexagon socket, size 2)		1013294	80	100	Page 114
Screws for cartridge holder M 2,5 x 14 (hexagon socket, size 2)		1013294	10	15	Page 39
Fluid box connector Luer-Lock (hexagon screw, size M8)		1013374	100	120	Page 114
Tightening screw (gearing VM-A)		1014519	120	140	Page 114
Tappet guidance H (gearing VM-B)		1014521	80	100	Page 39
Tappet guidance PEEK (gearing VM-B)		1014521	40	60	Page 39
Tappet centering screw (gearing VM-C)		1014520	100	140	Page 126

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 146*)* 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 lineary for other temperatures).
Casing Type	Plug-in case for 19“ rack
Color of Casing	Black, with light blue front panel
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	Light grey, dark grey
Control Lamps (Front)	1x Heating circuit (red) 1x Service request (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 Sensor socket 1x Actuator socket 1x Socket for heating 1x Thermocouple socket

4.2 Front Side

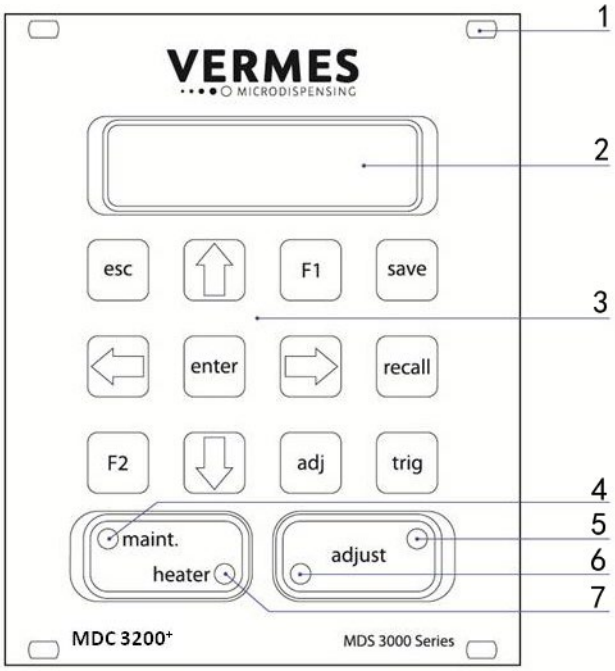


Fig. 1: Front Side

1 Mounting hole
2 LC display
3 Keypad with 12 soft keys
4 Control lamp for service request "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 24).

Control lamp for service request (maint.):

As soon as this lamp lights up, it is recommended to return the valve to the manufacturer (or licensed subcontractor) for regular periodic maintenance.

Control lamps for adjust:

The adjust for the valve is internally monitored; the result is visualized during the adjust by means of these two control lamps.

Green: The value is OK and can be confirmed by **[enter]**.

Red: The value is too high. You have to lower it according to the instructions of this manual (see paragraph 6.5 "The Adjust Process", page 48).

Outside of the adjust, the red adjust-LED is also ON, whenever the MDC has detected an error.

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

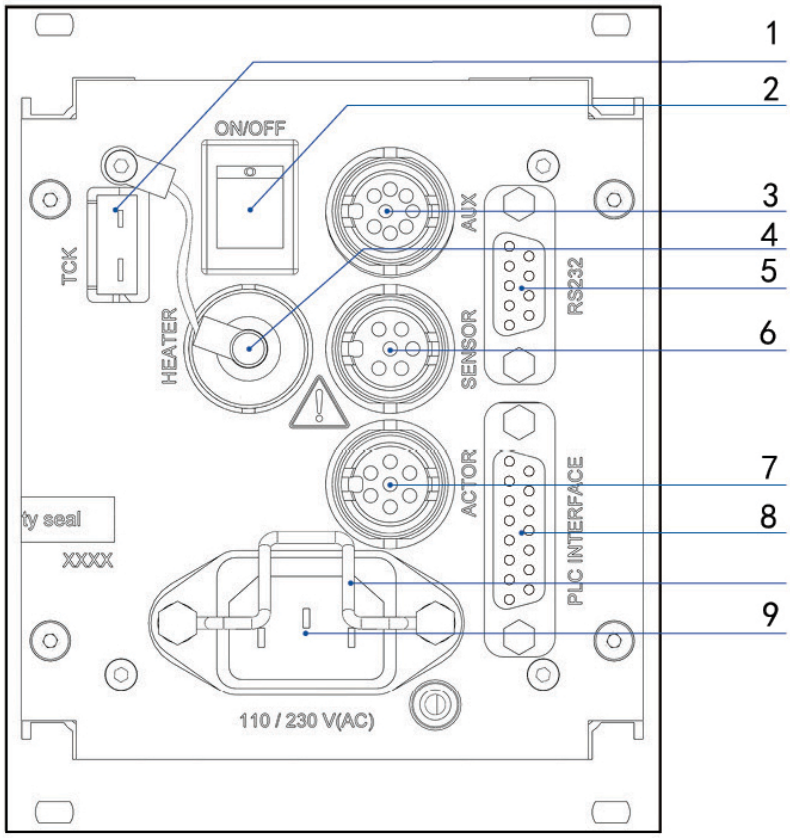


Fig. 2: Back side

1 Thermocouple „Type K“ socket
2 Mains switch
3 not activated
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.

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 Page 94.

RS-232C interface (9-pin):

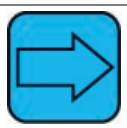
Since the system offers the possibility of external programming of dispensing parameters via PC, a local RS-232C is integrated to receive the data. For the communication protocol, refer to Page 67.

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 Page 48). 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, and 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 Needle Lift used is capped at 80 %. 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 are given 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.

4.5 Menu Structure

The main menu of the control unit MDC 3200j contains 4 submenus: “Pulse Parameters“, “Heater“, “Status” 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/Time”, “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 preset Setups. 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 sub menu 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 27).

- Dispensing parameters for a particular process can be recalled and modified in the sub-menu “Pulse Parameters“.
- “Heater” – select the settings for the heating.
- In the submenu “Status”, the current state of the system with respect to the maintenance interval can be verified by the function “Maint. Cycle”. With “Maint. Message” you can decide to show maintenance messages or not. Error messages concerning the system are shown with the function “Error“.
- The submenu “Service-Option” is used to enter service codes and to change the baud rate.

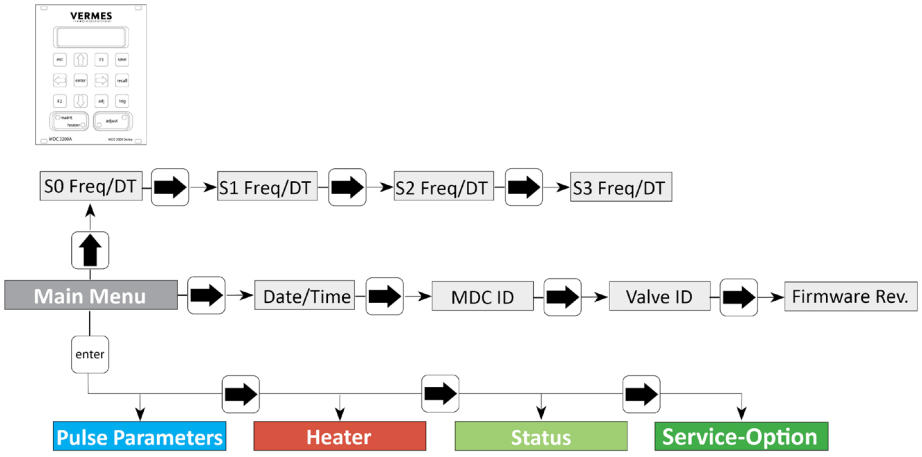


Fig. 3: Main menu

4.5.1 Main Menu

When you switch ON the MDC, you always start in the “Main Menu“. The display shows “Ready” (position 1, see Fig. 5). 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 setups. All levels are “wrap-around”, i.e. you can circle around between the items with both keys.

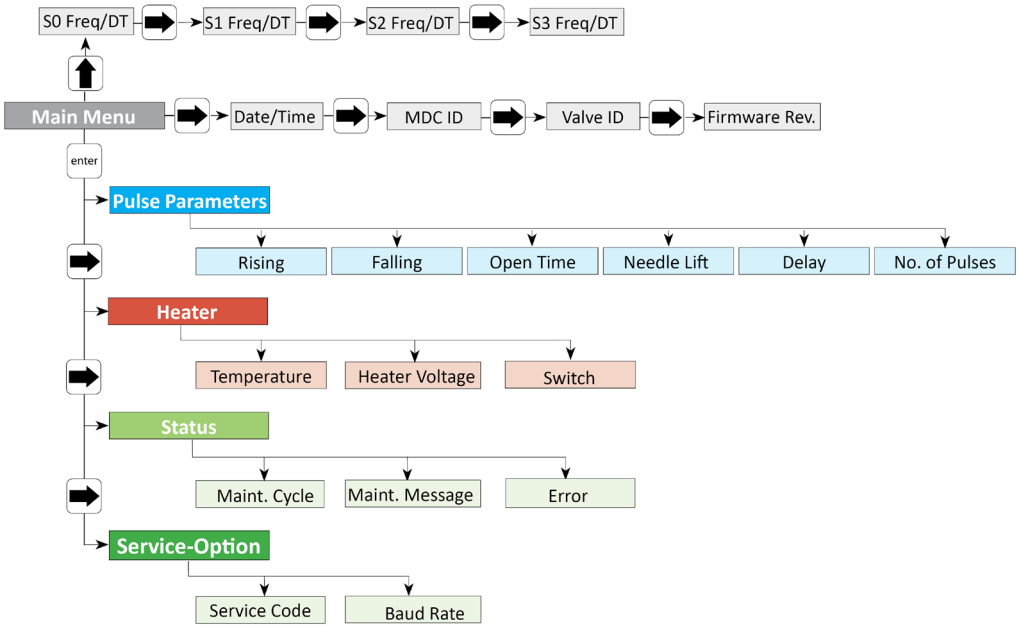


Fig. 4: Menu structure

INFORMATION!

On this level, the display jumps automatically back to “Ready”, 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 case a heater is connected, the current temperature is shown instead of “Ready”.

In the upper right corner of the display (position 2, see Fig. 5), the displayed letter(s) show(s), in which submenu you are (PP = Pulse Parameters, H = Heater, S = Status, SO = Service-Option).

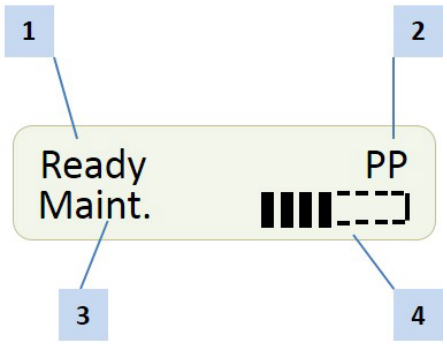


Fig. 5: Display main menu

In the lower line, a maintenance bar is shown (position 3, “Maint.”). The bar on the right side (Position 4) has eight sections. If all eight sections are filled, maintenance is recommended. If four of the sections are filled, it reaches half of the numbers of shots. Though be aware that this bar is only updated when starting the MDC!

If a heater is used, instead of “Ready” the current temperature is displayed.

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. You cannot enter values outside these ranges. The values for rising and falling are for 80 % needle lift. If the needle lift is smaller, the values might be lower.

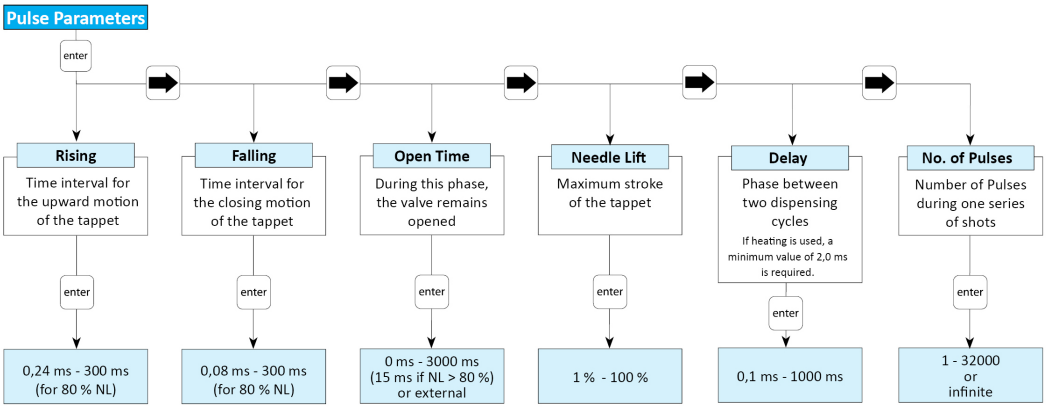


Fig. 6: Submenu „Pulse Parameters“

4.5.3 Submenu „Heater“

Several options (MDH-230te, MDH-230tf and MDH-230tg) are available to heat the nozzles of the microdispensing system MDS 3200j. If a heater is connected to the system, the main menu shows the current temperature (in °C) instead of “Ready”.

⚠ CAUTION

Danger of burns through high temperatures!

The nozzle heater can reach temperatures of up to 120 °C.

- Do not touch this area during operation.
- And afterwards only touch it once it has cooled down.

By using a heater, the dynamical viscosity of the fluid to be dispensed can be controlled. 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.

To reach a certain target temperature takes time. As an example the required times (in seconds) for a heater to reach a given temperature are shown in the following table. Please use these values only as a rough guide, since they are influenced by many different circumstances, e.g. the outer temperatures or the fluid box chosen. Those times would increase even further, if you

forget to switch your heater to the correct voltage (see menu picture below). For technical reasons it will always take a little longer until the heater LED switches from blinking to a steady light.

Target Temperature (°C)	Heating Time (s)			
	MDH-230tf (at 230 V)	MDH-230te (at 230 V)	MDH-230tf (at 110 V)	MDH-230tg (at 230 V)
30	40	-	-	40
40	50	60	-	70
60	50	-	-	70
120	80	140	400	80
160	160	-	-	120

Tab. 17: Heating times

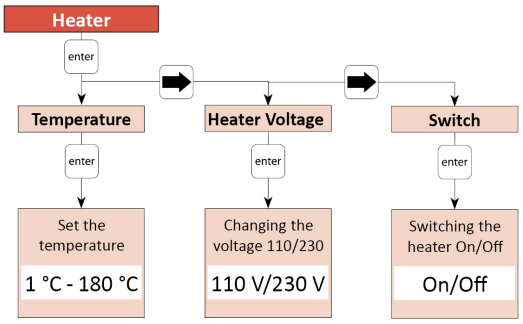


Fig. 7: Submenu „Heater“

All the important settings when using a heater can be set up in this submenu. With “Temperature”, you can select the temperature values, and with “Switch”, you can switch the heater ON and OFF. The third option (“Heater Voltage”) allows you to adapt your heater to the local voltage.

INFORMATION

„Temp:?“ without heater

While heater is turned “OFF”, the MDC will answer with “No Heater” to the serial command “TEMP:?”.

4.5.4 Submenu „Status“

With “Cycle Counter”, you can check the cycle count of the dispensing cycles. In “Maint. Message” you can decide to show or hide the maintenance messages. “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 (see paragraph 11.2 "Explanations of Error Messages", page 129).

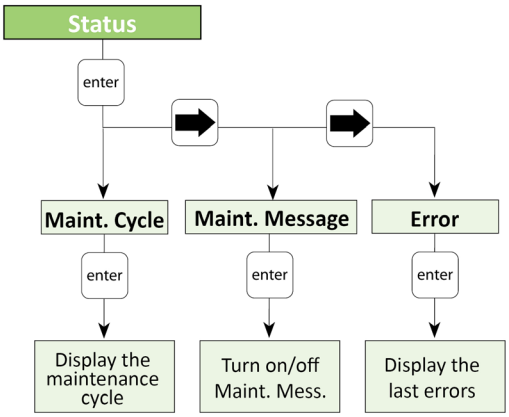


Fig. 8: Submenu „Status“

4.5.5 Submenu „Service-Option“

This menu has two sections. In “Service Code” you can enter a service code. 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).

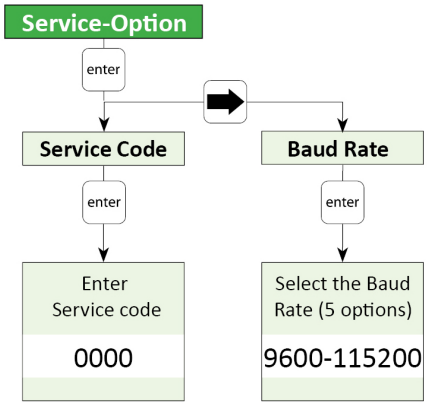


Fig. 9: Submenu „Service-Option“

Option	Explanation
SingleDosOK	You can select between the possibilities that the SingleDosOK signal is switched per pulse or per setup. (The default setting is per pulse. For the pin configuration of the PLC interface, see Page 94.)
DosOK with Delay	You can select, if before switching the signal DosOK there should be one delay executed at the end. (The default setting is OFF.)
Auxiliary Mode	Here the auxiliary mode can be switched ON or OFF (see paragraph 7.9 "Auxiliary Mode", page 59).
Factory Settings	Here any parameters can be returned to the default factory settings (see paragraph 7.8 "Factory Settings", page 59). 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 to the factory settings; also the heater will be turned OFF and the temperature set to 1°C) • 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]**).

Or 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". It cannot be changed by the user. It may be loaded to the working configuration and the RAM memory after major disturbances of the system.

5 Microdispensing Valve

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

5.1 Composition

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 unit (5)
- Fluid box (6)
- Media supply (7)

Fig. 10: Composition

The valve body (1) accommodates the electronics module and the actuator system. 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.

The tappet (2) emerges from the other side of the actuator system. It can be exchanged. 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 10.2 "Maintenance of the Tappet", page 123).

The connection between valve body and fluid box is made up of the tappet sealing (3). There are two groups of tappet sealings. One group consists of the Tappet Sealings PE and PTFE, which have to be used together with a tappet centering piece. The other group is made up by the Tappet Sealings LX. They can be made of different materials, as e.g. the Tappet Sealing LX CeTeDur 170. Tappet Sealings LX do not need a tappet centering piece (see paragraph 9.4.6 "Dismounting, Cleaning and Mounting a Tappet Sealing LX", page 119).

A small but important module is the nozzle insert (4), which has to be considered as a wearing part. The user may choose from a large number of insert types, according to the current application. They can differ in form and material.

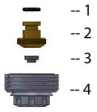


Fig. 11: Nozzle unit

1 O-ring
2 Tappet guidance
3 Nozzle insert (NI)
4 Nozzle adjustment nut (NAN)

The nozzle unit (5) includes the nozzle adjusting nut, the tappet guidance and the O-ring-N (see Fig. 11). The nozzle insert (NI) is a separate item, easily to be cleaned and to be exchanged in case of need. For optimizing dispensing result, VERMES Microdispensing offer a range of nozzle insert (NI).

The fluid box (6) is thermally isolated from the actuator system. Its purpose is to transport the liquid from the cartridge or the tank to the nozzle unit. In order to simplify independent cleaning, this module can easily be disengaged from the valve, just by opening two screws. Information how to assemble a fluid box you can find in (see paragraph 9.4.5 "Assembling of the Fluid Box", page 114).

The media supply (7) supplies the dispensing medium and is connected with the fluid box. VERMES Microdispensing GmbH has many different configurations available (see Page 141). 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.

5.2 Explosion View Valve

The explosion view of an MDV 3200A is given as an example. The other compatible valve models are built similarly.

IMPORTANT NOTE

Tappet Sealing LX

If you use a Tappet Sealing LX, you may not use a tappet centering piece with it.

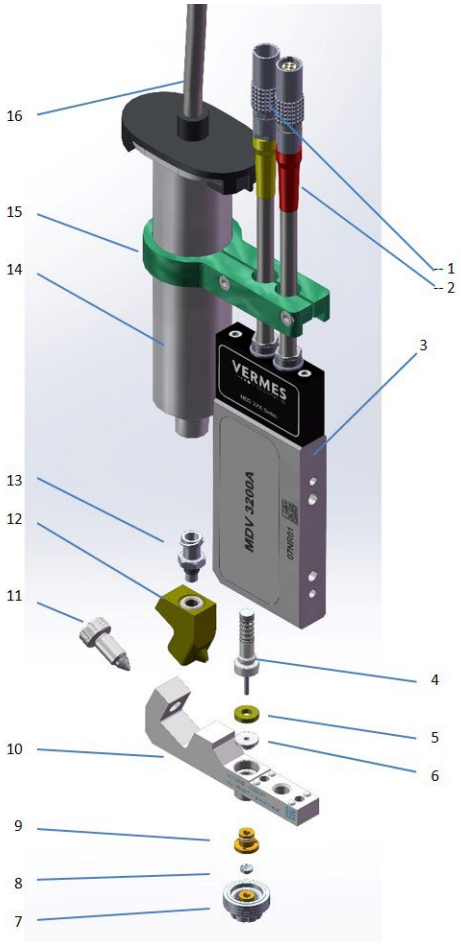


Fig. 12: Explosion view valve

1 Cable connection – Sensor (yellow)
2 Cable connection – Actuator (red)
3 Microdispensing valve
4 Tappet (with tappet spring and tappet centering screw)
5 Tappet centering piece
6 Tappet sealing
7 Nozzle adjustment nut
8 Nozzle insert
9 Tappet guidance with O-ring seal
10 Fluid box body
11 Tightening screw
12 Cartridge base
13 Fluid box connector Luer-Lock
14 Cartridge
15 Cartridge holder
16 Connection for compressed air

5.3 Technical Data

Parameter	Value
Dispensable Quantity	5 nl up to > 150 µl per cycle (for highly viscous medium)
Inlet Pressure Range	Depending on the supply unit (e.g. cartridge or pressure tank)
Dynamic Viscosity of Fluids	Low to high viscosity up to 200000 mPas
Response Time (PLC-interface)	ca. 115 µs
Dispensing Frequency (max.)	2 kHz
Dispensing Frequency (average)	350 kHz
Compatibility	all aqueous fluids, organic solvents, weak acids and bases
Dimensions (basic model)	115 mm x 39.5 mm x 12 mm
Weight	ca. 159 g (depending on configuration)
Position of Tappet in Absence of Voltage	Open

5.4 Valve Types

Compatible with the MDC 3200j are valves of the following series.

- MDV 3200j (low to high viscosity)
- MDV 3200-HM (low to high viscosity; with air-cooling)

Which type is best suited for your application? This depends on different criteria. Air cooled valves should be your choice, if you dispense with lots of power or if you use a nozzle heater and constant temperatures are important.

5.5 Special Features of the Valve

Normally Open

In its not energized state, i.e. in absence of voltage, the valve remains in open position, so that the tappet tip does not block the channel of the nozzle insert. The liquid in such a situation therefore may flow. In reality, this fact does not represent a problem, since for this model, usually high-viscous media are processed which in worst case drain off very slowly.

It is recommended however, that users bear this fact in mind, and reduce the supply pressure to atmospheric pressure during longer interruptions and before switching OFF the unit.

Quick-Change

Replacement of the nozzle unit (with adjusting nut, insert, tappet guidance and O-ring) is quick and easy, due to the quick-change feature of this unit. Afterwards the user has to carry out the adjust, in order to establish a convenient position of the unit 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. Ordering the equipment already at an early stage however is recommended; do not forget to specify the relevant data (Valve ID etc.).

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 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 Page 100 and Page 101.
- For nozzle inserts, special steel, stainless steel, ceramics and PEEK options are permanently in store, allowing for perfect tailoring of the configuration to the needs of the particular application.

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 visually, if any damages can be detected.

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 DVD with user manual and software
3 Fluid box*	10 MDT 304 - Nozzle Insert – Squeezing Out Tool
4 Nozzle unit*	11 Actuator cable (red)*
5 Nozzle insert*	12 Sensor cable (yellow)*
6 MDT 303 - Nozzle Insert Changing Tool	13 Mains cable (black)
7 Tappet guard	14 Tappet Grease TF 1 ml syringe

*These parts are included only, if ordered explicitly.

Fig. 13: Content

Options	Recommended options
Different models of fluid boxes Different fluid box connectors Nozzle heating	Cleaning set MDT 301 - Universal Tool MDT 310 - Tappet Changing Tool

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

INFORMATION

Information! (Some parts already preassembled)

Some elements of the equipment are usually delivered in preassembled state. If not, you can find the mounting of the tappet in paragraph 10.2, page 123 and the assembling of the fluid box in paragraph 9.4.5, page 114. Always make sure all screw couplings sit tight.

Proceed as follows:

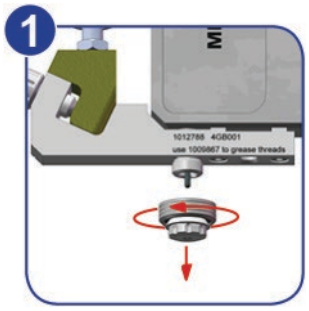


Fig. 14: Step 1: Separate the nozzle unit from the fluid box (1).

Fig. 15: Step 2: Mount a nozzle insert. (2)

Fig. 16: Step 2: Mount a nozzle insert. (3)

– Unscrew the tappet guidance from the nozzle adjusting nut. Use the Nozzle Insert Changing Tool MDT 303.
– Place the nozzle insert onto the tip of the tappet guidance; the large face of the nozzle insert has to point down. Firmly reattach the tappet guidance to the nozzle adjusting nut. Use tools MDT 301 and MDT 327 (see torque table Page 18). Make sure to keep the tool MDT 303 upright until the tappet guidance is fastened completely. Otherwise, the nozzle insert might drop out.

Fig. 17: Step 3: Mount the nozzle unit. (4)

– Screw the assembled nozzle unit (tappet guidance with seal, nozzle adjusting nut and nozzle insert) to the fluid box (2–3 rotations, to be executed manually).

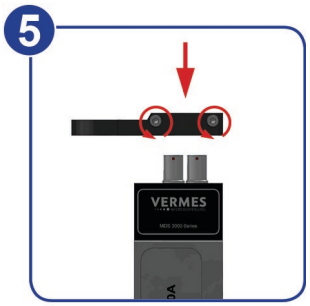


Fig. 18: Step 4: Install the media supply. (5)

– Push the cartridge holder over the actuator connector and sensor connector. Depending on the size of the cartridge, you have to select the correct cartridge holder.
– Screw tight the two screws (torque 10 – 15 cN.m).

Fig. 19: Step 4: Install the media supply. (6)

– Screw the Luer-Lock connector into the cartridge base CC, using tool MDT 327. If the space is tight, you might have to do this before attaching the cartridge holder. (Other cartridge bases exist, where the Luer-Lock connector is already integrated. There you can ignore this step.)

Fig. 20: Step 4: Install the media supply. (7)

– Place the cartridge itself into the cartridge holder and connect it to the fluid box connector Luer-Lock, screwing clockwise

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

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 INFORMATION

IMPORTANT! 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 Page 18).

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. 21: Distance of the bores 45 mm

IMPORTANT INFORMATION

INFORMATION! 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

WARNING! Switch off before removing plug

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

⚠ CAUTION

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 get 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 INFORMATION

IMPORTANT! (Switch off for 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 -30 V to 120 V (bipolar operation).

Fig. 22: 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. 23: 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

INFORMATION! (Connecting cables)

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

INFORMATION

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. 24). Then pull both connectors apart without losing the grip and they will separate.

Do not pull at the cables!

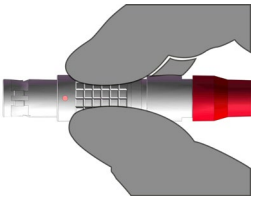


Fig. 24: Connector actuator cable - grip

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.

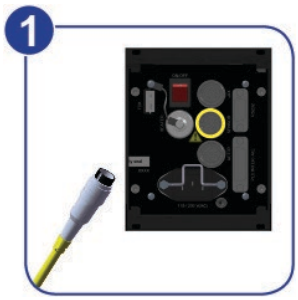


Fig. 25: Connecting the sensor cable – step 1

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

Fig. 26: 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

INFORMATION! (Connecting cables)

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

INFORMATION

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. 27, page 46). Then pull both connectors apart without losing the grip and they will separate.

Do not pull at the cables!

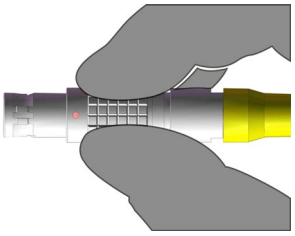


Fig. 27: Connector sensor cable - grip

6.3.3.3 Mains Cable

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

IMPORTANT INFORMATION

IMPORTANT! (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

INFORMATION! (Valve not connected)

If the valve is not connected, an error message (“101 Incorr. Valve“) appears on the screen. Switch OFF the system, disconnect it from the mains and complete the installation before continuing.

6.4 Valves with Air-cooling

If the valve has air-cooling adapters (MDV 3200-HM), connect it now to your compressed-air source (with hose diameters of 4 mm).

Insert one end of the hose to the air inlet of the valve (in). The retaining sleeve automatically latches. Connect the other end to the air supply.

The second connector (out), illustrated above, represents the outlet, evacuating the heated compressed air from the valve. When running the hose to the air supply, 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 hot melt application or other high temperature applications, you should set the pressure higher, at up to 4 bar.

IMPORTANT INFORMATION

IMPORTANT (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: Quality class 1

max. particle number/m^3: 0.1 – 0.5 µm: < 20000, 0.5 – 1 µm: < 400, 1 – 5 µm: < 10

- Water content: Quality class 4

max. pressure dew point +3°C

- Residual oil: Quality class 2

max. 0.1mg/m^3

6.5 The Adjust Process

This chapter explains the adjust, which is necessary for all valves. A thoroughly performed adjust is the basis for clear and reproducible dispensing results.

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.

This paragraph describes the normal adjust, without using a heater. An adjust with nozzle heater is described in paragraph 8.2.3, page 97. You can also control the adjust via the serial interface as remote adjust paragraph 7.10.3, page 62.

IMPORTANT INFORMATION

IMPORTANT! (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 Page 99).

INFORMATION

INFORMATION! (Correct installation of the nozzle unit)

You have to install the tappet guidance including the nozzle insert correctly (see paragraph 6.2, page 39 and paragraph 9.4.5, page 114). Otherwise the adjust may fail.

Adjust, step 1:

– You start the adjust by pressing the **[adj]**-key on the keypad of the control unit.

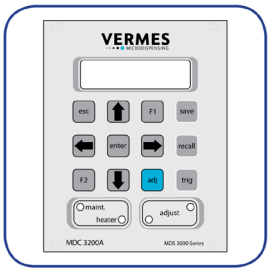


Fig. 28: Adjust, step 1 (starting the adjust)

You get the following message in the display:

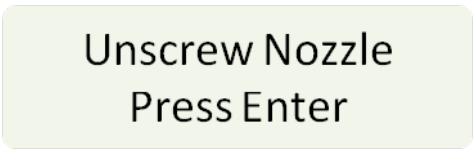


Fig. 29: Message Unscrew Nozzle Press Enter

– Unscrew the nozzle unit from the fluid box (counter-clockwise, max torque 50 cN.m). Use tool MDT 327 or MDT 301. It is important to perform the adjust only with the nozzle unit unscrewed. Otherwise, you cannot reproduce the result consistently.
– Afterwards press the **[enter]**-key.

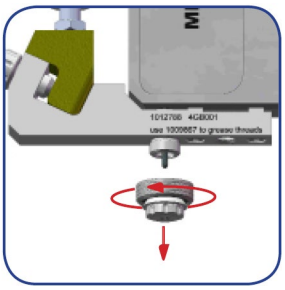


Fig. 30: Adjust – Unscrew nozzle unit

The display shows the message “500 Shots – Please Wait”. These shots help to prepare the valve for the adjust.

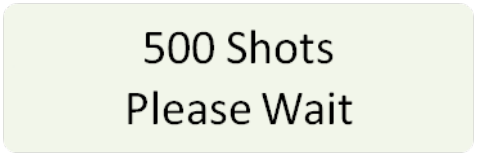


Fig. 31: Message 500 Shots – Please Wait

Wait until a new message on the display announces the next step.

Adjust, step 2:

For a few seconds in the display appears “Adjust Nozzle – Enter if green”.

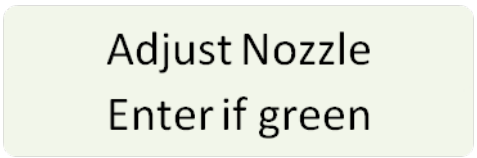


Fig. 32: Message Adjust Nozzle – Enter if green

After a few seconds, the initial message disappears from the display. Instead, the current value is shown. At first, it will be roughly between 960 and 985. Screw the nozzle unit towards the fluid box (clockwise).

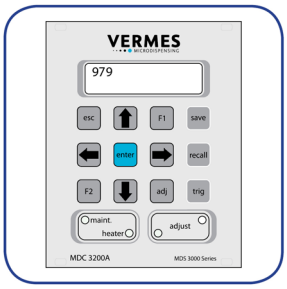


Fig. 33: Adjust value shown in the display

– Keep turning until the red adjust LED is ON. The value shown in the display should be about 1100.

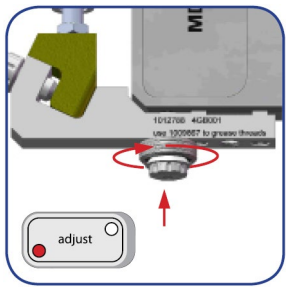


Fig. 34: Adjust – Screw nozzle unit far in

IMPORTANT NOTE

IMPORTANT! (upper limit)

Maximum admissible display value is 1250. Otherwise the tappet could break.

Adjust, step 3:

– Turn the nozzle unit counter-clockwise, until both adjust LEDs are OFF. The value shown in the display should be again just below 1000.

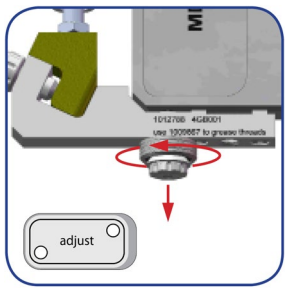


Fig. 35: Adjust – Unscrew nozzle unit

Adjust, step 4:

– Now turn the nozzle unit slowly clockwise, until the green adjust LED is ON. The value in the display should be between 1030 and 1040. Confirm the adjust with pressing **[enter]**.The adjust is finished and you are send back to the main menu.

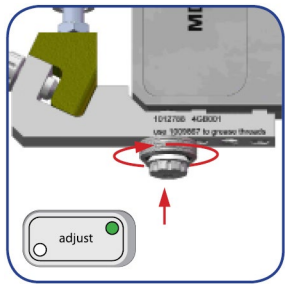


Fig. 36: Adjust – Screw nozzle unit back in

IMPORTANT INFORMATION

IMPORTANT!

- The whole procedure has to be repeated, if the value fluctuates or decreases within a short period of time (ca. 5 sec). Start again from step 1.
- Screw the nozzle unit carefully onto the fluid box. Avoid tilting the nut by tilting the nozzle unit. This procedure requires sufficient concentration.

INFORMATION

INFORMATION! (Information about the adjust)

- A correctly completed adjust can only be confirmed with **[enter]**, while the green adjust LED is ON. Make sure to complete the whole adjust (in, out, in). Do not press **[enter]** beforehand, even if the green adjust LED is ON. By going the whole range up and down, you make sure there are no dirt particles in the way of the tappet.
- The angular area, where the green adjust LED is ON, is normally small in a clean system. The rotation angle with the tool is below 30°. If you have got a clean system, but this angle is larger, then this might be a sign of wearout.

INFORMATION

INFORMATION! (Abort and end of procedure)

- The adjust can be aborted any time by pressing **[esc]**. The display changes back to the main menu.
- After the adjust the green lamp dims within approx. 5 s.

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 INFORMATION

IMPORTANT! (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 7 bar. This upper limit should not be exceeded in normal applications; in most cases, even a value of 4 bar is sufficient.

Standard values:

- Low-viscous fluids (e.g. water): 0.5 – 1.5 bar
- Medium viscosity (e.g. SMT-adhesives): 1.5 – 2.0 bar
- High viscosity (e.g. pastes): 2.0 – 7.0 bar

IMPORTANT INFORMATION

IMPORTANT! (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. 0.13

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 58).

Confirm the following parameter selection:

Rising 0.5, Open Time 1.5, Falling 0.17, 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 58) 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 28).
- 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

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 68).

- **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".

- 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.

INFORMATION

INFORMATION! (Open Time and Needle Lift)

The maximum value for the “Open Time” is limited to 15 ms, if the “Needle Lift” is set to more than 80 %. If not, the limit is 3000 ms. The length of the “Open Time” depends on the PLC-signal (logic 1).

7.3 Parameters for the Dispensing Process

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

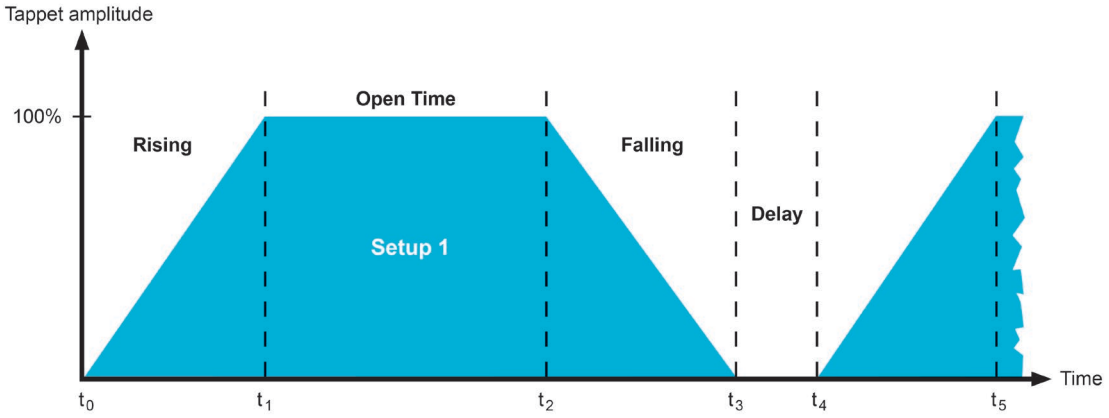


Fig. 37: System behavior

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 for ≤ 80 % NL = 3000 ms Max. open time for > 80 % NL = 15 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” (for needle lift ≤ 80 %). Maximum open time for needle lift > 80 % is restricted to 15 ms. (Please note the information in Needle Lift as well.)
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 %. For the range between 80 % and 100 %, the valve works in bipolar mode. The elevated temperature in this range reduces the average frequency and the lifetime of the valve. A needle lift between 70 % and 80 % is the best working range. **INFORMATION!** If a MDV 3200-HM valve is connected, the Needle Lift is limited to 80 %. Higher values cannot be entered.

Tab. 18: Parameters for dispensing

7.4 Minimum and Maximum Parameter Limits

Parameters	Min. Value	Max. Value	Transform. Factor (serial interface)
Rising	NL 1 % = RI 0.01 ms NL 10 % = RI 0.03 ms NL 20 % = RI 0.06 ms NL 30 % = RI 0.09 ms NL 40 % = RI 0.12 ms NL 50 % = RI 0.15 ms NL 60 % = RI 0.18 ms NL 70 % = RI 0.21 ms NL 80 % = RI 0.24 ms NL 90 % = RI 0.27 ms NL 100 % = RI 0.30 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 71.)
Falling	NL 1 % = FA 0.01 ms NL 10 % = FA 0.01 ms NL 20 % = FA 0.02 ms NL 30 % = FA 0.03 ms NL 40 % = FA 0.04 ms NL 50 % = FA 0.05 ms NL 60 % = FA 0.06 ms NL 70 % = FA 0.07 ms NL 80 % = FA 0.08 ms NL 90 % = FA 0.09 ms NL 100 % = FA 0.10 ms	300 ms	*100 e.g. FA = 0.08 ms ≙ 8
Open Time	0 ms	NL 1-80 % = 3000 ms NL 81-100 % = 15 ms	*10 e.g. OT = 2 ms ≙ 20
Needle Lift	1 %	100 % (80 % with MDV 3200-HM)	*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	120 °C	*1

Tab. 19: Minimum and maximum parameter limits

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

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, together with settings for heater.

- 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

INFORMATION!

Pressing **[esc]** causes the saving procedure to be aborted. You can also use the submenu "Pulse Parameters" (see paragraph 4.5.2, page 28) 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

INFORMATION!

[esc] interrupts the procedure at once.

7.8 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 = 0.20 ms, OT = 2.0 ms, NL = 80 %, 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

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	0.20	80	1	10.0
Setup 1	1.00	4.0	0.12	80	1	10.0
Setup 2	0.50	2.0	0.20	80	10	10.0
Setup 3	0.40	0.6	0.16	80	1	10.0

Tab. 20: Factory settings of the setups

With Setup ALL (see paragraph 4.5.5 "Submenu „Service-Option"", page 31) Setup 4 – 10 get the same values as setup 0 (working configuration).

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 between three options. You can either reset the setups 0 – 3, all setups 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]**.

7.9 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 4.5.5, page 31).

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 127).

7.10 Dispensing with a Heater

The Microdispensing System MDS 3200j can optionally be equipped with a nozzle heater. Several distinct options (MDH-230te, MDH-230tf or MDH-230tg; see Fig. 38) are available. If a heater is connected to the system, the main menu shows the current temperature (in °C) instead of "Ready". More detailed information about the menu, while using a heater, you can find in paragraph 4.5.3, page 28 and paragraph 7.10, page 60.

Fig. 38: MDH-230tg

⚠ CAUTION

CAUTION! (High temperatures, danger of burns)

The nozzle heater can reach temperatures of up to 120 °C. Do not touch this area during operation. Afterwards only touch it once it has cooled down.

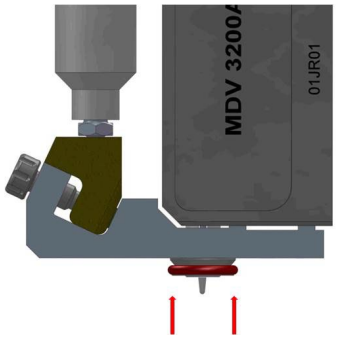
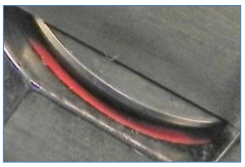
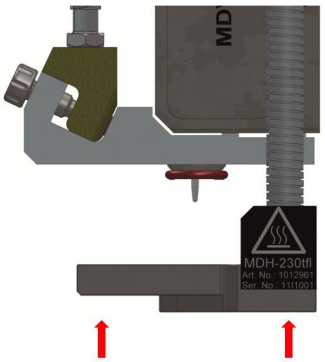
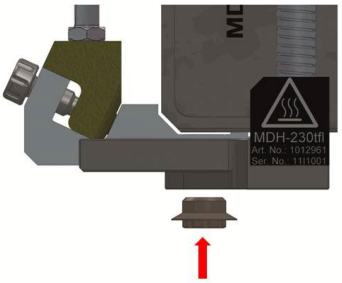
With a heater, you can control the dynamical viscosity of the fluid to be dispensed. For some liquids, dispensing without heating is impossible. Heating may also be required to ensure a constant process temperature, or when the dispensing has to take place above room temperature.

INFORMATION

INFORMATION!

The heater MDH-230tf is available in the variants MDH-230tfl and MDH-230tfr. The "l" resp. "r" in the name stands for "left angled" resp. "right angled", since both versions of the heater differ from each other only in their geometry.

7.10.1 Mounting the Heater MDH-230tf

Step 1 Wet the O-ring - Heater-fix lightly with Isopropanol and push it onto the Endless thrust block MDH 230t-fix. **CAUTION!** Make sure the heater is turned off in the control unit before you start.	
Step 2 Screw the Endless thrust block MDH 230t-fix with mounted O-ring - Heater-fix onto the fluid box. **INFORMATION!** The Endless thrust block MDH 230-tf cannot be tightened. Screw it to the end of the endless thread.	
Step 3 Push the heater onto the endless thrust block. **INFORMATION!** The O-ring has to fit perfectly into the bore, without it rising above the plane (see the picture below)!  Please make sure that the position of the heating tube is correct as shown in the picture.	
Step 4 Screw the nozzle unit manually onto the fluid box. **INFORMATION!** Fix the upper end of the heating tube. Otherwise, the movements of the valve could cause problems.	

Tab. 21: Mounting the heater

7.10.2 Heater and MDC

You can activate the heater via the heater submenu in the MDC menu (see picture below). Use the **[enter]** and arrow keys to navigate down to the heater submenu. Here you can switch ON the heater (submenu "Switch") and set the temperature (submenu "Temperature"). The possible temperature range lies between 1 °C and 120 °C. (Further information about the menu of the control unit you can find in paragraph 4.5.3, page 28.)

In the submenu "Heater Voltage" you can change the heater voltage between 110 V and 230 V to accommodate your local situation. (The current setting of the voltage is shown in the display of the control unit during startup. The results could be affected negatively, if these settings are not correct.)

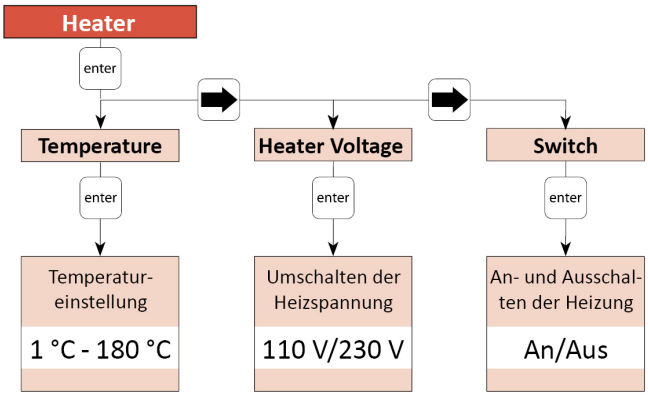


Fig. 39: Submenu Heater

INFORMATION

INFORMATION!

The heater can also be controlled via the serial interface. The relevant commands and information can be found in paragraph 8.1.2, page 68.

Instead of the internal control of the heater via MDC, you can also use an external heater control. There are several types available, MHC 3001 (order no. 1012948) for one heater or MHC 3002 (order no. 1012949) for two heaters.

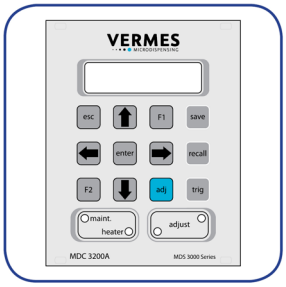
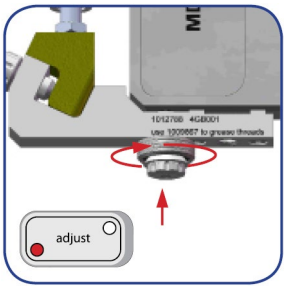
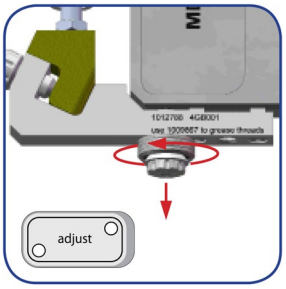
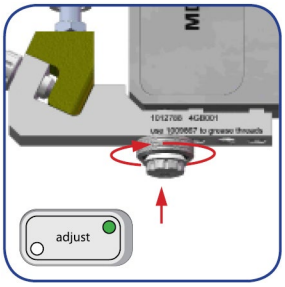
7.10.3 The Adjust with Heater

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 unit. The adjust is especially important to avoid any leakage during dispensing (see also paragraph 6.5, page 48).

IMPORTANT INFORMATION

IMPORTANT!

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 com-promise the results. Especially the O-ring-N around the tappet guidance has to be free of grease and dirt. Make sure the nozzle unit is unscrewed before the Adjust.

Step 1 Turn on the heater and bring the heater to the desired temperature. Wait a few moments for the system to settle in this temperature (see table in paragraph 4.5.3, page 28). Start the adjust by pressing the **[adj]**-key on the keypad of the control unit. First of 500 pulses will be shot to prepare the valve for the adjust.	
Step 2 Screw the nozzle unit “MDH 230tf-fix” up-wards to the fluid box until the red light is on. Use the tool MDT 301. The display shows a value of about 1100 or a little more. **CAUTION!** Please ensure that the tappet guidance “H” and the nozzle insert were mounted properly into the nozzle adjustment nut.	
Step 3 Screw the nozzle unit slowly away from the fluid box until the red light is off. The value shown in the display should be in the range of 985 – 1000. **CAUTION!** If the value is not stable or falls rapidly (within approx. 5 sec), the adjust has to be repeated. Begin again at step 1.	
Step 4 Screw the nozzle unit upwards to the fluid box until the green light is on. The value shown in the display should be in the range of 1030 – 1040. Confirm the successful adjust by pressing **[enter]**. **INFORMATION!** Confirming the successful adjust by pressing **[enter]** is only possible, if the green LED is on.	

IMPORTANT INFORMATION

IMPORTANT!

- Screw the nozzle unit carefully onto the fluid box. Avoid tilting the nut by tilting the nozzle unit.
- Make sure not to surpass a display value of 1250. Otherwise the tappet could break.

INFORMATION

INFORMATION!

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

7.10.4 Dismounting the Heater

To dismount the heater turn it OFF via the heater menu. Make sure to wait long enough for it to cool down sufficiently, before you go on.

– Screw off the nozzle unit, using tool MDT 327.
– Pull off the heater carefully.
– Screw off the Endless thrust block MDH 230t-fix.
– Remove the O-ring from the endless thrust block. Remember O-rings may not be cleaned in an ultrasonic bath.

7.11 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 99).

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

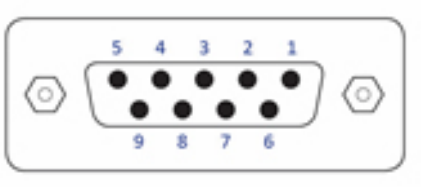


Fig. 40: Serial interface

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

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 4.5.5, page 31)
- Start bit: 1
- String length: 8 bit (ASCII)
- Parity: None
- Stop bit: 1
- Log: None

8.1.2 RS-232C Commands

The available commands for MDC 3200j are listed below. They are explained on the following pages, together with short examples. Commands are listed in the same order as the given list with command “Help”, but with “Help”, some commands are combined. This list is according to firmware revision 4072HVA-P.

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 table lists the values 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.

INFORMATION

INFORMATION!

GETTD only works, if the MDC has an RTC (Real Time Clock).

8.1.2.1 Overview

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
1. *ESR? (e.g. 50 errors)	3960	940
2. *ESR2? (e.g. 50 errors)	8740	1250
3. *IDN?	360	340
4. *OPC?	50	40
5. ADJUST:?	50	40
6. ADJUST:START	110	90
7. HEATER:?	100	70
8. HEATER:1:OFF	100	70
9. HEATER:1:ON	90	70
10. HEATER:110V	80	60
11. HEATER:230V	80	60
12. KEY:ENTER	60	40
13. KEY:ESCAPE	60	40
14. HELP	1860	640
15. LCD?	360	340
16. MAINT:STATUS	670	340
17. MAINT:MESSAGE:OFF	70	60
18. MAINT:MESSAGE:ON	70	60
19. SYSTEM:KLOCK:OFF	50	40
20. SYSTEM:KLOCK:ON	60	40
21. SYSTEM:SHOW:CYCLES	70	50
22. SYSTEM:SHOW:VALVEID	90	70
23. SYSTEM:SHOW:CONTROLLERID	100	70
24. SYSTEM:SHOW:STATUS	690	340
25. SYSTEM:SHOW:ACTTEMP	50	40
26. SYSTEM:DOSOKDELAY:OFF	80	60
27. SYSTEM:DOSOKDELAY:ON	80	60
28. SYSTEM:SINGLEDOSOK:SETUP	80	60
29. SYSTEM:SINGLEDOSOK:PULSE	80	60
30. SYSTEM:PASSWORD:<your password>	50	40
31. SYSTEM:PASSWORD:OFF	80	60
32. SYSTEM:PASSWORD:ON	80	60
33. SYSTEM:PASSWORD:SET:<your password>	80	70
34. SYSTEM:AUXILIARYMODE:OFF	120	100

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
35. SYSTEM:AUXILIARYMODE:ON	120	110
36. TEMP:?	80	60
37. TEMP:<set point in °C>	50	40
38. TRIGGER:SET:?	370	340
39. TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	80	50
40. TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	100	80
41. TRIGGER:ASET:?	370	340
42. TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	80	50
43. TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	100	80
44. STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	380	350
45. STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	400	380
46. STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	390	360
47. STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	390	380
48. VALVE:UP	60	40
49. VALVE:DOWN	60	40
50. VALVE:OPEN	60	40
51. VALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	70	50
52. VALVE:AOPEN	60	40
53. VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	70	50
54. SVALVE:OPEN	370	340
55. SVALVE:OPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	380	350
56. SVALVE:AOPEN	370	340
57. SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	380	350
58. WRITE:LCD:<text>	60	40
59. SETUP:SAVE:<setup-no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	250	80
60. SETUP:ASAVE:<setup-no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	100	70
61. SETUP:READ:<setup-no.>	370	340
62. SETUP:AREAD:<setup-no.>	370	340
63. BAUDRATE:0/1/2/3/4	60	40
64. GETTD	90	70
65. MDC:RESTART	170	150

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 HV, 4072HVA-P
		Return:	Micro Dispenser HV, 4072HVA-P

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:	669

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. You have to switch it OFF and ON again. The adjust must be repeated. This event however is an exception. • The nozzle unit is too far open (Result: 1) You have to screw the nozzle unit further towards the fluid box. 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 in (Result: 3) You have to screw the nozzle unit further 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 97.	
	Example:	Input:	ADJUST:START
		Result:	The adjust is initiated.
		Return:	Unscrew Nozzle Press Enter

7	**HEATER:?**		
	Description:	This command shows the state of the heater. This includes the specified temperature, the heater voltage and if it is switched ON or OFF.	
	Example:	Input:	HEATER:?
		Result:	Switched ON or OFF, specified temperature and heater voltage are given.
		Return:	ON,20°C,230V

8	**HEATER:1:OFF**		
	Description:	The connected heater is turned off.	
	Example:	Input:	HEATER:1:OFF
		Result:	The nozzle heater is deactivated.
		Return:	OK

9	**HEATER:1:ON**		
	Description:	The connected heater is turned on. With the heater turned on the minimum delay is 2.0 ms. Has a smaller delay been chosen, it will automatically be increased to 2.0 ms.	
	Example:	Input:	HEATER:1:ON
		Result:	The nozzle heater is activated.
		Return:	OK or No Heater (if there is no heater attached)

10	**HEATER:110V**		
	Description:	This command adjusts the heater control to a mains voltage of 110 V.	
	Example:	Input:	HEATER:110V
		Result:	Adjusts heater control to a mains voltage of 110 V.
		Return:	OK

11	**HEATER:230V**		
	Description:	This command adjusts the heater control to a mains voltage of 230 V.	
	Example:	Input:	HEATER:230V
		Result:	Adjusts heater control to a mains voltage of 230 V.
		Return:	OK

12	**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)

13	**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)

14	**HELP**		
	Description:	Shows a list with all RS-232C commands.	
	Example:	Input:	HELP
		Result:	List with all RS-232C commands.
		Return:	List with all commands

15	**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 immediately after switching ON, the content of the screen will be “READY”.
		Return:	„READY“

16	**MAINT:STATUS**	**MAINT = Maintenance**	
	Description:	This command provides the number of pulses in percent of the preset limits. It is useful, if you want to estimate the date of the next exchange or maintenance.	
	Example:	Input:	MAINT:STATUS
		Result:	Current percentage of the preset number of cycles (limit).
		Return:	Maintenance: 10 % Nozzle: 20 % Tappet: 30 % Maint. Message: ON

17	**MAINT:MESSAGE:OFF (MAINT = Maintenance)**		
	Description:	This command deactivates the maintenance message. The message “Maint.” will no longer be shown in line 2 of the display. Also the red maintenance LED will not be switched on, if the maintenance, nozzle or tappet limits are reached. By default, the maintenance message is activated.	
	Example:	Input:	MAINT:MESSAGE:OFF
		Result:	The maintenance message is deactivated.
		Return:	OK

18	**MAINT:MESSAGE:ON (MAINT = Maintenance)**		
	Description:	This command activates the maintenance message. The message “Maint.” will be shown in line 2 of the display. Also the red maintenance LED will be switched on, if the maintenance, nozzle or tappet limits are reached. By default, the maintenance message is activated.	
	Example:	Input:	MAINT:MESSAGE:ON
		Result:	The maintenance message is activated.
		Return:	OK

19	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

20	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

21	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

22	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

23	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: 13050

24	SYSTEM:SHOW:STATUS		
	Description:	This command sends the current status of KeyLock, DosOK with Delay, SingleDosOK and Auxiliary Mode.	
	Example:	Input:	SYSTEM:SHOW:STATUS
		Result:	Settings of the above listed items
		Return:	KeyLock: OFF DosOK with Delay: OFF SingleDosOK: per pulse Auxiliary Mode: OFF

25	**SYSTEM:SHOW:ACTTEMP**		
	Description:	The current temperature of the actuator (piezo) is displayed. **NOTE:** In case an MFC universal is connected to your MDC, you cannot use this command, since it would respond with a wrong value.	
	Example:	Input:	SYSTEM:SHOW:ACTTEMP
		Result:	The value appears in °C.
		Return:	70

26	**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.	
	Example:	Input:	SYSTEM:DOSOKDELAY:OFF
		Result:	Deactivates the DOSOK-delay.
		Return:	OK

27	**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.	
	Example:	Input:	SYSTEM:DOSOKDELAY:ON
		Result:	Activates the DOSOK-delay.
		Return:	OK

28	**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.	
	Example:	Input:	SYSTEM:SINGLEDOSOK:SETUP
		Result:	The single-DOSOK is set to “setup”.
		Return:	OK

29	**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.	
	Example:	Input:	SYSTEM:SINGLEDOSOK:PULSE
		Result:	The single-DOSOK is set to “pulse”.
		Return:	OK

30	**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

31	**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

32	**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

33	**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

34	**SYSTEM:AUXILIARYMODE:OFF**		
	Description:	This command deactivates the auxiliary mode. In auxiliary mode, the valve is disconnected. All other functionalities of the MDC can be used and tested.	
	Example:	Input:	SYSTEM:AUXILIARYMODE:OFF
		Result:	The auxiliary mode is deactivated.
		Return:	OK

35	**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.	
	Example:	Input:	SYSTEM:AUXILIARYMODE:ON
		Result:	The auxiliary mode is activated.
		Return:	OK

36	**TEMP:?**	**TEMP = temperature**	
	Description:	The command provides information about the current temperature of the nozzle heater; the measuring unit is °C. The MDC will answer “No Heater”, if the heater is turned “OFF” in the submenu “Heater”.	
	Example:	Input:	TEMP:?
		Result:	70 … the current temperature value amounts to 70 °C.
		Return:	70

37	**TEMP:<Set point in °C> (TEMP = temperature)**		
	Description:	This command is used to select a new target value for the heater; the measuring unit is °C. The maximum you can enter is 120 °C.	
	Example:	Input:	TEMP:60
		Result:	The temperature control sets the heating temperature to 60 °C.
		Return:	OK

38	**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, except for “Falling” which is 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: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 ≙ 0,15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	10,10,15,90,20,8

39	**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, except for “Falling”, which has to be entered in 1/100 ms. Values lower than “1” are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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 ≙ 0,15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	OK

40	**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, except for "Falling", which has to be entered in 1/100 ms. Values lower than "1" are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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 ≙ 0.15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

41	**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

42	**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. Minimum value for “Falling” is 0.01 ms, for “Rising” 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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:55,10,8,80,20,8
		Result:	The following values are assigned to the dispensing parameters: Rising: 55 ≙ 0,55 ms (ms = Millisecond) Open Time: 10 ≙ 1,0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	OK

43	**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. Minimum value for “Falling”: 0.01 ms, for “Rising” 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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:55,10,8,80,20,8,1
		Result:	The following values are assigned: Rising: 55 ≙ 0,55 ms (ms = Millisecond) 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:	OK

44	**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, except for "Falling", which has to be entered in 1/100 ms. Values lower than "1" are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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

45	**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, except for "Falling", which has to be entered in 1/100 ms. Values lower than "1" are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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 ≙ 0.15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,90,20,8

46	**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. Minimum value for “Falling” is 0.01 ms, for “Rising” 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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:55,10,8,80,20,8
		Result:	The following values are assigned to the dispensing parameters: Rising: 55 ≙ 0,55 ms (ms = Millisecond) Open Time: 10 ≙ 1,0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	55,10,8,80,20,8

47	**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. Minimum value for "Falling": 0.01 ms, for "Rising" 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 57). 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:55,10,8,80,20,8,1
		Result:	The following values are assigned: Rising: 55 ≙ 0,55 ms (ms = Millisecond) 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	**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

49	**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

50	**VALVE:OPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). **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.
		Return:	OK

51	**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, except for "Falling", which has to be entered in 1/100th 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".	
	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 ≙ 0,15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	OK

52	**VALVE:AOPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). **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.
		Return:	OK

53	**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”.	
	Example:	Input:	VALVE: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:	OK

54	**SVALVE:OPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). 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.
		Return:	30,10,15,80,20,8

55	**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, except for "Falling", which has to be entered in 1/100 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 the combination is intended to be used 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.	
	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 ≙ 0,15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	30,10,15,90,20,8

56	**SVALVE:AOPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). 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.
		Return:	30,10,15,80,20,8

57	**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.	
	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

58	**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

59	**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, except for "Falling", which has to be entered in 1/100 ms. Values lower than "1" are not admissible, only the open time can be "0". Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 57). 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

60	**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". Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 57). 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

61	**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, except "Falling", are given in 1/10 ms (i.e. 10 ≙ 1.0 ms). Falling is given in 1/100 ms (i.e. 100 ≙ 1.00 ms). Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 57).	
	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 ≙ 0,15 ms Needle Lift: 90 % Number of Pulses: 20 Delay: 8 ≙ 0,8 ms
		Return:	30,10,15,90,20,8

62	**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). Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 57).	
	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

63	**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

64	**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)

65	**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

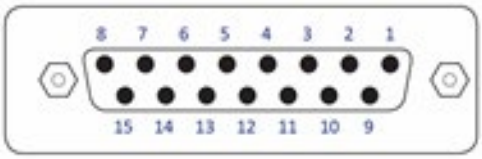


Fig. 41: PLC Interface: 15-pin, Sub-D

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 100 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

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, Ra=2.2 kΩ (valid for 0 V)	SingleDosOK
2	Input	0 / +24 V Ri=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 Ri=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, Ra=2.2 kΩ (valid for 0 V)	Set point Heating OK
6	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	Nozzle unit "adjusted" OK (means green adjust LED)
7	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	Mains voltage OK
8	Reserved	_____	_____
9	Output	24 V/50 mA	Power supply to external trigger
10	Ground	_____	Ground
11	Input	0 / 20 mA, Ri=500 Ω	Trigger Current Input
12	Reserved	_____	_____
13	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	During adjust: adjust failed. Nozzle unit screwed in too deep or not enough. Outside adjust: general error (24 V = error)
14	Output	0 / +24 V, Ra=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.

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

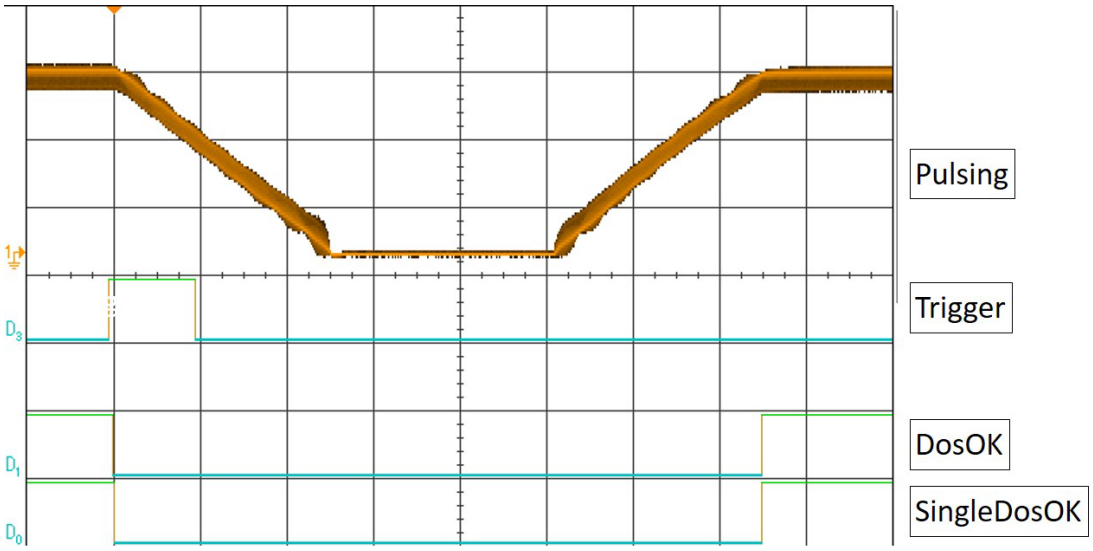


Fig. 42: Single-Shot Mode

8.2.2.2 Burst Mode (Example with Three Shots)

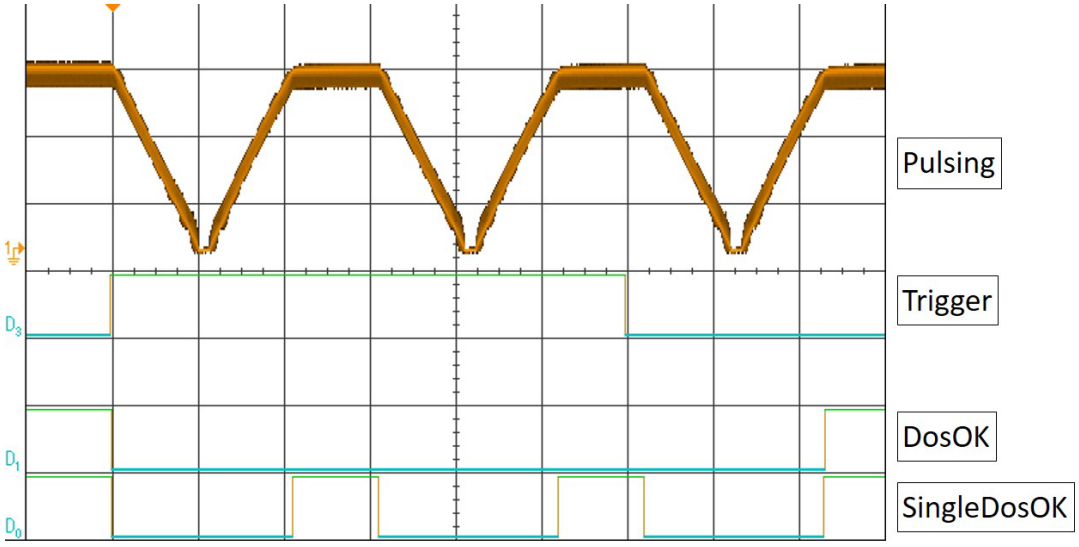


Fig. 43: Burst Mode (Example with Three Shots)

8.2.2.3 External Mode

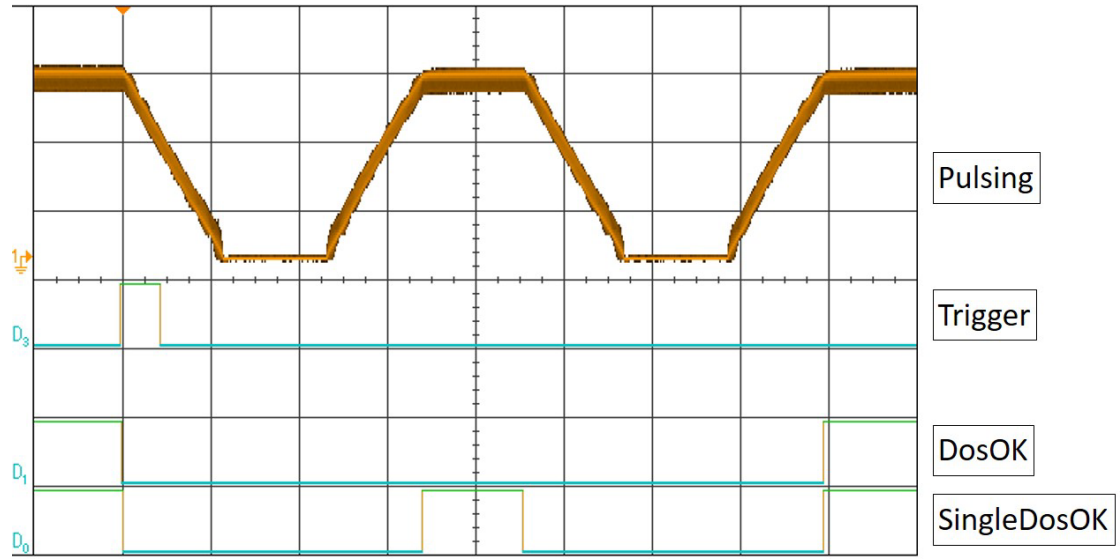


Fig. 44: External Mode

8.2.2.4 Infinite Mode

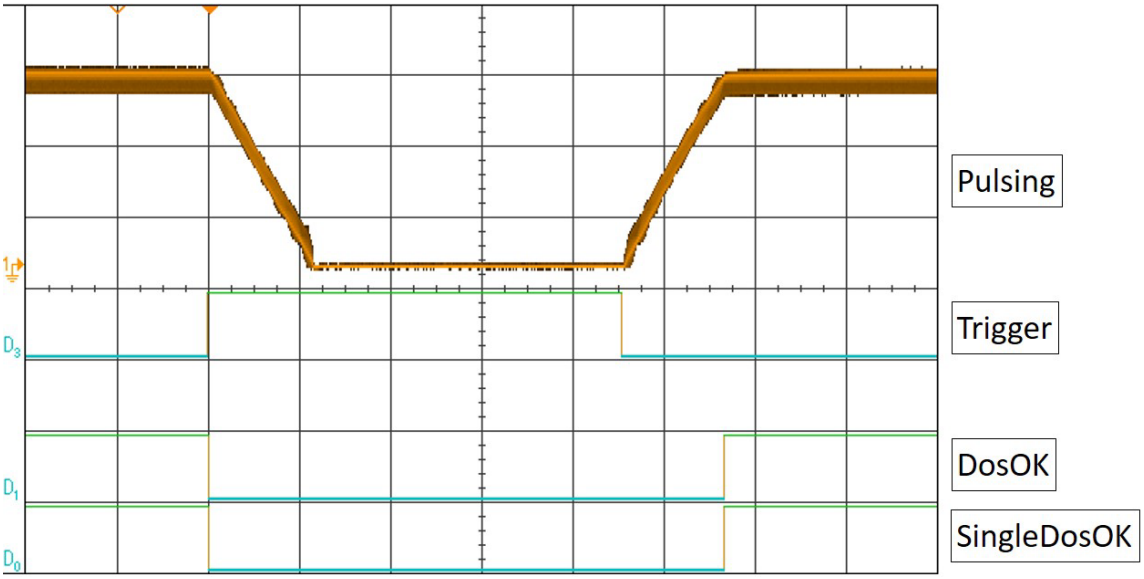


Fig. 45: Infinite Mode

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 48), 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.

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:

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.

1. Send the command “ADJUST:START” to the control unit via RS-232C. The system returns the message “Unscrew Nozzle Press Enter“.
2. The nozzle unit must be completely detached, so that the tappet becomes visible.

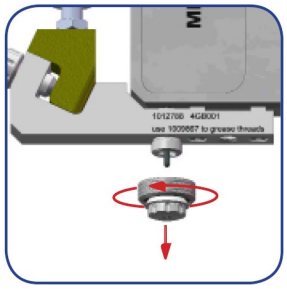


Fig. 46: Screw off nozzle unit

3. In order to confirm step 2, send a short trigger signal (500µs – 80 ms) to the control unit via PLC interface.

Short trigger signal:

- 5 V or 24 V (PIN2 + PIN4 or PIN3 + PIN4 Input signal of MDC via 15 pin Sub-D)
- Signal length: 500 µs – 80 ms

4. The system jets 500 shots to clear the valve for the adjust. The message “500 Shots Please Wait” is shown.
5. The system then returns the current adjust value, continuously repeating the transmission to the PC in intervals of 500 ms (via RS-232C).

An additional command to update the adjust value on the screen is not required.

6. Rotate the nozzle unit clockwise towards the fluid box, until the value displayed on the PC is in the tolerance range (between 1031 and 1040).
7. Confirm the indicated value (e.g. 1035) by sending a short trigger signal via PLC-interface (see Step 3), as described above. The system returns the current adjust value and either:

1 (value too low)

2 (value ok)

3 (value too high)

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

Beyond the tolerance range (1031–1040) it is impossible to confirm the values.

Outside the adjust range of 1031 to 1040, 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.

Long trigger signal:

- 5 V or 24 V (PIN2 + PIN4 or PIN3 + PIN4 Input signal of MDC via 15 pin Sub-D)
- Signal length: 110 ms – 200 ms

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 INFORMATION

IMPORTANT! (Prepare cleaning in advance)

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

⚠ CAUTION

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) is available upon request (order code 1010320), which is of particular interest for all surfaces in direct contact with the fluid.

⚠ WARNING

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 on Page 101.

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

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. 22: 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. 23: 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
- 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 dismounting 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

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

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

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 it-self 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

CAUTION!

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

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 Dismantling the Valve

Step 1:

– Complete the dispensing process. The valve is in closed position.
– Switch OFF the control unit and disconnect it from the mains.

Step 2:

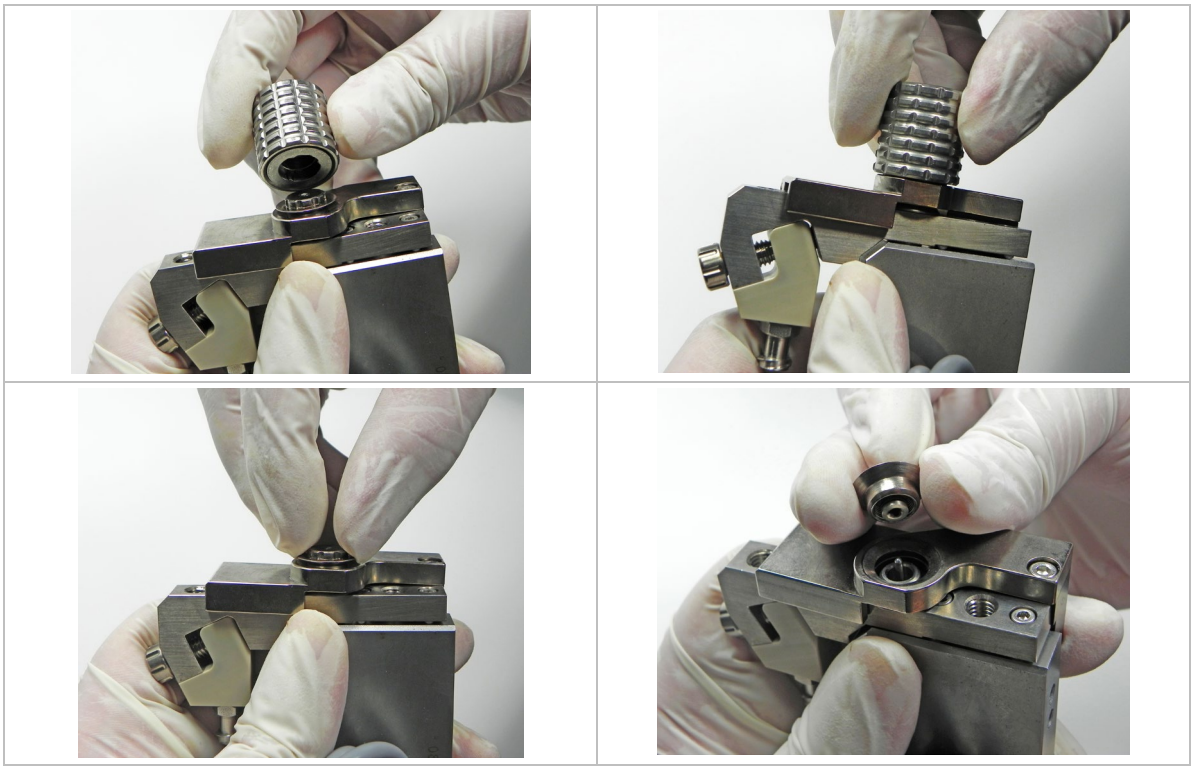
– Deactivate the compressed-air connector and disengage it.

Step 3:

– Remove the actuator cable and sensor cable from the valve.

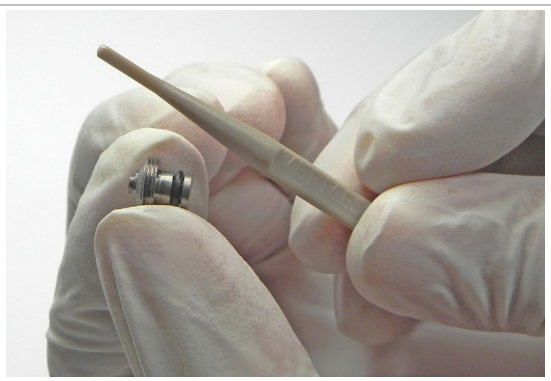
Step 4:

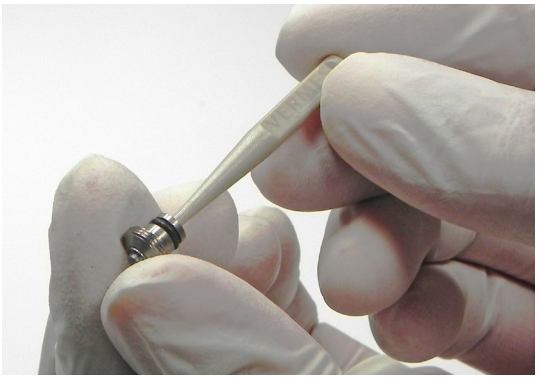
– Disassemble the valve as follows.
– Unscrew and remove the cartridge.
– Loosen the two screws for the cartridge holder. Remove the holder.
– Disconnect the nozzle unit, rotating counter-clockwise. You can use either tool MDT 301 or MDT 327 (in the pictures MDT 301 is used). Be careful that the valve has cooled down before touching it.



– Disassemble the nozzle unit. Unscrew the tappet guidance, together with the nozzle insert, from the nozzle adjusting nut. Use the nozzle changing tool MDT 303. The three pins of MDT 303 have to fit exactly into the three holes of the tappet guidance. If necessary, use MDT 301 and MDT 327 to unscrew it.

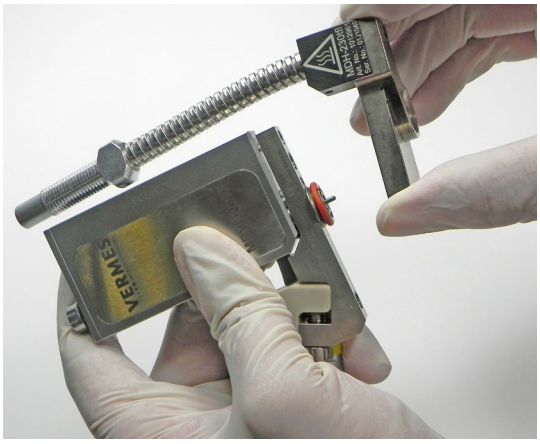
– Use the thin end of MDT 304, to push out the nozzle insert from behind.



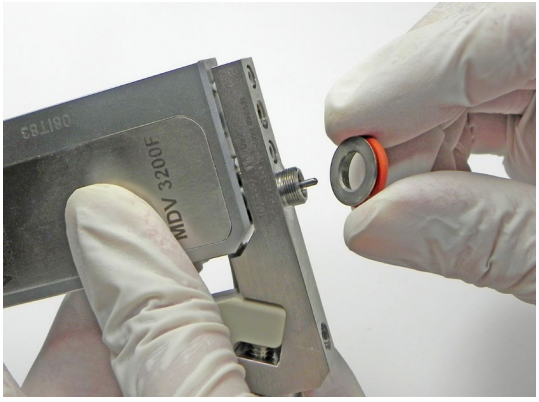


– Remove the O-ring from the tappet guidance. Pull it off carefully with a pair of tweezers. Be careful not to damage it.

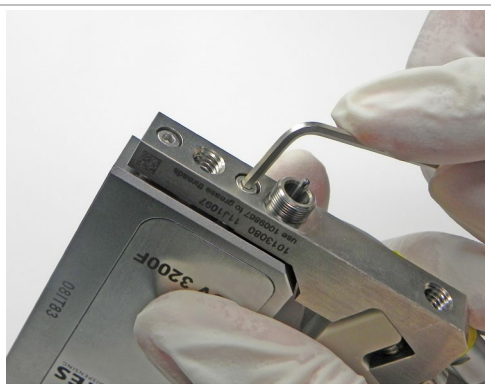
– Pull off the heater from the valve.

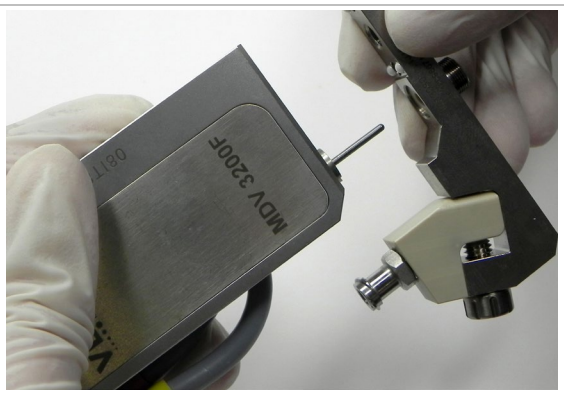


– Unscrew the endless thrust block with the O-ring, rotating counter-clockwise.



– Unscrew the two screws of the fluid box, rotating counter-clockwise. Pull off the fluid box from the valve.



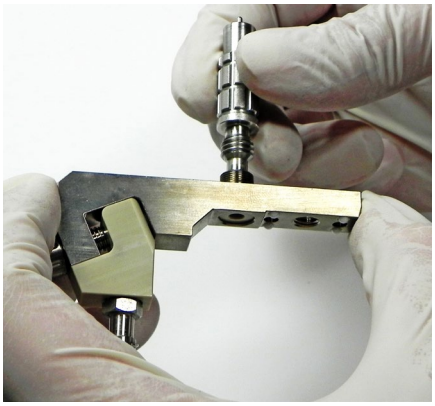


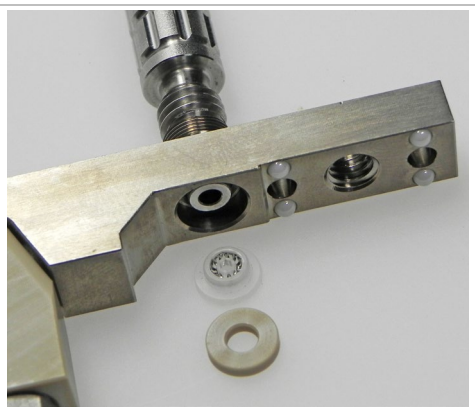
⚠ CAUTION

CAUTION! (Tappet can break)

Make sure to remove the fluid box carefully. The tappet could break or the sealing getting squeezed.

– Disengage the tappet centering piece and tappet sealing from the fluid box. Use the thicker side of tool MDT 304 or the blunt end of the “sealmounter” part of MDT 301 for this purpose. In case you use a Tappet Sealing LX, there is no tappet centering piece. You can find all the necessary information in paragraph 9.4.6, page 119.



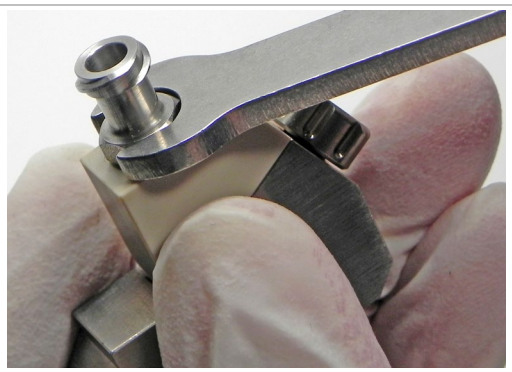


⚠ CAUTION

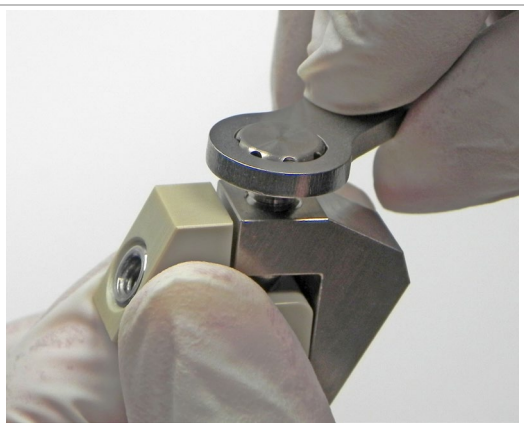
CAUTION! (damaged tappet sealing)

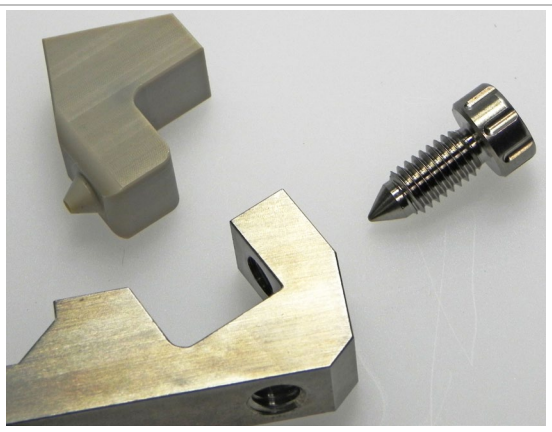
Only use the tools recommended by VERMES. Do **not** use a sharp tool to press the tappet sealing from the fluid box. It could cause damage to the tappet sealing, which might lead to a leakage.

– Open the Luer-Lock connector with the open-jawed wrench end of MDT 327. (There are other types of cartridge bases, where the Luer-Lock connector is directly integrated. For those this step is omitted.)



– Unscrew the tightening screw with the help of tool MDT 327, rotating counter-clockwise. Remove the tightening screw and the cartridge base from the fluid box.





9.4.4 Fine Purification

Step 5:

– Clean the single components in an ultrasonic bath.
– Push a cleaning rod or a fluidic brush through the media carrying channels of all the components.
– Place a beaker in the ultrasonic bath. Make sure it is large enough.
– Place the fluid box, tappet sealing, tappet centering piece, cartridge base, tightening screw, Luer-Lock connector, nozzle insert, nozzle adjustment nut (in case of NAN-fix without O-Ring) and the tappet guidance (without the O-ring) in the 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. (When setting the temperature, consider the cleaning medium you used before.)

Step 6:

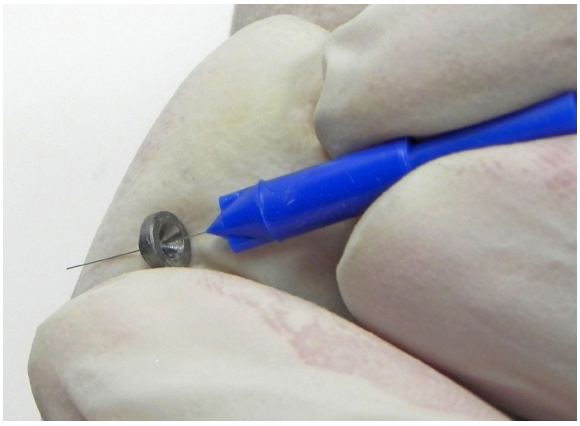
– For fine purification, you have to clean all components by hand. In general, you should take special care about those places, which get in contact with the medium or where two different parts fit together. First, you should clean the nozzle insert and the tappet guidance, since hardening would cause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

INFORMATION

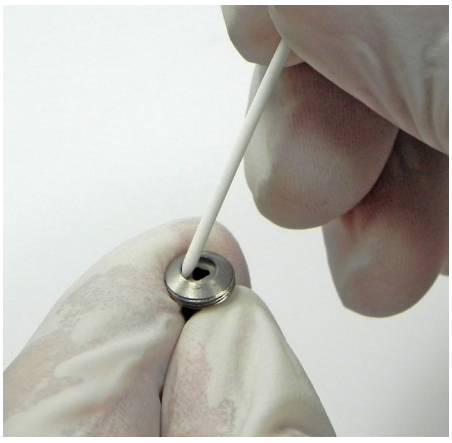
INFORMATION! (simpler cleaning)

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.

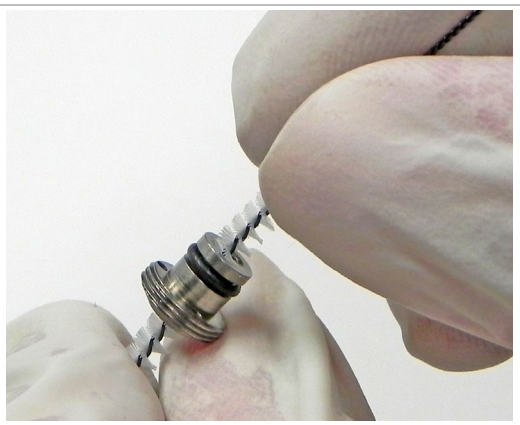
– Start with the nozzle insert. Clean it thoroughly from above and below with a cleaning rod. For the bore use a nozzle insert cleaning wire. These come with different sizes. They are not part of the cleaning toolkit CTK and have to be ordered separately.



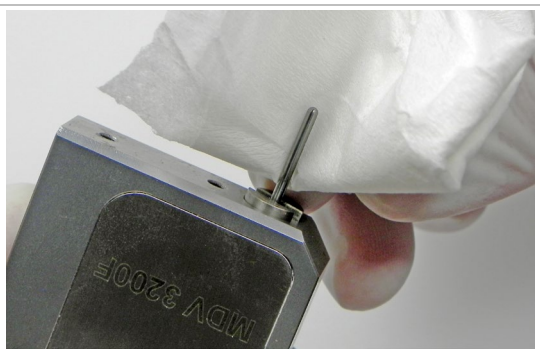
– Use a cleaning rod for the upper part of the tappet guidance. For the rest of the outer part of the tappet guidance use a fluidic brush and a fluid box cleaner.



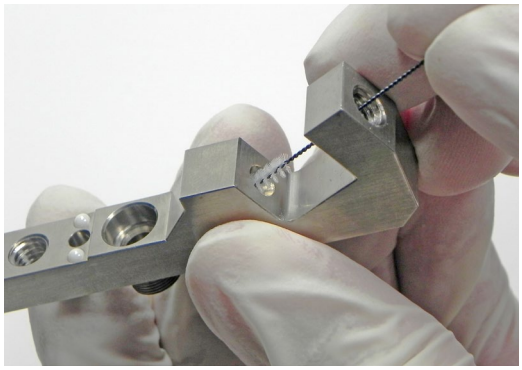
– Clean the bore of the tappet guidance with a fluidic brush. Move it back and forth several times to clear the hole of any traces of the medium.



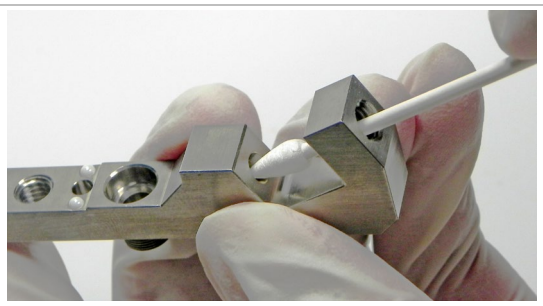
– Clean the valve with a lint-free cloth, especially the tappet.

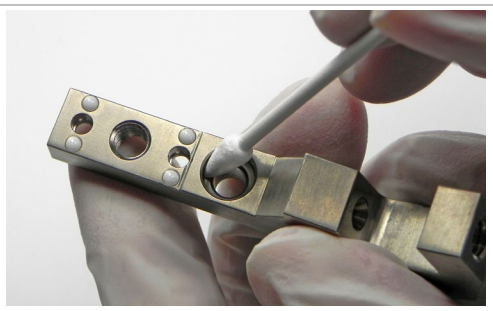


– With the fluid box, clean all bores and threads with a fluidic brush first.

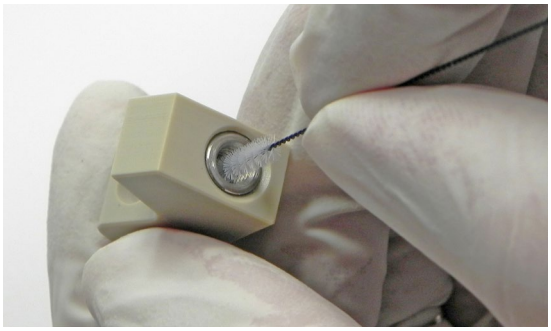


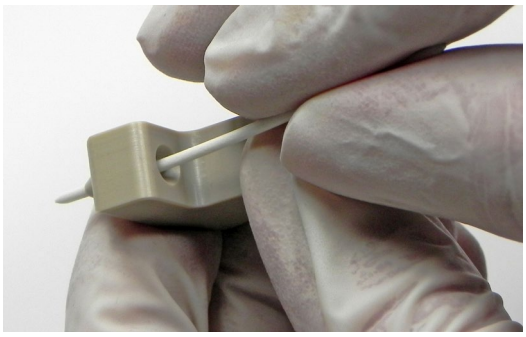
– Afterwards, use a fluid box cleaner. Check all bores as well and then clean the rest of the fluid box body.





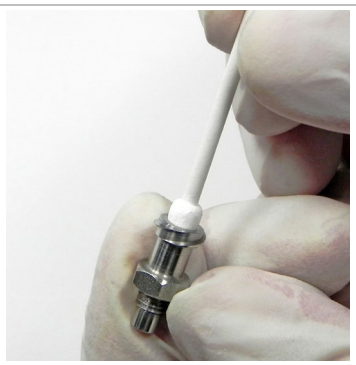
– For the cartridge base start with the fluidic brush to clean all bores and openings. Next, clear the bore with a cleaning rod.

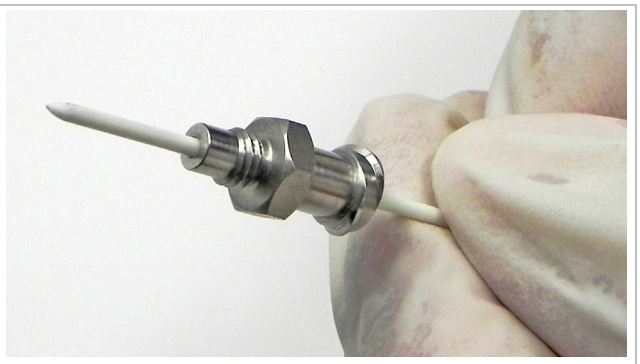




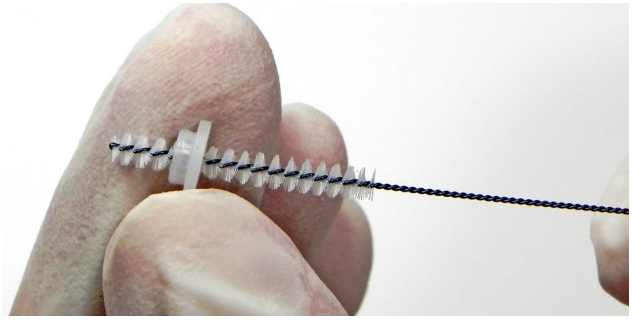
– Finally use a fluid box cleaner. Clean the wide opening of the bore and the thread of the Luer-Lock connector.

– For the Luer-Lock connector you start with a fluid box cleaner. Use it for the outside and the end of the bore. Then push a cleaning rod through the bore several times to remove any traces of the medium.

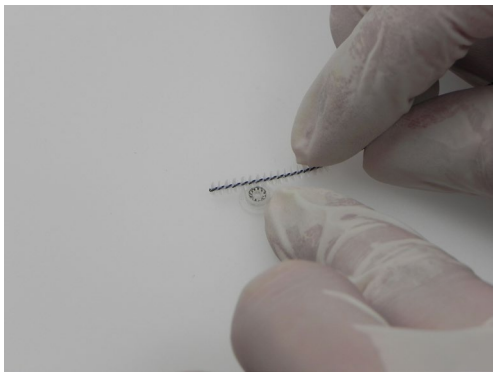


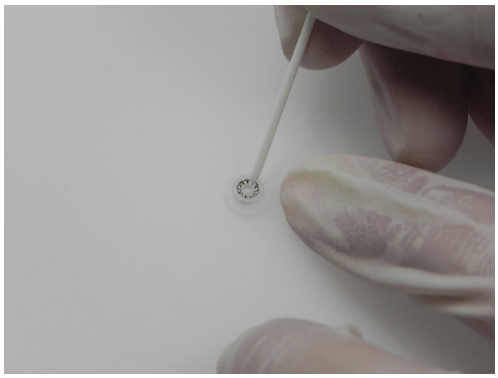


– Clean the bore of the tappet sealing carefully with a fluidic brush.

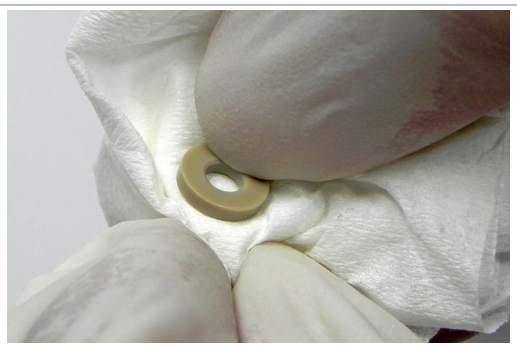


– Afterwards, you clean the outside of the tappet sealing. Keep using the fluidic brush, especially for the outer edge. Then clean the inner rim of the tappet sealing with a cleaning rod.





– Clean the outside of the tappet centering piece first with a lint-free cloth. Then use a fluidic brush for the bore.



– Finally clean all O-rings with a lint-free cloth.

Step 7:

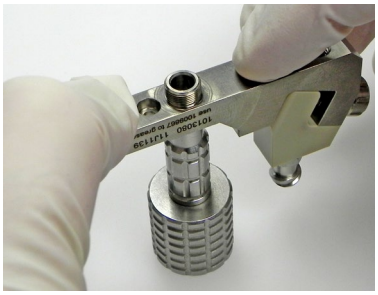
– Dry all the components in the air or with compressed air. For nozzle inserts, we recommend the use of MDT 324 Nozzle Insert Cleaning Holder.

In case you still have parts, which are not completely clean after the fine purification, repeat steps 5 and 6 for those components, several times if necessary. If that is still not helping, contact our Technical Support.

9.4.5 Assembling of the Fluid Box

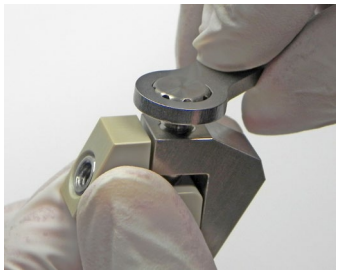
Step 8:

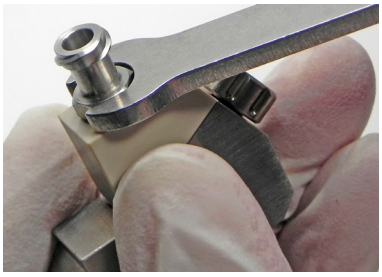
– Re-assemble the valve and its components in the following order.
– Place the tool MDT 301 upright and push the tappet sealing with the wider side down onto the pin. Situate the fluid box with the bore over the tappet sealing and push the fluid box straight down. A light “click”-noise will tell you, if the tappet sealing sits tight in the fluid box. You can remove the fluid box from the tool.



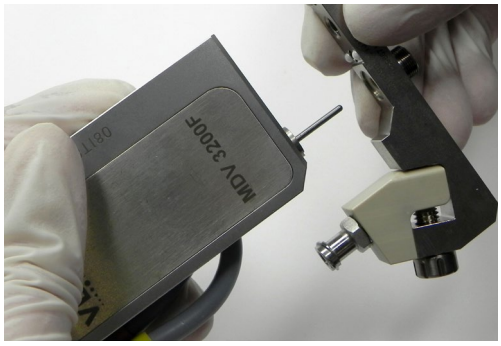
– Press the tappet centering into bore of the fluid box. Make sure it sits plane on the tappet sealing. The picture shows you how deep inside the bore the tappet centering piece has to sit. (If you use a tappet sealing LX instead of the pictured tappet sealing, you do not need a tappet centering piece. Refer to paragraph 9.4.6, page 119 with details on how to mount it correctly).

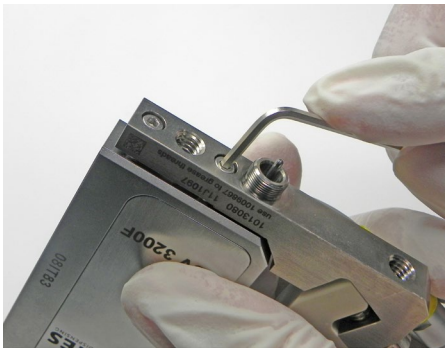
– Screw the cartridge base into the fluid box by tightening the tightening screw with tool MDT 327 (torque 120 – 140 cN.m).
– Then screw the Luer-Lock connector tight (torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m). Use the open-jaw wrench end of MDT 327. (In case you have got a cartridge base with integrated Luer-Lock connector, you can skip this last part.)



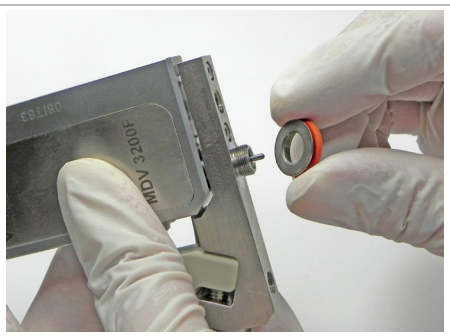


– Push the fluid box onto the tappet. Make sure to push straight, since otherwise the tappet or the sealing could be damaged. Screw the fluid box tight, by screwing the two screws clockwise (torque fluid box screw 80 – 100 cN.m).

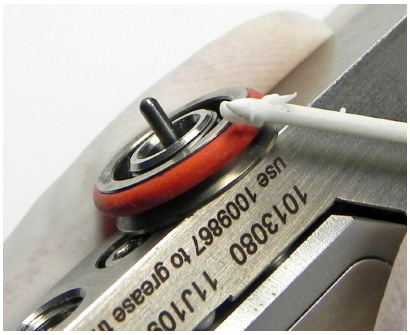


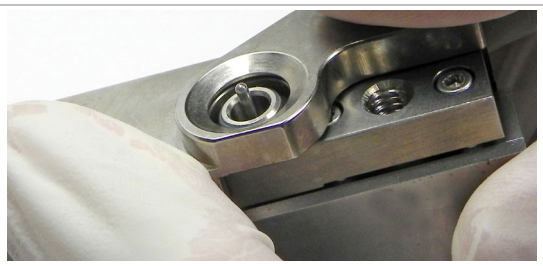


– Screw the endless thrust block MDH 230tf fix onto the thread of the fluid box.



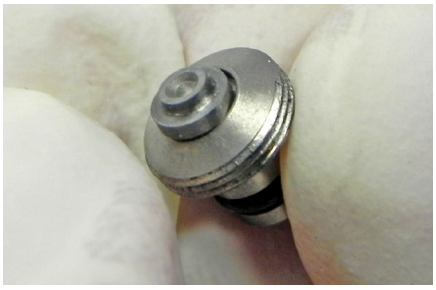
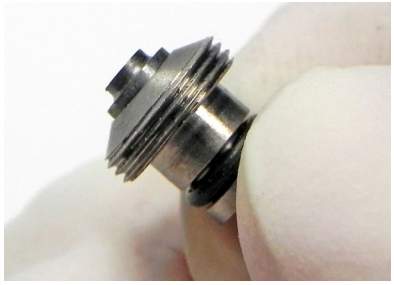
– Wet the O-ring - Heater-fix lightly, to help with the further assembly. Push the heater onto the valve, so that the opening is above the endless thrust block. Make sure the heater sits tight and that the O-ring does not spill out. The picture below right shows what it should look like.





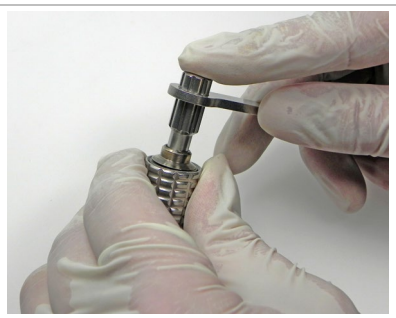

– Pull the O-ring back onto the tappet guidance. You have to be very careful to avoid damaging the O-ring.

– Press the nozzle insert into the tappet guidance. To sit correctly, it has to snap in lightly. Make sure it sits level within the socket.

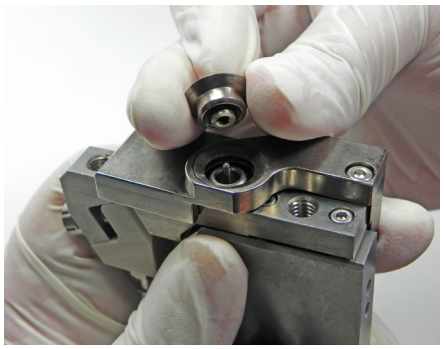



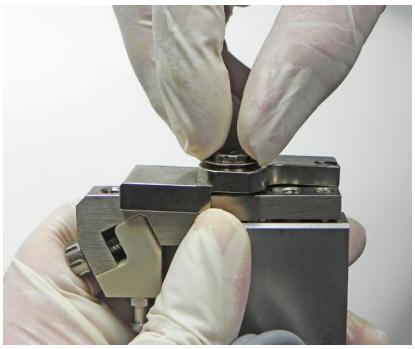
– Place the tappet guidance onto tool MDT 303, with the pins of the latter inside the three bores of the tappet guidance. Screw the tappet guidance into the nozzle adjustment nut. To

be able to screw the tappet guidance tight enough, use the tools MDT 301 and MDT 327, which will allow you to have a better grip (see picture). Make sure to fix the tools with your finger as shown. Otherwise, you might screw lop-sided.

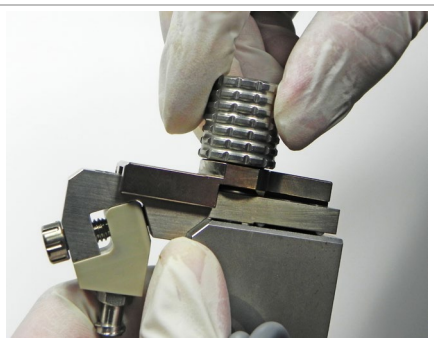


– Screw the nozzle unit lightly onto the valve.





– Use tool MDT 301 to screw the nozzle unit in. Do not screw until the end, but just for two rotations.



– Finally mount the cartridge holder, and connect the actuator and sensor cables as well as the compressed air. You can find more detailed information in paragraph 6.2, page 39 and paragraph 6.3, page 42.

9.4.6 Dismounting, Cleaning and Mounting a Tappet Sealing LX

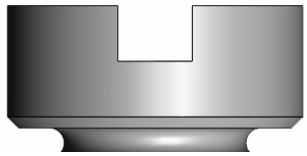
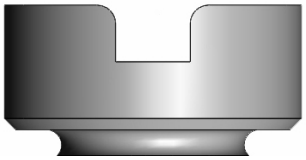
This chapter describes what to do during cleaning, if your system has a Tappet Sealing LX. These sealings come in the variants Tappet Sealing LX CeTeDur 170 and Tappet Sealing LX NBR 170. You can find notes regarding chemical and heat resistance in paragraph 9.3, page 101 and paragraph 9.2, page 100.

INFORMATION

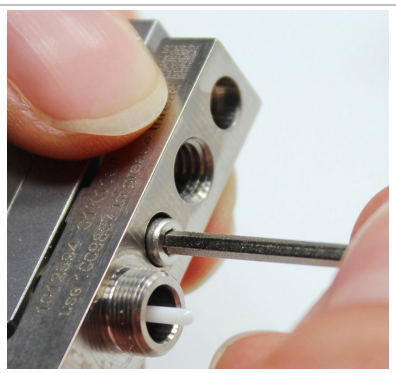
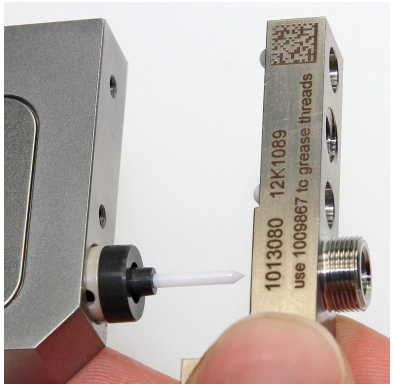
INFORMATION!

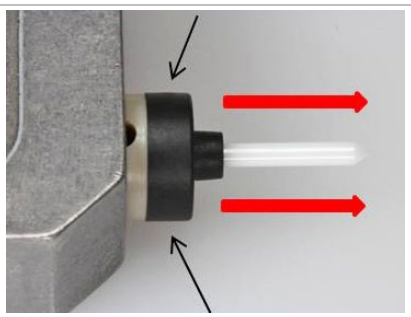
When using a tappet sealing LX, you do not need a tappet centering piece.

Make sure to use a tappet sealing LX CeTeDur only in connection with an improved tappet centering screw with rounded edges (see picture below, normal edges/rounded edges).

Normal:	Rounded:
	

9.4.6.1 Dismounting the Tappet Sealing LX

	**Step 1** Separate the fluid box from the valve, by screwing off the two holding screws (counter-clockwise, screw size 2) with a hexagon socket key.
	**Step 2** Pull the fluid box carefully off the tappet and move it away. **INFORMATION!** For dismounting, if the tappet sealing LX gets stuck in the fluid box, use the wide end of tool MDT 304 - Nozzle Insert – Squeezing Out Tool to push it out. **IMPORTANT INFORMATION!** Do never use pincers or other sharp objects. You might damage the LX sealing, which would cause leakages.

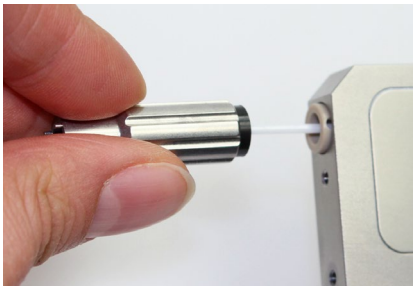
		**Step 3** Remove the tappet sealing LX carefully from the tappet. Press the sides of the sealing slightly (black arrows) to make sure it does not become upended.
		**IMPORTANT INFORMATION!** Take care that the tappet sealing LX does not get upended while removing it. If it does happen, you can try to right it, by pushing with the small end of tool MDT 304. This has to be done very careful or the sealing might get damaged. You have to be especially careful not to mount an upended tap-pet sealing LX, since it would cause leakage.
Correct	Upended	

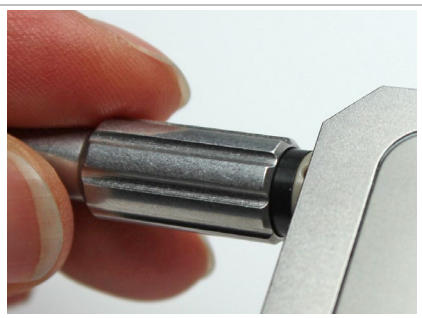
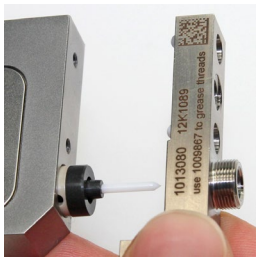
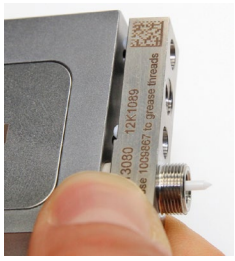
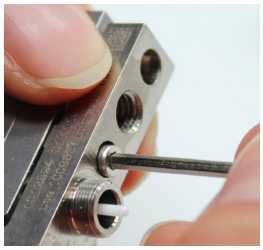
Tab. 24: Dismounting the Tappet Sealing LX

9.4.6.2 Cleaning the Tappet Sealing LX

For cleaning use an ultrasonic bath. Afterwards use compressed air to remove any remaining particles. But you have to make sure that the cleaning medium and temperature are okay for your sealing LX.

9.4.6.3 Mounting the Tappet Sealing LX

		**Step 1** Place the tappet sealing LX on a flat surface (wide side down) and pick it up with the wide end of tool MDT 303 – Nozzle Insert Changing Tool.
		
		**Step 2** Push the tappet sealing LX slowly onto the tappet until it fits press with the tappet centering screw (see arrow in the second picture). It is important for the tappet sealing to sit tight or it might cause leakages.

		
		**Step 3** Move the fluid box carefully over the tappet and push it towards the valve. Make sure the fluid box is straight, not tipped against the valve, since otherwise the tappet might break.
		**Step 4** Use a hexagon socket key to screw the fluid box tight to the valve with the two holding screws (screw size 2, torque 80 – 100 cN.m).

Tab. 25: Mounting the Tappet Sealing LX

10 Exchange of Sealings and Tappets

10.1 Exchange of Tappet Sealing

For replacement of sealings a particular counter is not provided, as the necessity depends on current applications, substances to be dispensed etc.

Some materials, caused by the tappet movement, tend to penetrate between tappet and sealing, giving rise to abrasion. Therefore, you have to inspect the sealing from time to time. To continue working with a damaged sealing inevitably entails unexpected interruptions, loss of material and an increased need of cleaning. In some cases, even the actuator can be damaged, due to the ingress of liquid.

The tappet sealing is exchanged as follows (Not correct for a tappet sealing LX. For it see paragraph 9.4.6, page 119):

Step 1:

– Complete the dispensing process. The valve is in closed position.

Step 2:

– Close the compressed air supply.

Step 3:

– Remove the nozzle unit.

Step 4:

– Disengage the fluid box as follows.
– Loosen the two fastening screws.
– Carefully pull off the fluid box from the tappet. The fluid box meanwhile should not be jammed, otherwise the tappet can break.

Step 5:

– Use the “Sealmounter” end of tool MDT 301 to squeeze out the tappet sealing and the tappet centering piece. Alternatively, you can use the thick end of tool MDT 304.

Step 6:

– To mount the centering piece and the new sealing, proceed as follows.
– Place the new sealing on the mandrel. The face with the lower diameter points upwards.
– Press the sealing into the fluid box (still by means of MDT 301). For this, place the MDT 301 standing upright and push down with the fluid box from above.
– Push the tappet centering piece into the fluid box, so that it is lying press above the tappet sealing. Make sure it sits tight.

Step 7:

– The fluid box has to be reinstalled as follows.
– Carefully push the fluid box onto the tappet. Make sure not to jam it.
– Attach and tighten the two screws you had removed beforehand (Required torque: 80 cN.m – 100 cN.m).

Step 8:

– Re-fix the nozzle unit to the fluid box.

10.2 Maintenance of the Tappet

As the tappet belongs to the wearing parts of the system, it has to be cleaned and exchanged in regular intervals (every 40 million shots) or in the case of problems (as soon as it starts to move in a sluggish way). Ceramics (CTF, SNTF) and tungsten carbide (TTF) items are available.

⚠ CAUTION

CAUTION! (Avoid damage to the tappet)

To avoid major damages, these procedures have to be carried out by personnel with proper training.

IMPORTANT INFORMATION

IMPORTANT! (Use tool MDT 310)

For dismounting and installation, the tappet changing tool MDT 310 is required (see paragraph 3.3.4, page 16).

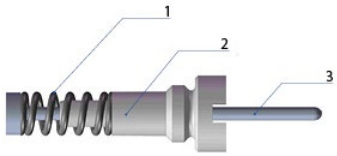
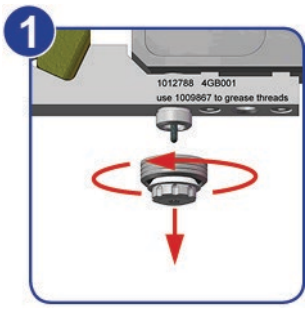
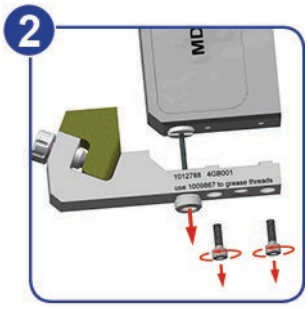


Fig. 47: Parts of the TTF-tappet (1 Tappet spring, 2 Tappet centering screw, 3 Tappet rod)

10.2.1 Dismounting the Tappet

I

	**Step 1:** Carefully remove the nozzle unit from the fluid box (1).
	**Step 2:** Both M2.5 hexagon screws of the fluid box must be loosened and unscrewed. Slowly slide away the fluid box from the tappet. The fluid box must not be jammed, otherwise the tappet may break off (2).

	**Step 3:** To unscrew the tappet itself, proceed as follows. Tool MDT 310 features a receptacle bore for the tappet. This bore has to be pushed carefully over the tappet, until the studs of the tool latch in the corresponding recess of the tappet centering screw (3).
	In order to disengage the tappet, rotate the tool counter-clockwise, with a slight constant pressure (4).
	Separate the tool from the tappet. The tappet can now be removed through the case bore of the valve (5).

Tab. 26: Dismounting the tappet

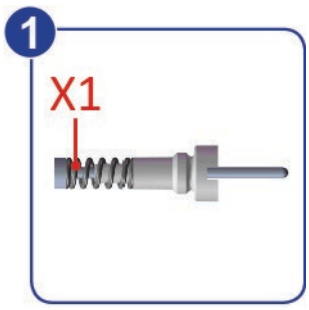
10.2.2 Installation of the Tappet

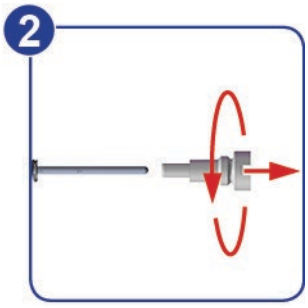
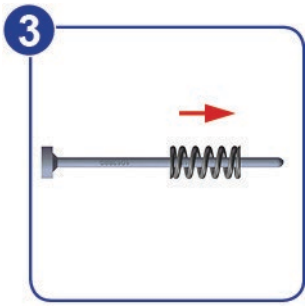
To re-install a tappet, perform the sequence described above in reversed order.

Place a small droplet of Tappet Grease TF (order no. 1014637; droplet size ca. 2 mm) on the tappet and another on the tappet spring. Then distribute the grease evenly by rotating the tappet slightly while moving it three times in and out, before you push it in finally. Make sure that the tappet tip is free of grease.

After completion, do not forget to execute the adjust.

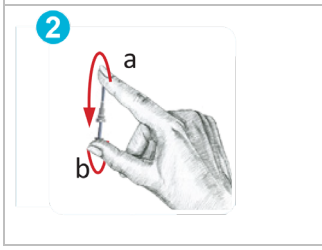
10.2.3 Disassembly of the Tappet

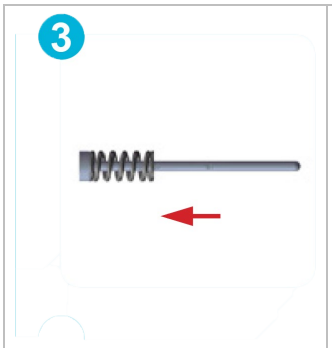
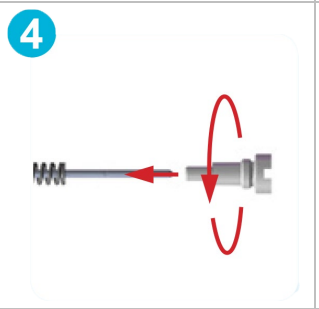
	**Step 1:** Hold the tappet at the guiding face between thumb and index finger (X1).

	**Step 2:** By slightly rotating, separate the tappet centering screw from the tappet rod.
	**Step 3:** Remove the tappet spring from the tappet rod.
	**Step 4:** All of the parts should be subjected to ultrasonic cleaning (if required).

Tab. 27: Disassembly of the tappet

10.2.4 Remounting the Tappet and 2-Finger-Wipp-Test (2-Finger-Seesaw-Test)

	**Step 1:** The following test shows, if the tappet runs smoothly through the tappet centering screw. If it does not, you have to clean the parts again. Push the tappet centering screw onto the tappet with the wide end pointing away from the tappet tip.
	**Step 2:** Hold the tappet with the tappet centering screw between index finger and thumb. Turn the hand with the tappet several times upside down so that the ends of the tappet switch between a and b. The tappet centering screw has to slide smoothly on the tappet from one end to the other. Remove the tappet centering screw after the test.

	**Step 3:** Push the tappet spring onto the rod..
	**Step 4:** While slowly rotating, push the tappet centering screw onto the rod. The wide end of the tappet centering screw has to point towards the tappet tip
	**Step 5:** Place a small droplet of Tappet Grease TF (order no. 1014637; droplet size ca. 2 mm) on the tappet and another on the tappet spring. Then distribute it evenly, by rotating the tappet slightly while moving it three times in and out, before finally pushing it in. Make sure that the tappet tip is free of grease. The dispensing process may be continued after you have performed the adjust process.

Tab. 28: Remounting the tappet and 2-Finger-Wipp-Test

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 128 will give you a quick overview. In paragraph 11.2, page 129 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 94). 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 29).

INFORMATION

Valve status depending on error

If the valve is open or closed after an error message, depends on the respective error. In paragraph 11.2, page 129 it is mentioned for each error.

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?
101	101 Incorr. Valve	Valve	Start-up
102	102 Incorrect Piezo Type	Valve	Start-up
104	104 Sensor Communication Error	Valve	Operation
190	190 Incorrect Valve Data	Valve	Start-up, Operation
191	191 NozzleTappet Load Err. Enter	Valve	Start-up
192	192 NozzleTappet Save Err. Enter	Valve	Operation
199	199 Valve Error Escape for Auxi.	Valve	Start-up
300	300 Act. Calib. wrong pr.Enter	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
502	502 MDV TempHigh Please Wait	Valve	Start-up, Operation
601	601 USART Buffer Overflow	RS-232C	Operation
701	701 Valve Driver Defect	MDC	Start-up, Operation
702	702 Watchdog TimeOut pr. Enter	MDC	Start-up, Operation
703	703 RS Power Supply 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
802	802 wrong Heater pr. 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

101	**101 Incorr. Valve**	
	This message sometimes appears during startup of the system. The control unit checks the data of valve and control unit. If the control unit does not recognize the valve resp. the required valve type (e.g. finds a low viscosity valve), the error message is displayed.	
	Error code display:	101 Incorr. Valve
	Error code status menu:	101 Incorr. Valve
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF control unit, and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • Maybe an inadequate valve type has been installed. • Check MDC (if possible, test system with another MDC • Send MDC and/or valve to VERMES Microdispensing or to your supplier
	Valve:	Valve still open (start-up of the MDC)

102	**102 Incorrect Piezo Type**	
	The piezoelectric element does not match the current application (Valve Passport). This error message appears with the start-up of the control unit.	
	Error code display:	102 Incorrect Piezo Type
	Error code status menu:	102 Incorrect Piezo Type
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF control unit, and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • Exchange valve
	Valve:	Valve still open (start-up of the MDC)

104	**104 Sensor Communication Error**	
	This error message appears, when there is a problem with the sensor cable. **Important Note!** This error message can also appear, when the MDC is connected to an MFC 3000 for cooling a valve, and you switched ON the MDC too early. When using an MFC for cooling, you always have to keep this order of steps: 1. Switch ON MFC 2. Switch ON the channel used for cooling at the MFC 3. Switch ON MDC	
	Error code display:	104 Sensor Communication Error
	Error code status menu:	104 Sensor Communication Error
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF control unit, and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • Exchange valve
	Valve:	Valve is closed

190	**190 Incorrect Valve Data**	
	This error message appears, if a checksum error occurs while writing the Cycle Counter.	
	Error code display:	190 Incorrect Valve Data (Press Enter)
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge error message.
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open; otherwise, it is closed.

191	**191 NozzleTappet Load Err.**	
	During startup of the control unit, the system reads the counters (e.g. nozzle counter, tappet counter). If a problem arises, this error message is displayed. Corresponding values may be doubtful, until a new cycle is started.	
	Error code display:	191 NozzleTappet Load Err Enter.
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge error message. The MDC restarts.
	Valve:	Valve still open (start-up of the MDC)

192	**192 NozzleTappet Save Err.**	
	This error message appears, if an error occurs while writing the tappet or nozzle interval. This can happen e.g. with the items “Set Nozzle” or “Set Tappet” in the submenu “Status”.	
	Error code display:	192 NozzleTappet Save Err. Enter
	Error code status menu:	Save Error
	Error handling:	• Press **[enter]** key to acknowledge error message.
	Valve:	Valve is closed

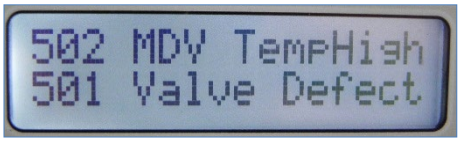
199	**199 Valve Error**	
	General valve data error (Sensor connection). When the checksum of the valve EEPROM is compared to software data during startup, mismatch is notified by this message. This error message appears with the start-up of the MDC. At this point, you have the opportunity to switch to Auxiliary Mode. **Important Note!** This error message can also appear, when the MDC is connected to an MFC 3000 for cooling a valve, and you switched ON the MDC too early. When using an MFC for cooling, you always have to keep this order of steps: 1. Switch ON MFC 2. Switch ON the channel used for cooling at the MFC 3. Switch ON MDC	
	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
	Valve:	Valve still open (start-up of the MDC)

300	**300 Act. Calib. wrong**	
	The error message “300 Act. Calib. wrong pr. Enter” appears, if the calibration values of the actuator 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:::	300 Act. Calib. wrong pr. Enter
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge error message.
	Valve:	Valve still open (start-up of the MDC)

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
	Valve:	Valve still open (start-up of the MDC)

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
	Valve:	Valve is open

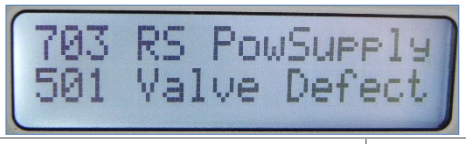
501	**501 Valve Defect Error**	
	The valve fails during operation, e.g. due to a damaged piezoelectric element.	
	Error code display:	501 Valve Defect Error
	Error code status menu:	501 Valve Defect Error
	Error handling:	• Switch off the MDC, remove the valve and send it to VERMES Microdispensing or to your supplier (regular maintenance is advisable)
	Valve:	Valve is open

502	**502 MDV TempHigh**	
	Automatic shut-down because of high temperature In order to protect the piezoelectric element from excessive heat, the temperature is internally monitored by a corresponding circuit. This is automatically switching OFF the system in case of need. As the needle lift has a big impact on the condition of the piezo, the temperature limit is depended on the needle lift as well. Limits:: NL ≤ 80 % = 140 °C NL > 80 % = 120 °C (from 81 % – 100 % the temperature is variable at ca. 140 °C – 120 °C) Once the temperature has fallen below 80 °C, the display changes from "502 MDV TempHigh Please Wait" to "502 MDV TempHigh Press Enter". After pressing the **[enter]** key, you can again trigger normally. During the display of "502 MDV TempHigh" the valve is closed. If the error message happens directly after starting the MDC, pressing **[enter]** will initiate a re-start. In certain circumstances, it can happen that in this phase an error "501 Valve Defect Error" is detected. In this case, both errors are shown in the display of the MDC (see picture below). Follow the instructions regarding error 501.  **Important Note!** This error message can also appear, when the MDC is connected to an MFC 3000 for cooling a valve, and you switched ON the MDC too early. When using an MFC for cooling, you always have to keep this order of steps: 1. Switch ON MFC 2. Switch ON the channel used for cooling at the MFC 3. Switch ON MDC	
	Error code display:	502 MDV TempHigh Please Wait
	Error code status menu:	502 MDV TempHigh
	Error handling:	• The temperature of the valve is too high. System has to cool off, then press [enter]. Maybe you have to lower the Needle Lift and/or frequency parameters, in order to prevent a re-occurrence of the problem. In case of an air cooled valve, you need to increase the air flow. • Switch OFF control unit, and inspect the sensor and actuator cables and their connections. If a cable is damaged, it must be exchanged before restarting. • If your dispensing application includes the use of an MFC and a flow control valve FCV, make sure the channel for cooling in the MFC is switched "ON", before you start the MDC (see also User Manual MFC 3000, chapter 3.8.3)
	Valve:	Valve is closed

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
	Valve:	Valve remains unchanged.

701	**701 Valve Driver Defect**	
	A hardware failure of the valve control is probable (e.g. short circuit in the connection of the piezoelectric element). This problem is possible during startup of the MDC and also with system in operation.	
	Error code display:	701 Valve Driver Defect
	Error code status menu:	701 Valve Driver Defect
	Error handling:	• Switch OFF the MDC immediately. Inspect the actor cable connection. Worn, kinked or charred cables must be exchanged. • The MDC must be returned to the manufacturer. The valve has to be checked (if that is not possible, it has to be send as well).
	Valve:	Valve is open

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
	Valve:	Valve still open (start-up of the MDC)

703	**703 RS Power Supply**	
	This error message appears, if a problem with the power supply forces a re-start of the system. If this happens more than once, you need to change your dispensing parameters, since your current settings use too much power over time. In certain circumstances, it can happen that in this phase an error "501 Valve Defect Error" is detected. In this case, both errors are shown in the display of the MDC (see picture below). Follow the instructions regarding error 501. 	
	Error code display:	703 RS Power Supply pr. Enter
	Error code status menu:	703 RS Power Supply
	Error handling:	• Press **[enter]** key to acknowledge error message. • Lower the dispensing frequency, since your current settings need too much power.
	Valve:	Valve still open (start-up of the MDC)

800	**800 wrong H calib**	
	The error message "800 wrong H calib 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. Calibr. 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).
	Valve:	Valve still open (start-up of the MDC))

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
	Valve:	Valve is closed

802	**802 wrong Heater**	
	The MDC is connected with an MHA-K-230/48. The heater connected with the MHA is incompatible or there is no heater attached to it.	
	Error code display:	802 wrong Heater pr. Enter
	Error code status menu:	802 wrong Heater

	Error handling:	• Press **[enter]** key to acknowledge error message. Heater status will be switched "OFF" in the submenu "Heater". • Heater incorrect or no heater – change to/attach the correct heater. • If the heater was compatible, check the cable connection between MDC, MHA and heater
	Valve:	Valve is closed

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.	
	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.
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

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
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

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
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

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.
	Valve:	Valve is closed

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
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

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”.
	Valve:	Valve is closed

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 Page 150). Attach it, clearly visible, at the exterior of the package.

⚠ CAUTION

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.

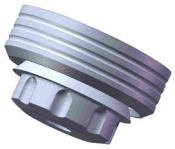
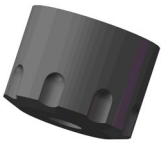
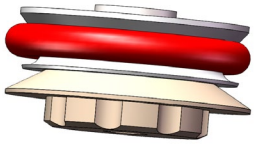
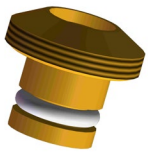
12.3 Recycling and Disposal

	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

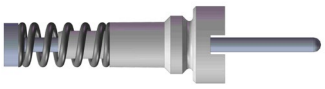
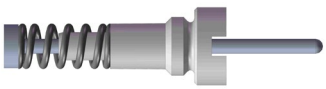
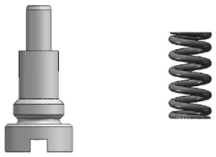
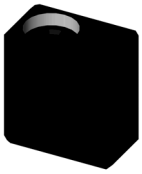
Here are some of the most important spare and extra parts as well as tools. For a complete list, please check our homepage at www.vermes.com.

13.1 Nozzle Adjusting Nuts

		
NAN-fix H NBR Order no. 1010549	**NAN - universal** Order no. 1009012	**Nozzle Adjustment Nut – MDH-230tf** Order no. 1012967 (with bearing O-ring)
		
NAN-universal+10 Order no. 1012268 **Tappet CTF15+10** Order no. 1013078 **Tappet H CTF15+10** Order no. 1013193 **Tappet H TTF15+10** Order no. 1013187 **Tappet TTF15+10** Order no. 1012974	**Tappet CTF10+10** Order no. 1013301 **Tappet H CTF10+10** Order no. 1013077 **Tappet H TTF 7+10** Order no. 1013188 **Tappet Guidance TG+10** Order no. 1012264 (further sizes available)	**Tappet Guidance H - NBR** Order no. 1012971 **Tappet Guidance H - EPDM** Order no. 1013366 **Tappet Guidance H - Viton** Order no. 1013361 **Tappet Guidance H - Silicone** Order no. 1013367 (all TGs with O-ring)

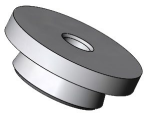
Tab. 29: Nozzle Adjustment Nuts

13.2 Tappets

		
CTF Tappet Tappet H CTF 4 Order no. 1013192 Tappet H CTF 7 Order no. 1013191 Tappet H CTF 10 Order no. 1013190 Tappet H CTF 15 Order no. 1013189	**TTF Tappet** Tappet H TTF 4 Order no. 1013184 Tappet H TTF 7 Order no. 1013182 Tappet H TTF 10 Order no. 1013183 Tappet H TTF 15 Order no. 1013176	**Tappet rod TTF** TTF 4 Order no. 1012892 TTF 7 Order no. 1012891 TTF10 Order no. 1012890 TTF15 Order no. 1012889
		
Tappet centering screw H Order no. 1013171 **Tappet spring TTF** Order no. 1012924	**Protection for tappet** Order no. 1008760 (with screw)	**Tappet spring TTF** Order no. 1014620

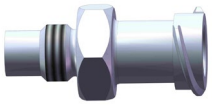
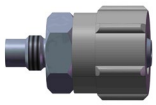
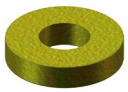
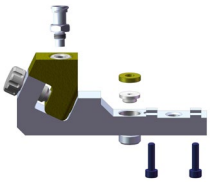
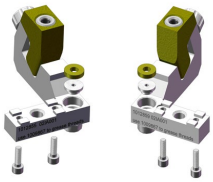
Tab. 30: Tappet

13.3 Sealings

		
Tappet sealing PE Order no. 1007067 PTFE Order no. 1010247	**Tappet sealing LX CeTeDur 170** Order no. 1013327 (no tappet centering piece needed) Other variants on request	**O-Ring-N (O-ring for Tappet Guidance)** NBR Order no. 1007063 (black) EPDM Order no. 1007064 (blue) Silicone Order no. 1010037 (red) Viton Order no. 1008762 (green) CeTeDur Order no. 1010613 (transparent)

Tab. 31: 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)	**Fluid box connector Luer-Lock** Order no. 1007060	**Fluid box connector tube** 3 mm Order no. 1007059 4 mm Order no. 1012797
		
MDX 3081 MDX 3081 /03 Order no. 1013174 MDX 3081 /10 Order no. 1013170 MDX 3081 /30 Order no. 1013172 MDX 3081 F /10 Order no. 1013175	**Tappet Centering Piece PEEK** Order no. 1009419	**Fluid Box Body MDF 3070-SH** Order no. 1012994
		
Fluid Box MDF 3070-CC-RHC Order no. 1013168	**Fluid Box MDF 3070-CC left or right** left Order no. 1012855 right Order no. 1012859	**Fluid Box MDF 3070-twin** Order no. 1012211
		
Set of Screws for Fluid Box Order no. 1011014	**Cartridge Base CHI** Order no. 1014060 **Cartridge Base CHI-HT** Order no. 1014517	**Cartridge Base CCI** Order no. 1014267 **Cartridge Base CCI-HT** Order no. 1014518
		
Cartridge Base CH Order no. 1015638	**Cartridge Holder** 30 ccm Order no. 1008743 10 ccm Order no. 1008742 5 ccm Order no. 1012912 3 ccm Order no. 1008753	**Tightening Screw** PEEK Order no. 1013487 Stainless Steel Order no. 1010027

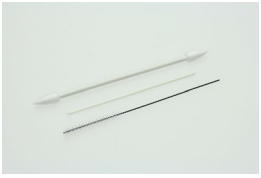
Tab. 32: Supply unit

13.5 Heater Controller

		
Heater Controller MHC 3001: Order no. 1012948 (for 1 heater) MHC 3002: Order no. 1012949 (for 2 heaters)	**MFC 3000** Order no. 1014981	**Heater MDH-230tfl/r** MDH-230tfl: Order no. 1012961 MDH-230tfr: Order no. 1012962

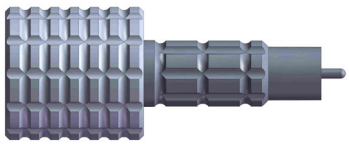
Tab. 33: Heater and Heater Controller

13.6 Cleaning

		
CTK – Cleaning Tool Kit Order no. 1010320 consists of : 25 pcs. Fluid Box Cleaners (P: 1013266) 20 pcs. Cleaning Rods (P: 1010313) 20 pcs. Fluidic Brushes (P: 1010314) (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.)

Tab. 34: Cleaning

13.7 Tools

		
MDT 301 – Universal Tool Order no. 1010208	**MDT 303 -Nozzle Insert Changing Tool** Order no. 1007083	**MDT 304 - Nozzle Insert - Squeezing Out Tool** Order no. 1007085
		
MDT 306 - Torque Wrench Tool VM Order no. 1015062 BitVM Set Order no. 1013398	**MDT 310 - Tappet Changing Tool** Order no. 1008344	**Hexagon Socket Key Set** Order no. 1012993 (can be ordered separately)
		
MDT 316 - Nozzle Insert Cleaning Tool Order no. 1013324	**MDT 324 - Nozzle Insert Cleaning Holder** Order no. 1014310	**MDT 327 – Multi-Function Tool** Order no. 1014440

Tab. 35: 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- 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 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 J04-400 Order no.: 1014613 J04-500 Order no.: 1014614 J04-600 Order no.: 1014629		

Tab. 36: Nozzle Inserts

14 Attachments

14.1 EU Declaration of Conformity

EU Declaration of Conformity

VERMES MICRODISPENSING

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: Palnkamer Straße 18
83624 Otterfing

Product Name: **Microdispensing Systems (MDS 3200j Series)**

Model Number:

System	Control Unit	Valve
MDS 3200j MDS 3200j-HM	MDC 3200j MDC 3200j	MDV 3200j MDV 3200-HM

We declare that these products are specified to the relevant EU 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	Restriction of Hazardous Substances (RoHS)

EN 61326-1
EN 55011
EN 61000-3-2
EN 61000-3-3
EN 61000-6-2
EN 61010-1

Otterfing, 02.02.2020
Place and date of issue

Jürgen Städtler
Managing Director

VTK-GF-VT-009e-1

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Fig. 48: EU Declaration of Conformity

14.2 Dimensional Drawing MDC 3200j

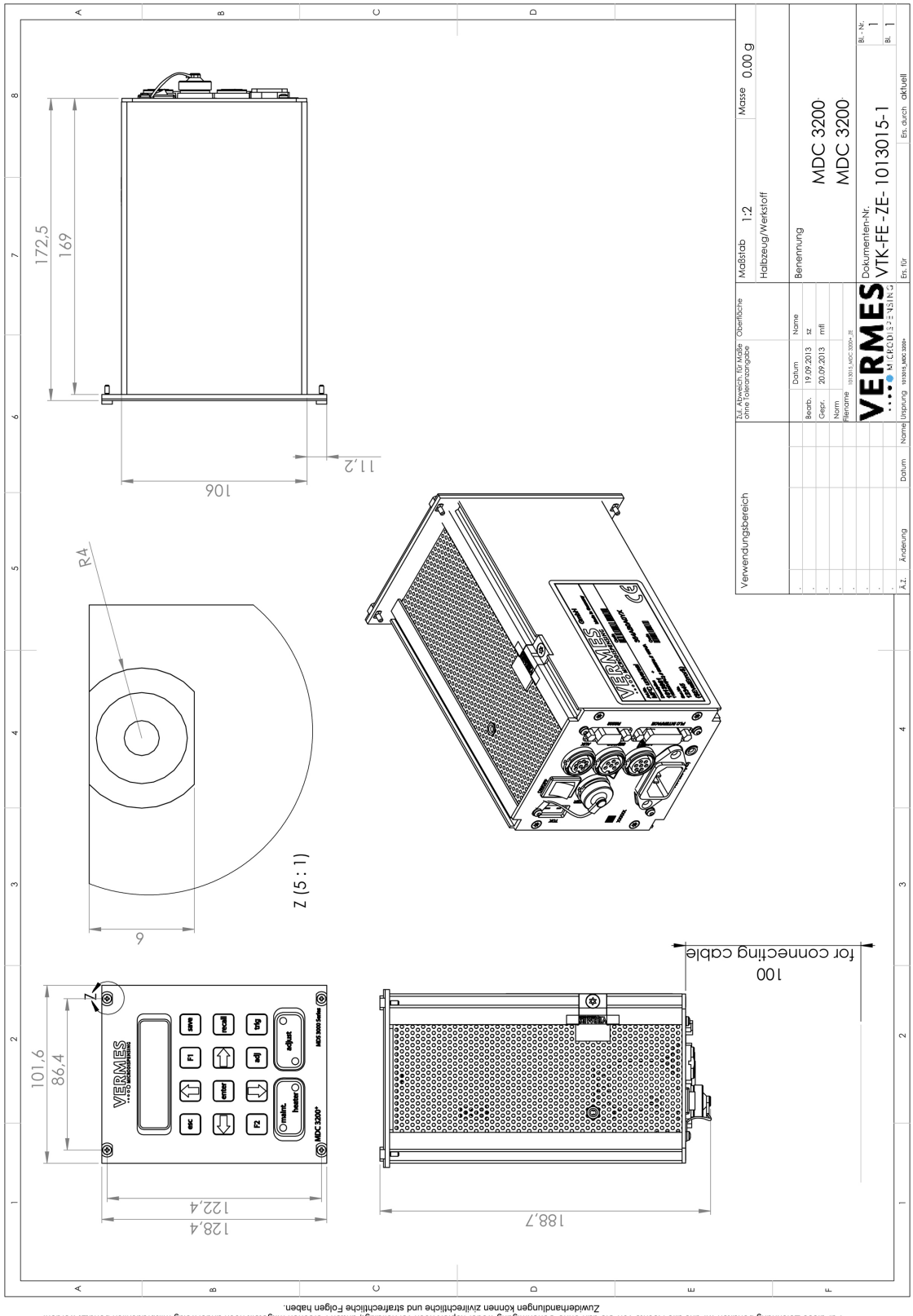

Fig. 49: Dimensional Drawing MDC 3200j

14.3 Dimensional Drawing MDV 3200j

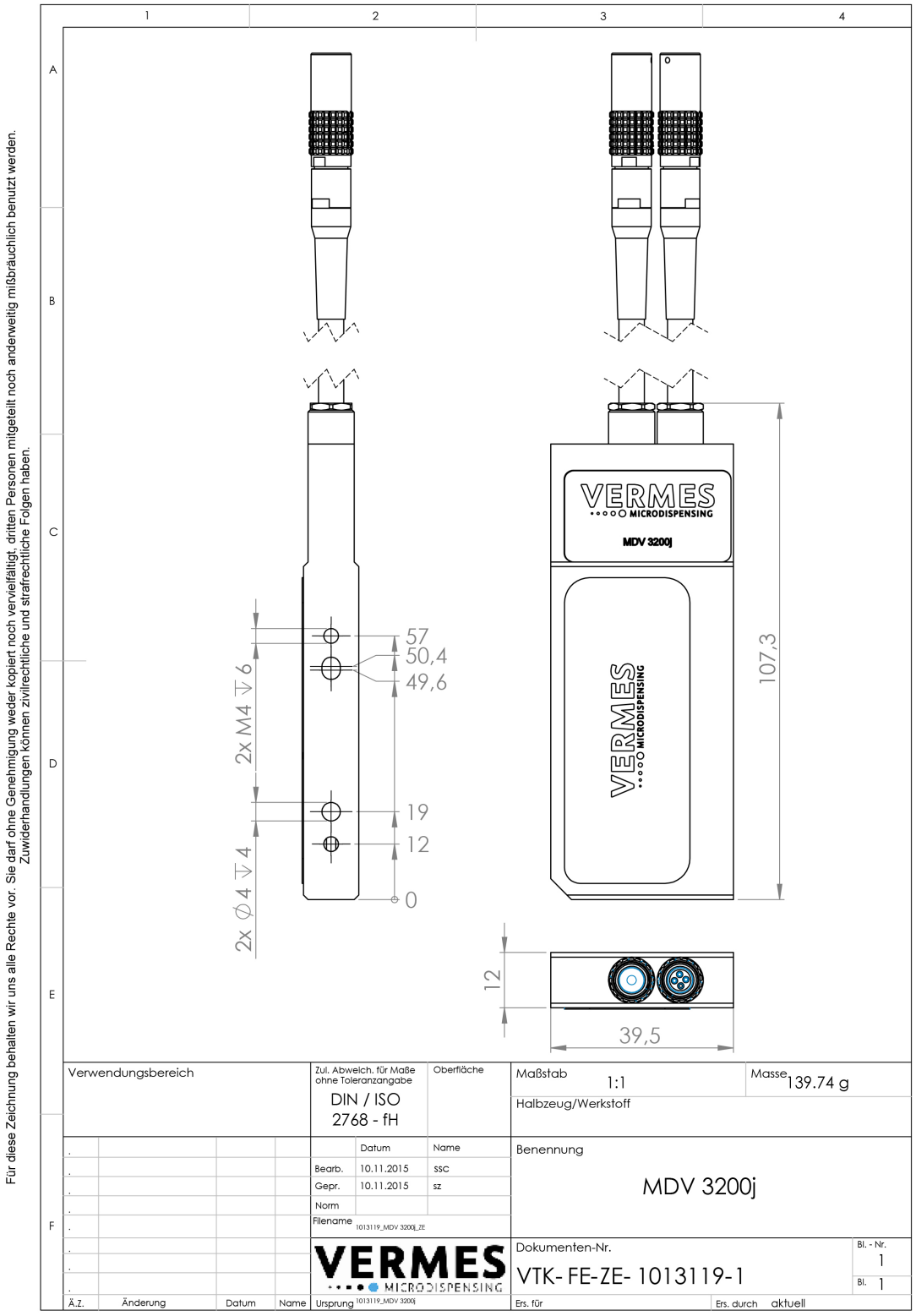

Fig. 50: Dimensional Drawing MDV 3200j

14.4 Connection Diagram PLC interface

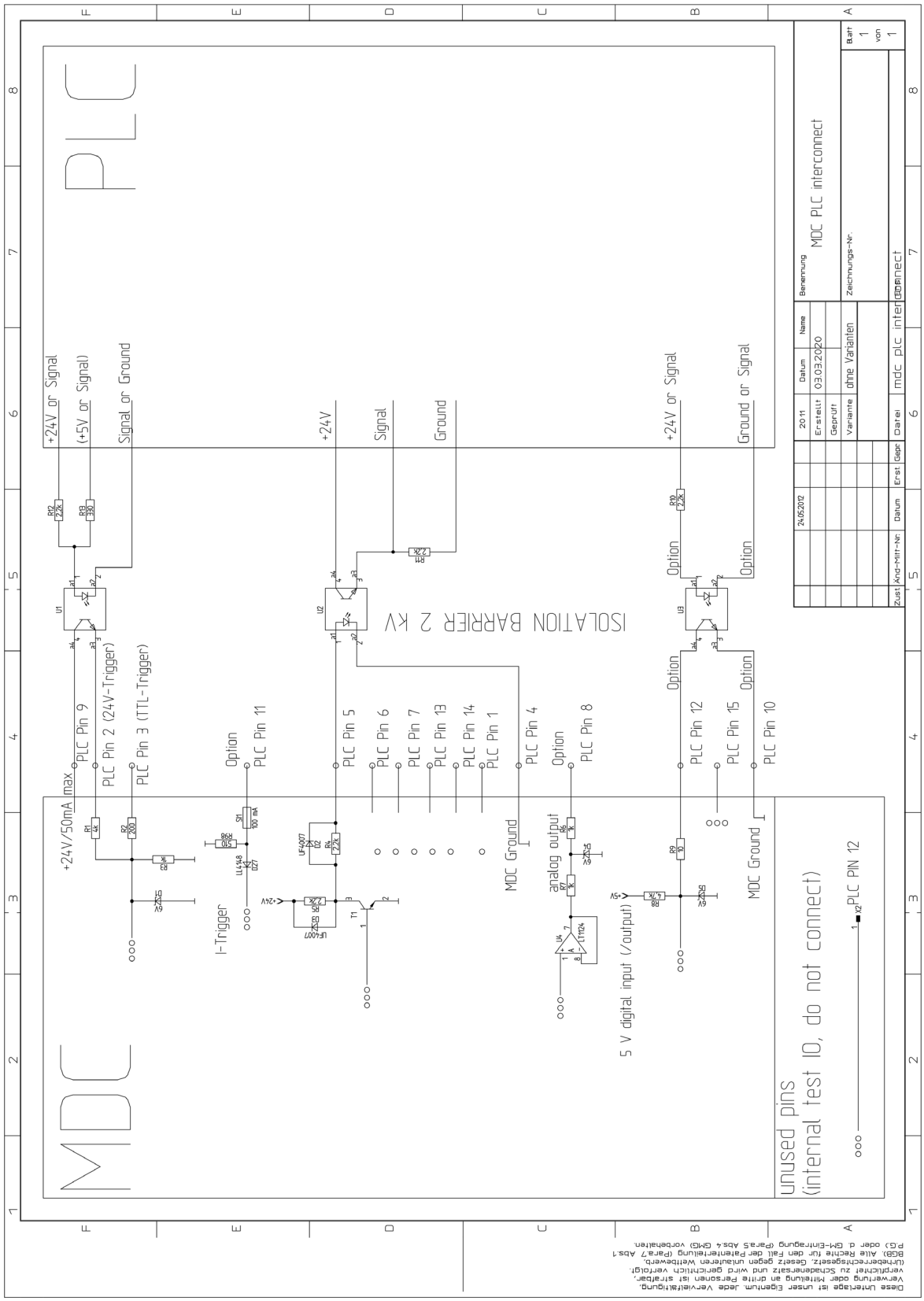

Fig. 51: Connection Diagram PLC interface

14.5 Overview of the MDC Menu

For a more detailed description of the menus and submenus, see paragraph 4.5, page 26.

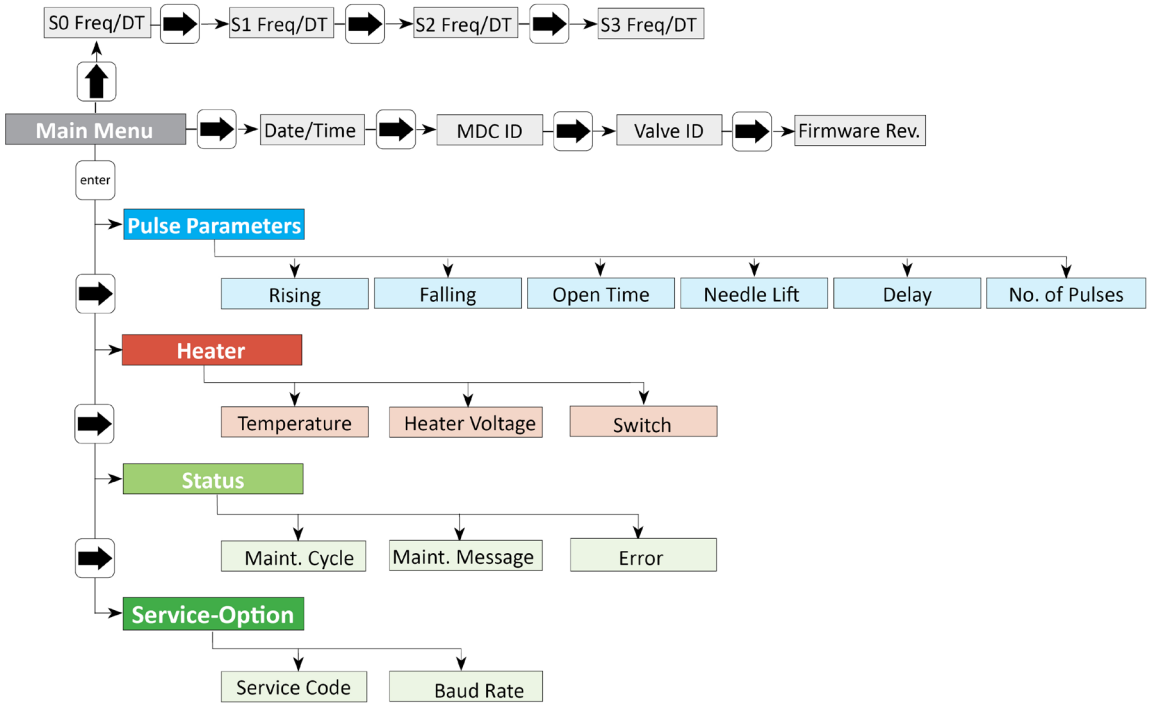

Fig. 52: Overview of the MDC Menu

14.6 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 138). The manufacturer is not liable for any damage resulting from inadequate packaging or transport.

15 List of figures

16 List of tables

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