precision dots

VERMES
MICRODISPENSING

Microdispensing System
MDS 1560-V

VERMES
MICRODISPENSING

HEATING JETTING
ERROR   STATUS

24°C   3.7 bar
Set 1 | 100 Hz

MDV 1560-V
MDS 1000 Series • Made in Germany • www.vermes.com
Powered by DST

MDC 1500-V MDS Series

POWERED BY®
DST

User Manual for Microdispensing Systems of the MDS 1560-V Series

System	Control Unit	Valve
MDS 1560-V	MDC 1500-V	MDV 1560-V*

Tab. 1:   Available products

*It is possible to use the MDV 1560-V without the MDC, by controlling it via the PLC connection from your XY-machine. In that mode, some functions would not be available, e.g. the serial commands (see paragraph 5.5, page 45).

1   Introduction

With a micro dispensing system of the MDS 1000 line from VERMES Microdispensing you have bought a high quality product. Due to the long-standing experience of the team in regards to modern devices and electronic controls, these products provide highest functionality and reliability.

Thank you very much for your trust in us.

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

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

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

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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 1000 Product Family

The Microdispensing System MDS 1560-V is a member of the MDS 1000 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 1000 product family uses the Dynamic Shockwave Technology (DST), which has been developed by VERMES Microdispensing GmbH. A system is composed of a high precision valve based on a high precision microdispensing valve (MDV series), a control unit (MDC series) and an optional selectable supply unit. (It is possible to use the MDV 1560-V without the MDC, by controlling it via the PLC connection from your XY-machine. In that mode, some functions would not be available, e.g. the serial commands.)

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

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

2   Safety Notes

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

2.1   Obligations and Liability

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

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

2.1.1   Obligations of the Customer

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

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

2.1.2   Obligations of the Operator

All persons in charge of the system must:

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

2.2   Residual Risks

The 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:

- 2014/30/EU Electromagnetic Compatibility
- 2011/65/EU Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS 2013-01-03)
- EN 61326-1
- EN 55011

Despite this comprehensive inherent safety structure, the operation of the microdispensing system MDS 1560-V 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).

Problems with a potential to impair safety aspects must be solved immediately. 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 the system is transmitted to any other department or institution, this manual must accompany it.

2.3   Contracted Use

The system MDS 1560-V 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 stationary in a conveniently equipped industrial environment, which allows the positioning and controlling of the dispensing system.

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, max. degree of soiling: 2

- Power cables must feature a protective conductor. In the case of cables not delivered by Vermes Microdispensing, the guarantee for the MDS 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 7.3.1 "Installation of the Control Unit", page 61).

- For exact dispensing results, use compressed air, free of fine particles, dust, oil and condensate, quality classes 7, 4, 4 acc. to DIN/ISO 8573-1:2010.

Type of pollution	Quality class	Explanation
Solid particles	7	Mass concentration max. 5 – 10 mg/m^3 (particle size max. 40 µm)
Water content	4	max. pressure dew point +3 °C
Residual oil	4	5 mg/m^3 max.

Tab. 2:   Necessary quality classes for the compressed air

2.5   Warnings

- During operation, the MDV can be very loud. You need to wear ear protection in its vicinity. Build a housing around the valve to keep the noise down.

- Handle the power cables correctly: Always seize the cable at the plug. Never touch it with wet hands.

- Under no circumstances connect a schuko-plug (type F, CEE 7/4) with a socket build for an unearthed plug (type C, CEE 7/17). The system would not be grounded.

- The cable should never be squeezed or kinked. Never place the instrumentation (or any other object) on the cable.

- Damaged cables may give rise to fire and danger caused by electricity. Inspect them visually in regular intervals. You should exchange damaged parts at once.

- In the case of a major disturbance, disconnect the equipment immediately from the power.

- 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.

- For longer interruptions, switch OFF the control unit.

- Before disconnecting the control unit from the mains, switch it OFF.

- Repeatedly switching ON and OFF the equipment may reduce the lifetime of the power unit.

- Before charging the fluid system with an aggressive, reactive or toxic substance, you have to verify that it is compatible with all of the contacting components inside the system.

- The supply pressure at the cartridge or in the pressure tank of 7 bar resp. 100 bar (according to the system configuration, the latter only with special components) should never be exceeded.

- If you use the valve with a heater, the temperature in that area can reach up to 99 °C. Do not touch it during operations and afterwards only once it had enough time to cool down.

- When cleaning the components in contact with the transported substance, you should place the device in a safe and stable position, without being subjected to vibrations.

- The MDV is normally open, if the actuator pressure is turned off, and the transported liquid can flow (exception: normally closed function is activated, see paragraph 6.3.2, page 52). Before switching OFF the microdispensing system, do not forget to lower the cartridge 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, you must 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
BY	Bayonet
CTF	Ceramics Tappet Flat
CTK	Cleaning Tool Kit
DST	Dynamic Shockwave Technology
MDC	Controller (MicroDispensingControl unit)
MDF	Fluid box (MicroDispensingFluid box)
MDH	Heater (MicroDispensingHeater)
MDS	System (MicroDispensingSystem)
MDT	Tool (MicroDispensing Tool)
MDV	Valve (MicroDispensingValve)
MDX	Supply unit
MFC	Multifunctional Controller
NFN	Nozzle Fixation Nut
NI	Nozzle Insert
PDTF	Poly Diamond Tappet Flat
PLC	Programmable Logic Controller
POD	Point of Dispensing
TTF	Tungsten carbide Tappet Flat

Tab. 6:   Abbreviations

3.3   Tools

The following tools are required to install and to operate the MDS:
- MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)
- MDT 306 - Torque Wrench Tool VM black (Order no. 1015062)
- MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)
- MDT 323 - Nozzle Insert – Squeezing Out Tool TA (Order no.1014283)
- MDT 324 - Nozzle Insert Cleaning Holder (Order no.1014310)
- MDT 327 - Multi-Function Tool (Order no.1014440)
- MDT 328 - Tappet Sealing Changing Tool (Order no.1014503)
- Hexagon Key Set (Order no. 1012993)

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

IMPORTANT NOTE

No foreign tools

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

3.3.1 MDT 303 - Nozzle Insert Changing Tool

The MDT 303 is required for the exchange of the nozzle insert. The 3 pins of the MDT 303 grip into the receptacle bores of the tappet centering screw in order to remove it from the fluid box body.	
Intended Purpose: 1. Screwing apart/together fluid box body and tappet centering screw	
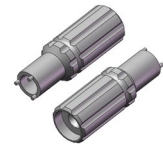
Tab. 7:   MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)

3.3.2 MDT 316 - Nozzle Insert Cleaning Tool

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

Tab. 8:   MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)

3.3.3 MDT 323 - Nozzle Insert – Squeezing Out Tool TA

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

Tab. 9:   MDT 323 - Nozzle Insert – Squeezing Out Tool TA (Order no. 1014283)

3.3.4 MDT 324 - Nozzle Insert Cleaning Holder

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

Tab. 10:   MDT 324 - Nozzle Insert Cleaning Holder (Order no. 1014310)

3.3.5 MDT 327 - Multi-Function Tool

The knobs of the MDT 327 grip 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. Changing of the Connector BY 2. Fixing/removing the tightening screw to/from the fluid box 3. Fixing/removing the Nozzle Fixation Nut 4. Picking up a nozzle insert	

Tab. 11:   MDT 327 - Multi-Function Tool (Order no. 1014440)

3.3.6 MDT 328 - Tappet Sealing Changing Tool

The MDT 328 is used to mount and demount the tappet sealing and the tappet centering piece.

Intended Purpose:	
1. Squeezing out of the tappet sealing from the fluid box 2. Squeezing out of the tappet centering piece from the fluid box 3. Pushing the tappet sealing into the fluid box	

Tab. 12:   MDT 328 - Tappet Sealing Changing Tool (Order no. 1014503)

3.3.7 Hexagon Key Set

The set includes three hexagon keys (sizes 2, 2.5 and 3) for hex-screws, with blades made of hardened steel and ergonomic grips.

Intended Purpose:	
1. Mounting and demounting the cartridge holder (2) 2. Fixing of the valve, in-situ (3)	

Tab. 13:   Hexagon Key Set (Order no. 1012993)

3.3.8 MDT 306 - Torque Wrench Tool VM black

The MDT 306 allows you to screw tight screws with an exactly set tightening torque. The value can be adjusted continuously at the torque wrench tool.

You can order the necessary bits separately or together with the torque wrench as a set in a tool box (MDTS 1 - Torque Wrench Tool Set TA, order no. 1013521). Additional information is in the Quick Reference Guide "Torque Wrench Tool VM MDT 306". You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).

Intended Purpose:

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

Tab. 14:   MDT 306 - Torque Wrench Tool VM (Order no. 1015062)

3.3.9 Torques (in cN.m)

Element	Gearing Profile	Bit Order No.	Torque (cN.m)		Cross Reference
			Min.	Max.	
Nozzle Fixation Nut (hexagon screw, size 7)	⬡	1014204	150	180	Page 39
Screws for valve fixation (size M4, thread depth 5 mm)	⊕	1013373	150	180	Page 61
Screws for cartridge holder M 3 x 12 (hexagon socket, size 2)	⬡	1013294	50	60	Page 57
Connector BY (in mounting body PEEK; hexagon socket, size 2.5)	⬡	1016631	70	80	Page 57
Connector BY (in metal mounting body; hexagon socket, size 2.5)	⬡	1016631	90	100	Page 57
Tightening screw PEEK (gearing VM-A)	✹	1014519	110	120	Page 126
Tappet centering screw BY (gearing VM-B)	◯	1014521	100	140	Page 41

Tab. 15:   Torques (in cN.m)

4 Control Unit MDC

This chapter contains relevant information about the control unit MDC 1500-V (pictured below). It describes the menu structure, keypad and functions of the control unit.

Fig. 1:   MDC 1500-V

4.1 Technical Data

	Value
Dimensions	128 mm H x 51 mm W x 189 mm D *(w/o Kabel)* *(see dimensional drawing,* paragraph 15.3, page 167*)* 3 RU x 20 HP
Weight	ca. 550 g
Supply Voltage	24 V DC
Power Consumption	Max. 40 W (with activated heater)
Current Consumption	Max. 1.7 A During start-up, this value can increase by a factor of 5 (start-up peak).
IP Code	IP30
Ambient Temperature	10 ℃ - 50 ℃
Air Humidity	The relative humidity rH might not surpass 80% at 31 ℃ or 50% at 50 ℃ (connect linearly for other temperatures).
Casing Type	Plug-in case for 19" rack
Color of Casing	Black
Ventilation	Convection
Display	OLED-Display
Keypad	10 softkeys
Color of Keys	Blue, white
Control Lamps (Front)	1x Heating (yellow) 1x Jetting (green) 1x Error (red) 1x Status (blue)
Plug Contacts (Back)	1x 15 pin Sub-D PLC 1x 6 pin pressure control 1x 12 pin valve control 1x 9 pin Sub-D RS-232C 1x Power plug (24 V DC)

4.2 Front Side
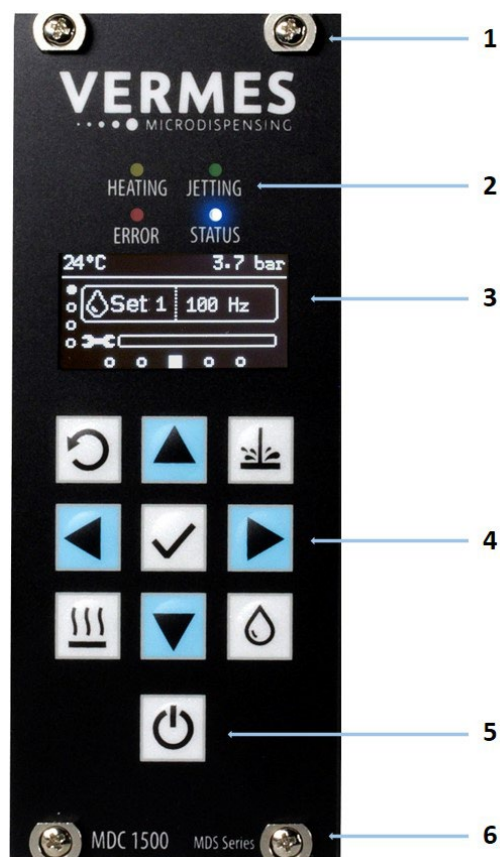
Fig. 2:   Front Side

1	Mounting holes (top)	4	Keypad with 9 soft keys
2	Control lamps (Heating – yellow, Jetting – green, Error – red, Status – blue)	5	Power button
		6	Mounting holes (bottom)
3	Display (OLED)		

Heating control lamp:

This yellow LED indicates the activity of the heating.

• Heating ON – LED ON

• Heating OFF – LED OFF

• Heating up phase – LED flashes

Jetting control lamp:

This green LED is ON, whenever the valve is dispensing. When the dispensing times are very short, the jetting control lamp flashes.

Error control lamp:

This red LED is flashing, whenever the MDC has detected an error

(see chapter 12, page 135).

Status control lamp:

This blue LED is ON, whenever the MDC is ON and ready for dispensing.

If the LED is flashing, instead of showing a steady light, there are two possible reasons:

- You have connected an electronic pressure regulator and now you have changed the target pressure for the actuator. The system is currently changing the actuator pressure accordingly. During this regulation phase, you cannot dispense. This phase usually takes a few seconds. This phase is also marked by an up-and-down arrow symbol in the display.
- If you send the serial command SYS:FIND, the status control lamp flashes for ten seconds. A beep sound marks the beginning and end of these ten seconds.

OLED display:

Data and menu options are shown in the illuminated OLED ("organic light emitting diode") display. In the upper line appear the values for the current heater temperature and actuator pressure (see Fig. 3). Some elements of the display change with the menu items.
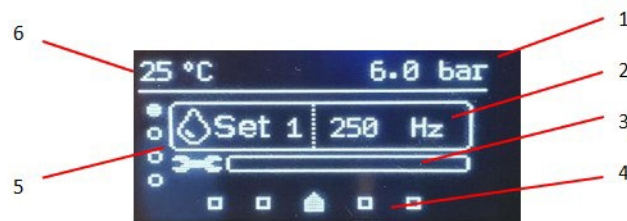
Fig. 3:   Display (menu item "Setup 1")

1	Actuator pressure (in bar)	4	Currently selected menu section (here: "Dispensing Setting")
2	Dispensing frequency (for the selected setup)	5	Selected setup
3	Progress bar service interval	6	Heater temperature (in °C)

Keypad with 9 softkeys:

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

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

Power button:

With the power button, you switch the MDC ON and OFF. When switching it OFF, you have to confirm by pressing the **[Enter]**-key.

4.3   Back Side
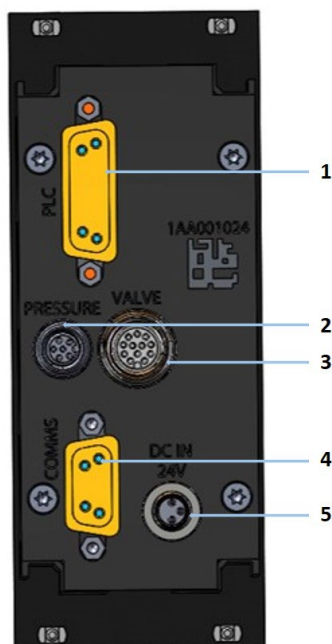
Fig. 4:   Back side

1   PLC interface (Sub-D, 15-pin)
2   Socket for pressure control (M8, 6-pin)
3   Socket for valve control (M12, 12-pin)

4   RS-232C interface (Sub-D, 9-pin)
5   Power connector (M8, 3-pin)

PLC Interface (Sub-D, 15-pin):
Different inputs and outputs may be connected. For the communication protocol, refer to paragraph 9.2, page 105.

Socket for pressure control (M8, 6-pin):
For the connection of a pressure regulator (see chapter 6, page 46).

Socket for valve control (M12, 12-pin):
For the connection of the valve control.

RS-232C interface (Sub-D, 9-pin):
Since the system offers the possibility of external programming of dispensing parameters via PC, a local RS-232C is integrated to receive the data. For the communication protocol, refer to paragraph 9.1.1, page 75.

Power connector (M8, 3-pin):
Connects the control unit to power supply via an external power supply. The MDC needs 24 V DC.
PIN functions: 1 – GND, 3 – Positive Voltage in, 4 – PE

4.4 Function Keys

Function Key	Function
▲	**[↑]-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.
◀	**[←]-key** The screen moves one menu step back. or The cursor is shifted one position to the left.
▶	**[→]-key** The screen moves one menu step ahead. or The cursor is shifted one position to the right.
✓	Pressing the **[Enter]**-key confirms the menu selection and opens the corresponding submenu. or The entry of a value is confirmed. The screen changes to the next-higher menu level.
↻	Pressing the **[Back]**-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.
⊥	The **[Purge]**-key opens the valve. The valve remains open as long the key is pressed. You can use the **[Purge]**-key in every submenu.
◊	Pressing the **[Trigger]**-key instantaneously launches a dispensing procedure according to the selected parameter settings. The **[Trigger]**-key only works in the menu section "Dispensing Setting". For dispensing it will use the parameters of the setup (1, 2, 3 or 4), which are selected at that moment.
)))	The **[Heater]**-key starts the internal heater. The **[Heater]**-key only works in the main menu. The heating control lamp shows the status of the heater.
⏻	The **[Power]**-key starts the MDC. The **[Power]**-key only works in the main menu.

4.5 Menu Structure

The control unit contains five menu sections: "General Settings", "System Information", "Dispensing Setting", "Heater Setting" and "Pressure Setting" (see Fig. 5, page 27). These menu sections are not directly displayed. The current selected menu section is only indicated by the highlighted icon in the bottom of the display (see Fig. 3, page 23). With the keys **[→]** and **[←],** you can switch around between the menu sections. The home section is "Dispensing Setting".

The main menu of the control unit contains nine menu items: "General Settings", "System Information", "Setup 1", "Setup 2", "Setup 3", "Setup 4", "Heater", "Act. Pressure" and "Cart.Pressure" (see Fig. 6, page 28). After starting the MDC, you always start in the menu item "Setup 1". With the arrow keys, you can switch around between the menu items. By pressing the **[Back]**-key in the main menu, you always jump back into the menu item "Setup 1".

With **[Enter]**, you reach the next level of the menu item. If the level contains several submenu items (e.g. menu item "General Settings" and "System Information"), you can switch around the submenu items with the keys **[↓]** and **[↑]**. The end level of a menu item is a page, where you can view or change the respective settings, e.g. the target temperature in the menu item "Heater". By pressing the **[Back]**-key, you jump back into the respective menu item.

Menu items are always "wrap-around", i.e. you can move on from the last item in a menu directly on to the first. The information shown in the display might differ, depending on the menu item you are in.

To change a numerical value, press the **[Enter]**-key. Then use the arrow keys to change the value (**[↑]**-key and **[↓]**-key to increase or decrease the value, **[→]** and **[←]** to choose the position).

- In the menu item "General Settings", you can check and change general settings, e.g. the baud rate of the serial interface.
- In the menu item "System Information", you can find relevant system information, e.g. the type of valve.
- In the menu items "Setup 1", "Setup 2", "Setup 3" and "Setup 4", you can check and change the settings for the dispensing process.
- In the menu item "Heater", you can check and change the temperature settings for the heating.
- In the menu items "Act. Pressure" and "Cart. Pressure", you can check and change the settings for the compressed air supply.

General Settings	System Information	Dispensing Setting	Heater Setting	Pressure Setting
General Settings ←	**System Information** ←	**Setup 1** →	**Heater** →	**Act. Pressure**
enter ↓	enter ↓	↓		↓
Pressure Alert	SN Valve/MDC	**Setup 2**		**Cart. Pressure**
↑	↓	↓		
PLC Voltage	Cycle Count	**Setup 3**		
↓	↓	↓		
Baud Rate	Service In	**Setup 4**		
↓				
Factory Reset				
↓				
Service				
↓				
Parameters Lock				
↓				
Service Code				
↓				
Display Timeout				
↓				
Regulator Type				
↓				
MDV Plugout				
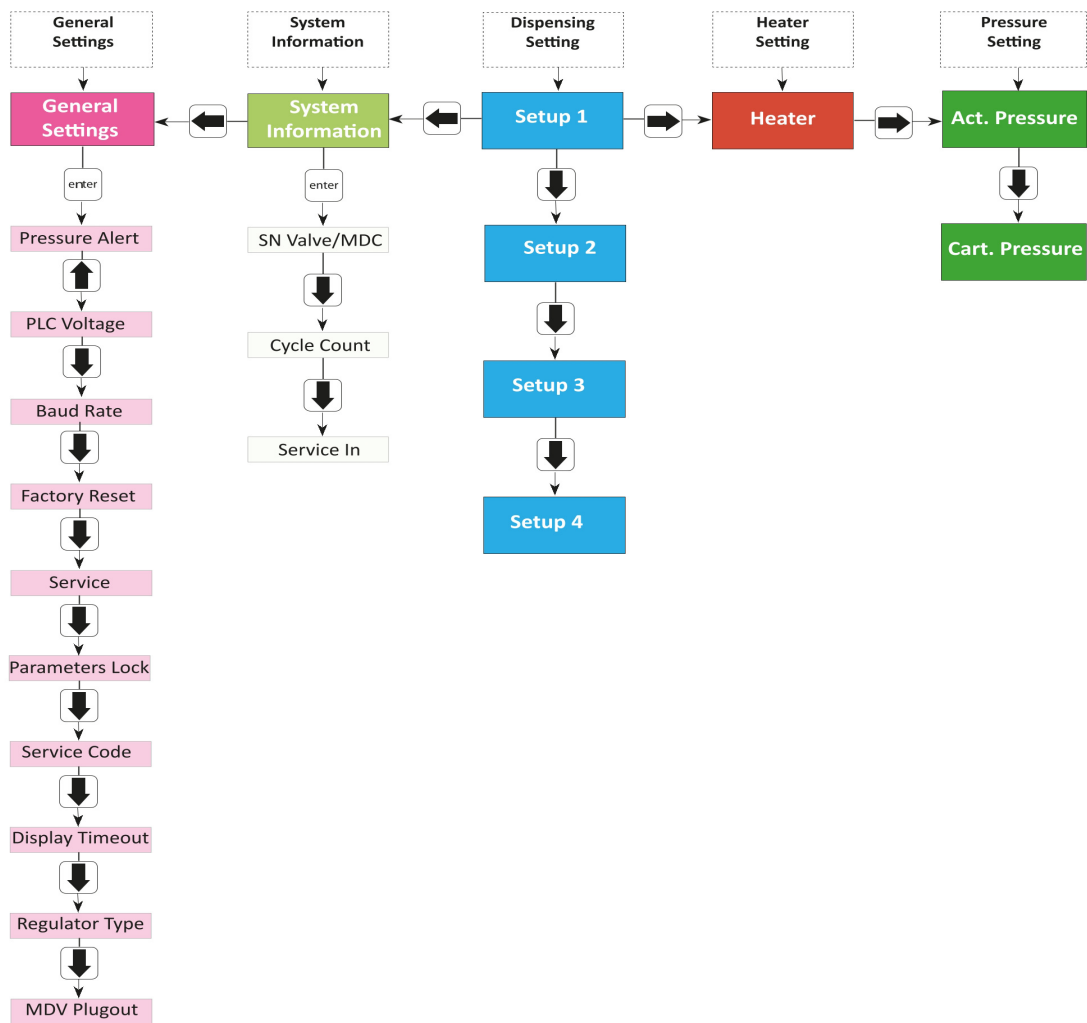
Fig. 5: Menu structure

4.5.1 Main Menu

When you switch ON the MDC, you always start in the menu item "Setup 1" of the main menu. To move between the menu items of the main menu, use the arrow keys. With **[Back]**-key, you always jump back into the menu item "Setup 1". With **[Enter]**, you reach the next level of the menu item. If the level contains several submenu items (e.g. menu item "General Settings" and "System Information"), you can switch around the submenu items with the keys **[↓]** and **[↑]**. The end level of a menu item is a page, where you can view or change the respective settings, e.g. the target temperature in the menu item "Heater". By pressing the **[Back]**-key, you jump back into the respective menu item.
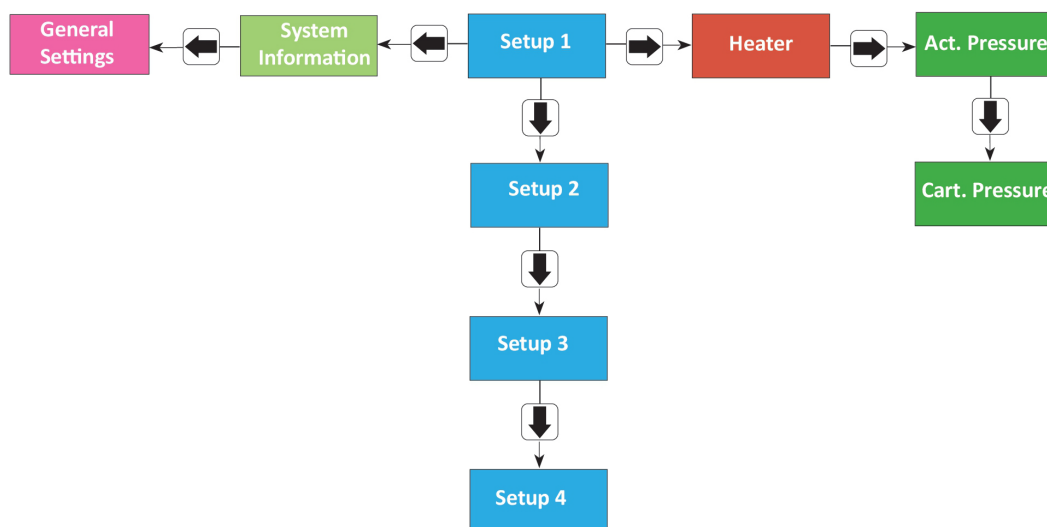
Fig. 6:   Main Menu

In the main menu, the upper left corner shows the current heater temperature. The upper right corner shows the current actuator pressure. In menu items "Setup 1", "Setup 2", "Setup 3" and "Setup 4", a progress bar is shown in the lower line. The progress bar shows the state of the service interval.

This table explains the menu items.

Menu item	Explanation
General Settings	The menu item "General Settings" contains seven submenu items. There you can check and change general settings, e.g. the baud rate of the serial interface.
System Information	The menu item "System Information" contains three submenu items. There you can find relevant system information, e.g. the serial numbers of valve and MDC.
Setup 1 Setup 2 Setup 3 Setup 4	In each of these menu items, you can check and change the dispensing parameters Open Time, Close Time and Number of Pulses for the respective setup.
Heater	In the menu item "Heater", you can check and change the temperature settings for the heater.
Act. Pressure Cart. Pressure	In these two menu items, you can check and change the settings for the compressed air supply (depending on the type of pressure regulator).

Tab. 16:   Menu items of the main menu

4.5.2 Submenu "General Settings"

With **[Enter]**-key, you can find ten menu items in the submenu of "General Settings".

- Pressure Alert
- PLC Voltage 5 V/24 V
- Baud Rate
- Factory Reset
- Service
- Parameters Lock ON/OFF
- Service Code
- Display Timeout
- Regulator Type
- MDV Plugout

You can use the **[↑]**-key or **[↓]**-key to switch between these items. With **[Enter]**, you reach the setting page of the chosen menu item. By pressing the **[Back]**-key, you jump back into the respective menu item.

Fig. 7:   Submenu "General Settings"

This table explains the menu items.

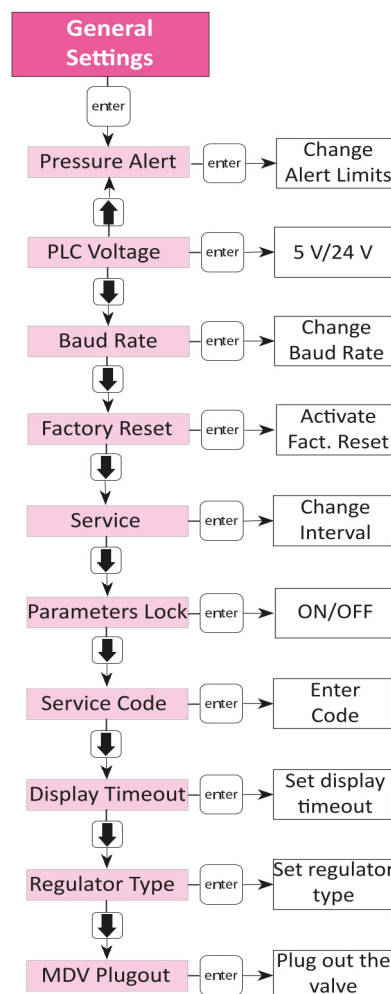| Menu item	Explanation
Pressure Alert	Here you can switch ON or OFF the pressure alert and set the limits for the pressure alert paragraph 6.1.2, page 48. You can switch between OFF -> +-0,1bar -> +-0,2bar -> +-0,3bar -> +-0,4bar -> +-0,5bar. In case the alarm is triggered, you receive error message 3000301 (see paragraph 12.2 "Explanations of Error Messages", page 137).
PLC Voltage 5 V/24 V	Here you can set the voltage for the PLC signal (see paragraph 9.2, page 105). You can select between 5 V and 24 V. This is then set for inputs and outputs of the PLC interface. The default setting is 24 V.
Baud Rate	Here you can change the baud rate of the serial interface. There are seven possible values: 9600, 19200, 38400, 57600, 115200 (default), 230400 and 460800. **Important note!** After changing the baud rate, make sure you have the same baud rate at your PC. If the two baud rates are not the same, the serial communication does not work.
Factory Reset	Here you can perform a Factory Reset. All parameters will be reset to their default values (see paragraph 8.7 "Factory Settings", page 72). **Information!** During dispensing, factory reset is not possible, since it would affect your dispensing results.
Service	The service function allows you to count the number of shots and to set a service interval. As maximum you can enter 4000000000, the default value is 500000000. In "System Info" you can check, when the service interval will end. You can also find this information as a progress bar in menus items "Setup 1", "Setup 2", "Setup 3" and "Setup 4". When you set your service interval to "OFF", this information is no longer shown. Each time you change the service interval, the count is reset to 0. **Information!** These numbers are also saved in the valve. Therefore, you can unplug a valve and later plug it in again without losing this information.
Parameters Lock	Here you can activate or deactivate the parameters lock. While the parameters lock is active, you can change no settings at the MDC (except to deactivate the parameters lock). You can still scroll through the menu to check information. The parameters lock protects your dispensing process from accidental or unauthorized changes, which could affect your results. The parameters lock only affects the keypad. You can still make changes via the RS-232C interface.
Service Code	Here you can enter a service code. To enter the code, use the arrow keys. Confirm your entry by pressing the **[Enter]**-key. In the current firmware revision, there are three service codes. **9001** – Here you can change the minimum Close Time. The new value can be between 0.1 ms and 5000 ms. This setting is saved in the valve, not in the control unit. **9110** – With this service code, you can work with the function "normally closed" (see paragraph 6.3.2 "Normally Closed", page 52). Here you can configure the setting between ON and OFF. If it is set to ON, the actuator pressure regulator will not be switched off, in case the MDC is turned off by the command "SYS:POWER:OFF" or by pressing the **[Power]**-key. **9111** – With this service code, you can work with the function "normally closed" (see paragraph 6.3.2 "Normally Closed", page 52). Here you can

	configure the setting between ON and OFF. If it is set to ON, the actuator pressure regulator will not be switched off, in case the MDV is plugged out or a fatal error appears.
Display Timeout	Here you can set a timeout for the MDC display (in minutes). The display will be switched off if it has been idle in the designated time. You can switch on the display again by pressing any key of the keypad. You can set a value between 0 (= OFF) and 100 (= 100min). With the parameter "0", you turn off the display timeout.
Regulator Type	Here you can configure the type(s) of actuator/cartridge pressure regulator(s) respectively. There are three options available for each regulator: • Auto. – automatic detection of the type of the connected pressure regulator by the MDC • Mech. – mechanical pressure regulator is connected • Elec. – electronic pressure regulator is connected
MDV Plugout	Here you can plug the valve out from the MDC by pressing the **[Enter]**-key, when the message "Plug out?" is displayed. It is recommended to use this function before detaching the valve (e.g. for cleaning purpose).

Tab. 17:   Menu items of the submenu "General Settings"

4.5.3 Submenu "System Information"

With **[Enter]**, you can find three menu items in the submenu of "System Information".

· Serial number valve/MDC

· Cycle Count (counts the cycles shot with this valve, e.g. 125444455)

· Service In

You can use **[↑]**-key or **[↓]**-key to switch between these items. With **[Enter]**, you can view the information of the chosen menu item. By pressing the **[Back]**-key, you jump back into the respective menu item.
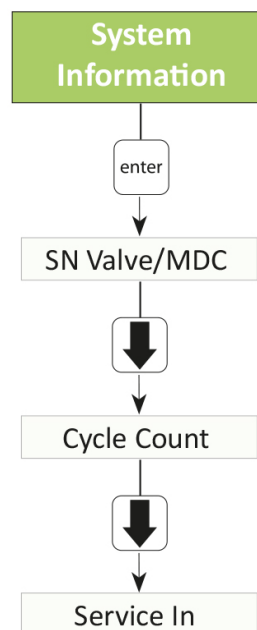
Fig. 8:   Submenu "System Information"

This table explains the menu items.

Menu item	Explanation
Serial number valve/MDC	Here you can find the following information. · Revision of firmware (e.g. 4013PV1-D) · Serial number of the valve (e.g. 10PG1001) · Serial number of the MDC (e.g. 1AA001024)
Cycle Count	Here you can find the cycle counter of the valve.
Service In	Here you can find information, after how many cycles your next service interval ends. This menu item is hidden, if Service is set to "OFF".

Tab. 18:   Menu items of the submenu "System Information"

4.5.4 Submenus "Setup 1(/2/3/4)"

With menu items "Setup 1", "Setup 2", "Setup 3" and "Setup 4", you can store parameter sets for dispensing. With the **[↑]**-key or the **[↓]**-key, you can switch between the setups. By pressing the **[Enter]**-key, you enter the setting page of the chosen setup. There you can change the general dispensing parameters (see paragraph 8.3, page 69) for the chosen setup. These parameters are the following.

- Open Time (in milliseconds)
- Close Time (in milliseconds)
- No. Pulses (Number of Pulses)

To switch between the parameters, press the **[↑]**-key or the **[↓]**-key.

The chosen setup can be triggered via the **[Trigger]**-key.

In these menu items, a progress bar shows the state of your service interval (unless the service function is switched off). When you are in one of the menu items, in the upper right corner a frequency is shown. This is the dispensing frequency resulting from your current parameter settings.
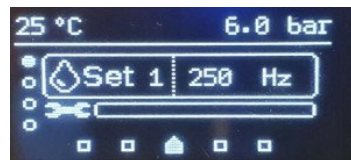
Fig. 9:   Display with progress bar

Settings regarding the temperature are changed in the menu item "Heater" (see paragraph 4.5.5, page 35). Settings regarding the supply pressure are changed in menu items "Act.Pressure" and "Cart.Pressure" (see paragraph 4.5.6, page 36).
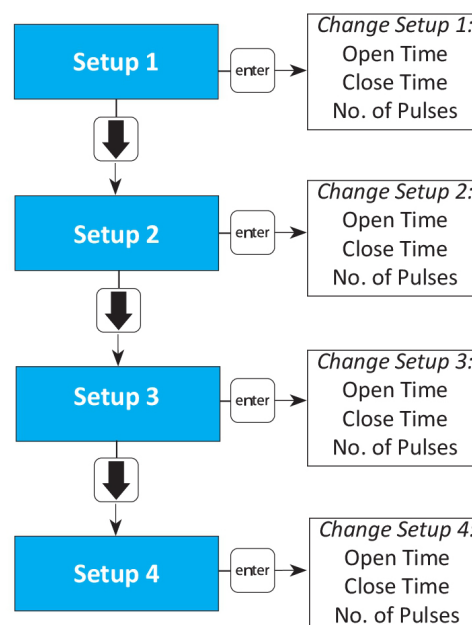
Fig. 10:   Submenus "Setup 1", "Setup 2", "Setup 3" and "Setup 4"

This table explains the menu items.

Menu item	Explanation
Setup 1	Here you can change the dispensing parameters for setup 1. If you select this setup with the **[Enter]**-key, you reach the setting page. There you can use the **[↓]**-key and **[↑]**-key to move between the parameters as follows. • Open Time (in milliseconds, range of 0.7 ms – 5000 ms; 0 means external mode) • Close Time (in milliseconds, range of 0.7 ms – 5000 ms) • No. Pulses (number of pulses, range of 1 – 500000; 0 means infinite mode) Press the **[Enter]**-key on an option to change the parameter.
Setup 2	Here you can change the dispensing parameters for setup 2. If you select this setup with the **[Enter]**-key, you reach the setting page. There you can use the **[↓]**-key and **[↑]**-key to move between the parameters as follows. • Open Time (in milliseconds, range of 0.7 ms – 5000 ms; 0 means external mode) • Close Time (in milliseconds, range of 0.7 ms – 5000 ms) • No. Pulses (number of pulses, range of 1 – 500000; 0 means infinite mode) Press the **[Enter]**-key on an option to change the parameter..
Setup 3	Here you can change the dispensing parameters for setup 3. If you select this setup with the **[Enter]**-key, you reach the setting page. There you can use the **[↓]**-key and **[↑]**-key to move between the parameters as follows. • Open Time (in milliseconds, range of 0.7 ms – 5000 ms; 0 means external mode) • Close Time (in milliseconds, range of 0.7 ms – 5000 ms) • No. Pulses (number of pulses, range of 1 – 500000; 0 means infinite mode) Press the **[Enter]**-key on an option to change the parameter.
Setup 4	Here you can change the dispensing parameters for setup 4. If you select this setup with the **[Enter]**-key, you reach the setting page. There you can use the **[↓]**-key and **[↑]**-key to move between the parameters as follows. • Open Time (in milliseconds, range of 0.7 ms – 5000 ms; 0 means external mode) • Close Time (in milliseconds, range of 0.7 ms – 5000 ms) • No. Pulses (number of pulses, range of 1 – 500000; 0 means infinite mode) Press the **[Enter]**-key on an option to change the parameter.

Tab. 19:   Menu items "Setup 1", "Setup 2", "Setup 3" and "Setup 4"

4.5.5 Submenu "Heater"

By pressing the **[Enter]**-key at the menu item "Heater", you enter its setting page. There you can change the temperature (in °C) of the heater, with an accuracy of 1 °C.

With the **[Heater]**-key, you can switch the heater ON or OFF. Therefore, this function is not part of the menu item "Heater". The status of the heater is shown by the heating control lamp (see paragraph 4.2 "Front Side", page 22).
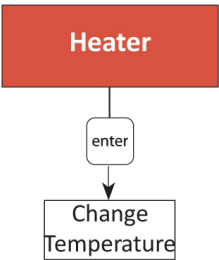
Fig. 11:   Submenu "Heater"

> ⚠ **CAUTION**
>
> **High temperature**
>
> The nozzle heater can reach temperatures of up to 99 °C. Do not touch this area during operation, since there is the danger of severe burns. Afterwards only touch it once it has cooled down and use heat resistant gloves.

With 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. This time is influenced by many different circumstances, e.g. the outer temperatures.

This table explains the menu item.

Menu item	Explanation
Heater	Here you can set the target temperature for the heater (in °C). You can set the temperature with an accuracy of 1 °C. In the top of the display, the current temperature is shown.

Tab. 20:   Menu item "Heater"

4.5.6 Submenus "Act. Pressure" and "Cart. Pressure"

With menu items "Act. Pressure" and "Cart. Pressure", you can change all settings connected to the supply pressure, if you use an electronic pressure regulator. With a mechanical pressure regulator, this submenu is mainly used to control the settings.

INFORMATION

Type of pressure regulator

You can configure the type of the actuator/cartridge pressure regulator respectively via the keypad of the control unit ((see paragraph 4.4 "Function Keys", page 25)) or via the serial interface RS-232C (paragraph 9.1.2.5, page 90).

You can use **[↑]**-key or **[↓]**-key to switch between these menu items. With **[Enter]**, you enter the setting page of the chosen menu item. There you can change the pressure for the chosen item.

· Actuator Pressure (in bar)

· Cartridge Pressure (in bar, if activated and if an electronic pressure regulator is connected)
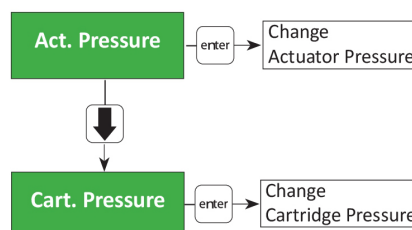
Fig. 12:   Submenus "Act. Pressure" and "Cart. Pressure"

This table explains the menu items.

Menu item	Explanation
Actuator Pressure	Here you can change the actuator pressure, if you have connected an electronic pressure regulator for actuator pressure. The target pressure is displayed once the MDC detects the electronic pressure regulator. When you change the target pressure, an up-and-down arrow symbol is shown for a few seconds (see Fig. 13). It shows that the actuator pressure is currently changed. In case you use a mechanical pressure regulator, you can set the target pressure in this menu item. This is then controlled by the pressure alert (see paragraph 6.1.2 "Using the Pressure Alert", page 48).
Cartridge Pressure	Here you can change the cartridge pressure, if you have connected an electronic pressure regulator for the cartridge pressure. In case the cartridge pressure is deactivated, instead of a pressure value only the message "ND" is shown. In this case, pressing the **[Enter]**-key in this menu has no effect.

Tab. 21:   Menu items "Act. Pressure" and "Cart. Pressure"

Fig. 13:   Arrow symbol for pressure regulation

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 values saved for the setups 1 – 4 in the EEPROM (Electrically Erasable Programmable Read Only Memory) into the RAM.

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 (see paragraph 9.1.2 "RS-232C Commands", page 77).

The four EEPROM memory sets can be used to save different parameter setups when programming the controller through the keypad interface.

In order to change the values saved in the EEPROM working configuration you may use the MDC keypad (enter the parameters in the menu section "Dispensing Setting", then press **[Enter]**).

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

- MDC1500:SETUP1 <Open Time>,<Close Time>,<Number of Pulses>,1
- MDC1500:SETUP2 <Open Time>,<Close Time>,<Number of Pulses>,1
- MDC1500:SETUP3 <Open Time>,<Close Time>,<Number of Pulses>,1
- MDC1500:SETUP4 <Open Time>,<Close Time>,<Number of Pulses>,1

On top of the working configuration and the four parameter setups there is another parameter setting saved in the software on the EEPROM. This is the "factory setting". The user cannot change the factory setting. The factory setting can 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 of the Valve

The Microdispensing valves of Vermes Microdispensing are modular. A valve MDV 1560-V is composed of six different modules:

- Valve body (with electronics, actuator system and integrated heater) (7)
- Tappet (not visible) (2)
- Tappet sealing (not visible) (3)
- Nozzle insert (some types not visible) (4)
- Nozzle fixation nut (5)
- Media supply (1)

Fig. 14:   Composition

The valve body (7) accommodates the electronics to control the DST actuator system. The electronics receive the controlling signals from the MDC via the connector at the top of the valve. The electronics are also connected with the actuator system, representing the core of the microdispensing valve. The actuator system houses the mechanics to drive the tappet. The compressed air connection for the actuator pressure (8) and the connection for the responding outlet air exhaust are at the top of the valve. At the bottom, near the tappet, a heater (6) is integrated into the valve.

At the bottom of the valve is the inlet where the tappet (2) runs. The tappet can be exchanged. Powered by the valve 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, of carbide metal or of poly diamond. They can have different forms or sizes. A tappet should be checked and cleaned regularly or exchanged if necessary (see paragraph 11.2.1 "Maintenance of the Tappet", page 133).

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

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

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

The media supply (1) supplies the dispensing medium and is connected with the fluid box. VERMES Microdispensing GmbH has many different configurations for cartridges available (see paragraph 14.4, page 158). 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 (watch the maximum pressure of the pressure tank). There are four types of fluid box bodies (20, 30, 40 and 60), which represent different heights (small, medium, large). In general, higher means bigger shearing force. Therefore, you would use a higher fluid box body with high viscous media or with media, which contain large particles. For low viscosity and for the highest dispensing frequency, we would recommend the 20- or 30-variant. You can distinguish the variants by markings on the top (see Fig. 15, with MDF 1500-BY-20 as an example).

Fig. 15:   Fluid Box Body MDF 1500-BY-20

5.2 Explosion View Valve

The explosion view of an MDV 1560-V.
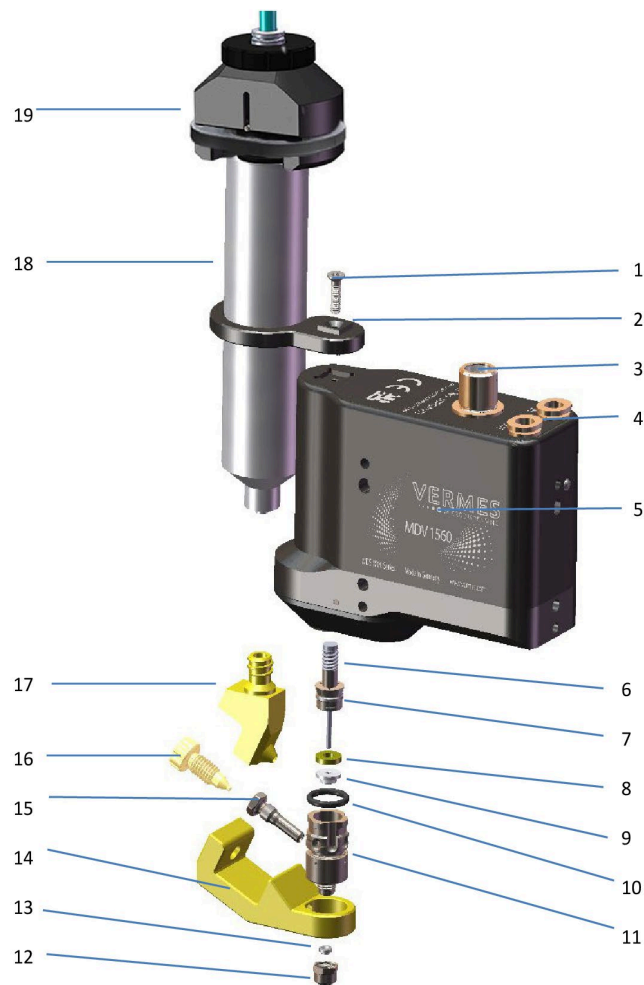
Fig. 16:   Explosion view valve

1 Screw for cartridge holder
2 Cartridge holder
3 Cable connection
4 Compressed air actuator (in and out)
5 Valve MDV 1560-V
6 Tappet rod with tappet spring
7 Tappet centering screw BY
8 Tappet centering piece
9 Tappet sealing
10 O-ring BY

11 Fluid box body MDF 1500-BY
12 Nozzle fixation nut
13 Nozzle insert
14 Mounting body PEEK BY
15 Connector BY
16 Tightening screw PEEK
17 Cartridge base CHI
18 Cartridge
19 Adapter Safe for compressed air (connection for cartridge)

You can find a description of the interface for the cable connection (3) with pin functions in paragraph 9.3, page 111.

5.3 Technical Data

Parameter	Value
Inlet Pressure Range (Cartridge Pressure)	Depending on the supply unit (e.g. cartridge or pressure tank) and the dispensing medium
Inlet Pressure Range (Actuator Pressure)	1.5 to 8 bar (for dispensing is usually a minimum of 3 bar necessary)
Dynamic Viscosity of Fluids	Low to high viscosity up to 2000000 mPas
Response Time (PLC-interface)	30 µs
Dispensing Frequency (max.)	700 Hz
Dispensing Frequency (average)	500 Hz
IP Code	IP40
Compatibility	all aqueous fluids, organic solvents, weak acids and bases
Dimensions (basic model)	100 mm x 35 mm x 90 mm
Weight	ca. 390 g
Position of Tappet in Absence of Pressure	Open (optionally a normally closed function is possible, see paragraph 6.3.2, page 52)

5.4   Special Features of the Valve

Dynamic Shockwave Technology (DST)

The valve is based on the Dynamic Shockwave Technology, which was developed by VERMES Microdispensing. Through an optimized channel guidance and configuration of the compression geometries, this actuator principle generates a shockwave in the actuator, which is converted into a highly dynamic linear movement due to the special piston area. This allows to achieve the power and precision needed even at small strokes.

Normally Open

In the absence of actuator pressure, the valve remains in open position, so that the channel of the nozzle insert is not blocked by the tappet tip. 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.

We recommend however that users bear this fact in mind, and reduce the cartridge pressure to atmospheric pressure during longer interruptions and before switching OFF the unit. Also, only switch off the actuator pressure after removing the fluid box or the cartridge.

IMPORTANT NOTE

Normally closed version optionally possible

It is possible to apply a normally closed function to the MDS 1560-V. Details of how to work with the function, see paragraph 6.3.2, page 52.

With Bayonet Fluid Box

Thanks to the bayonet system, you can remove the fluid box easily from the valve. There are no screws. This allows for a very quick exchange of nozzle fixation nut and nozzle insert or of the tappet for cleaning or maintenance purposes.

Highest Flexibility

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

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

Functionality Independent of the Position

The functionality of the valves does not depend on the fitting position, and they can be mounted from three different sides. This simplifies the integration into an existing process considerably.

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 or from the machine via PLC signals.

Comprehensive Material Selection

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

- All parts in contact with the transported medium consist of high-alloy special steel, rust- and acid-resisting, or modifications of high-duty polymers of the PE (Polyethylene), PEEK (Polyetheretherketone) and PTFE (Polytetrafluoroethylene) family.

- Sealings can be made of different materials. You can find notes regarding heat resistance and chemical resistance in paragraph 10.2, page 114 and paragraph 10.3, page 115.

- For nozzle inserts, special steel, stainless steel and ceramics options are permanently in store, allowing for perfect tailoring of the configuration to the needs of the particular application. E.g. do we recommend using mounting bodies and tightening screws of stainless steel for very low viscosity media.

5.5 Use Valve without MDC

It is possible to use the MDV 1560-V without the MDC, by controlling the valve via the PLC connection from your XY-machine. You have to connect the PLC cable with the 12-pin cable connection at the valve. You control the dispensing, the heater and the temperature measuring via the various pins of the interface. For dispensing, if the signal is "high", the tappet is "up" (i.e. the valve is open).

You can find a description of this interface with pin functions and a picture of the pins in see Fig. 40, page 111.

In that mode, some functions would not be available. These include e.g.:

- Serial commands
- Measuring actuator pressure
- Using the pressure alert
- Cycle counter
- Error messages
- Showing the serial number

Make sure to regard the following points carefully.

Dispensing:

- Constant voltage supply of 24 V necessary
- Trigger signal with 24 V necessary
- The timing of the trigger signal needs to be very accurate
- High requirements for the control (be aware of the PLC jittering; Open Time and Close Time need an accuracy of << 0.1 ms)

Temperature regulation:

- We recommend using a PID controller with 24 V PWM to regulate the heating element

INFORMATION

Voltage of the PLC interface cannot be changed

Be aware that you cannot switch the voltage of the PLC interface to 5 V, if you use the valve without MDC. Your PLC connection has to be designed to work with 24 V.

6 Pressure Supply

The MDS needs a finely controlled compressed air supply for dispensing. You have to distinguish between the actuator pressure, which affects the valve, and the cartridge pressure, which moves the dispensing medium. In this chapter, you will find all the necessary information. In the attachments in paragraph 15.10, page 175 and in paragraph 15.11, page 176 you can find connection diagrams for the MDS. They show you where to connect the compressed air supply with electronic pressure regulation or with mechanical pressure regulation.

6.1 Actuator Pressure

The actuator pressure drives the tappet. When the actuator pressure is applied, the valve is closed. Without actuator pressure, the valve is open. The following picture explains this mechanism. Therefore, the airflow depends on the actuator pressure and on the dispensing frequency. How much airflow you will need, you can find in see Necessary Airflow, page 47.
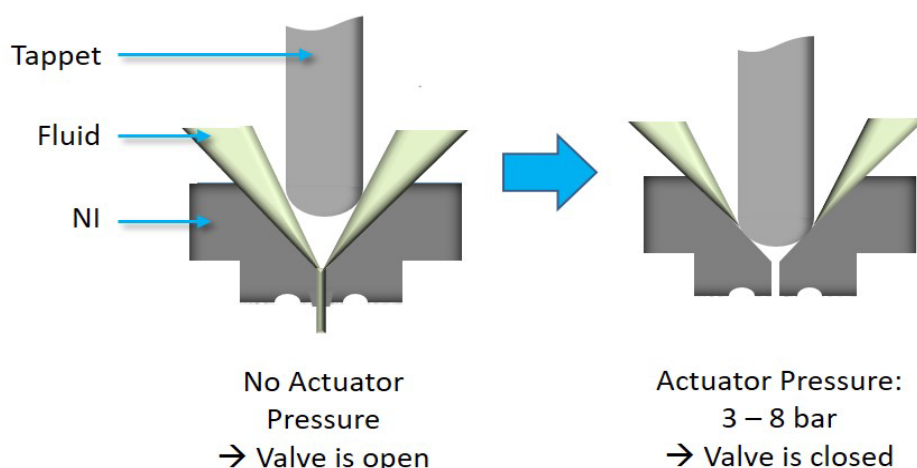
Fig. 17: Actuator pressure

The actuator pressure produces the power of the valve. The actuator pressure therefore determines the dispensing momentum. In general, the higher the viscosity of your dispensing medium, the higher you have to set the actuator pressure to always have the same momentum and therefore the same dispensing result.

At the outlet of the compressed air from the actuator, a silencer is integrated to lower the noise level. It is even better to divert the exhaust air with a hose attached to the outlet.

INFORMATION

Compressed air tube at higher dispensing frequencies

For dispensing frequencies above 300 Hz it can stabilize the pressure supply to use wider compressed air tubes (8 mm width instead of 6 mm). It also helps to shorten the compressed air tube, if possible. For other applications, a tube width of 6 mm is enough.

You can set the actuator pressure between 1.5 bar and 8 bar (for clean dispensing you will usually need at least 3 bar). In case the actuator pressure sinks below 1.5 bar, you get an error. If you reset the dispensing parameters to the factory settings (see paragraph 8.7 "Factory Settings", page 72), the target value for the actuator pressure is set to 5 bar. The current value for the

actuator pressure is shown in the upper right corner of the display. The value in the display should always be your reference, since it is more precise than a customary pressure regulator.

There are two ways to set the target value for the actuator pressure, via the keypad of the control unit (see paragraph 4.4 "Function Keys", page 25) or via the serial interface RS-232C (see paragraph 9.1.2 "RS-232C Commands", page 77).

– To change the target value for the actuator pressure via the keypad, select the menu item "Act. Pressure" (see paragraph 4.5.6, page 36).

– Press the **[Enter]**-key.

– Set the target value for the actuator pressure.

– Confirm the new value by pressing the **[Enter]**-key.

To change the target value for the actuator pressure via the serial interface RS-232C, use the command MDP:ACT:TARGET <actuator pressure> (see paragraph 9.1.2.5 "Explanations of Pressure Commands", page 90). To request the current actuator pressure, use the command MDP:ACT:STAT?. The current target value for the actuator pressure shows the command MDP:ACT:TARGET?.

INFORMATION

Set actuator pressure in dependence of fluid box body

The minimum actuator pressure you set to still have a tight system, depends on the fluid box body you use.

- Fluid Box Body MDF 1500-BY-20: 3 bar
- Fluid Box Body MDF 1500-BY-30: 3 bar
- Fluid Box Body MDF 1500-BY-40: 3 bar
- Fluid Box Body MDF 1500-BY-60: 6 bar

6.1.1 Necessary Airflow

How much airflow you will need approximately, to reach the desired actuator pressure, you can find in the following graph.
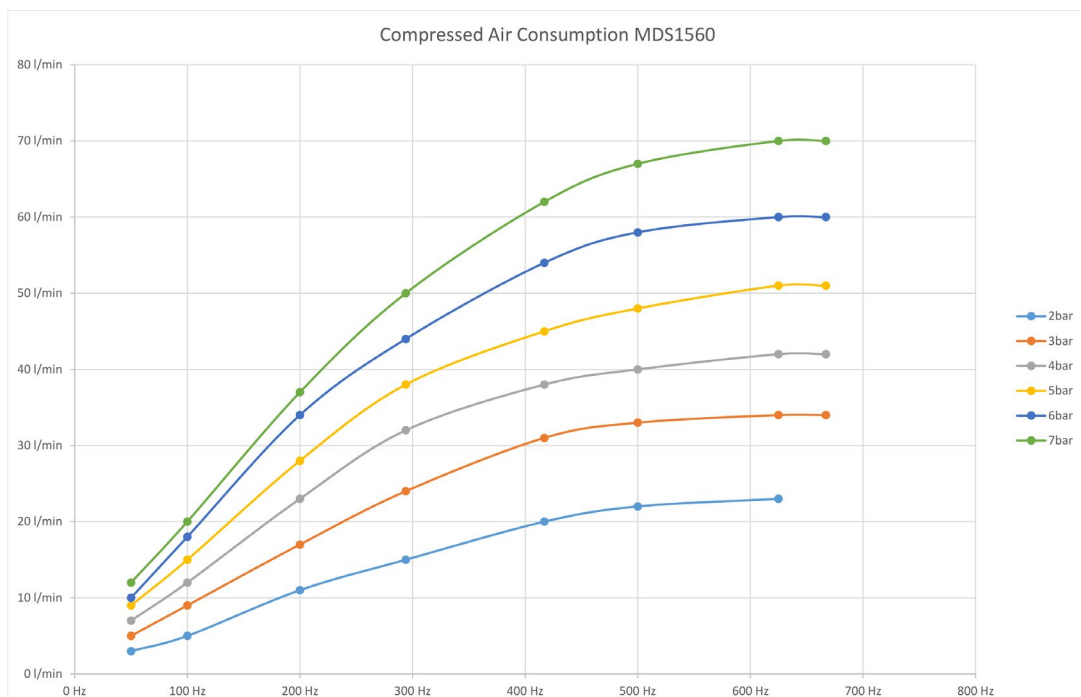
Fig. 18:   Compressed air consumption

6.1.2 Using the Pressure Alert

The actuator pressure has a major influence on your dispensing result. To make sure that you only dispense with the correct actuator pressure, you can set a pressure alert. In case the actual actuator pressure deviates too far from the target value, the pressure alert is activated and the dispensing process stops. This also means that the target value for the cartridge pressure is set to zero, to avoid leakage of the dispensing medium.

You can set one of five different thresholds for the deviation from the target pressure:

• 100 mbar

• 200 mbar

• 300 mbar

• 400 mbar

• 500 mbar

You can set the pressure alert in two ways, via the keypad of the control unit (menu item "General Settings->Pressure Alert", see paragraph 4.5.2, page 29) or via the serial interface RS-232C (pressure commands, see paragraph 9.1.2.5, page 90).

– To set the pressure alert via the keypad, select the menu item "General Settings".

– Press the **[Enter]**-key.

– Select the submenu "Pressure Alert" with the **[↑]**-key.

– Select the threshold for the pressure alert with the arrow keys.

– Confirm the new value by pressing the **[Enter]**-key.

To set the pressure alert via the serial interface RS-232C, use the command MDP:ACT:ALERT <threshold for pressure alert>. To request the current threshold of the pressure alert, use the command MDP:ACT:ALERT?. The response "0" means that no threshold is set and therefore the pressure alert is deactivated.

If you reset the dispensing parameters to the factory settings (see paragraph 8.7 "Factory Settings", page 72), the pressure is turned OFF.

The pressure alert is useful when working with mechanical pressure regulators as well as when working with electronic pressure regulators. More information can be found in paragraph 6.3.3, page 53 and paragraph 6.3.1, page 50.

Especially if you set your pressure alert for a narrow threshold you have to make sure to use very good precision pressure regulators.

INFORMATION

Tight limits for high precision

In case a high precision is important for your application, you should set tight limits for the pressure alert. That way you will be informed even about small differences.

Be aware though, that high dispensing frequencies will lead to stronger pressure fluctuations because of the shortly higher air consumption. For such an application, you should set wider limits to be able to achieve a continuous dispensing process.

6.2 Cartridge Pressure

With the cartridge pressure you drive the dispensing medium. The higher the viscosity of your dispensing medium, the higher you should set the cartridge pressure. You can use the following values as a guideline.

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

In contrast to the actuator pressure, the cartridge pressure cannot be checked internally. In case you use an electronic pressure regulator, the control unit recognizes it automatically. When it is connected, you can set the target pressure in two ways, via the keypad of the control unit (see paragraph 4.4 "Function Keys", page 25) or via the serial interface RS-232C (see paragraph 9.1 "Serial Interface RS-232C: 9-Pin Sub-D", page 75). You can set values between 0 bar and 8.0 bar.

To change the cartridge pressure via the keypad, select the menu item "Cart. Pressure" (see paragraph 4.5.6, page 36).

– Select the submenu "Cart. Pressure" with the **[↓]**-key.

– Press the **[Enter]**-key.

– Set the target value for the cartridge pressure.

– Confirm the new value by pressing the **[Enter]**-key.

INFORMATION

Display message "ND", if cartridge pressure not activated

In case the cartridge pressure is deactivated, instead of a pressure value only the message "ND" is shown. In this case, pressing the **[Enter]**-key in this menu has no effect.

Check the compressed air supply for the cartridge pressure.

To set the cartridge pressure via the serial interface RS-232C, use the command MDP:CART:TARGET <cartridge pressure> (see paragraph 9.1.2.5 "Explanations of Pressure Commands", page 90). The current target value for the cartridge pressure shows the command MDP:CART:TARGET?.

6.3   Compressed Air Supply

The MDS 1560-V needs a finely controlled compressed air supply for dispensing. Especially the repeatability of the dispensing depends on it. Therefore, you have to use precision pressure regulators for the pressure regulation.

At the pressure regulator, you should always have a higher incoming pressure than you allow through for the actuator pressure or cartridge pressure (at least 1 bar more).

For exact dispensing results, use compressed air, free of fine particles, dust, oil and condensate, quality classes 7, 4, 4 acc. to DIN/ISO 8573-1:2010.

Type of pollution	Quality class	Explanation
Solid particles	7	Mass concentration max. 5 – 10 mg/m^3 (particle size max. 40 µm)
Water content	4	max. pressure dew point +3 °C
Residual oil	4	5 mg/m^3 max.

Tab. 22:   Necessary quality classes for the compressed air

⚠ CAUTION

Avoid uncontrolled compressed air release

An uncontrolled release of compressed air can cause damages and injuries. Therefore, your controlling machine needs to have a stopcock with air vent. Additionally your XY-machine needs to follow the directives for working with compressed air.

To demount a valve, you must always switch off the pressure.

You can find information on how to connect the pressure regulators to the MDS 1560-V and to the pressure supply in the connection diagrams in paragraph 15.10, page 175 (with electronic pressure regulators) and in attachment paragraph 15.11, page 176 (with mechanical pressure regulators).

6.3.1   Using an Electronic Pressure Regulator

With an electronic pressure regulator, drift effects are suppressed through constant automatic readjustments. This results in a higher process stability for the actuator pressure as well as for the cartridge pressure. You will need an electronic pressure regulator of good quality, where the readjustments are done quickly (for the connection diagram, see attachment paragraph 15.10, page 175).

We recommend the devices you can find at the end of the chapter: pressure regulators for actuator pressure (see Fig. 19, page 51 and see Fig. 20, page 52) and a pressure regulator for cartridge pressure (see Fig. 21, page 52). Additionally you will need the Connection Cable for Pressure Control Valves MDC 1500 (order no. 1014937, see paragraph 7.3.3, page 62).

The control unit can detect, if an electronic pressure regulator for the actuator pressure or for the cartridge pressure is connected. This is checked every time you press a key on the keypad. This works only, if the pressure regulator has enough supply pressure.

It still makes sense to use the pressure alert (see paragraph 6.1.2, page 48). It can help to prevent errors caused by the external pressure supply falling below the set value.

INFORMATION

Problems the pressure alert can solve

In case you use an electronic pressure regulator, the pressure alert can warn you from the following problems:

• Supply pressure set incorrectly

- Supply pressure off
- Pressure regulation ranges set incorrectly at the pressure regulator
- Pressure regulator malfunctioning

In case of an error (see chapter 12, page 135), the pressure is switched off automatically. However, this is not the case, if you use the normally closed function by sending the service code 9111 (see paragraph 4.5.2 "Submenu "General Settings"", page 29).

In case the actuator pressure falls below 1.5 bar, the cartridge pressure is switched off to avoid a leakage of dispensing medium.

IMPORTANT NOTE

Customize electronic pressure regulators

Each type of electronic pressure regulators can have a different range for the pressure regulation. Therefore, on each electronic pressure regulator the minimum and maximum values for pressure and voltage are noted.

In case you want to control your electronic pressure regulators via the MDC, you **have to** send these values via the serial commands MDP:ACT:REGU <min-volt>,<min-bar>,<max-volt>,<max-bar> (for actuator pressure) and MDP:CART:REGU <min-volt>,<min-bar>,<max-volt>,<max-bar> (for cartridge pressure) to the MDC. The MDC then adjusts these values proportionally.

With the serial commands MDP:ACT:REGU? or MDP:CART:REGU? you can check your settings.

Default settings are:

0 V = 0 bar, 10 V = 10 bar (actuator pressure regulator)

0 V = 0 bar, 10 V = 6 bar (cartridge pressure regulator)

In case you use a different pressure regulator than one of the examples listed below, you have to adjust the values. You can find the necessary information printed on your pressure regualtor or in its documentation.

In case the pressure regulation works very slow it could be a sign that the pressure regulation ranges are not set correctly for your pressure regulator.

Fig. 19:   Pressure regulating valve for actuator pressure MDV 15XX (order no. 1014936; VPPM-6L-L-1-G18-0L10H-V1P-S1)

Fig. 20:   Pressure regulating valve with display for actuator pressure MDV 15XX (order no. 1016664; VPPM-6L-L-1-G18-0L10H-V1P-S1C1)

Fig. 21:   Pressure regulating valve for cartridge pressure (order no. 1014655; VEAA-L-3-D9-Q4-V1-1R1)

6.3.2 Normally Closed

What is a normally closed function?

When working with the MDS 1560-V system, it is possible to use a normally closed function by adding mechanical parts in the pressure supply. This function is especially helpful in case the pressure supply is disconnected manually or accidentally, since the MDV 1560-V can stay closed for a longer time, thanks to the pressure supplied by the pressure tank. The close time of the MDV 1560-V depends on the capacity of the pressure tank. This time span will decrease in case of leakage, so it is important to make sure your system is tight.

How to work with a normally closed function?

For the normally closed function, enter the service codes 9110 or 9111 via the keypad of the MDC, to keep the MDV 1560-V closed in case of:

- Switching off the MDC
- A power drop of the MDC
- Fatal error(s) of the MDC

For the explanation of the service codes, see paragraph 4.5.2, page 29.

Also, you need to use an electronic pressure regulator (see paragraph 6.3.1, page 50) together with a Pressure Tank-1500 (order no. 1016963, see Fig. 22, page 53) and a Check Valve-1500 (order no. 1016962, see Fig. 23, page 53).

Fig. 22:   Pressure Tank-1500 (order no. 1016963)

Fig. 23:   Check Valve-1500 (order no. 1016962)

The following connection diagram gives you an overview how to connect the necessary parts to realize the normally closed function.
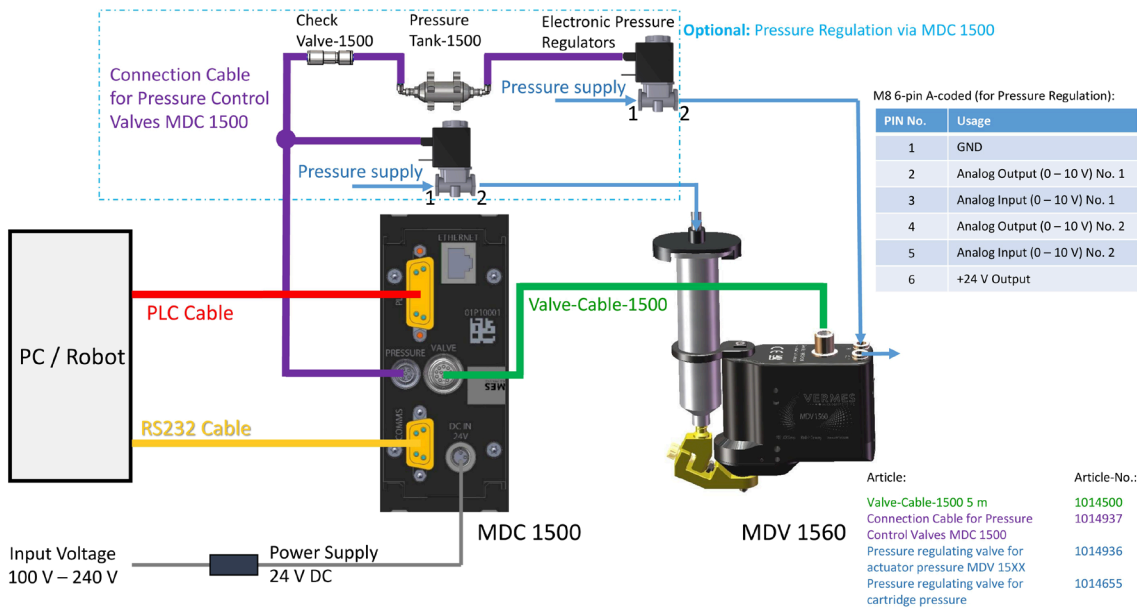
Connection Diagram MDS 1560

Fig. 24:   Connection diagram (using the function "normally closed")

6.3.3 Using a Mechanical Pressure Regulator

When using a mechanical device, we recommend a precision pressure regulator, since the dispensing depends on the quality of the pressure supply.

For controlling the actuator pressure, the pressure regulator does not need a manometer, since you can control the actuator pressure via the pressure submenu of the display (see paragraph 4.5.6 "Submenus "Act. Pressure" and "Cart. Pressure"", page 36).

When using a mechanical pressure regulator, it is important to check the actual pressure regularly, or to use the pressure alert (see paragraph 6.1.2 "Using the Pressure Alert", page 48),

since you might have drift effects (e.g. caused by the temperature). The pressure regulator has to fit with the expected airflow (see see Necessary Airflow, page 47).

INFORMATION

Setting pressure alert with mechanical pressure regulator

If you use a mechanical pressure regulator, you should follow these steps when setting a pressure alert:

1. Set the target pressure in the MDC.
2. Set the pressure alert in the MDC.
3. Set the mechanical pressure regulator, so that the pressure is within the limits.
4. Begin the dispensing process.
5. Whenever the pressure alert gives an alarm, re-set the mechanical pressure regulator.

The cartridge pressure has to be set via an external manometer. We recommend to use a digital manometer with high precision, since the stability of the cartridge pressure has an influence of the precision of the dispensing result (for the connection diagram, see attachment paragraph 15.11, page 176). You can use a pressure regulator with a small airflow.

7 Initial Operation

7.1 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.

7.1.1 Unpacking

After receiving the merchandise:

– Check the package visually for any kind of damage.

If yes:

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

If no damage is detected:

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

7.1.2 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 Tappet Grease TF 1 ml syringe
3 Fluid box*	10 MDT 323 - Nozzle Insert – Squeezing Out Tool TA
4 Nozzle fixation nut*	
5 Nozzle insert*	11 Valve-Cable-1500 (black)
6 MDT 303 - Nozzle Insert Changing Tool	12 Cartridge holder
	13 Power cable (black)
7 MDT 328 - Tappet Sealing Changing Tool	

*These parts are included only, if ordered explicitly.
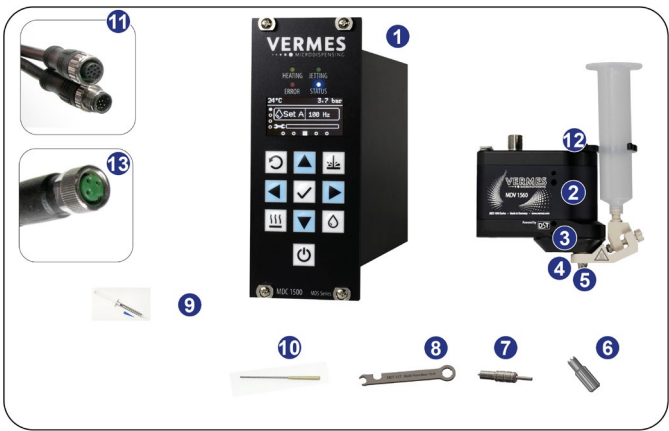

Fig. 25:   Content

Options	Recommended options
Different models of fluid boxes Different fluid box connectors Different nozzle inserts Different tappets	Cleaning set MDT 306 - Torque Wrench Tool VM MDT 324 - Nozzle Insert Cleaning Holder

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

7.2 First Assembling of the Valve

This chapter describes how to ready your microdispensing system for the first dispensing session. Always make sure all screw couplings sit tight (torque values in paragraph 3.3.9, page 19).
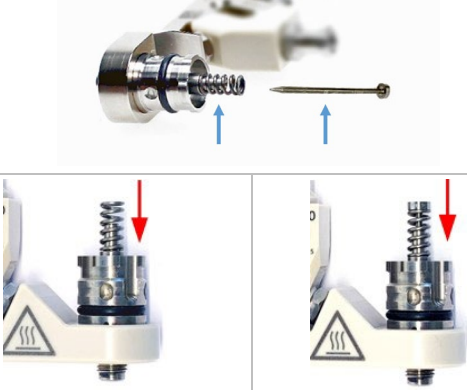

INFORMATION
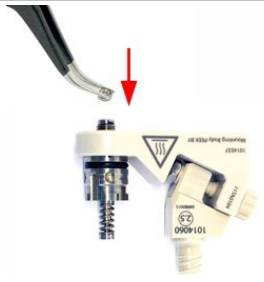
Some parts preassembled

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

Proceed as follows:

Picture	Explanation
	Step 1 (fluid box body) Mount the fluid box body onto the mounting body PEEK (there is only one mounting direction possible). Mount a Connector BY onto the Fluid box body by using an MDT 327 (torque stainless steel 90 – 100 cN.m, PEEK 70 – 80 cN.m).). Make sure the Connector BY fits into the bore of the Fluid box body. **Important Note!** For the connector BY to correctly grip into the fluid box body, you may **not** press the fluid box body tightly into the mounting body. There needs to be a small gap between the mounting body and the Fluid box body. **Important note!** This step will be optional, if you re-assemble the valve later, since usually you would not remove the Connector BY from the mounting body.
	Step 2 (O-ring) Pull the O-Ring-BY over the fluid box body.
	Step 3 (cartridge base) Mount the cartridge base onto the fluid box. Use MDT 327 or the MDT 306 - Torque Wrench Tool VM with BitVM-A to fix the cartridge base with the tightening screw by screwing clockwise (torque 110 – 120 cN.m).

	Important note! If you use a Cartridge Base CH, you need to screw the Fluid Box Connector Luer Lock into the top bore of the cartridge base CH. Use the open-ended wrench of the MDT 327 (hexagon screw size M8, torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m).
	Step 4 (tappet sealing) Push the tappet sealing with the wider side down onto the pin of an MDT 328. Push the MDT 328 with the tappet sealing straight into the fluid box. When the tappet sealing sits tight, you will hear a light noise.
	Step 5 (tappet centering piece) Press the tappet centering piece into the fluid box body. Use the MDT 328 to make sure the tappet centering piece is lying straight on the tappet sealing. **Important note!** When using a 2G tappet rod, you do not need a tappet centering piece.
	Step 6 (tappet and tappet centering screw) Screw the Tappet Centering Screw BY into the fluid box. Do not screw it tight yet. Screw it only for two rotations.
	Grease the tappet and the tappet spring with Grease TF for tappet. Place the tappet spring onto the tappet centering screw BY. Push the tappet rod through the tappet spring into the fluid box (as indicated by the red arrow). Make sure the tappet goes through the tappet sealing.
	Screw the Tappet Centering Screw BY completely into the fluid box (torque 100 – 140 cN.m). Use MDT 303 - Nozzle Insert Changing Tool. The three small pins of MDT 303 have to fit in exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 clockwise while pressing it down slightly to the

	fluid box. Combine the MDT 303 with MDT 327 for a better leverage. Alternatively, you can use the MDT 306 with BitVM-B.
	Step 7 (nozzle insert) Clip the nozzle insert into the fluid box. Use tweezers to pick up the nozzle insert and to place it onto the fluid box body. Use the small hole of MDT 327 to press the nozzle insert to make sure the it sits flat.
	Step 8 (nozzle fixation nut) Screw the nozzle fixation nut clockwise onto the fluid box. Use MDT 327 - Multi-Function Tool. Alternatively use the MDT 306 - Torque Wrench Tool VM with Bit Hexagon Socket (torque 150 – 180 cN.m).
	Step 9 (fluid box) Push the fluid box carefully in a 45° angle onto the valve. Make sure that the fluid box sits correctly inside the valve and touches the frame. There will be a resistance due to a spring inside the valve. This is easier, if you slightly lower the actuator pressure first. .
	Straighten the fluid box until it latches in. Alternately, you can mount the fluid box rectangular to the right or to the left. This would also affect the position of the cartridge holder (see step 10).
	Step 10 (cartridge holder) Screw the cartridge holder on top of the valve body (torque between 50 – 60 cN.m). You need the MDT 329 or a Hexagon Key 2 mm. Depending on the size of the cartridge, you have to select the correct cartridge holder.

	Step 11 (cartridge) Push the cartridge into the cartridge holder and screw it onto the fluid box (clockwise).
	Step 12 (Adapter for compressed air) Screw the Adapter for Compressed Air onto the cartridge (clockwise). Make sure it sits tightly.
	Assembling completed The completely assembled valve with the fluid box in straight position.
	Optional positions Alternately, you can mount the fluid box rectangular to the left (picture left) or to the right (picture right). Then the complete assembly would look like this. Be aware that you have to switch around the cartridge holder to mount it for the right position.

Tab. 23:   First assembling of the valve

7.3 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

⚠ CAUTION

Loud Noise

When you work in the direct vicinity of the operating MDS, you must wear ear protection. Build a housing around the MDV, to keep the noise levels down.

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). Especially ensure to build a housing around the MDV, to keep the noise levels down.

7.3.1 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. It can help to use guide rails to reduce the weight-loading. In case you use several MDCs in your application and you want to install two of them next to each, you should only use one guide rail in between them.

IMPORTANT NOTE

Potential damage to the control unit

Do not close the four pan-head screws too tight; otherwise the front panel can be damaged (see torque table paragraph 3.3.9, page 19).

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

7.3.2 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. You can mount the valve from three different sides (see Fig. 26, page 62).
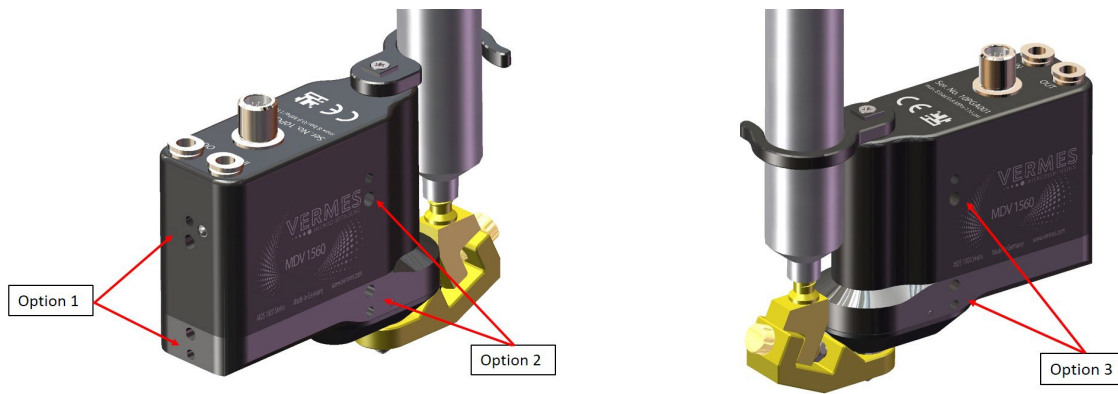
Fig. 26:   Mounting options for the valve

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 same side of the valve as the bores.

IMPORTANT NOTE

Corrosion

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

7.3.3 Wiring of the MDS

You have to connect your control unit with the valve and a power supply.

⚠ 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 cable cannot hang too loose, since then it might start to swing and get damaged, because of the vibrations of the valve. On the other hand, you need enough length in your cable, if the valve is moved in the z-axis.

7.3.3.1 Valve-Cable-1500

The valve is connected to the control unit by means of the twelve pin Valve-Cable-1500 5m (order no. 1014500, see Fig. 27, page 63; also available as 7 m version, order no. 1015064). The Valve-Cable-1500 5m is responsible for supplying power to the valve as well as allowing the necessary sensor data transfer. You can use the Valve-Cable-1500 with a drag-chain.

Fig. 27:   Valve-Cable-1500 and its plugs

IMPORTANT NOTE

Switch off for connection/disconnection

Before you connect the valve to the control unit or separate it from it, switch OFF the MDC with the **[Power]**-key.

You have to connect the valve as described below.

– Step 1: First, fix the male plug to the corresponding socket on the rear side of the control unit. The rear side is illustrated in paragraph 4.3, page 24.
– Step 2: Fix the female plug to the 12-pin socket on top of the MDV 1560-V (see Fig. 28).

Fig. 28:   Connecting the Valve-Cable-1500 with the valve

INFORMATION

Using MDV 1560-V without MDC

If you use your MDV 1560-V without an MDC, you have to leave out steps 1 and 2. Instead, you connect a PLC outlet of your XY-machine directly to the MDV 1560-V. For the pin functions, see paragraph 9.3.1, page 111.

7.3.3.2   Power Supply

Power to the control unit is supplied by the Power Supply 24 V 4 A (order no. 1014501, see Fig. 29, page 64).

Fig. 29:   Power Supply 24 V 4 A and its plug

- – Step 1: Plug the cable into the socket at the rear side of the control unit. The rear side is illustrated in paragraph 4.3, page 24.
- – Step 2: Connect the power supply to the power.

INFORMATION

Valve not connected

If the valve is not connected, a message will appear to plug in the valve and confirm it by pressing **[Enter]**. You can skip this part by pressing the **[Back]**-key. In that case a message ("No Valve") appears on the screen and the error control lamp is ON.

In case you want to use your own power supply, you have to make sure its properties are the same as those of the Power Supply 24 V 4 A.

7.3.3.3   Connection Diagram

The following connection diagram gives you an overview how to connect all the cables and compressed air supplies (example with electronic pressure regulators). You can find an example connection diagram with mechanical pressure regulation in the attachments, paragraph 15.11, page 176.

IMPORTANT NOTE

Use silencer at compressed air outlet

We strongly recommend to use a silencer at the compressed air outlet at the valve (see the connection diagram), to decrease the noise level. If that is difficult, at least attach a tube at the outlet to lead the compressed air away.

Remember that the outlet may **not** be completely blocked!

Connection Diagram MDS 1560
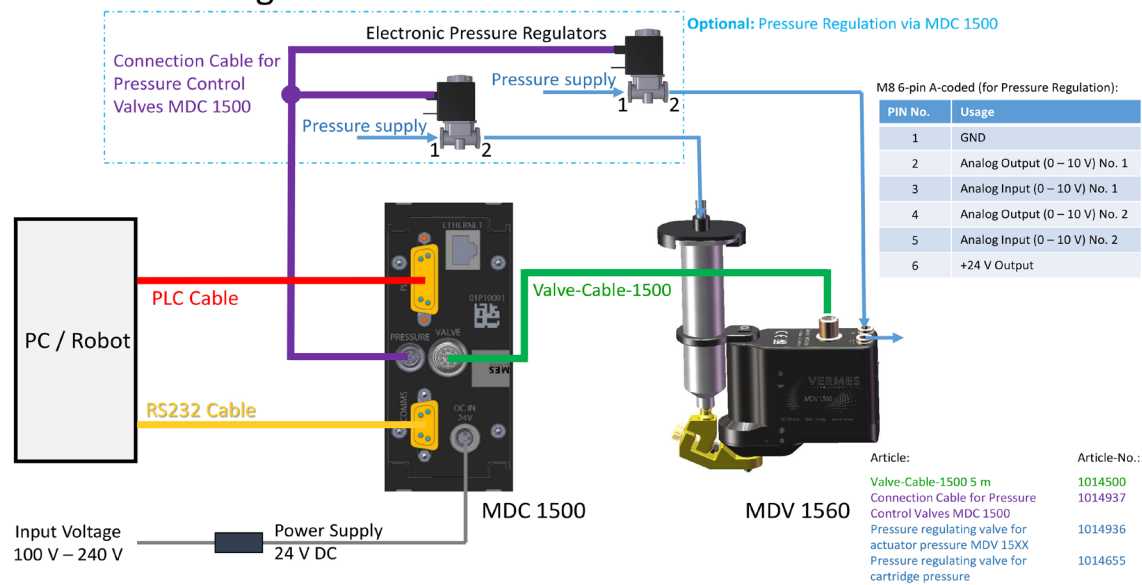
Fig. 30:   Connection Diagram MDS 1560-V (with electronic pressure regulator)

PIN No.	Usage
1	GND
2	Analog Output (0 – 10 V) No. 1
3	Analog Input (0 – 10 V) No. 1
4	Analog Output (0 – 10 V) No. 2
5	Analog Input (0 – 10 V) No. 2
6	+24 V Output

M8 6-pin A-coded (for Pressure Regulation):

Article:	Article-No.:
Valve-Cable-1500 5 m	1014500
Connection Cable for Pressure Control Valves MDC 1500	1014937
Pressure regulating valve for actuator pressure MDV 15XX	1014936
Pressure regulating valve for cartridge pressure	1014655

7.4 Initial Liquid Supply

   – Step 1: Activate the actuator pressure.

   – Step 2: If not using a prefilled cartridge, fill an empty one with the required fluid, till up to 80 % of its capacity.

   – Step 3: Insert the cartridge into the corresponding holder and screw it onto the Luer-Lock connector, rotating clockwise.

   – Step 4: Place the compressed-air adaptor onto the cartridge and rotate clockwise until it latches in place.

   – Step 5: Connect the PVC hose with coupler plug KS4-CK-6 to air supply. A coupler socket type KD4-1/2-A is required.

IMPORTANT NOTE

Check for leakage

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

Step 6: After establishing a convenient cartridge pressure, activate the pneumatic supply.

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 NOTE

Do not activate system without dispensing medium

Do not activate the system "dry" (i.e. without dispensing medium). Otherwise, it might damage the system.

IMPORTANT NOTE

Avoid uncontrolled compressed air release

An uncontrolled release of compressed air can cause damages and injuries. Therefore, your controlling machine needs to have a stopcock with air vent. Additionally your XY-machine needs to follow the directives for working with compressed air.

7.5 Removing Air Inclusions from the Fluid Box

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

Press the **[Purge]**-key (see paragraph 4.4, page 25), until dispensing medium reaches the nozzle.

When this measure is complete, set your dispensing parameters and start the dispensing process.

7.6   Parameter Input and Start

– Step 1: Enter the dispensing parameters (either recommended by the manufacturer or determined in your own experiments) into the submenus of the menu section "Dispensing Setting" of the control unit (see paragraph 4.5.4, page 33).

– Step 2: Press **[Enter]** to acknowledge the selection.

– Step 3: Return to the first level of the menu by pressing **[Back]** repeatedly.

– Step 4: Start the dispensing process by pressing **[Trigger]**.

INFORMATION

Starting the dispensing process

The key **[Trigger]** only works in the submenus of the menu section "Dispensing Setting". The other methods to start a dispensing process work in all the menu levels.

8 Operation

8.1 Triggering a Dispense Sequence

There are three different options to trigger a dispense sequence:

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

  Press the **[Trigger]**-key, a dispensing sequence with the parameters of the selected setup 1, 2, 3 or 4 will be triggered (only possible, if the correct setup is selected in "Dispensing Setting").

- **via RS-232C command**

  Use the command "MDV:TRIGGER 1", "MDV:TRIGGER 2", "MDV:TRIGGER 3" or "MDV:TRIGGER 4" (depending on the setup; further commands in paragraph 9.1.2, page 77).

- **via PLC command**

  Selection of the dispensing setup (1, 2, 3 or 4) by direct I/O (see paragraph 9.2, page 105 and paragraph 7.3, page 61)

8.2 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 causes a predefined number of dispense cycles.

  Number of Pulses: predefined value (e.g. 1–500000)

- Single-Shot Mode

  Each dispense point is triggered by an individual 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

- Activation via RS-232C signal: Number of Pulses "0" in the command MDC1500:SETUP1" (or MDC1500:SETUP2, MDC1500:SETUP3, MDC1500:SETUP4 respectively)

- 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 Close 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". Alternatively, you can activate it via the keypad. Press the **[Trigger]**-key to start dispensing. The process stops, once you press the **[Back]**-key.

- 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".

  Open Time: "external"

  If you want to set the external mode via the serial interface, you have to set Open Time and Close Time to "0" and Number of Pulses to "1".

  When the trigger signal is set to "logic 1", the valve will open. It will remain open while the signal remains on "logic 1". It will start to close when you switch the trigger signal to "logic 0".

After the valve has completely closed, the controller is ready to receive the next trigger signal to start the process again.

8.3 Parameters for the Dispensing Process

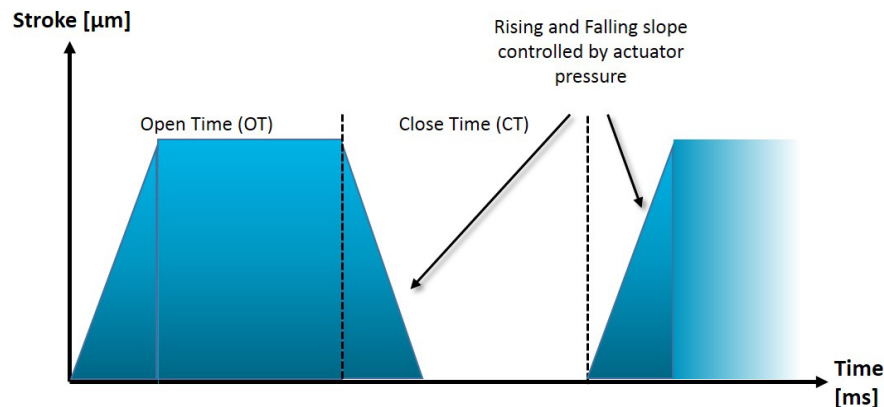The profile of the system behavior is illustrated below (Y axis = amplitude of the tappet).

Fig. 31:   System behavior

This diagram includes the following parameters.

Parameter	Unit	Description
Open Time (OT)	ms	During this phase, the valve remains in opened state. The Open Time includes the time during which the valve opens and the time while the valve is completely open. How fast the valve opens depends on the actuator pressure. The Open Time is adjustable in steps of 0.1 ms. Max. Open Time = 5000 ms **Important Note!** When working in External mode, the cycle is initiated with following properties: Open Time remains active until the signal returns to the state "logic 0".
Close Time (CT)	ms	The Close Time is the time between two dispensing cycles. The Close Time includes the time during which the valve closes and the time while the valve is completely closed. How fast the valve closes depends on the actuator pressure. The Close Time is adjustable in steps of 0.1 ms. Max. Close Time = 5000 ms
Supply Pressure Actuator (PRA)	bar	The actuator pressure is necessary to close the valve (by moving the tappet into the nozzle insert). The actuator pressure has an influence on the power of the valve and the tappet speed.
Supply Pressure Cartridge (PRC)	bar	This parameter causes a continuous flow of the dispensing medium.
Nozzle Insert Temperature (NT)	°C	This parameter is necessary to control the viscosity of the dispensing medium.

Tab. 24:   Parameters for dispensing

8.4   Minimum and Maximum Parameter Limits

Parameters	Min. Value	Max. Value
Open Time	0.7 ms (0 = external)	5000 ms
Close Time	0.7 ms	5000 ms
Supply Pressure Actuator	1.5 bar	8 bar
Supply Pressure Cartridge	0.1 bar	6 bar
Number of Pulses (NP)	1 pulse (0 = infinite)	500000 pulses
Heater	20 °C	99 °C

Tab. 25:   Minimum and maximum parameter limits

8.5   Input of Values

Modification of parameter values is simple. The name of the parameter appears in the OLED display. If the last digit before the decimal point is underlined, 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 two values (e.g. 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 **[Back]**. The screen returns to the next-higher menu level.

8.6   Sequence Mode

The sequence mode allows combining two setups, which then can be triggered with just one command. You can switch to sequence mode via serial RS-232C commands (see paragraph 9.1.2.3, page 82).

A sequence consists of the following parts.

• Trigger delay (optional, range from 0.7 ms – 5 s or "0" for no trigger delay)

• Start setup (one of the four setups 1, 2, 3 or 4)

• Sequence delay (optional, range from 0.7 ms – 5 s or "0" for no sequence delay)

• End setup (one of the four setups 1, 2, 3 or 4; but not the same setup as the start setup)

INFORMATION

Start setup and end setup must differ

You cannot use the same setup as start setup and end setup.

If the sequence mode is activated, triggering of a setup automatically causes to dispense the whole sequence, in case it is defined. If the sequence mode is deactivated or there is no sequence for this setup, only the setup itself will be dispensed.

The following RS-232C commands exist.

• MDC1500:SEQUENCE:MODE <ON/OFF>

The sequence mode is activated or deactivated.

• MDC1500:SEQUENCE:MODE?

You ask the system, if the sequence mode is activated.

• MDC1500:SEQUENCE <trigger delay>,<start setup>,<sequence delay>,<end setup>

You send the sequence parameters for a sequence. For each setup, there can only be one sequence at a time.

• MDC1500:SEQUENCE1?

• MDC1500:SEQUENCE2?

• MDC1500:SEQUENCE3?

• MDC1500:SEQUENCE4?

You ask the system for the sequence parameters of the given setup.

Example

I want to combine setup 1 and setup 3. The sequence delay between the two setups should be 10 ms. I do not need a trigger delay beforehand.

Setting the values:

MDC1500:SEQUENCE 0,1,10m,3

Activating the sequence mode:

MDC1500:SEQUENCE:MODE 1

8.7 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:

- Heater: Target temperature 30 ℃
- Actuator pressure: 5 bar (limit: OFF)
- Cartridge pressure: 1 bar

The following table lists the factory settings of the setups.

	OT [ms]	CT [ms]	NP
Setup 1	2.0	5.0	10
Setup 2	4.0	5.0	10
Setup 3	6.0	5.0	10
Setup 4	8.0	5.0	10

Tab. 26:   Factory settings of the setups

The default value for the baud rate is 115200.

You can use the menu to reset changed parameters to their factory settings (see paragraph 4.5.2 "Submenu "General Settings"", page 29). Go to the menu item "General Settings" and press **[Enter]**. Then press the **[↑]**-key or **[↓]**-key as often as necessary to reach the menu item "Factory Reset". Press the **[Enter]**-key. Confirm by pressing **[Enter]** once more.

IMPORTANT NOTE

No factory reset during dispensing

While you are dispensing, a factory reset is impossible, since a factory reset could change the dispensing results.

8.8 Dispensing with a Heater

With the heater, you can control the dynamic 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.

⚠ CAUTION

High temperatures, danger of burns

The nozzle heater can reach temperatures of up to 99 °C. Do not touch this area during operation, since there is the danger of severe burns. Afterwards only touch it once it has cooled down and use heat resistant gloves.

You can activate the heater with the [**Heater**]-key (see paragraph 4.4 "Function Keys", page 25). You can set the target temperature via the submenu "Heater" in the MDC menu (see picture below). Use the [→]-key to navigate down to the submenu "Heater". Press [**Enter**]. Here you can set the target temperature. The possible temperature range lies between 20 °C and 99 °C. In the top of the display, you can see the current temperature. (Further information about the menu of the control unit you can find in paragraph 4.5, page 26.) The status of the heater (OFF, ON or heating up) is shown by the heater control lamp (see paragraph 4.2, page 22).
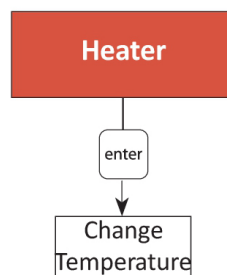

Fig. 32:   Submenu Heater

IMPORTANT NOTE

Keeping a stable temperature

For technical reasons, the temperature sensor of the heater is not placed directly in the nozzle channel. Therefore, the temperature which is set will always differ slightly from the temperature of the dispensing medium in the nozzle channel, where it is slightly lower. This difference also depends on the type of mounting body you use.

When you dispense with very high frequencies, it can be difficult to keep a stable temperature at just above room temperature, because of the heat from the actuator system. Try to find a parameter setup that is a couple of degrees centigrade higher.

INFORMATION

Controlling heater via serial interface

The heater can also be controlled via the serial interface RS-232C. The relevant commands and information can be found in paragraph 9.1.2, page 77. You can find the safety routines of the heater in paragraph 12.3, page 154. In case of error messages, you can find all information in the chapter "Error Situations" (see chapter 12, page 135).

8.9   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 cartridge pressure to atmospheric pressure. Disengage the pneumatic supply. If required, close the cartridge by using the cartridge locking pin MDT 309.

   – Step 3: Remove the bayonet fluid box and with all the parts which can come in contact with the dispensing medium.

   – Step 4: Lower the actuator pressure to atmospheric pressure.

   – Step 5: Switch OFF the control unit. After switching OFF the control unit, please wait a few seconds.

After working with self-curing substances, immediate cleaning is advisable in order to avoid clogging. This concerns all parts in contact with the dispensing medium. The fluid box has to be dismantled and cleaned (see chapter 10, page 113).

9   Communication Interfaces

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

9.1   Serial Interface RS-232C: 9-Pin Sub-D
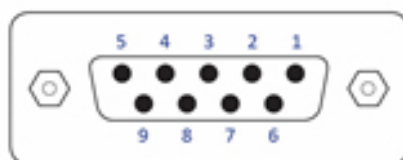
Fig. 33:   Serial interface

The local interface is structured according to SCPI Standard.

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

INFORMATION

Communication while triggering

Do not send instructions through this interface in the course of a running dispensing cycle. Communication is only possible between distinct sequences (signal DosOK on "high").

After sending data or parameters to the control unit, you have to wait for the "OK" signal before you can start further actions.

The serial interface belongs to the MDC. Therefore, the serial commands are not available, if you use your MDV without an MDC.

9.1.1   Pin Functions

PIN	Characteristics	Level	Function
1	Reserved for future use	_____	_____
2	Out	TX	Serial transmission signal
3	In	RX	Serial reception signal
4	Reserved for future use	_____	_____
5	Ground		Ground
6	Reserved for future use	_____	_____
7	Reserved for future use	_____	_____
8	Reserved for future use	_____	_____
9	Reserved for future use	_____	_____

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 4.5.2, page 29)
- Start bit: 1
- String length: 8 bit (ASCII)
- Parity: None
- Stop bit: 1
- Log: None

9.1.2 RS-232C Commands

The available commands are listed below. They are explained on the following pages, together with short examples. The order the commands are listed here is the same order as they appear in the HELP command. This list is according to firmware revision 4113PV1-G.

Each command has to be followed by a carriage return (CR, \r, 0x0d).

INFORMATION

Response to commands

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

- OK, to acknowledge a command sent
- OK, followed by a value or set of values, asked for in the command (The two information commands, "*IDN?" and "HELP" are exceptions, there the "OK" at the beginning is omitted.)
- "Not OK", if the command is recognized, but the information sent was incorrect (e.g. a value outside the range)
- NAK ("not acknowledged"), if the transmission is okay, but the command unknown/incorrect
- "ERROR", if there is an error with the transmission (e.g. no carriage return)

Every command response ends with "\r\n". If a command has multiple lines of response (e.g. SYS:ESR?), then each line ends with "\r" and the overall response ends with "\r\n".

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 (CR, \r, 0x0d).

The reaction times for the commands are given in the table in the next chapter. The table lists the values for the default and the lowest baud rate, since these have a great influence on the times. The length of a response is also influential. Please be aware that your hardware and processor load also influences the reaction times. Therefore, the given times can only be seen as guidelines. In general, you should not send commands within less than 50 ms, since that is the information time resolution of the MDC.

Example

Command to MDC:

SYS:TERM:BAUD?

Response from MDC:

OK 115200

Unit prefixes for numerical values

To make it easier for you to enter very large or very small numerical values, you can use the unit prefixes Mega, kilo, milli and micro. You simply add the corresponding letter at the end of the value (see table below). After a factory reset, all values except Number of Pulses are set to milli. Without prefix, the units are seconds (s), bar (bar) and degree centigrade (°C). Values in the output will always use prefixes to avoid rounding errors.

Prefix	Abbreviation	Factor	Example
Mega	M	1000000	1M -> 1000000
Kilo	k	1000	20k -> 20000
		1	5 -> 5
milli	m	0.001	25m -> 0.025
micro	u	0.000001	15u -> 0.000015

Tab. 27: Unit prefixes for numerical values

9.1.2.1 Overview

RS-232C commands	Command Category	Reaction time (ms) For baud rate:	
		9600 bits/s	115200 bits/s
1. *IDN?	Information	64	5
2. HELP	Information	1068	90
3. MDC1500:SETUP1 <OT>,<CT>,<NP>,<1>	Trigger	36	17
4. MDC1500:SETUP1?	Trigger	23	4
5. MDC1500:SETUP2 <OT>,<CT>,<NP>,<1>	Trigger	54	36
6. MDC1500:SETUP2?	Trigger	22	4
7. MDC1500:SETUP3 <OT>,<CT>,<NP>,<1>	Trigger	53	37
8. MDC1500:SETUP3?	Trigger	24	4
9. MDC1500:SETUP4 <OT>,<CT>,<NP>,<1>	Trigger	54	36
10. MDC1500:SETUP4?	Trigger	22	5
11. MDC1500:SEQUENCE <trigger delay>,<start setup>,<sequence delay>,<end setup>	Trigger	56	37
12. MDC1500:SEQUENCE1?	Trigger	26	3
13. MDC1500:SEQUENCE2?	Trigger	28	3
14. MDC1500:SEQUENCE3?	Trigger	26	3
15. MDC1500:SEQUENCE4?	Trigger	26	4
16. MDC1500:SEQUENCE:MODE <ON/OFF>	Trigger	31	14
17. MDC1500:SEQUENCE:MODE?	Trigger	23	2
18. MDC1500:RUN <OT>,<CT>,<NP>	Trigger	56	37
19. MDH:TARGET <target temperature>	Heater	26	3
20. MDH:TARGET?	Heater	28	3
21. MDH:ALERT <temperature limit>	Heater	26	3
22. MDH:ALERT?	Heater	26	4
23. MDH:MODE <ON/OFF>	Heater	31	14
24. MDH:STAT?	Heater	16	4
25. MDP:ACT:ALERT <limit for actuator pressure>	Pressure	36	14
26. MDP:ACT:ALERT?	Pressure	25	4
27. MDP:ACT:MODE?	Pressure	24	14
28. MDP:ACT:MODE <ON/OFF>	Pressure	27	3
29. MDP:ACT:REGU <min volt>,<min bar>,<max volt>,<max bar>	Pressure	21	4
30. MDP:ACT:REGU?	Pressure	22	4
31. MDP:ACT:REGU:TYPE <1/2/3>	Pressure	30	28
32. MDP:ACT:STAT?	Pressure	27	3

RS-232C commands	Command Category	Reaction time (ms)	
		For baud rate:	
		9600 bits/s	115200 bits/s
33. MDP:ACT:TARGET <target actuator pressure>	Pressure	23	13
34. MDP:ACT:TARGET?	Pressure	13	2
35. MDP:CART:MAX <limit for cartridge pressure>	Pressure	26	3
36. MDP:CART:MAX?	Pressure	23	13
37. MDP:CART:MODE?	Pressure	123	112
38. MDP:CART:MODE <ON/OFF>	Pressure	64	47
39. MDP:CART:REGU <min volt>,<min bar>,<max volt>,<max bar>	Pressure	40	4
40. MDP:CART:REGU?	Pressure	24	15
41. MDP:CART:REGU:TYPE <1/2/3>	Pressure	30	28
42. MDP:CART:TARGET <target cartridge pressure>	Pressure	15	3
43. MDP:CART:TARGET?	Pressure	22	13
44. MDV:ESR?	Valve	27	5
45. MDV:INFO?	Valve	13	2
46. MDV:CYCLES?	Valve	14	3
47. MDV:JET?	Valve	112	102
48. MDV:TEMP?	Valve	64	49
49. MDV:TRIGGER <setup no.>	Valve	21	5
50. MDV:SERVICE <interval>	Valve	129	115
51. MDV:SERVICE?	Valve	21	4
52. MDV:SERVICEIN?	Valve	21	4
53. MDV:STOP	Valve	41	4
54. MDV:OPEN	Valve	22	4
55. MDV:CLOSE	Valve	20	2
56. MDV:PLUGOUT	Valve	1442	1440
57. SYS:ESR?	System	28	3
58. SYS:ENTER	System	24	4
59. SYS:FIND	System	100	89
60. SYS:INFO?	System	34	17
61. SYS:IPC?	System	22	3
62. SYS:KLOCK <ON/OFF>	System	18	4
63. SYS:KLOCK?	System	23	3
64. SYS:PLC:VOLTAGE <5/24>	System	21	2
65. SYS:PLC:VOLTAGE?	System	23	13
66. SYS:POWER:OFF	System	17	3

RS-232C commands	Command Category	Reaction time (ms)	
		For baud rate:	
		9600 bits/s	**115200 bits/s**
67. SYS:RESET <0/1/2/3>	System	23	13
68. SYS:RESTART	System	14	4
69. SYS:READY?	System	158	21
70. SYS:PLOCK <ON/OFF>	System	19	3
71. SYS:PLOCK?	System	23	3
72. SYS:TERM:BAUD <baud rate>	System	36	3
73. SYS:TERM:BAUD?	System	22	4

9.1.2.2 Explanations of Information Commands

1	*IDN?	**IDN? = Identification Query**	
	Description:	Device specific information, formatted as follows: manufacturer, type of MDC, serial number of MDC, firmware version. Important for contact with our Technical Support.	
	Example:	Input:	*IDN?
		Result:	Vermes Microdispensing, MDC 1500, 01P10015, 4113PV1-G
		Return:	Vermes Microdispensing, MDC 1500, 01P10015, 4113PV1-G

2	**HELP**		
	Description:	Shows a list with all RS-232C commands.	
	Example:	Input:	HELP
		Result:	List with all RS-232C commands.
		Return:	*IDN? HELP SYS:IPC? … MDP:CART:MODE

9.1.2.3 Explanations of Trigger Commands

3	**MDC1500:SETUP1 <Open Time>,<Close Time>,<Number of Pulses>,<EEPROM flag>**		**MDC = Microdispensing controller**
Description:	With this command, you change the pulse parameter set for setup 1 currently present in the RAM. Use the following order. Open Time, Close Time, number of pulses. If you enter a "1" as fourth parameter, these settings are saved in the EEPROM of the control unit. Then they are still present even after re-starting the MDC. If you set the Open Time and the Close Time to "0" and the Number of Pulses to "1", the valve changes into external mode. External mode does only work in Setup 1. If you set the number of pulses to "0", the valve changes into infinite mode.		
Example:	Input:	MDC1500:SETUP1 10m,800u,100	
	Result:	The pulse parameters of setup 1 are changed in the RAM. The new values are not stored in the EEPROM. New parameters: Open Time: 10m $\triangleq$ 10 ms Close Time: 800u $\triangleq$ 0.8 ms Number of Pulses: 100	
	Return:	OK	

4	**MDC1500:SETUP1?**		**MDC = Microdispensing controller**
Description:	The pulse parameter set for setup 1 currently present in the RAM is displayed in the following order. Open time, Close Time, number of pulses.		
Example:	Input:	MDC1500:SETUP1?	
	Result:	Information is given about the current pulse parameters of Setup 1 (e.g. Open Time 10 ms, Close Time = 10 ms, Number of Pulses = 100).	
	Return:	OK 10m, 10m, 100	

5	**MDC1500:SETUP2 <Open Time>,<Close Time>,<Number of Pulses>,<EEPROM flag>**		**MDC = Microdispensing controller**
Description:	With this command, you change the pulse parameter set for setup 2 currently present in the RAM. Use the following order. Open Time, Close Time, number of pulses. If you enter a "1" as fourth parameter, these settings are saved in the EEPROM of the control unit. Then they are still present even after re-starting the MDC. If you set the number of pulses to "0", the valve changes into infinite mode.		
Example:	Input:	MDC1500:SETUP2 10m,800u,100	

	Result:	The pulse parameters of setup 2 are changed in the RAM. The new values are not stored in the EEPROM. New parameters: Open Time: 10m ≙ 10 ms Close Time: 800u ≙ 0.8 ms Number of Pulses: 100
	Return:	OK

6	**MDC1500:SETUP2?**		**MDC = Microdispensing controller**
Description:	The pulse parameter set for setup 2 currently present in the RAM is displayed in the following order. Open time, Close Time, number of pulses.		
Example:	Input:	MDC1500:SETUP2?	
	Result:	Information is given about the current pulse parameters of Setup 2 (e.g. Open Time 10 ms, Close Time = 10 ms, Number of Pulses = 100).	
	Return:	OK 10m, 10m, 100	

7	**MDC1500:SETUP3 <Open Time>,<Close Time>,<Number of Pulses>,<EEPROM flag>**		**MDC = Microdispensing controller**
Description:	With this command, you change the pulse parameter set for setup 3 currently present in the RAM. Use the following order. Open Time, Close Time, number of pulses. If you enter a "1" as fourth parameter, these settings are saved in the EEPROM of the control unit. Then they are still present even after re-starting the MDC. If you set the number of pulses to "0", the valve changes into infinite mode.		
Example:	Input:	MDC1500:SETUP3 10m,800u,100	
	Result:	The pulse parameters of setup 3 are changed in the RAM. The new values are not stored in the EEPROM. New parameters: Open Time: 10m ≙ 10 ms Close Time: 800u ≙ 0.8 ms Number of Pulses: 100	
	Return:	OK	

8	**MDC1500:SETUP3?**		**MDC = Microdispensing controller**
Description:	The pulse parameter set for setup 3 currently present in the RAM is displayed in the following order. Open time, Close Time, number of pulses.		
Example:	Input:	MDC1500:SETUP3?	
	Result:	Information is given about the current pulse parameters of Setup 3 (e.g. Open Time 10 ms, Close Time = 10 ms, Number of Pulses = 100).	
	Return:	OK 10m, 10m, 100	

9	**MDC1500:SETUP4 <Open Time>,<Close Time>,<Number of Pulses>,<EEPROM flag>**		**MDC = Microdispensing controller**
	Description:	With this command, you change the pulse parameter set for setup 4 currently present in the RAM. Use the following order. Open Time, Close Time, number of pulses. If you enter a "1" as fourth parameter, these settings are saved in the EEPROM of the control unit. Then they are still present even after re-starting the MDC. If you set the number of pulses to "0", the valve changes into infinite mode.	
	Example:	Input:	MDC1500:SETUP4 10m,800u,100
		Result:	The pulse parameters of setup 4 are changed in the RAM. The new values are not stored in the EEPROM. New parameters: Open Time: 10m ≙ 10 ms Close Time: 800u ≙ 0.8 ms Number of Pulses: 100
		Return:	OK

10	**MDC1500:SETUP4?**		**MDC = Microdispensing controller**
	Description:	The pulse parameter set for setup 4 currently present in the RAM is displayed in the following order. Open time, Close Time, number of pulses.	
	Example:	Input:	MDC1500:SETUP4?
		Result:	Information is given about the current pulse parameters of Setup 4 (e.g. Open Time 10 ms, Close Time = 10 ms, Number of Pulses = 100).
		Return:	OK 10m, 10m, 100

11	MDC1500:SEQUENCE <Trigger delay>,<Start setup>,<Sequence delay>,<End setup>		MDC = Microdispensing controller
Description:		This command is used to combine two setups with a delay between them ("sequence delay"). Optionally, you can also add a trigger delay, which would cause a delay before the start of the sequence (see paragraph 8.6, page 71). There are four parameters.	
		• Trigger delay (range 0.7 ms – 5 s or 0 [= no delay])	
		• Start setup (one of the four setups 1, 2, 3 or 4)	
		• Sequence delay (range 0.7 ms – 5 s or 0 [= no delay])	
		• End setup (one of the four setups 1, 2, 3 or 4, but not the same as the start setup)	
		Specified values must be integer and positive. In case you enter a parameter outside the possible range, the response will be a "Not OK".	
		Important Note!	
		You can only dispense a sequence, if the MDC is set to sequence mode.	
Example:		Input:	MDC1500:SEQUENCE 0,1,10m,3
		Result:	The dispensing sequence contains the following values: Trigger Delay: 0 ≙ no trigger delay Start setup: Setup 1 Sequence delay: 10m ≙ 10 ms End setup: Setup 3
		Return:	OK

12	MDC1500:SEQUENCE1?		MDC = Microdispensing controller
Description:		This command returns the sequence parameters for the respective setup. The response contains four parameters.	
		• Trigger delay (range 0.7 ms – 5 s or 0 [= no delay])	
		• Start setup (one of the four setups 1, 2, 3 or 4)	
		• Sequence delay (range 0.7 ms – 5 s or 0 [= no delay])	
		• End setup (one of the four setups 1, 2, 3 or 4, but not the same as the start setup)	
		In case there is no sequence set for setup 1, the response will be: OK 0, 1, 0, 0	
Example:		Input:	MDC1500:SEQUENCE1?
		Result:	The response returns the sequence parameters for setup 1.
		Return:	OK 0, 1, 20m, 3

13	MDC1500:SEQUENCE2?		MDC = Microdispensing controller

Description:	This command returns the sequence parameters for the respective setup. The response contains four parameters.
	• Trigger delay (range 0.7 ms – 5 s or 0 [= no delay])
	• Start setup (one of the four setups 1, 2, 3 or 4)
	• Sequence delay (range 0.7 ms – 5 s or 0 [= no delay])
	• End setup (one of the four setups 1, 2, 3 or 4, but not the same as the start setup)
	In case there is no sequence set for setup 2, the response will be: OK 0, 2, 0, 0

Example:	Input:	MDC1500:SEQUENCE2?
	Result:	The response returns the sequence parameters for setup 2.
	Return:	OK 0, 2, 20m, 3

14	**MDC1500:SEQUENCE3?**	**MDC = Microdispensing controller**
Description:	This command returns the sequence parameters for the respective setup. The response contains four parameters.	
	• Trigger delay (range 0.7 ms – 5 s or 0 [= no delay])	
	• Start setup (one of the four setups 1, 2, 3 or 4)	
	• Sequence delay (range 0.7 ms – 5 s or 0 [= no delay])	
	• End setup (one of the four setups 1, 2, 3 or 4, but not the same as the start setup)	
	In case there is no sequence set for setup 3, the response will be: OK 0, 3, 0, 0	

Example:	Input:	MDC1500:SEQUENCE3?
	Result:	The response returns the sequence parameters for setup 3.
	Return:	OK 0, 3, 20m, 4

15	**MDC1500:SEQUENCE4?**	**MDC = Microdispensing controller**
Description:	This command returns the sequence parameters for the respective setup. The response contains four parameters.	
	• Trigger delay (range 0.7 ms – 5 s or 0 [= no delay])	
	• Start setup (one of the four setups 1, 2, 3 or 4)	
	• Sequence delay (range 0.7 ms – 5 s or 0 [= no delay])	
	• End setup (one of the four setups 1, 2, 3 or 4, but not the same as the start setup)	
	In case there is no sequence set for setup 4, the response will be: OK 0, 4, 0, 0	

Example:	Input:	MDC1500:SEQUENCE4?
	Result:	The response returns the sequence parameters for setup 4.
	Return:	OK 0, 4, 20m, 3

16	**MDC1500:SEQUENCE:MODE <ON/OFF>**	**MDC = Microdispensing controller**

Description:	This command activates or deactivates the sequence mode (see paragraph 8.6, page 71). If the MDC is set to sequence mode and you send a trigger command for the setup, which is the start setup, the whole sequence will be dispensed. There are two possible values. 0 – sequence mode will be deactivated 1 – sequence mode will be activated	
Example:	Input:	MDC1500:SEQUENCE:MODE 1
	Result:	The sequence mode gets activated.
	Return:	OK

17	**MDC1500:SEQUENCE:MODE?**	**MDC = Microdispensing controller**	
	Description:	This command shows, if the MDC is in the sequence mode (1 means "yes", 0 means "no", see also paragraph 8.6, page 71).	
	Example:	Input:	MDC1500:SEQUENCE:MODE?
		Result:	The response shows, if the MDC is in the sequence mode (here: yes).
		Return:	OK 1

18	**MDC1500:RUN <Open Time>,<Close Time>,<Number of Pulses>**	**MDC = Microdispensing controller**	
	Description:	This command is used to start a dispensing cycle with the given parameters (Reaction time: 200 ms). Values lower than "1" are not admissible. Specified values must be integer and positive. In case you enter a parameter outside the possible range, the response will be a "Not OK".	
	Example:	Input:	MDC1500:RUN 10m,10m,10k
		Result:	The following parameters are set: Open Time: 10m ≙ 10 ms Close Time: 10m ≙ 10 ms Number of Pulses: 10000 Then dispensing starts with these parameters
		Return:	OK

9.1.2.4 Explanations of Heater Commands

19	MDH:TARGET <target temperature>		MDH = Microdispensing heater
Description:	With this command, you can change the target temperature of the heater. As parameter, enter the target temperature in °C. The value has to be between 20 and 99. Using the unit prefixes, you could enter a temperature value with a precision of less than 1 °C, but usually this would not make sense.		
Example:	Input:	MDH:TARGET 30	
	Result:	The target temperature is changed to 30 °C.	
	Return:	OK	

20	MDH:TARGET?	MDH = Microdispensing heater
Description:	This shows the target temperature set for the heater.	
Example:	Input:	MDH:TARGET?
	Result:	The target temperature of the heater is shown.
	Return:	OK 30

21	MDH:ALERT <limit for temperature alert>		MDH = Microdispensing heater
Description:	With this command, you can change the temperature alert of the heater. As parameter enter the target temperature in millidegree Celsius, i.e. an input of 500m represents 0.5 °C. The value you enter has to be between 500 and 2000. In case the heater is ON and the actual temperature is more than this value below or above the target temperature, the heater control lamp is flashing.		
Example:	Input:	MDH:ALERT 700m	
	Result:	The limit for temperature alert is changed to 0.7 °C.	
	Return:	OK	

22	MDH:ALERT?	MDH = Microdispensing heater
Description:	This shows the limit for temperature alert set for the heater in millidegree centigrade. I.e. 500m represents 0.5 °C.	
Example:	Input:	MDH:ALERT?
	Result:	The limit for temperature alert is shown.
	Return:	OK 700m *(i.e. 0.7°C)*

23	MDH:MODE <ON/OFF>		MDH = Microdispensing heater
Description:	The heater is turned ON or OFF. There are two possible parameters. 0 – deactivate heater 1 – activate heater		
Example:	Input:	MDH:MODE 1	
	Result:	The nozzle heater is activated.	
	Return:	OK (or "Not OK", if heater was already ON)	

24	**MDH:STAT?**	**MDH = Microdispensing heater**	
	Description:	The command provides information about the current state (ON, OFF) and temperature of the nozzle heater; the measuring unit is millidegree centigrade.	
	Example:	Input:	MDH:STAT?
		Result:	Current status and temperature of the heater (in millidegree centigrade)
		Return:	OK OFF, 20048m (example OFF) OK ON, STABLE, 30000m (example ON)

9.1.2.5 Explanations of Pressure Commands

25	**MDP:ACT:ALERT <threshold for pressure alert>**		**MDP = microdispensing pressure, ACT = actuator**
	Description:		With this command, you set the threshold for the pressure alert. Only the values 0, 100 mbar, 200 mbar, 300 mbar, 400 mbar or 500 mbar are possible. The threshold determines how far the actual pressure may fall below or rise above the target pressure, before a pressure alert is activated. Once the pressure is outside the permitted range, a pressure alert is activated and the dispensing process is stopped. A value of "0" means that there is no limit and the pressure alert is deactivated. You can find further information in paragraph 6.1.2, page 48.
	Example:	Input:	MDP:ACT:ALERT 200m
		Result:	For the actuator pressure, a limit of +/- 200 mbar is set.
		Return:	OK

26	**MDP:ACT:ALERT?**		**MDP = microdispensing pressure, ACT = actuator**
	Description:		This command shows you the thresholds for the actuator pressure. The value tells how far the actual pressure may fall below or rise above the target pressure, before a pressure alert is activated. In case the pressure falls outside the range, a pressure alert is activated and the dispensing process is stopped. A value of "0" means that there is no threshold. The pressure alert is deactivated. You can find further information in paragraph 6.1.2, page 48.
	Example:	Input:	MDP:ACT:ALERT?
		Result:	The pressure limit for the actuator is shown (here +/-300 mbar).
		Return:	OK 300m

27	**MDP:ACT:MODE?**		**MDP = microdispensing pressure, ACT = actuator**
	Description:		This command checks, if the regulation for the actuator pressure is activated. There are two possible parameters. 0 – pressure regulation is deactivated 1 – pressure regulation is activated
	Example:	Input:	MDP:ACT:MODE?
		Result:	It is shown, if the pressure regulation for the actuator is activated (here: yes).
		Return:	OK 1

28	**MDP:ACT:MODE <ON/OFF>**		**MDP = microdispensing pressure, ACT = actuator**
	Description:		This command activates/deactivates the regulation for the actuator pressure. There are two possible parameters. 0 – deactivate pressure regulation 1 – activate pressure regulation
	Example:	Input:	MDP:ACT:MODE 0
		Result:	The pressure regulation for the actuator pressure is deactivated.
		Return:	OK

29	MDP:ACT:REGU <min-volt>,<min-bar>,<max-volt>,<max-bar>		MDP = microdispensing pressure, ACT = actuator
Description:		With this command, you fit the pressure control of the actuator pressure to your pressure regulator. Set the voltage for the minimum actuator pressure and the voltage for the maximum actuator pressure according the notes of your pressure regulator. For further information, read paragraph 6.1, page 46. You have to change these settings every time you use a new pressure regulator.	
Example:		Input:	MDP:ACT:REGU 0,50m,10000m,8000m
		Result:	The settings for regulating the actuator pressure are changed according to the information on your pressure regulator (e.g. 0 mV for 50 mbar and 10000 mV for 8000 mbar).
		Return:	OK

30	MDP:ACT:REGU?		MDP = microdispensing pressure, ACT = actuator
Description:		This command shows you the settings for controlling the actuator pressure. Compare the values with the information on your pressure regulator. The information is listed in the following order. - Minimum voltage (base unit V) - Minimum pressure (base unit bar) - Maximum voltage (base unit V) - Maximum pressure (base unit bar)	
Example:		Input:	MDP:ACT:REGU?
		Result:	The settings for regulating the actuator pressure are shown (here min voltage 0 mV, min pressure 50 mbar, max voltage 10000 mV and max pressure 8000 mbar).
		Return:	OK 0, 50m, 10000m, 8000m

31	MDP:ACT:REGU:TYPE <1/2/3>		MDP = microdispensing pressure, ACT = actuator
Description:		With this command, you select the type of the actuator pressure regulator. There are three possible parameters. 1 – electronic pressure regulator 2 – mechanical pressure regulator 3 – automatic detection of pressure regulator In case you enter a parameter outside the possible range, the response will be a "NOT OK".	
Example:		Input:	MDP:ACT:REGU:TYPE 1
		Result:	The type of the actuator pressure regulator is configured as electronic.
		Return:	OK

32	**MDP:ACT:STAT?**		**MDP = microdispensing pressure, ACT = actuator**
Description:		This command shows the current status of the actuator pressure.	
Example:	Input:	MDP:ACT:STAT?	
	Result:	The current status of the actuator pressure is shown.	
	Return:	OK STABLE, 3500m *(example with stable pressure)* OK UNSTABLE, 0m *(example without pressure)*	

33	**MDP:ACT:TARGET <actuator pressure>**		**MDP = microdispensing pressure, ACT = actuator**
Description:		With this command, you set the target pressure for the actuator pressure. The base unit is bar.	
Example:	Input:	MDP:ACT:TARGET 4000m	
	Result:	The target pressure for the actuator is set to 4 bar (= 4000 mbar).	
	Return:	OK	

34	**MDP:ACT:TARGET?**		**MDP = microdispensing pressure, ACT = actuator**
Description:		This command shows you the target pressure for the actuator pressure. The values are given in bar.	
Example:	Input:	MDP:ACT:TARGET?	
	Result:	The target pressure for the actuator (here 3.5 bar).	
	Return:	OK 3500m	

35	**MDP:CART:MAX <cartridge pressure limit>**		**MDP = microdispensing pressure, CART = cartridge**
Description:		With this command, you set the maximum pressure for the cartridge pressure. The base unit is bar. The highest value you can set is 6 bar. It is possible to set a higher pressure when you use your own regulator. In this case, you should contact our Support before setting. In case you send a value of 0 bar, the maximum is deactivated. The control unit will just have the maximum pressure from the pressure regulator. As long as there is a maximum set, you cannot enter a cartridge target pressure above the limit, neither via keypad nor via RS-232C interface. **Important Note!** In case you set a maximum pressure that is higher than the maximum your analog pressure regulator can provide, it will be accepted. However, the highest pressure your system actually provides will not proceed the limit of your pressure regulator. In case you use an electronic pressure regulator, it depends on the maximum you have set with the command MDP:CART:REGU < >.	
Example:		Input:	MDP:CART:MAX 5700m
		Result:	The maximum pressure for the cartridge is set to 5.7 bar (= 5700 mbar).
		Return:	OK

36	**MDP:CART:MAX?**		**MDP = microdispensing pressure, CART = cartridge**
Description:		With this command, you check the maximum pressure for the cartridge pressure. The base unit is bar. In case the response is 0 bar, the pressure maximum is deactivated.	
Example:		Input:	MDP:CART:MAX?
		Result:	The maximum cartridge pressure is shown (here: 5.7 bar = 5700 mbar).
		Return:	OK 5700m

37	**MDP:CART:MODE?**		**MDP = microdispensing pressure, CART = cartridge**
Description:		This command checks, if the regulation for the cartridge pressure is activated. There are two possible parameters. 0 – pressure regulation is deactivated 1 – pressure regulation is activated	
Example:		Input:	MDP:CART:MODE?
		Result:	It is shown, if the cartridge pressure regulation is activated (here: yes).
		Return:	OK 1

38	**MDP:CART:MODE <ON/OFF>**		**MDP = microdispensing pressure, CART = cartridge**
Description:		This command activates/deactivates the regulation for the cartridge pressure. There are two possible parameters. 0 – deactivate pressure regulation 1 – activate pressure regulation	
Example:		Input:	MDP:CART:MODE 0
		Result:	The pressure regulation for the cartridge pressure is deactivated.
		Return:	OK

39	**MDP:CART:REGU <min-volt>,<min-bar>,<max-volt>,<max-bar>**		**MDP = microdispensing pressure, CART = cartridge**
	Description:	With this command, you fit the pressure control of the cartridge pressure to your pressure regulator.	
		Set the voltage for the minimum cartridge pressure and the voltage for the maximum cartridge pressure according the notes of your pressure regulator. For further information, read paragraph 6.2, page 49.	
		You have to change these settings every time you use a new pressure regulator.	
		Important Note!	
		The default settings are 0 V = 0 bar, 10 V = 6 bar. The maximum value permitted for the cartridge channel is 9.9 bar.	
	Example:	Input:	MDP:CART:REGU 0,50m,10000m,8000m
		Result:	The settings for regulating the cartridge pressure are changed according to the information on your pressure regulator (e.g. 0 mV for 50 mbar and 10000 mV for 8000 mbar).
		Return:	OK

40	**MDP:CART:REGU?**		**MDP = microdispensing pressure, CART = cartridge**
	Description:	This command shows you the settings for controlling the cartridge pressure. Compare the values with the information on your pressure regulator. The information is listed in the following order.	
		• Minimum voltage (base unit V)	
		• Minimum pressure (base unit bar)	
		• Maximum voltage (base unit V)	
		• Maximum pressure (base unit bar)	
	Example:	Input:	MDP:CART:REGU?
		Result:	The settings for regulating the cartridge pressure are shown (here min voltage 0 mV, min pressure 50 mbar, max voltage 10000 mV and max pressure 8000 mbar).
		Return:	OK 0, 50m, 10000m, 8000m

41	**MDP:CART:REGU:TYPE <1/2/3>**		**MDP = microdispensing pressure, CART = cartridge**
	Description:	With this command, you select the type of the cartridge pressure regulator. There are three possible parameters.	
		1 – electronic pressure regulator	
		2 – mechanical pressure regulator	
		3 – automatic detection of pressure regulator	
		In case you enter a parameter outside the possible range, the response will be a "NOT OK".	
	Example:	Input:	MDP:CART:REGU:TYPE 2
		Result:	The type of the cartridge pressure regulator is configured as mechanic.
		Return:	OK

42	**MDP:CART:TARGET <cartridge pressure>**		**MDP = microdispensing pressure, CART = cartridge**
	Description:	With this command, you set the target pressure for the cartridge pressure. The base unit is bar.	
	Example:	Input:	MDP:CART:TARGET 2700m
		Result:	The target pressure for the cartridge is set to 2.7 bar (= 2700 mbar).
		Return:	OK

43	**MDP:CART:TARGET?**		**MDP = microdispensing pressure, CART = cartridge**
	Description:	This command shows you the target pressure for the cartridge pressure. The values are given in bar.	
	Example:	Input:	MDP:CART:TARGET?
		Result:	The target pressure for the cartridge is shown (here 2.7 bar).
		Return:	OK 2700m

9.1.2.6 Explanations of Valve Commands

44	**MDV:ESR?**	**MDV = Microdispensing valve, ESR? = Event Status Register Query**	
	Description:	This command shows the latest error messages which refer to the valve, starting with the latest event. Together with the error code a number of relevant data is shown (e.g. ID of MDC and MDV, firmware revision, parameter settings of the setups, actuator pressure values etc.) as well as a time stamp. At the most 50 error messages will be shown.	
		Explanation of the shown data:	
		Error ID,	
		How many times the same error happened,	
		MDC ID,	
		MDV ID,	
		Firmware ID,	
		Heater Status *(0 = OFF, 1 = ON)*,	
		Heater Set Point,	
		Actual Measured Temperature,	
		Actual Open Time,	
		Actual Close Time,	
		Actual Number of Pulses,	
		Actual Cycle Counter,	
		Open Time Setup A,	
		Close Time Setup A,	
		Number of Pulses Setup A,	
		Open Time Setup B,	
		Close Time Setup B,	
		Number of Pulses Setup B,	
		Open Time Setup C,	
		Close Time Setup C,	
		Number of Pulses Setup C,	
		Open Time Setup D,	
		Close Time Setup D,	
		Number of Pulses Setup D,	
		Actuator Pressure Error Status,	
		Actuator Pressure Set Point,	
		Actual Measured Actuator Pressure,	
		Error happened at HOURS:MINUTES:SECONDS	
	Example:	Input:	MDV:ESR?
		Result:	List of the valve relevant error messages (example with two errors)
		Return:	OK 1000602, 1, 1AA000531, 12RGB010, 4013PV1-E, 0, 28, 22305m, 700u, 700u, 500k, 760, 5900u, 7700u, 2,3600u, 5m, 30, 6m, 5m, 101, 8m, 5m, 10, 0, 1500m, 1504m, 10:4:1\r 1000601, 1, 1AA000531, 12RGB010, 4013PV1-E, 0, 28, 26307m, 3600u, 5m, 30, 878, 5900u, 7700u, 2, 3600u, 5m, 30, 6m, 5m, 101, 8m, 5m, 10, 0, 1500m, 1512m, 10:9:0\r

45	**MDV:INFO?**	**MDV = Microdispensing valve**	
	Description:	The valve type and ID are displayed. This information is important, if you have to contact our Technical Support. In case no valve is connected, the response is: NOT OK In case a valve is connected, but the connection not yet confirmed (e.g. by pressing the [**Enter**]-key), the response is: OK VDET	
	Example:	Input:	MDV:INFO?
		Result:	Type and ID of the connected valve.
		Return:	OK MDV 1560, 11PG1001

46	**MDV:CYCLES?**	**MDV = Microdispensing valve**	
	Description:	The current value of the cycle counter is indicated.	
	Example:	Input:	MDV:CYCLES?
		Result:	Current value of the cycle counter.
		Return:	OK 1235000

47	**MDV:JET?**	**MDV = Microdispensing valve**	
	Description:	This command shows if the system is currently dispensing. There are two possible responses: 0 – Not dispensing 1 – Dispensing	
	Example:	Input:	MDV:JET?
		Result:	The system is currently not dispensing.
		Return:	OK 0

48	**MDV:TEMP?**	**MDV = Microdispensing valve**	
	Description:	The command provides information about the current temperature of the actuator; the measuring unit is millidegree centigrade.	
	Example:	Input:	MDV:TEMP?
		Result:	Current temperature of the actuator (in millidegree centigrade, as shown by the "m" at the end)
		Return:	OK 23000m

49	**MDV:TRIGGER <setup number>**		**MDV = Microdispensing valve**
	Description:	With this command you start dispensing with the parameters of the chosen setup currently present in the RAM. There are four possible parameters. 1 – setup 1 2 – setup 2 3 – setup 3 4 – setup 4	
	Example:	Input:	MDV:TRIGGER 1
		Result:	You start dispensing with the parameters of setup 1.
		Return:	OK

50	**MDV:SERVICE <interval>**		**MDV = Microdispensing valve**
	Description:	This command allows you to set a service interval. The highest value you can enter is 4000000000. When you change the service interval, the counter is automatically reset to "0".	
	Example:	Input:	MDV:SERVICE 5000000

		Result:	The service interval is set to 5000000.
		Return:	OK

51	**MDV:SERVICE?**		**MDV = Microdispensing valve**
	Description:	This command tells you at which value the service interval is set. When no service interval is set, the response is "0".	
	Example:	Input:	MDV:SERVICE?
		Result:	The service interval is set to 5000000.
		Return:	OK 5000000

52	**MDV:SERVICEIN?**		**MDV = Microdispensing valve**
	Description:	This command checks, after how many more shots the service interval ends. When no service interval is set, the response is "0".	
	Example:	Input:	MDV:SERVICEIN?
		Result:	The service interval ends after 350000 more shots.
		Return:	OK 350000

53	**MDV:STOP**	**MDV = Microdispensing valve**	
	Description:	This command stops a running dispensing process (Reaction time: 200 ms).	
	Example:	Input:	MDV:STOP
		Result:	Dispensing is stopped.
		Return:	OK

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

55	**MDV:CLOSE**	**MDV = Microdispensing valve**	
	Description:	This command closes the valve. It is the only command accepted in a "MDV:OPEN" phase. In other situations it has no effect.	
	Example:	Input:	MDV:CLOSE
		Result:	The valve closes.
		Return:	OK

56	**MDV:PLUGOUT**	**MDV = Microdispensing valve**	
	Description:	With this command you plug the microdispensing valve out from the MDC. It is recommended to use this command before detaching the valve (e.g. for cleaning purpose).	
	Example:	Input:	MDV:PLUGOUT
		Result:	The valve is plugged out from the MDC.
		Return:	OK

9.1.2.7 Explanations of System Commands

57	**SYS:ESR?**	**SYS = system, ESR? = Event Status Register Query**	
	Description:	This command shows the latest error messages, starting with the latest event. Together with the error code a number of relevant data is shown (e.g. ID of MDC and MDV, firmware revision, parameter settings of the setups, actuator pressure values etc.) as well as a time stamp. The list includes those errors, which are relevant for the valve and can be found separately with the command MDV:ESR?. At the most 50 error messages will be shown. Explanation of the shown data: Error ID, How many times the same error happened, MDC ID, MDV ID, Firmware ID, Heater Status *(0 = OFF, 1 = ON)*, Heater Set Point, Actual Measured Temperature, Actual Open Time, Actual Close Time, Actual Number of Pulses, Actual Cycle Counter, Open Time Setup A, Close Time Setup A, Number of Pulses Setup A, Open Time Setup B, Close Time Setup B, Number of Pulses Setup B, Open Time Setup C, Close Time Setup C, Number of Pulses Setup C, Open Time Setup D, Close Time Setup D, Number of Pulses Setup D, Actuator Pressure Error Status, Actuator Pressure Set Point, Actual Measured Actuator Pressure, Error happened at HOURS:MINUTES:SECONDS	
	Example:	Input:	SYS:ESR?
		Result:	List of the latest error messages (example with three errors)
		Return:	OK 1000602, 1, 1AA000531, 12RGB010, 4013PV1-E, 0, 28, 22305m, 700u, 700u, 500k, 760, 5900u, 7700u, 2,3600u, 5m, 30, 6m, 5m, 101, 8m, 5m, 10, 0, 1500m, 1504m, 10:4:1\r 1000601, 1, 1AA000531, 12RGB010, 4013PV1-E, 0, 28, 26307m, 3600u, 5m, 30, 878, 5900u, 7700u, 2, 3600u, 5m, 30, 6m, 5m, 101, 8m, 5m, 10, 0, 1500m, 1512m, 10:9:0\r 3000302, 1, 1AA000531, 12RGB010, 4013PV1-E, 0, 28, 23920m, 900u, 1m, 2, 1158, 900u, 1m, 2, 3600u, 5m, 30, 6m, 5m, 101, 8m, 5m, 10, 1, 1500m, 996m, 11:46:57\r

58	**SYS:ENTER**	**SYS = system**	
	Description:	The acknowledgement signal is transferred to the control unit. This serial command can only be used to acknowledge error messages "Valve plugged IN" or "Valve plugged OUT" on the display of the MDC. The function of the command is identical to pressing the **[Enter]**-key on the keypad. In all other cases, you cannot use this command instead of pressing the **[Enter]**-key.	
	Example:	Input:	SYS:ENTER
		Result:	The ENTER signal is send.
		Return:	OK

59	**SYS:FIND**	**SYS = system**	
	Description:	This command causes the Status control lamp to flash for ten seconds. Beginning and end of the flashing are marked by a beep sound. This command helps you to identify a specific MDC within a cluster of control units, if you use more than one in your application.	
	Example:	Input:	SYS:FIND
		Result:	The Status control lamp flashes for ten seconds.
		Return:	OK

60	**SYS:INFO?**	**SYS = system**	
	Description:	The type and the ID of the control unit is displayed.	
	Example:	Input:	SYS:INFO?
		Result:	Type and ID of the control unit.
		Return:	OK MDC 1500, 01P10018

61	**SYS:IPC?**	**SYS = system**	
	Description:	Monitoring the last trigger impulses. After this, the counter is cleared to zero.	
	Example:	Input:	SYS:IPC?
		Result:	Number of the last pulses. (Afterwards clears the counter to zero.)
		Return:	OK 669

62	**SYS:KLOCK <ON/OFF>**	**SYS = system, KLOCK = keypad lock**	
	Description:	This command activates/deactivates the locking function. Access to the keypad is permitted or not accordingly. The parameter decides if the key lock is activated or deactivated. 0 – deactivate the key lock 1 – activate the key lock	
	Example:	Input:	SYS:KLOCK 0
		Result:	The keypad of the control unit can be used.
		Return:	OK

63	**SYS:KLOCK?**	**SYS = system, KLOCK = keypad lock**	
	Description:	This command is used to check, if the key lock is activated. There are two possible parameters in the response. 0 – key lock is deactivated (i.e. the keypad of the control unit can be used) 1 – key lock is activated (i.e. the keypad of the control unit cannot be used)	
	Example:	Input:	SYS:KLOCK?

		Result:	It is shown, if the key lock is activated (here: yes).
		Return:	OK 1

64	**SYS:PLC:VOLTAGE <PLC voltage>**		**SYS = system**
Description:	This command sets the voltage of the PLC signal. Possible values are 5 (= 5 V) and 24 (= 24 V). This change affects all the input and output pins of the PLC interface. The default setting is 24 V.		
Example:	Input:	SYS:PLC:VOLTAGE 5	
	Result:	The voltage of the PLC signal is set to 5 V.	
	Return:	OK	

65	**SYS:PLC:VOLTAGE?**		**SYS = system**
Description:	This command shows the voltage set for the PLC signal. Possible responses are 5 and 24.		
Example:	Input:	SYS:PLC:VOLTAGE?	
	Result:	The voltage set for the PLC signal.	
	Return:	OK 5	

66	**SYS:POWER:OFF**		**SYS = system**
Description:	With this command, you can switch off the MDC. The function is identical to pressing the [power]-key on the keypad. **Information!** The MDC can only be switched on again by pressing the [power]-key on the keypad. You cannot switch on the MDC via the RS-232C interface.		
Example:	Input:	SYS:POWER:OFF	
	Result:	The MDC is switched off.	
	Return:	OK	

67	**SYS:RESET <0/1/2/3>**		**SYS = system**
Description:	This command tells the MDC to reset the settings to the factory settings (without shutting down the power). There are four possible parameters. 0 – All settings are reset. 1 – The setups are reset. 2 – The heater settings are reset. 3 – The pressure settings are reset. If you do not enter a parameter, the parameter "0" is used.		
Example:	Input:	SYS:RESET 0	
	Result:	All settings of the MDC are reset to the factory settings.	
	Return:	OK	

68	**SYS:RESTART**	**SYS = system**
Description:	This command tells the MDC to shut down (without shutting down the power) and then to restart. The MDC is shut down normally as if you had used the **[Power]**-key.	
Example:	Input:	SYS:RESTART
	Result:	The MDC is shut down and then restarts.
	Return:	OK

69	**SYS:READY?**	**SYS = system**	
Description:		This command shows, if the system is ready for dispensing or not. If not, there is an active error. The latter case is the same as when an error is shown via the PLC interface. Overall, there are five possible answers. 0, <error code> – there is an error (any case not covered with the other three "0" answers) 0, SET TARGET PRESSURE – actuator pressure is set to "OFF" 0, UPDATE VALVE – MDV information is not in line with firmware revision 0, IN REGULATION – controller is actively regulating the actuator pressure to the set point (only possible, if a digital pressure regulator is connected) 1 – system ready **Important Note!** If you can still dispense with an active error, depends on the type of error. For more information, please check paragraph 12.2, page 137.	
Example:	Input:	SYS:READY?	
	Result:	It is shown, if the system is ready.	
	Return:	OK 1	

70	**SYS:PLOCK <ON/OFF>**	**SYS = system, PLOCK = parameters lock**	
Description:		This command activates/deactivates the parameters lock. While the parameters lock is active, you can change no settings at the MDC (except to deactivate the parameters lock). You can still scroll through the menu to check information. The parameters lock protects your dispensing process from accidental or unauthorized changes, which could affect your results. The parameters lock only affects the keypad. You can still make changes via the RS-232C interface. The parameter decides if the parameters lock is activated or deactivated. 0 – OFF (parameters lock is deactivated) 1 – ON (parameters lock is activated)	
Example:	Input:	SYS:PLOCK 0	
	Result:	The parameters lock is deactivated.	
	Return:	OK	

71	**SYS:PLOCK?**	**SYS = system, PLOCK = parameters lock**	
Description:		With this command, you can check if the parameters lock is activated. There are two possible parameters in the response. 0 – OFF (parameters lock is deactivated) 1 – ON (parameters lock is activated) While the parameters lock is active, you can change no settings at the MDC (except to deactivate the parameters lock). You can still scroll through the menu to check information. The parameters lock protects your dispensing process from accidental or unauthorized changes, which could affect your results. The parameters lock only affects the keypad. You can still make changes via the RS-232C interface.	
Example:	Input:	SYS:PLOCK?	
	Result:	It is shown, if the parameter lock is activated (here: yes).	
	Return:	OK 1	

72	**SYS:TERM:BAUD <baud rate>**	**SYS = system, BAUD = baud rate**	

Description:	This command changes the baud rate of the serial interface. There are seven possible baud rates (9600, 19200, 38400, 57600, 115200 (default), 230400 and 460800). Enter the respective baud rate as parameter.	
	Important Note!	
	After reading the response, the sender has to switch his baud rate as well; otherwise, the communication will break down.	
Example:	Input:	SYS:TERM:BAUD 19200
	Result:	The baud rate is switched to 19200.
	Return:	OK

73	**SYS:TERM:BAUD?**		**SYS = system, BAUD = baud rate**
	Description:	This command shows the current baud rate of the serial interface. There are seven possible baud rates (9600, 19200, 38400, 57600, 115200 (default), 230400 and 460800).	
	Example:	Input:	SYS:TERM:BAUD?
		Result:	The current baud rate is shown (here: 115200).
		Return:	OK 115200

9.2 PLC Interface: 15-pin, Sub-D
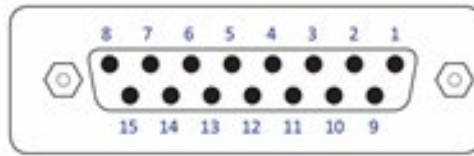
Fig. 34:   PLC Interface: 15-pin, Sub-D

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 30 µs.

The minimum length for a trigger signal has to be 20 µs.

Access is possible to:

• Status bits

• Set-Trigger signals initiating dispensing cycles (pulses) or complete packages of pulses (bursts)

• Information about the status of the heater

9.2.1 Pin Functions

INFORMATION

Switching between 24 V and 5 V via RS-232C

With the serial command SYS:PLC:VOLTAGE you can switch between 24 V and 5 V for the input pins and output pins of the PLC interface. Alternatively, you can make this switch via the keypad of the MDC, in the menu "General Settings -> PLC Voltage" (see paragraph 4.5.2, page 29). The change always affects every pin. The default setting is 24 V. The table with the pin functions lists the values for the 5 V-option in brackets. You can find further information about the heater pins (pin 5 and pin 6) in paragraph 9.2.3, page 110.

PIN	Characteristics	Level	Function
1	Output	0/+24 V (0/+5 V), Ra=2.2 kΩ (valid for 0 V)	SingleDosOK
2	Input	0/+24 V, Ri=1.3 kΩ (0/+5 V, Ri=290 Ω)	Trigger Voltage Input Positive edge triggering
3	Input	0/+24 V, Ri=24.4 kΩ (0/+5 V, Ri=2.8 kΩ)	Select 1
4	Ground	_____	Ground for trigger input
5	Input	0/+24 V, Ri=24.4 kΩ (0/+5 V, Ri=2.8 kΩ)	Heater ON
6	Output	0/+24 V (0/+5 V), Ra=2.2 kΩ (valid for 0 V)	Heating OK
7	Input	0/+24 V, Ri=24.4 kΩ (0/+5 V, Ri=2.8 kΩ)	Reserved for later use
8	Do not connect	_____	No connection
9	Voltage Output	24 V/50 mA (5 V/50 mA)	Power supply to external trigger
10	Ground	_____	Ground for other PLC signals
11	Input	0/+24 V, Ri=24.4 kΩ (0/+5 V, Ri=2.8 kΩ)	Select 2
12	Output	0/+24 V (0/+5 V), Ra=2.2 kΩ (valid for 0 V)	Reserved for later use
13	Output	0/+24 V (0/+5 V), Ra=2.2 kΩ (valid for 0 V)	General error
14	Output	0/+24 V (0/+5 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	Do not connect	_____	No connection

For the connection diagram, see paragraph 15.10, page 175.

9.2.2 PLC-Signals

The following graphs show you the different PLC-signals Trigger, DosOK and SingleDosOK (in the picture abbreviated as SDOS OK) and their behavior in various dispensing modes. Another graph shows you the behavior of the PLC-signals in case of an error.

DosOK

The signal DosOK shows the length of a dispensing burst.

It consists of (OT + CT) x NP => during the pulsing burst the signal is "low". When the signal changes to "high", the system is ready for dispensing. This also means that you can only send serial commands while the signal is "high".

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 closing. Before the drop is formed it takes another little moment, since the tappet has to move down to impact on the nozzle (see paragraph 8.3, page 69).

9.2.2.1 Single-Shot Mode
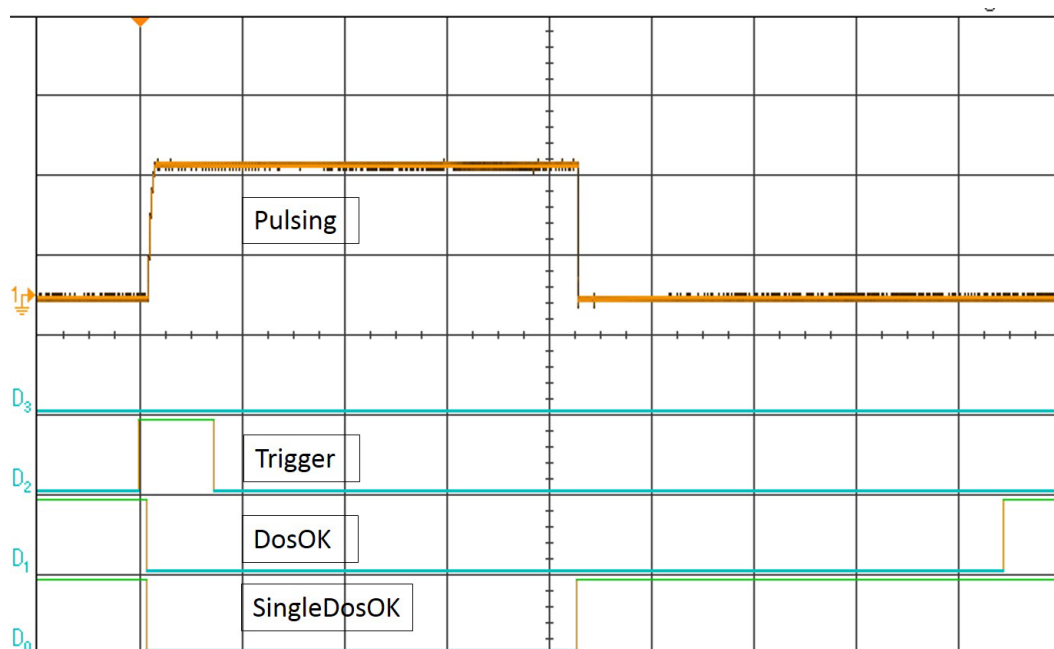
Fig. 35:   Single-Shot Mode

9.2.2.2 Burst Mode (Example with Two Shots)
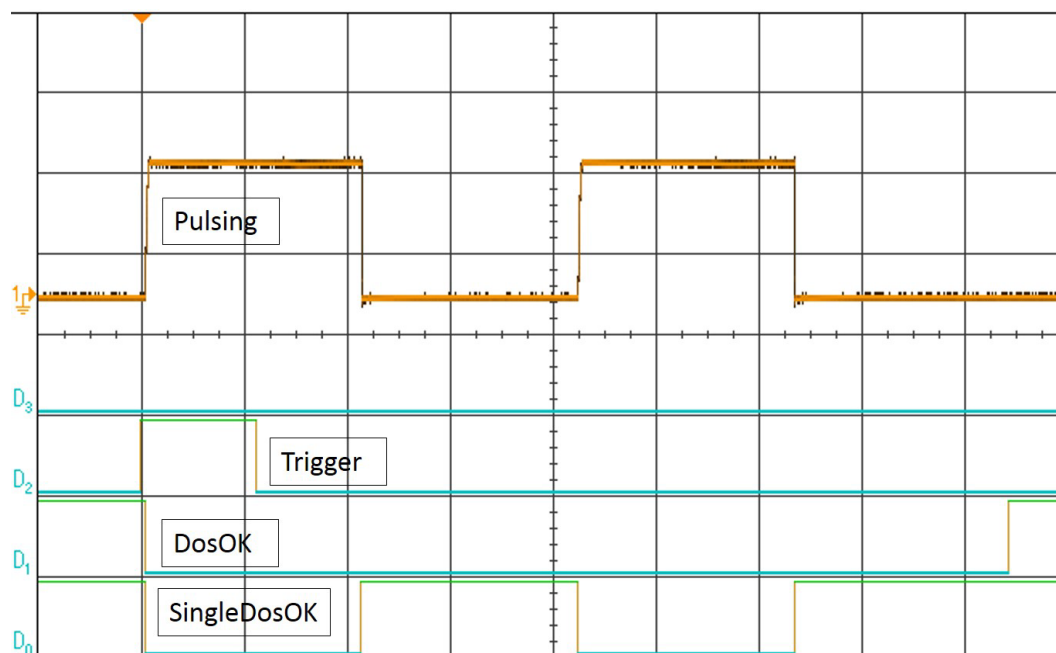
Fig. 36:   Burst Mode (Example with Two Shots)

9.2.2.3 External Mode
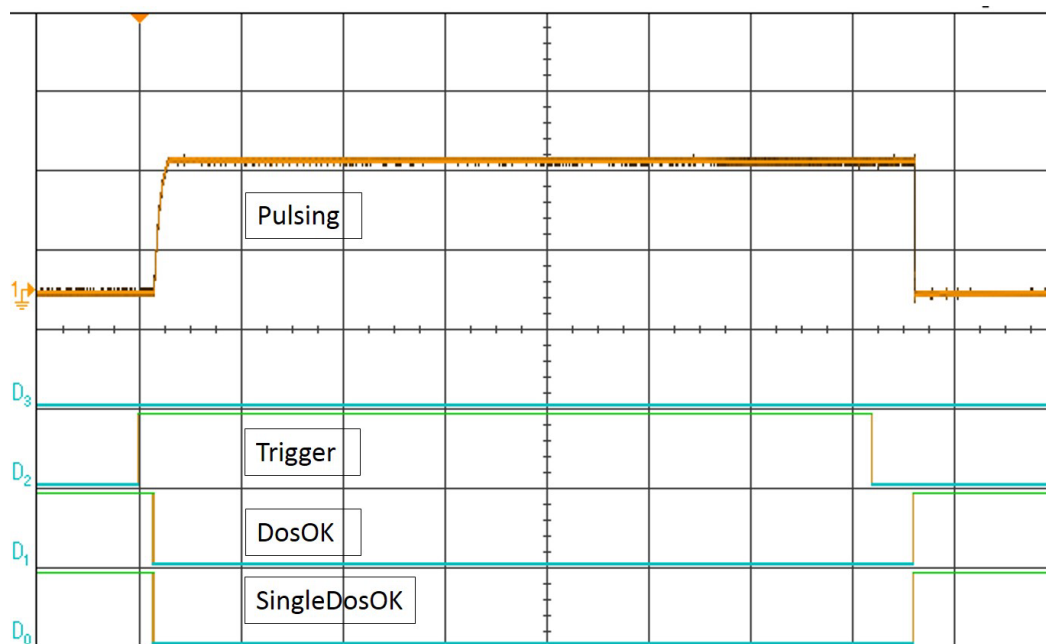
Fig. 37:   External Mode

IMPORTANT NOTE

Slight delay between trigger signal and tappet movement
When the signal DosOK jumps to "high", the tappet still has to move down to impact on the nozzle. Therefore, you have to wait a little moment with the next trigger signal. The waiting time depends on the actuator pressure and the fluid box you use. You have to find it experimentally.

9.2.2.4 Infinite Mode
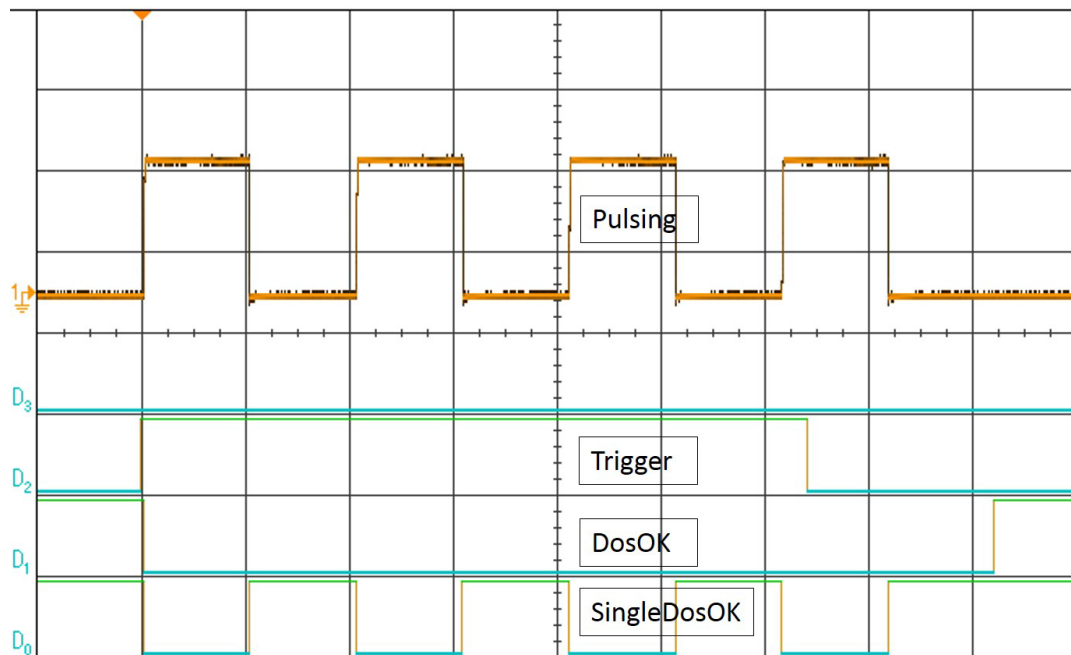
Fig. 38:   Infinite Mode

9.2.2.5 PLC-Signals in Case of an Error
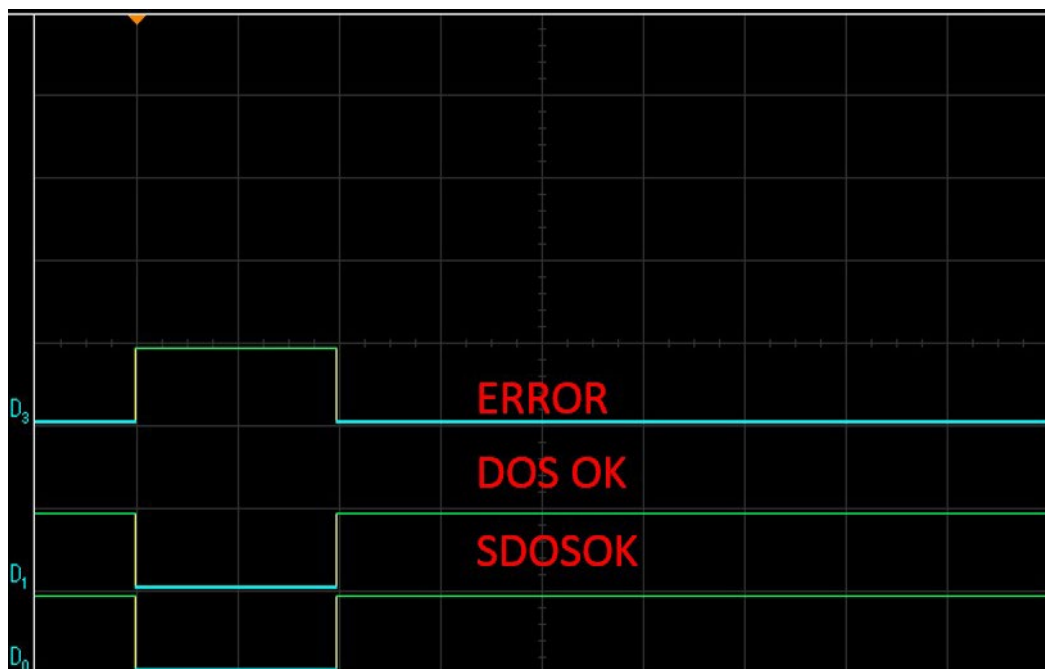
Fig. 39:   PLC-Signals in Case of an Error

9.2.3 Heater Pins of the PLC Interface

The PLC interface has two pins, which are used for the heater, pin 5 and pin 6. The following table shows the relevant settings.

INFORMATION

Error relating to the heater

An error relating to the heater is shown like any other system error by the error pin of the PLC interface (pin 13). You can find information regarding the display and correction of errors in the chapter "Error Situations" (see chapter 12, page 135).

PIN	Characteristic	Meaning	Status	Explanation
5	Input	Heater is switched ON or OFF	High	Heater will be activated
			Low	Heater will be deactivated
6	Output	Shows status of the heater	High	These three conditions must be met: • The heater is ON. • The current temperature has reached the target temperature. • The temperature value is stable.
			Low	At least one of the three conditions for "high" is not met. (From the signal alone, it is not possible to determine which condition is not met.)

Tab. 28:   Explanation of the heater pins

9.2.4 Select Pins

You can select setups via the select pins. The following shows the match-up between the setups and the select pin settings.

	Select 1 (PLC Input)	Select 2 (PLC Input)
Setup 1	Low	Low
Setup 2	Low	High
Setup 3	High	Low
Setup 4	High	High

Tab. 29:   Factory settings of the setups

9.3 Interface of the Cable Connection at the Valve: M12, 12-pin, A-coded

On top of the valve is the connector for the twelve pin Valve-Cable-1500, which connects valve and control unit. The Valve-Cable-1500 5m is responsible for supplying power to the valve as well as allowing the necessary sensor data transfer. You have to use this connector, if you want to use the valve without an MDC, controlling it via your XY-machine (see also paragraph 5.5, page 45).

The following figure shows the numbering of the pins, when you look at the connector of the valve (see Fig. 40).
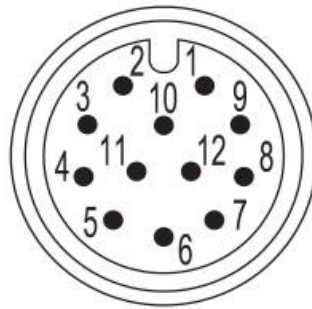
Fig. 40:   Connector for the Valve-Cable-1500 at the valve (pin numbers)

9.3.1 Pin Functions

PIN	Characteristics	Level	Function
1	Input	0/+24 V	Valve Trigger
2	Constant	Ground	Heater -
3	Measurement		PT100 Sense
4	_____	_____	Internal / Do Not Connect
5	_____	_____	Internal / Do Not Connect
6	_____	_____	Internal / Do Not Connect
7	_____	_____	Internal / Do Not Connect
8	Constant	Ground	Ground (valve)
9	Constant	24 V	Valve +
10	PWM	24 V max.	Heater +
11	Measurement		PT100 -
12	Measurement		PT100 +
Shield	Constant	Ground	Ground (shield)

9.4   Interface for an Electronic Pressure Regulator: M8, 6-pin, A-coded

With this interface at the back side of the MDC, you can control up to two electronic pressure regulators:

- One for the actuator pressure (e.g. Pressure regulating valve for actuator pressure MDV 15XX, order no. 1014936; pin 2 "Analog Output 1" and pin 3 "Analog Input 1")

- One for the cartridge pressure (e.g. Pressure regulating valve for cartridge pressure, order no. 1014655; pin 4 "Analog Output 2" and pin 5 "Analog Input 2")

To connect both pressure regulating valves, you need a Y-cable, the Connection Cable for Pressure Control Valves MDC 1500 (order no. 1014937). For further information, see paragraph 6, page 46.

9.4.1   Pin Functions

PIN	Characteristics	Level	Function
1	Ground	_____	Power and signal reference level
2	Output	0-10 V	Analog Output 1
3	Input	0-10 V	Analog Input 1
4	Output	0-10 V	Analog Output 2
5	Input	0-10 V	Analog Input 2
6	Power output	+24 V	Power for pressure regulator

10 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.

10.1 Preliminary Notes

IMPORTANT NOTE

Prepare cleaning in advance

We recommend preparing the cleaning procedure in advance. That way you can work quickly while your machine is offline.

⚠ **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 is available upon request (CTK 2.5, order code 1014632), which is of particular interest for all surfaces in direct contact with the fluid.

⚠ **WARNING**

Potential chemical reaction!

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

Before introducing aggressive purifying agents or solvents to the system, verify compatibility with the material of all adjacent parts. Refer to the list on Page 115.

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

10.2 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. 30:   Heat Resistance of Sealing Materials

10.3 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. 31:   Compatibility between Sealing Material and Selected Media

10.4 Cleaning Methods

The following methods are available:

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

For a thorough cleaning process you need:

- A cleaning tool kit CTK 2.5
- Nozzle insert cleaning wires (of the correct size)
- A lint-free cloth
- An ultrasonic bath
- A beaker with a compatible cleaning liquid (e.g. Isopropanol)
- A pointed pair of tweezers
- The necessary tools for mounting and demounting as recommended by VERMES (see paragraph 3.3, page 16).

10.4.1 Pre-purifying

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

⚠ **CAUTION**

Potential liquid spurts

During this procedure, liquid droplets may be expulsed!

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

Step 1:
- Complete the dispensing process. The valve is in closed position.
  Do NOT switch OFF the control unit.

Step 2:
- Separate the compressed-air connection from the cartridge.
- 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 to the cartridge as follows (use the same pressure as for dispensing or a slightly higher value).
- 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 **[Purge]**.

– Keep the **[Purge]**-key pressed until the procedure is complete and no more liquid flows out through the nozzle fixation nut.

INFORMATION

Closing with serial command

Alternatively, the procedure can be performed by the RS-232C interface. Use the commands MDV:OPEN and MDV:CLOSE 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.

10.4.2 Rinsing with a purifying agent

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

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

⚠ **WARNING**

Potential chemical reactions

Before the start of the procedure, carefully read the safety data sheets of the dispensed substance and the cleaning agent. 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 from the cartridge.
– The pressure must be reduced to 0 bar.
– Disconnect the PP adapter fitting from the cartridge.

Step 3:

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

⚠ **CAUTION**

Check for leaks

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

Step 4:

– Reinstall the compressed-air connection to the cartridge as follows (use the same pressure as for dispensing or a slightly higher value).

– 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 **[Purge]**.

– Keep the **[Purge]**-key pressed until the procedure is complete and no more liquid flows out through the nozzle unit.

INFORMATION

Closing with serial command

Alternatively, the procedure can be performed by the RS-232C interface. Use the commands MDV:OPEN and MDV:CLOSE 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.

10.4.3 Disassembling of the Valve

> ⚠ **CAUTION**
>
> **No dispensing medium residues**
>
> Before demounting the fluid box from the valve, make sure that no dispensing medium is left inside the system.

Preliminary steps:

- The dispensing process must be completed. The valve is in closed position.
- Switch OFF the control unit and disconnect it from the mains.
- Reduce the cartridge pressure to atmospheric pressure.
- Detach the valve with fluid box from dispensing robot
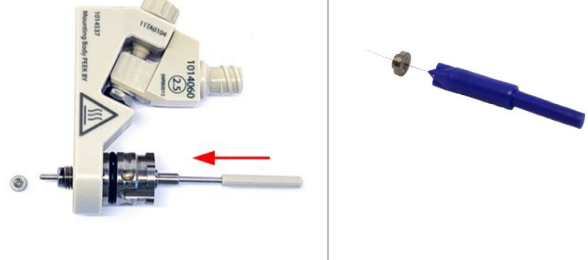
> ⚠ **CAUTION**
>
> **High temperatures, danger of burns**
>
> Be careful if you have used the heater with your application. The nozzle heater can reach temperatures of up to 99 °C. Do not touch this area before it has cooled, since there is the danger of severe burns. Use heat resistant gloves.

Disassemble the valve as follows.

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

	Step 3 (cartridge) Unscrew the cartridge counter-clockwise and remove it from the fluid box. If necessary, use the MDT 309 - Cartridge locking pin. **Important note!** Make sure that no medium spills into the machine, especially when using a low viscous dispensing medium.
	Step 4 (tappet) Pull the tappet from the fluid box. Pull the tappet spring from the tappet rod.
	Step 5 (nozzle fixation nut) Remove the nozzle fixation nut by screwing counter-clockwise. Use the MDT 327 - Multi-Function Tool.
	Step 6 (nozzle insert) Use the thin end of MDT 323 - Nozzle Insert – Squeezing Out Tool TA, to push out the nozzle insert from the fluid box. **Important note!** Immediately use a cleaning wire to push through the channel of the nozzle insert, to avoid hardening of residue medium.
	Step 7 (tappet centering screw) Unscrew the Tappet Centering Screw BY from the fluid box (counter-clockwise). Use the MDT 303 - Nozzle Insert Changing Tool. The three pins of MDT 303 have to fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 counter-clockwise while pressing it down slightly to the fluid box. Combine the MDT 303 with MDT 327 for a better leverage.
	Step 8 (tappet sealing and tappet centering piece) Disengage the tappet centering piece and tappet sealing from the fluid box. Use the thicker side of tool MDT 323 (as shown) or the thicker end of the MDT 328. **Important note!** When using a 2G Tappet rod, you do not need a tappet centering piece.

	Step 9 (cartridge base) Unscrew the tightening screw with the help of the MDT 327, rotating counter-clockwise. Remove the tightening screw and the cartridge base from the fluid box.
	Important note! If you use a Cartridge Base CH, you need to screw off the fluid box connector Luer Lock. Unscrew it (counter-clockwise) with the open-ended wrench of the MDT 327 (hexagon screw size M8).
	Step 10 (O-ring) Remove the O-ring from the fluid box body. Pull it off carefully with a pair of tweezers. Be careful not to damage the O-ring. **Caution!** You could omit this step, only if the solvent you use is compatible with the material of the O-ring.
	Unusual (connector BY) Usually you will **not** remove the Connector BY (see arrow) and the fluid box body. In case the connector is clogged, use MDT 327 to screw it out (counter-clockwise).

Tab. 32: Disassembling of the valve

⚠ **CAUTION**

Damaged tappet sealing

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

10.4.4 Fine Purification

First, 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 nozzle insert, tappet sealing, tappet centering piece, cartridge base, tightening screw, nozzle fixation nut and the fluid box body in the beaker.

> ⚠ **CAUTION**
>
> **Damage of O-ring/tappet sealing**
>
> Unless the compatibility between the O-ring/tappet sealing and the solvent is excellent, do not insert the O-ring/tappet sealing into the solvent.

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

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

> ⚠ **WARNING**
>
> **High temperature, danger of burns**
>
> Be aware of your dispensing medium when setting the temperature, if the dispensing medium is inflammable. Otherwise, with too high temperatures deflagration might occur. Set the temperature as low as possible within the effective range.
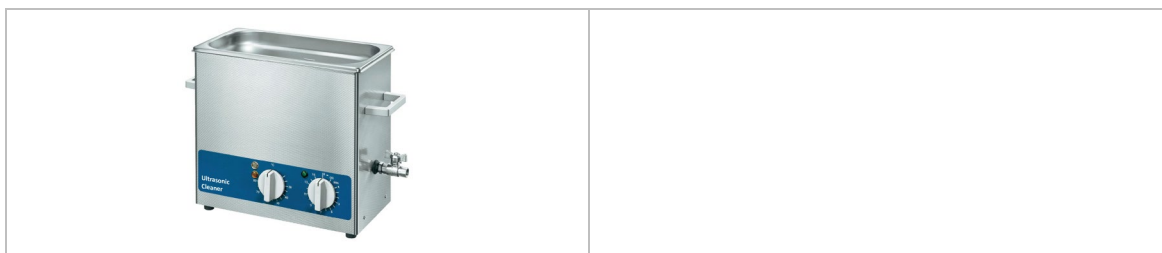
– Take the beaker with the components out of the ultrasonic bath. Then use tweezers to take the components out of the beaker.

Next, clean all components by hand.

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

INFORMATION

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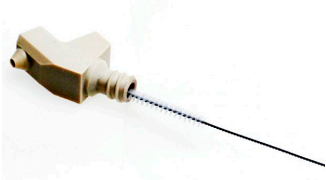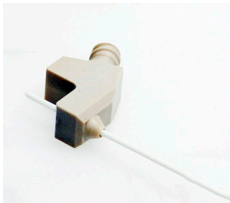
For some uncomplicated media it is possible to clean the parts just by using a fluid like ethanol and compressed air, which can simplify the cleaning process. Before you try it, you should always contact our Technical Support.

INFORMATION

Nozzle inserts with small openings

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

cleaning, please clean it with MDT 316 - Nozzle Insert Cleaning Tool. For operating the MDT 316 please refer to the "Quick Reference Guide – MDT 316 - Nozzle Insert Cleaning Tool".
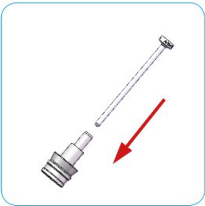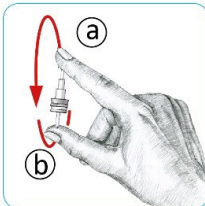
	Step 1 (nozzle insert) Start with the nozzle insert. For the bore use a nozzle insert cleaning wire. These come with different sizes. They are not part of the cleaning toolkit CTK and have to be ordered separately. **Important note!** Use the MDT 324 - Nozzle Insert Cleaning Holder with all Vermes nozzle inserts. With it, you can safely keep the nozzle insert in place during cleaning and drying with compressed air. Clean the surface of the inner channel using a fluidic brush. Clean it thoroughly from above and below with a cleaning rod.
	Step 2 (nozzle fixation nut) Clean the nozzle fixation nut. Use a cleaning rod to clean the inside/outside of the nozzle fixation nut. Pay special attention to sharp corners and edges.
	Push a fluid box cleaner through the opening of the nozzle fixation nut to remove persistent residues.
	Clean the bore of the nozzle fixation nut using a fluidic brush.
	Step 3 (fluid box body) With the fluid box, clean all bores and threads with a fluidic brush first.
	Afterwards, use a fluid box cleaner. Check all bores as well and then clean the rest of the fluid box body.

Step 4 (cartridge base)
For the cartridge base, start with the fluidic brush to clean all bores and openings of the cartridge base.

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

Important note!
If you use a cartridge base without integrated luer lock, you need to clean the Fluid Box Connector Luer Lock as follows. Otherwise, you can continue with next step.

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

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

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

Step 5 (tappet sealing and tappet centering piece)
For the tappet sealing, clean the bore of the tappet sealing carefully with a fluidic brush.

Afterwards, clean the outside of the tappet sealing. Keep using the fluidic brush, especially for the outer edge.

Then clean the inner rim of the tappet sealing with a cleaning rod.

	Clean the outside of the tappet centering piece first with a lint-free cloth.
	Use a fluidic brush for the bore of the tappet centering piece. **Important note!** There is no tappet centering piece, if you use a 2G tappet rod.
	Step 6 (valve body) Clean the valve with a lint-free cloth.
	Step 7 (O-ring) Clean all O-rings with a lint-free cloth.

Tab. 33:   Clean all components by hand

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

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

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

Tab. 34:   Two-Finger-Seesaw-Test
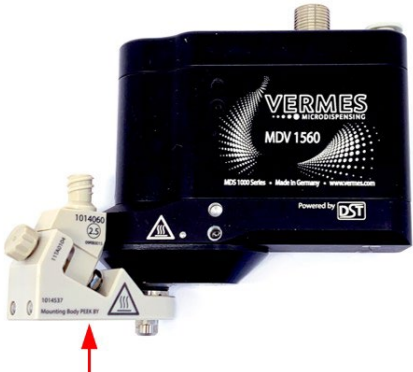
In case you still have parts, which are not completely clean after the fine purification, repeat the corresponding cleaning steps for those components several times, if necessary. If that is still not helping, contact our Technical Support.

10.4.5 Assembling of the Valve

Re-assemble the valve and its components as follows.

	Unusual (connector BY) In the exceptional case that you removed the connector BY as well, you have to mount it first. Push the fluid box body into the mounting body PEEK (there is only one mounting direction possible). Fasten it by screwing in the Connector BY with the use of the MDT 327 (torque stainless steel 90 – 100 cN.m, PEEK 70 – 80 cN.m). Make sure the Connector BY fits into the bore of the fluid box body. **Important Note!** For the connector BY to correctly grip into the fluid box body, you may **not** press the fluid box body tightly into the mounting body. There needs to be a small gap between the mounting body and the Fluid box body.
	Step 1 (O-ring) In case that you removed the O-ring, you have to mount it onto the fluid box body. Pull the O-Ring-BY over the fluid box body with a pair of tweezers.
	Step 2 (cartridge base) Mount the cartridge base onto the fluid box. Use MDT 327 or the MDT 306 - Torque Wrench Tool VM with BitVM-A (torque 110 – 120 cN.m) to fix the cartridge base with the tightening screw PEEK by screwing clockwise.
	Important Note! If you use a cartridge base without integrated luer lock, you need to screw the Fluid Box Connector Luer Lock into the top bore of the cartridge base. Use the open-ended wrench of the MDT 327 (hexagon screw size M8, torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m).

	Step 3 (tappet sealing) Push the Tappet Sealing PE/PTFE/HT with the wider side down onto the pin of an MDT 328 - Tappet Sealing Changing Tool. Push the MDT 328 with the tappet sealing straight into the fluid box. When the tappet sealing sits tight, you will hear a light noise.
	Step 4 (tappet centering piece) Press the tappet centering piece into the fluid box body. Use the MDT 328 to make sure the tappet centering piece rests flat on the tappet sealing. **Important note!** When using a 2G Tappet rod, you do not need a tappet centering piece.
	Step 5 (tappet and tappet centering screw) Screw the Tappet Centering Screw BY into the fluid box. Do not screw it tight yet. Screw it only for two rotations.
	Important note! Before mounting, please 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 (for placing see blue arrows in the picture). Make sure that the tappet tip is free of grease. Rotate the tappet and pull it in and out for three times to spread the grease. Place the tappet spring onto the tappet centering screw BY.
	Push the tappet rod through the tappet spring into the fluid box. Make sure the tappet goes through the tappet sealing.
	Screw the Tappet Centering Screw BY completely into the fluid box (torque 100 – 120 cN.m). Use MDT 303 - Nozzle Insert Changing Tool. The three small pins of MDT 303 have to fit in exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 clockwise while pressing it down slightly to the

	fluid box. Combine the MDT 303 with MDT 327 for a better leverage. Alternatively, you can use the MDT 306 with BitVM-B.
	Step 6 (nozzle insert) Pick up the nozzle insert with tweezers, clip it into the fluid box. Use the small hole of MDT 327 to press the nozzle insert to make sure the it sits flat.
	Step 7 (nozzle fixation nut) Screw the nozzle fixation nut clockwise onto the fluid box. Use MDT 327 - Multi-Function Tool. Alternatively, use the MDT 306 - Torque Wrench Tool VM with Bit Hexagon Socket (torque 150 – 180 cN.m).
	Step 8 (fluid box) Push the fluid box carefully in a 45° angle onto the valve. Make sure that the fluid box sits correctly inside the valve and touches the frame. There will be a resistance due to a spring inside the valve. This is easier, if you slightly lower the actuator pressure first.
	Straighten the fluid box until it latches in. Alternately, you can mount the fluid box rectangular to the right or to the left. This would also affect the position of the cartridge holder (see "Optional positions" in the end of the table).

	Step 9 (cartridge) Push the cartridge into the cartridge holder and screw it onto the fluid box (clockwise).
	Step 10 (Adapter for compressed air) Screw the Adapter for Compressed Air onto the cartridge (clockwise). Make sure it sits tight.
	Assembling completed The completely assembled valve with the fluid box in straight position.
	Optional positions Alternately, you can mount the fluid box rectangular to the left (picture left) or to the right (picture right). Then the complete assembly would look like this. Be aware that you have to switch around the cartridge holder to mount it for the right position.

Tab. 35:   Assembling of the valve

11 Maintenance

We suggest to clean and to check your system regularly, especially wearing parts like nozzle insert, sealing and tappet. This chapter gives you an overview of the wearing parts that require high attention. To help you with these regular check-ups, you can set a service interval of your choosing, which is shown at the MDC (see paragraph 11.1, page 131).

11.1 Service Interval

With the service interval, you can set a counter, after how many shots you want to make a regular check of your system. You can set the number yourself. The highest possible value you can enter is 4000000000.

INFORMATION

New service interval resets the service counter

When you set a new service interval, the service counter is reset automatically to zero.

You have two ways to set the service interval and to check on it, via the menu of the MDC or via the RS-232C interface.

Service interval via menu of the MDC

To set a service interval, go to the submenu "General Settings" (see paragraph 4.5.2, page 29). There find the menu item "Service" and press the **[Enter]**-key. Set the new value and confirm it with **[Enter]**. In case you set the service interval to 0, the display shows "OFF".

To check how many shots are left in your service interval, go to the submenu "System Information" (see paragraph 4.5.3, page 32). There go to the menu item "Service In".

You can see the status of the service interval also in the menu in the "Setup" submenus (see paragraph 4.5.4, page 33). There is a progress bar to show the setting (see Fig. 41). In case the service interval is deactivated, the progress bar is not displayed (see Fig. 42).
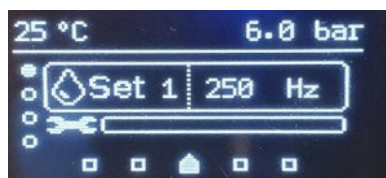
Fig. 41:   Progress bar service interval
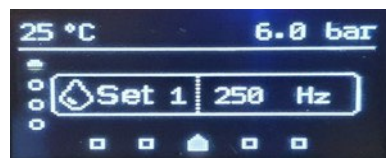
Fig. 42:   Progress bar service interval deactivated

Service interval via RS-232C

To set and check the service interval via RS-232C commands, you have three serial commands (see paragraph 9.1.2, page 77).

To set a service interval:

MDV:SERVICE <interval>

To check the service interval:

MDV:SERVICE?

To check the shots left for the current service interval:

MDV:SERVICEIN?

Alternatively, you can use the service interval, to track how many shots are still left of your warranty of a new or overhauled system. After you receive the system, simply set the number of shots from the respective warranty as service interval.

11.2 Maintenance of Tappet, Tappet Sealing and Nozzle Insert

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

11.2.1 Maintenance of the Tappet

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

Fig. 43:   Example - TTF Tappet (consists of tappet rod and tappet spring)

11.2.2 Maintenance of the Tappet Sealing

For replacement of tappet sealings a particular counter is not provided, as the necessity depends on current applications, substances to be dispensed etc. Caused by the tappet movement, some materials tend to penetrate between tappet and tappet sealing, giving rise to abrasion. Therefore, you have to inspect the tappet sealing from time to time. To continue working with a damaged tappet sealing inevitably entails unexpected interruptions, loss of material and an increased need of cleaning.
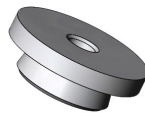
Fig. 44:   Example - Tappet Sealing PE

11.2.3 Maintenance of the Nozzle Insert

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

Fig. 45:   Example - Nozzle Insert N11

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

For the necessary steps of de-/mounting the tappet/tappet sealing/nozzle insert, please see paragraph 10.4.3, page 119. Before disassembling the system, perform the cleaning procedure explained in the same chapter. There you will also find the necessary information of how to clean the tappet/tappet sealing/nozzle insert.

12 Error Situations

The following pages list all the error messages you could encounter when using this system. The table in paragraph 12.1, page 136 will give you a quick overview. In paragraph 12.2, page 137, every error message is explained in detail.

In case of an error, the red error control lamp on the front side of the MDC starts flashing. This information can also be obtained via pin 13 of the PLC interface (see paragraph 9.2.1 "Pin Functions", page 106).

There are three different levels of priority for errors. Priority 1 is the lowest and priority 3 is the highest. The first digit of the error code shows the priority level. Beginning at error priority 2, an error message appears in the display (unless the error affects the display as well).

- Errors of priority level 1 concern information and are only saved in the background. (Exceptions: 1000513 and 1000514. Since they cannot be saved, they are shown on the display.)

- Errors of priority level 2 appear on the display and have to be confirmed.

- Errors of priority level 3 are so serious that the dispensing process is disrupted (e.g. because the heater or the pressure supply are affected).

For some errors of priority 3, you cannot simply confirm the error message by pressing **[Enter]** to clear the display. Instead pressing **[Enter]** leads you to 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). We recommend checking the relevant serial numbers (e.g. MDC and MDV) and the firmware revision before contacting the support.

The seven-digit error code also shows which module is affected by the error. You can see it in the fourth and fifth digit of the error code (see Tab. 36).

For example, the error code 3000102 (ERROR_VALVE_PLUGGEDOUT) concerns the valve and has a priority level of 3.

Module	4th and 5th digit
Valve	01
Heater	02
Pressure system	03
MDC/Whole system	04
Internal communication	05
External communication	06

Tab. 36:   Module affected by the error

At the end of the chapter, the heater safety routines are explained, to make sure that the potentially high temperatures do not pose a safety risk.

12.1 Table of Error Messages

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

Error Code	Message in display	Related to	When?
1000402	-	MDC/Whole system	Start-up
1000403	-	MDC/Whole system	Start-up
1000404	-	MDC/Whole system	Operation
1000405	-	MDC/Whole system	Start-up
1000413	-	MDC/Whole system	Operation
1000501	-	Internal communication	Operation
1000511	-	Internal communication	Start-up
1000512	-	Internal communication	Operation
1000513	SYSTEM, ERROR LOG	Internal communication	Operation
1000514	VALVE, ERROR LOG	Internal communication	Operation
1000515	-	Internal communication	Operation
1000516	-	Internal communication	Operation
1000601	-	External communication	Operation
1000602	-	External communication	Operation
1000603	-	External communication	Operation
2000203	HEATER, HEATER ERROR	Heater	Operation
2000304	ACTUATOR, PRESSURE SUPPLY	Pressure system	Operation
2000406	VOLTAGE, TOO LOW	MDC/Whole system	Operation
2000412	SYSTEM, BEEPER ERROR	MDC/Whole system	Operation
3000101	VALVE, HIGH TEMPERATURE	Valve	Operation
3000102	- (shows plugin/plugout animation)	Valve	Operation
3000103	SYSTEM, INTERNAL ERROR	Valve	Operation
3000104	SYSTEM, INTERNAL ERROR	Valve	Operation
3000105	SYSTEM, INTERNAL ERROR	Valve	Operation
3000106	VALVE, INVALID DATA	Valve	Operation
3000201	SYSTEM, INTERNAL ERROR	Heater	Operation
3000202	HEATER, HIGH TEMPERATURE	Heater	Operation
3000301	ACTUATOR, PRESSURE LIMIT	Pressure system	Operation
3000302	ACTUATOR, LOW PRESSURE	Pressure system	Operation
3000303	ACTUATOR, HIGH PRESSURE	Pressure system	Operation
3000401	SYSTEM, BOOTUP ERROR	MDC/Whole system	Start-up
3000407	SYSTEM, BOOTUP ERROR	MDC/Whole system	Start-up
3000408	SYSTEM, BOOTUP ERROR	MDC/Whole system	Start-up
3000409	SYSTEM, KEYPAD ERROR	MDC/Whole system	Operation
3000410	SYSTEM, BOOTUP ERROR	MDC/Whole system	Start-up
3000411	SYSTEM, BOOTUP ERROR	MDC/Whole system	Start-up
3000414	SYSTEM, INTERNAL ERROR	MDC/Whole system	Operation
3000505	SYSTEM, INTERNAL ERROR	Internal communication	Operation
3000506	SYSTEM, INTERNAL ERROR	Internal communication	Start-up
3000507	SYSTEM, INTERNAL ERROR	Internal communication	Start-up
3000508	SYSTEM, INTERNAL ERROR	Internal communication	Operation
3000509	SYSTEM, INTERNAL ERROR	Internal communication	Operation
3000510	SYSTEM, INVALID DATA	Internal communication	Operation
3000517	SYSTEM, INTERNAL ERROR	Internal communication	Operation
3000518	SYSTEM, INTERNAL ERROR	Internal communication	Operation
3000519	SYSTEM, DISPLAY ERROR	Internal communication	Operation
3000520	SYSTEM, REGULATOR ERROR	Internal communication	Operation
3000521	SYSTEM, LED ERROR	Internal communication	Operation
3000522	SYSTEM, INTERNAL ERROR	Internal communication	Operation

12.2 Explanations of Error Messages

1000402	**System error**
This error appears during the start-up of the system. The error happens, if an external signal had caused a reset of the processor.	
Error code display:	-
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During start-up
Error handling:	• No action necessary, this error does not affect the dispensing process

1000403	**System error**
This error appears during the start-up of the system. The error happens, if a problem had caused a reset of the processor.	
Error code display:	-
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During start-up
Error handling:	• No action necessary, this error does not affect the dispensing process

1000404	**System error**
This error appears during the operation of the system. The error happens, if a problem has caused a malfunctioning of the processor clock.	
Error code display:	-
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000405	**System error**
This error appears during the start-up of the system. The error happens, if a voltage drop at the processor had caused a reset.	
Error code display:	-
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During start-up
Error handling:	• No action necessary, this error does not affect the dispensing process

1000413	System error
This error appears during the operation of the system. The error happens, when there is a problem with refreshing the user interface of the control unit.	
Error code display:	-
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000501	Internal error
This error appears during the operation of the system. The error happens, if a problem occurs with the initialization of the on board communication modules.	
Error code display:	-
Relates to:	Internal communication
Consequences:	• On board communication might be disturbed
Happens when?	During operation
Error handling:	• If relevant display parts are affected (e.g. pressure sensor readings), re-start the control unit

1000511	Internal error
This error appears during the start-up of the system. The error happens, if a problem occurs with the reading of prior saved errors from the control unit.	
Error code display:	-
Relates to:	Internal communication
Consequences:	-
Happens when?	During start-up
Error handling:	• No action necessary, this error does not affect the dispensing process

1000512	Internal error
This error appears during the operation of the system. The error happens, if a problem occurs with the reading of prior saved errors from the valve.	
Error code display:	-
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000513	Internal error
This error appears during the operation of the system. The error happens, if a problem occurs within the control unit. **Important Note!** This error cannot be recorded internally. Therefore, this error is shown on the display, despite only being an error of priority 1.	
Error code display:	SYSTEM – ERROR LOG
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad.

1000514	Internal error
This error appears during the operation of the system. The error happens, if a problem occurs with the internal communication in the valve. **Important Note!** This cannot be recorded internally. Therefore, this error is shown on the display, despite only being an error of priority 1.	
Error code display:	VALVE – ERROR LOG
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad.

1000515	Internal error
This error appears during the operation of the system. The error happens, if a problem occurs within the control unit.	
Error code display:	-
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000516	Internal error
This error appears during the operation of the system. The error happens, if a problem occurs with the internal communication in the valve.	
Error code display:	-
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000601	Communications error
This error appears during the operation of the system. The error happens, if a problem occurs with the data transfer via the RS-232C interface.	
Error code display:	-
Relates to:	External communication
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000602	Communications error
This error appears during the operation of the system. The error happens, if a timeout occurs during the communication via the RS-232C interface.	
Error code display:	-
Relates to:	External communication
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

1000603	Communications error
This error appears during the operation of the system. The error happens, if a buffer overflow occurs during communication via the RS-232C interface.	
Error code display:	-
Relates to:	External communication
Consequences:	-
Happens when?	During operation
Error handling:	• No action necessary, this error does not affect the dispensing process

2000203	Heater error
This error appears during the operation of the system. The error happens, if there is a problem with the heating, while the heater is switched on.	
Error code display:	HEATER – HEATER ERROR
Relates to:	Heater
Consequences:	• Heater is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the control unit. • Do **not** turn on the heater, before you have re-started the control unit.

2000304	Pressure error
This error appears during the operation of the system. The error happens, if there is not enough pressure at the pressure regulator to achieve the set target pressure. **Important Note!** This error can only happen, if there is an electronic pressure regulator attached. **Important Note!** It is possible that the error disappears on its own, in case it was just a one-time pressure loss.	
Error code display:	ACTUATOR – PRESSURE SUPPLY
Relates to:	Pressure system
Consequences:	• Dispensing is not allowed
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Make sure there is enough supply pressure for the pressure regulator.

2000406	Voltage error
This error appears during the operation of the system. The error happens, if there is not enough voltage reaching the control unit. **Important Note!** It is possible that the error disappears on its own, in case it was just a one-time voltage loss.	
Error code display:	VOLTAGE – TOO LOW
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Check your power supply. You might have to unplug it and to plug it in again. • If it happens repeatedly, contact the Technical Support (see Page 7)

2000412	Beeper error
This error appears during the operation of the system. The error happens, if there is a problem with the responses from the beeper, which gives a warning sound in certain occasions (e.g. when the status control lamp starts blinking).	
Error code display:	SYSTEM – BEEPER ERROR
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • If it happens again, re-start the control unit.

3000101	Valve error - overtemp
This error appears during the operation of the system. The error happens, when the valve becomes too hot. For this reason, the control unit checks if the frame temperature surpasses the allowed value (default is 100 °C).	
Error code display:	VALVE – HIGH TEMPERATURE
Relates to:	Valve
Consequences:	• Heater is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Let the valve cool down for a few minutes. • In case the error appears again, check your dispensing parameters. Could you lower the dispensing frequency? If you cannot find a solution, contact our Technical Support (see Page 7).

3000102	Valve error – plugged out
This error appears during the operation of the system. The error happens, when the valve is not connected to the control unit.	
Error code display:	*Plugin/plugout animation is shown*
Relates to:	Valve
Consequences:	• Heater is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Connect the valve and press the **[Enter]**-key. • If you press the **[Back]**-key, you cannot dispense, but you can enter the menu of the control unit (e.g. to check information or to change parameters). • In case the error appears although the valve is connected, check the cable connection. • In case the error appears again, although the valve is connected **correctly**, contact our Technical Support (see Page 7).

3000103	**Valve error**
This error appears during the operation of the system. The error happens, if a problem occurs during the initialization of the valve.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Valve
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the control unit. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000104	**Valve error**
This error appears during the operation of the system. The error happens, if a serious problem occurs within the valve.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Valve
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the control unit. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000105	**Valve error**
This error appears during the operation of the system. The error happens, if a serious problem occurs within the valve.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Valve
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the control unit. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000106	Valve error – invalid data
This error appears during the operation of the system. The error happens, if there is a problem with the data from the valve.	
Error code display:	VALVE – INVALID DATA
Relates to:	Valve
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Unplug the valve and plug it back in again. • Re-start the control unit. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000201	Heater error
This error appears during the operation of the system. The error happens, if a problem occurs while reading the temperature from the heater.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Heater
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the control unit. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000202	Heater error - overtemp
This error appears during the operation of the system. The error happens, if the temperature of the heater rises too high (150 °C or higher).	
Error code display:	HEATER – HIGH TEMPERATURE
Relates to:	Heater
Consequences:	• Heater is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Wait until the heater has cooled down (below 90 °C). • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000301	Actuator pressure alert
This error appears during the operation of the system. The error happens, if the actuator pressure is not within the limits set by the pressure alert. **Important Note!** This error happens mostly in applications with a very high dispensing frequency, since then pressure fluctuations are more likely to happen.	
Error code display:	ACTUATOR – PRESSURE LIMIT
Relates to:	Pressure system
Consequences:	• Cartridge pressure is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Check the pressure supply. Are there pressure fluctuations? • Reset the target pressure. • Check if you could work with a lower dispensing frequency. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000302	Actuator pressure low
This error appears during the operation of the system. The error happens, if the actuator pressure is below the necessary minimum pressure (default 1500 mbar). **Important Note!** This error happens mostly if the compressed air supply is not sufficient. **Important Note!** It is possible that the error disappears on its own, in case it was just a one-time pressure loss.	
Error code display:	ACTUATOR – LOW PRESSURE
Relates to:	Pressure system
Consequences:	• Cartridge pressure is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Check the pressure supply. Are there pressure fluctuations? • Reset the target pressure. • Check if you could work with a lower dispensing frequency. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000303	Actuator pressure high
This error appears during the operation of the system. The error happens, if the actuator pressure is above the allowed maximum pressure (default 8000 mbar). **Important Note!** It is possible that the error disappears on its own, in case it was just a one-time pressure loss.	
Error code display:	ACTUATOR – HIGH PRESSURE
Relates to:	Pressure system
Consequences:	• Cartridge pressure is turned off • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Check the pressure supply. Are there pressure fluctuations? • Reset the target pressure. • Check if you could work with a lower dispensing frequency. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000401	Booting error
This error appears during the start-up of the system. The error happens, when there is a problem while booting the system. **Important Note!** With this error it is undefined which modules might be affected. Therefore, re-start the system.	
Error code display:	SYSTEM – BOOTUP ERROR
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During start-up
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Change to Setup 1 and re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000407	Keypad error

This error appears during the start-up of the system. The error happens, when there is a problem with the initialization of the keypad.

Important Note!

This error is automatically followed by the error 3000401 ERROR_BOOTING. Look there for further details. The error code 3000407 will only appear in the error log, which you can request via the RS-232C interface.

Error code display:	SYSTEM – BOOTUP ERROR
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During start-up
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Change to Setup 1 and re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000408	Booting error

This error appears during the start-up of the system. The error happens, when there is a problem with the parts of the MDC during the booting.

Important Note!

This error is automatically followed by the error 3000401 ERROR_BOOTING. Look there for further details. The error code 3000408 will only appear in the error log, which you can request via the RS-232C interface.

Error code display:	SYSTEM – BOOTUP ERROR
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During start-up
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Change to Setup 1 and re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000409	Keypad error
This error appears during the operation of the system. The error happens, when there is a problem with reading the entries of the keypad.	
Error code display:	SYSTEM – KEYPAD ERROR
Relates to:	MDC/Whole system
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000410	Booting error
This error appears during the start-up of the system. The error happens, when there is a problem with the parts of the MDC during the booting. **Important Note!** This error is automatically followed by the error 3000401 ERROR_BOOTING. Look there for further details. The error code 3000410 will only appear in the error log, which you can request via the RS-232C interface.	
Error code display:	SYSTEM – BOOTUP ERROR
Relates to:	MDC/Whole system
Consequences:	• LEDs are not working properly
Happens when?	During start-up
Error handling:	• In case the control lamps are not working properly, check the error log if this error happened. • Change to Setup 1 and re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000411	Booting error
This error appears during the start-up of the system. The error happens, when there is a problem with the parts of the MDC during the booting. **Important Note!** This error is automatically followed by the error 3000401 ERROR_BOOTING. Look there for further details. The error code 3000411 will only appear in the error log, which you can request via the RS-232C interface.	
Error code display:	SYSTEM – BOOTUP ERROR
Relates to:	MDC/Whole system
Consequences:	• Display is not working properly
Happens when?	During start-up
Error handling:	• In case the display is not working properly, check the error log if this error happened. • Change to Setup 1 and re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000414	System error
This error appears during the operation of the system. The error happens, when there is an undefined problem in the system.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	MDC/Whole system
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000505	Internal error
This error appears during the operation of the system. The error happens, when there is a problem in the internal communication module.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000506	Internal error
This error appears during the start-up of the system. The error happens, when there is a problem with the initialization of the control unit.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During start-up
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000507	Internal error
This error appears during the start-up of the system. The error happens, when there is a problem with the re-start of the control unit and the system has to use the factory settings.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During start-up
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000508	Internal error
This error appears during the operation of the system. The error happens, when there is a serious problem with the internal communication.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000509	Internal error
This error appears during the operation of the system. The error happens, when there is a serious problem with the internal communication.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000510	Internal error
This error appears during the operation of the system. The error happens, when there is a serious problem with the internal communication.	
Error code display:	SYSTEM – INVALID DATA
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000517	Internal error
This error appears during the operation of the system. The error happens, when there is a problem during the internal communication with the pressure sensor for the actuator pressure.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000518	Internal error
This error appears during the operation of the system. The error happens, when there is a problem during the internal communication with the pressure sensor for the ambient pressure.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000519	Display error
This error appears during the operation of the system. The error happens, when there is a problem with a buffer overflow during the internal communication with the display.	
Error code display:	SYSTEM – DISPLAY ERROR
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000520	Regulator error
This error appears during the operation of the system. The error happens, when there is a problem with the internal communication with the actuator regulator.	
Error code display:	SYSTEM – REGULATOR ERROR
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000521	LED error
This error appears during the operation of the system. The error happens, when there is a problem during the internal communication with the regulation of the control lamps.	
Error code display:	SYSTEM – LED ERROR
Relates to:	Internal communication
Consequences:	-
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

3000522	Internal error
This error appears during the operation of the system. The error happens, when there is a serious problem with the internal communication.	
Error code display:	SYSTEM – INTERNAL ERROR
Relates to:	Internal communication
Consequences:	• Heater is turned off • Pressure is turned off (actuator and cartridge) • Dispensing is stopped
Happens when?	During operation
Error handling:	• Press the **[Enter]**-key or the **[Back]**-key of the keypad. • Re-start the system. • In case the error appears repeatedly, contact our Technical Support (see Page 7).

12.3 Heater Safety Routines

There are several safety routines for the heater, to avoid unnecessary risks.

- If the heater is on, while the valve is unplugged, the heater will be deactivated.

- If the actuator temperature rises too high (> 100 °C), the heater will be deactivated.

- If the heater is on, while you switch off the MDC with the **[Power]**-key, the heater will be deactivated as well.

- In case of a power failure, heater and pressure supply will be deactivated first right away, to decrease the load and give the MDC the time for a power failure routine.

13 Transport, Storage and Disposal

13.1 Transport

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

– If the original packaging is no longer available, select a suitable material for the package.

– Pack in a way that protects the delivery against shock and vibrations.

– Fill empty spaces with appropriate material (e.g. paper, insulating air cushion, Styrofoam).

– Decontaminate the system completely before shipping it.

– Fill out the corresponding form completely (see paragraph 15.12, page 177). Attach it, clearly visible, at the exterior of the package.

⚠ **CAUTION**

Decontamination

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

13.2 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.

13.3 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.

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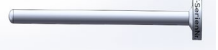
Here are some of the most important spare and extra parts as well as tools. For the latest and complete list, please check our homepage at www.vermes.com.

14.1 Nozzle Fixation Nuts

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

Tab. 37: Nozzle Fixation Nuts
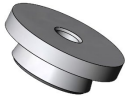
14.2 Tappets

Tappet rod CTF CTF 0 Order no. 1016089 CTF 4 Order no. 1013126 CTF 7 Order no. 1013125 CTF10 Order no. 1013124 CTF15 Order no. 1012884	**Tappet rod TTF** TTF 0 Order no. 1015963 TTF 4 Order no. 1012892 TTF 7 Order no. 1012891 TTF10 Order no. 1012890 TTF15 Order no. 1012889 TTF20 Order no. 1013185 TTF23.5 Order no. 1015125 TTF30 Order no. 1016497	**Tappet rod SNTF** SNTF 0 Order no. 1018090 SNTF 4 Order no. 1014240 SNTF 7 Order no. 1014243 SNTF10 Order no. 1014244 SNTF15 Order no. 1014245 SNTF 23.5 Order no. 1015752
Tappet rod 2G CTF 2G CTF 4 Order no. 1015241 2G CTF 7 Order no. 1015242 2G CTF10 Order no. 1015243 2G CTF15 Order no. 1015244	**Tappet rod 2G TTF** 2G TTF 4 Order no. 1015235 2G TTF 7 Order no. 1015236 2G TTF10 Order no. 1015218 2G TTF15 Order no. 1015217	**Tappet rod 2G SNTF** 2G SNTF 4 Order no. 1015253 2G SNTF 7 Order no. 1015254 2G SNTF10 Order no. 1015255 2G SNTF15 Order no. 1015256
Tappet rod 2G CTF + 10 mm 2G CTF 4 +10 mm Order no. 1015644 2G CTF 7 +10 mm Order no. 1015645 2G CTF 10 +10 mm Order no. 1015646 2G CTF 15 +10 mm Order no. 1015647 (only compatible with 1015316)	**Tappet rod 2G TTF + 10 mm** 2G TTF 4 +10 mm Order no. 1015639 2G TTF 7 +10 mm Order no. 1015640 2G TTF 10 +10 mm Order no. 1015641 2G TTF 15 +10 mm Order no. 1015642 (only compatible with 1015316)	**Tappet rod 2G SNTF + 10 mm** 2G SNTF 4 +10 mm Order no. 1015648 2G SNTF 7 +10 mm Order no. 1015649 2G SNTF 10 +10 mm Order no. 1015650 2G SNTF 15 +10 mm Order no. 1015651 (only compatible with 1015316)

Tappet spring	**Tappet centering screw**	**Tappet Grease TF**
TF-PR Order no. 1014620 SN Order no. 1017165 SB Order no. 1014748 (blue)	BY (stainless steel) Order no. 1014228 HM-BY (carbide) Order no. 1014679 23.5 BY Order no. 1014709 2G BY Order no. 1015221	1 ml Order no. 1014637 10 ml Order no. 1014636 310 ml Order no. 1014635
Tappet centering screw 2G BY +10 mm Order no. 1015316		

Tab. 38:   Tappets

14.3 Sealings

Tappet sealing PE Order no. 1007067 PTFE Order no. 1010247	**Tappet Centering Piece PEEK** Order no. 1009419	**Tappet sealing HT** Order no. 1015823
O-Ring-BY NBR Order no. 1014226 (black) Viton Order no. 1014385 (green)		

Tab. 39:   Sealings
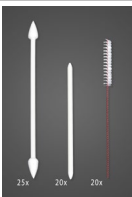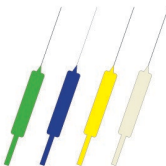
14.4 Supply Unit

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)	**Cartridge Holder 1500** 30 ccm Order no. 1014499 10 ccm Order no. 1014498 5 ccm Order no. 1014713	**Fluid Box Connector CH-HO** Order no. 1014352
Connector BY Order no. 1014234	**Cartridge Base CHI-HT** Order no. 1014517	**Cartridge Base CHI** Order no. 1014060
Cartridge Base CH Order no. 1015638	**Fluid Box Body MDF 1500-BY** 1500-BY-20 Order no. 1014623 1500-BY-30 Order no. 1016111 1500-BY-40 Order no. 1014538 1500-BY-60 Order no. 1014624 1500-BY-20+10mm Order no. 1015421 1500-BY-30+10mm Order no. 1017152 1500-BY-40+10mm Order no. 1015127	**Mounting Body** BY Order no. 1014369 PEEK-BY Order no. 1014537

Double Channel Fluid Box Body MDF 1500-BY	Adapter Safe for compressed air	Tightening Screw
1500-BY-40 Order no. 1016196 1500-BY-60 Order no. 1016197	3 ccm Order no. 1014953 5 ccm Order no. 1014952 10 ccm Order no. 1014951 30/55 ccm Order no. 1014950	PEEK Order no. 1013487 PEEK (with insert) Order no. 1013139 Stainless Steel Order no. 1010027

Tab. 40:   Supply unit

14.5 Cleaning Tools

CTK – Cleaning Tool Kit 2.5	Nozzle Insert Cleaning Wires		Set – NI Cleaning Reamers
Order no. 1014632 consists of: 25 pcs. Fluid Box Cleaners (P: 1013266) 20 pcs. Cleaning Rods 2.5 (P: 1014631) 20 pcs. Fluidic Brushes 2.5 (P: 1014422) (P = Order no. for only these parts)	size 100 (blue) size 120 (white) size 150 (green) size 200 (orange) size 300 (yellow) size 400 (red) size 500 (gray)	Order no. 1011208 Order no. 1011488 Order no. 1010380 Order no. 1010379 Order no. 1012208 Order no. 1012209 Order no. 1015396	Order no. 1014627 (6 pcs.)
MDT 316 - Nozzle Insert Cleaning Tool Order no. 1013324	MDT 324 - Nozzle Insert Cleaning Holder Order no. 1014310 (PEEK) Order no. 1017320 (Stainless Steel)		
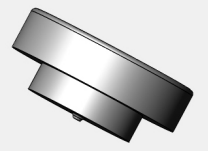
Tab. 41:   Cleaning Tools

14.6 Tools

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

Tab. 42:   Tools

14.7 Nozzle Inserts

Nozzle Insert N11

N11- 70   Order no. 1010343
N11- 80   Order no. 1013255
N11- 90   Order no. 1013129
N11-100   Order no. 1009837
N11-120   Order no. 1010344
N11-150   Order no. 1009838
N11-165   Order no. 1015953
N11-200   Order no. 1009839
N11-250   Order no. 1014416
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- 30   Order no. 1016080
N14- 50   Order no. 1016081
N14- 70   Order no. 1015070
N14- 100   Order no. 1015069
N14- 120   Order no. 1015028
N14- 150   Order no. 1015068
N14- 200   Order no. 1015150
N14- 250   Order no. 1013055
N14- 300   Order no. 1012097
N14- 400   Order no. 1012098
N14- 600   Order no. 1014532
N14-1200 Order no. 1012901

Nozzle Insert N16

N16-150   Order no. 1012950
N16-200   Order no. 1012951
N16-500   Order no. 1012218
N16-600   Order no. 1012219
N16-700   Order no. 1012220
N16-800   Order no. 1012843
N16-900   Order no. 1012844
N16-1000 Order no. 1012845

Nozzle Insert N17

N17- 70   Order no. 1013155
N17- 100   Order no. 1013959
N17- 150   Order no. 1013136
N17- 200   Order no. 1012780

Nozzle Insert N21

N21-100   Order no. 1013045

Nozzle Insert N25

N25- 30   Order no.: 1015233
N25- 40   Order no.: 1015234
N25- 50   Order no.: 1015175
N25- 60   Order no.: 1015866
N25- 70   Order no.: 1015174
N25-100   Order no.: 1013427
N25-120   Order no.: 1014535
N25-150   Order no.: 1013426
N25-180   Order no.: 1014660
N25-250   Order no.: 1014659
N25-500   Order no.: 1013428

Nozzle Insert N27

N27- 50   Order no.: 1015173
N27-200   Order no.: 1015207

Nozzle Insert N34

N34- 30   Order no.: 1017094
N34- 40   Order no.: 1016787
N34- 50   Order no.: 1015452
N34- 70   Order no.: 1015453
N34- 80   Order no.: 1017146
N34- 90   Order no.: 1017147
N34-100   Order no.: 1015231
N34-120   Order no.: 1015454
N34-150   Order no.: 1015455
N34-200   Order no.: 1015230
N34-250   Order no.: 1015456
N34-300   Order no.: 1015228
N34-350   Order no.: 1015696
N34-400   Order no.: 1015229

Nozzle Insert N43	Nozzle Insert N64	Nozzle Insert J01
N43-150 Order no.: 1014457	N64- 50 Order no.: 1016131 N64- 80 Order no.: 1015971 N64- 90 Order no.: 1016132 N64-100 Order no.: 1015025 N64-120 Order no.: 1015026 N64-180 Order no.: 1015027	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	Nozzle Insert J03	Nozzle Insert J04
J02-50 Order no.: 1013032 J02-70 Order no.: 1012878	J03- 200 Order no.: 1012885	J04-200 Order no.: 1012936 J04-300 Order no.: 1015149 J04-400 Order no.: 1014613 J04-500 Order no.: 1014614 J04-600 Order no.: 1014629

Tab. 43:   Nozzle Inserts

14.8 Other Parts

MDC 1500-V Order no. 1017139	**MDV 1560-V** Order no. 1017138	**Valve-Cable-1500** 5m Order no. 1014500 7m Order no. 1015064
Power Supply 24 V 4 A Order no. 1014501	**Power Cable 24 V** Order no. 1014502	**Connection Cable for Pressure Control Valves MDC 1500** Order no. 1014937
Pressure regulating valve for actuator pressure MDV 15XX Order no. 1014936	**Pressure regulating valve for cartridge pressure** Order no. 1014655	**Check valve-1500** Order no. 1016962
Pressure Tank-1500 Order no. 1016963	**Adapter for Connection Cable Pressure Control Valves MDC 1500** Order no. 1017291	

Tab. 44: Other Parts

14.9 Accessories for Hot Melt Applications

Additional Heaters MCH30-48-1500-HT Order no. 1015387 MDH-48-BY-HT Order no. 1015386 (for hot melt applications)	**Fluid Box Body MDF 1500-BY-HT** 1500-BY-HT-40 Order no. 1015385 1500-BY-HT-60 Order no. 1015717 1500-BY-HT-40-JIC2 Order no. 1016709 1500-BY-HT-60-JIC2 Order no. 1017020 (for hot melt applications)	**MHC 48-2** Order no. 1015680 (heater controller)

Metal Cartridge 30 ccm Order no. 1015697 JIC2 30 ccm, L Order no. 1016247	**Adaptor for MCH30-48-1500-HT-HO** Order no. 1015635 (only compatible with 1016709 or 1017020)	**O-Ring** O-Ring-BY Viton Order no. 1014384 O-Ring-JIC-2 Viton Order no. 1016680
Tightening screw-HT stainless steel Order no. 1015671		

Tab. 45:   Accessories for Hot Melt Applications

15 Attachments

15.1 Declaration of Incorporation

EU Declaration of Incorporation

VERMES
MICRODISPENSING

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

Company Name: **VERMES Microdispensing GmbH**

Address: Rudolf-Diesel-Ring 2
                   83607 Holzkirchen

Product Name: **Microdispensing System**

Model Number:

System	Control unit	Valve
MDS 1560-V	**MDC 1500-V**	**MDV 1560-V**

Commissioning of the partly completed machinery is prohibited until it has been established that machinery in which the partly completed machinery is installed is in compliance with the provisions of the Machinery Directive 2006/42/EC.

We declare that these products are specified to the relevant EU directives.
Directive 2014/30/EU   Electromagnetic Compatibility Directive (EMC)
Directive 2011/65/EU   Restriction of Hazardous Substances
(with EU 2015/863)   (RoHS 2) (with amendment)
Regulation (EC) 1907/2006   REACH regulation

Essential Requirements from Annex I of the directive 2006/42/EG that apply and are met:
1.1.5
1.1.6
1.3.2
1.3.4
1.3.7
1.5.1
1.5.4

Holzkirchen, 24/4/2024
Place and date of issue

Stefan Hirte
Managing Director

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Fig. 46:   EU Declaration of Incorporation

15.2 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: Rudolf-Diesel-Ring 2
                     83607 Holzkirchen

Product Name: **Microdispensing System**
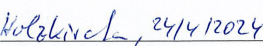
Model Number:
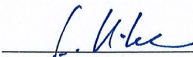
System	Control unit	Valve
MDS 1560-V	MDC 1500-V	MDV 1560-V

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

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

Directive 2014/30/EU   Electromagnetic Compatibility Directive
                                        (EMC)

Directive 2011/65/EU   Restriction of Hazardous Substances
(with EU 2015/863)   (RoHS 2) (with amendment)
Regulation (EC) 1907/2006   REACH regulation
EN 61326-1
EN 55011

Holzkirchen, 24/4/2024
_____   _____
Place and date of issue   Stefan Hirte
                                     Managing Director

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Fig. 47:   EU Declaration of Conformity

15.3 Dimensional Drawing MDC 1500-V
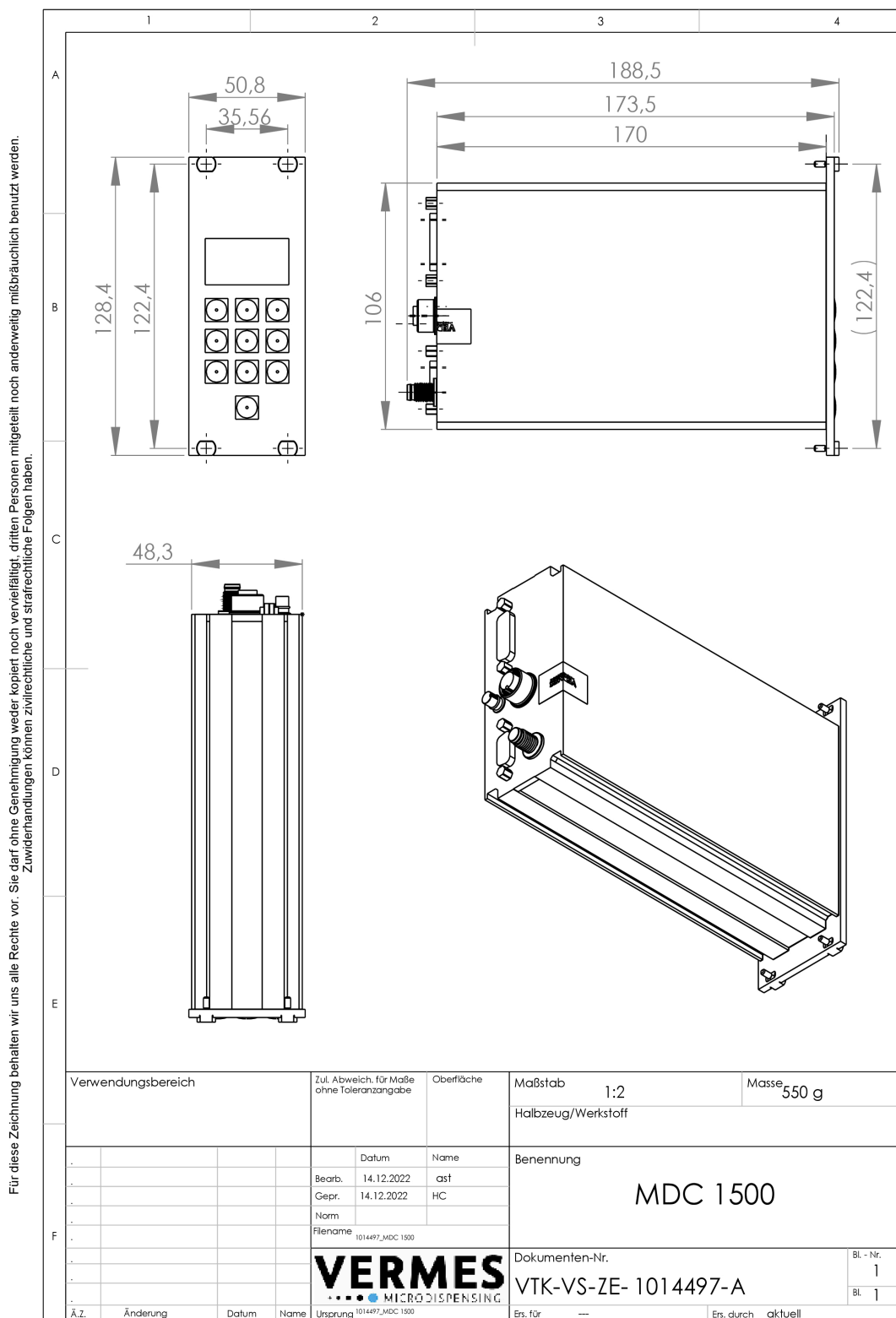
Fig. 48:   Dimensional Drawing MDC 1500-V

15.4 Dimensional Drawing MDV 1560-V – with Accessories

Fig. 49:   Dimensional Drawing MDV 1560-V – with Accessories

15.5 Dimensional Drawing MDV 1560-V - Positioning

Fig. 50: Dimensional Drawing MDV 1560-V – Positioning

15.6 Drawing Center of Gravity MDV 1560-V
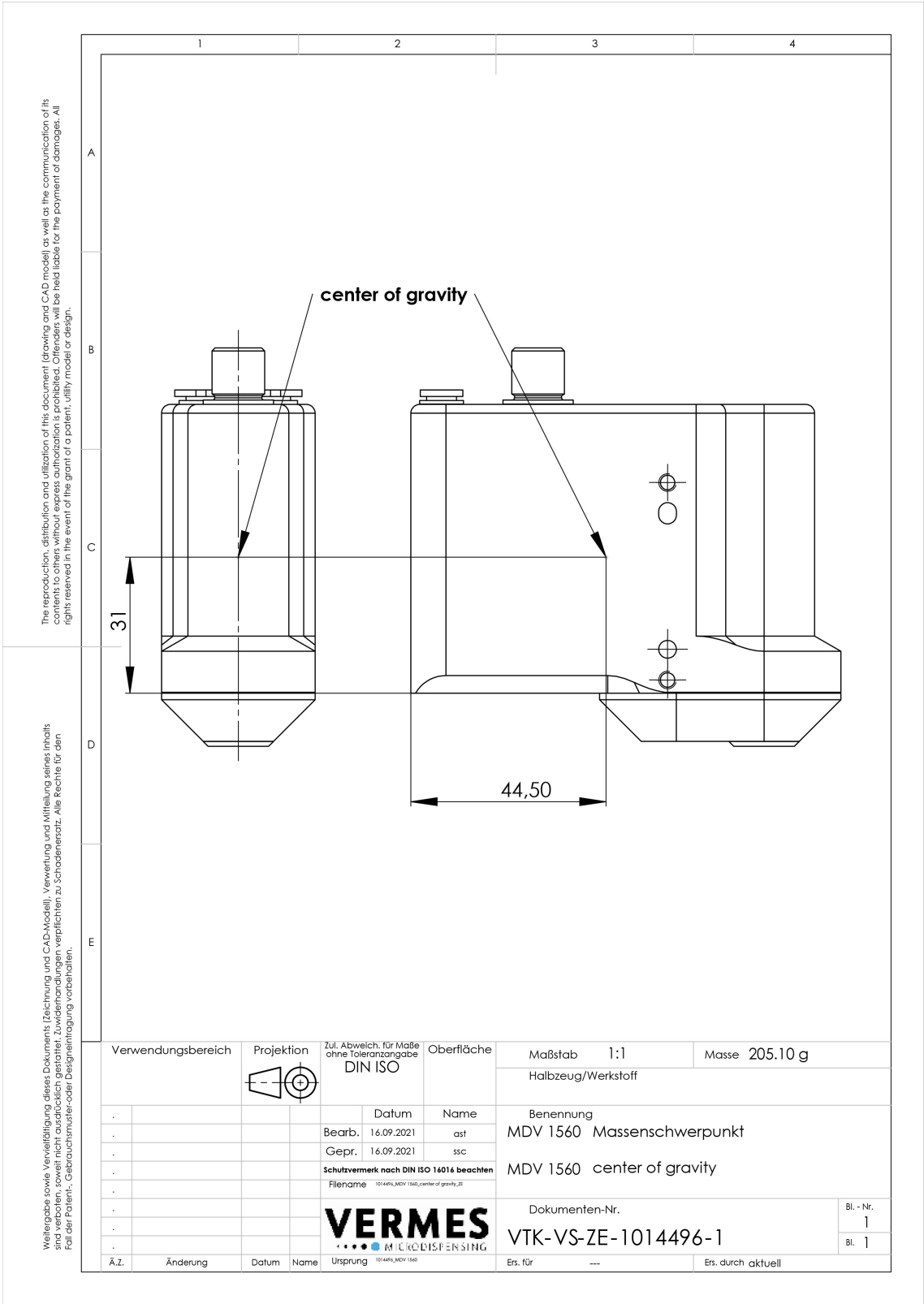
Fig. 51:   Drawing Center of Gravity

15.7 Connection Diagram PLC interface

Fig. 52: Connection Diagram PLC interface

15.8 Overview of the MDC Menu

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

Pressure Setting

Act. Pressure

Function		
If using a mechanical regulator	Set the target pressure, which is controlled by the pressure alert.	
If using an electric regulator	Target pressure is shown and can be changed	
Options	1.5 - 8 bar (default 5 bar, limits OFF) (setting depends on the fluid box body)	
Others	Press [Enter]-key, valve will open, potential liquid spurts	

Cart. Pressure

Function	Change Cartridge Pressure, if using an electric regulator
Options	0 - 8 bar (default 1 bar)
Others	If ON, shows pressure value. If OFF, shows "ND"; [Enter]-key has no effect in this menu

Heater Setting

Heater

Function	Set the Target Temperature (in °C)
Others	- Factory setting: 30 °C - With an accuracy of 1 °C - Current Temperature shown on top of the display - Heater ON/OFF only via the [Heater]-key

Dispensing Setting / start menu

Setup 1 → **Setup 2** → **Setup 3** → **Setup 4**

For each Setup, set the three parameters within the range as below:
Open Time: 0.7 - 5000 ms
Close Time: 0.7 - 5000 ms
Number of Pulses: 1 - 50000   (0=infinite)

Close Time

System Information

System Information

SN Valve/MDC

Function	Check FW Revision/ Valve ID / MDC ID

Cycle Count

Function	Check Cycle Count of the Valve

Service In

Function	Check Service Interval	this item is hidden, if "Service" is OFF
Others		

Service Interval

General Settings

General Settings

PLC Voltage

Function	Set PLC Voltage
Options	5 V / 24 V (default)
Others	Voltage setting should fit your device

Baud Rate

Function	Change the Baud Rate
Options	9600/19200/38400/57600/ 115200 (default)/230400/460800
Others	Must set the same Baud Rate at your PC

Factory Reset

Function	Reset parameters to default values
Others	NOT possible during dispensing

Service

Function	Set a shot counter to define the Service Interval
Options	Max. 4,000,000,000 (default 500,000,000)
Others	- Reset to 0 once service interval changed - If OFF, menu item "Service In" is hidden - If ON, a progress bar shows the state of the service interval

Parameters Lock

Function	(un-)lock all settings via MDC
Options	ON/OFF (only affects keypad)
Others	If ON: read-only (no write access)

Service Code

Function	Enter Service Code
Options	9001 (to set min. Close Time, range: 0.1 ms and 5000 ms, setting is saved in the valve) 9110 (option: ON/OFF; when ON, the actuator pressure regulator stays ON in case the MDC is powered off) 9111 (option: ON/OFF; when ON, the actuator pressure regulator stays ON in case the MDV is plugged out or a fatal error appears)
Others	Change min. Close Time is NOT recommended, since the dispensing could be unstable. Before changing it, consult our Support.

Display Timeout

Function	Set the idle time before the display is switched off
Range	0 min to 100 min (0 = OFF)
Others	The display can be switched on again by pressing any key

Regulator Type

Function	Configure the type of the pressure regulator
Options	Elec. (electronic)/Mech. (mechanical)/Auto. (automatically detected by MDC)

MDV Plugout

Function	Plug the valve out from the MDC by pressing [Enter]-key

Pressure Alert

Function	- Pressure Alert ON/OFF - Set limits for pressure alert
Options	0.1/0.2/0.3/0.4/0.5 bar/OFF (factory setting)
Others	Error 3000301 appears, when outside the limits

Information
- At each menu item, press [Enter]-key to reach the page where you can change the settings, or to view the information.
- Use arrow keys to change the value. Confirm the change with [Enter]-key. Quit the change with [Back]-key (MDC returns to the respective menu item).
- Press [Back]-key in any main menu item (menus with bigger blocks in the table), MDC returns to the start menu "Setup1".
- Press [Back]-key in any submenu item (menus with smaller blocks in the table), MDC returns to the respective main menu.
- Menus are always "wrap-around", i.e. you can move on from the last item in a menu directly on to the first.
- Texts in dashed frames are not displayed.

Fig. 53:   Overview of the MDC Menu

15.9 Overview of the Command Functions

Details of the commands listed below are explained in paragraph 9.1.2, page 77.

	RS-232C commands	Functions
1	*IDN?	Check device information
2	HELP	Check all RS-232C commands
3	MDC1500:SETUP1 <OT>,<CT>,<NP>,<1>	Change the pulse parameter set for setup 1
4	MDC1500:SETUP1?	Check the pulse parameter set for setup 1
5	MDC1500:SETUP2 <OT>,<CT>,<NP>,<1>	Change the pulse parameter set for setup 2
6	MDC1500:SETUP2?	Check the pulse parameter set for setup 2
7	MDC1500:SETUP3 <OT>,<CT>,<NP>,<1>	Change the pulse parameter set for setup 3
8	MDC1500:SETUP3?	Check the pulse parameter set for setup 3
9	MDC1500:SETUP4 <OT>,<CT>,<NP>,<1>	Change the pulse parameter set for setup 4
10	MDC1500:SETUP4?	Check the pulse parameter set for setup 4
11	MDC1500:SEQUENCE <trigger delay>,<start setup>,<sequence delay>,<end setup>	Combine two setups with a delay between them
12	MDC1500:SEQUENCE1?	Check the sequence parameters for setup 1
13	MDC1500:SEQUENCE2?	Check the sequence parameters for setup 2
14	MDC1500:SEQUENCE3?	Check the sequence parameters for setup 3
15	MDC1500:SEQUENCE4?	Check the sequence parameters for setup 4
16	MDC1500:SEQUENCE:MODE <ON/OFF>	De-/activate the sequence mode
17	MDC1500:SEQUENCE:MODE?	Check if the MDC is in the sequence mode
18	MDC1500:RUN <OT>,<CT>,<NP>	Start a dispensing cycle with the given parameters
19	MDH:TARGET <target temperature>	Change the target temperature of the heater
20	MDH:TARGET?	Check the target temperature set for the heater
21	MDH:ALERT <temperature limit>	Change the limit for temperature alert of the heater
22	MDH:ALERT?	Check the limit for temperature alert set for the heater
23	MDH:MODE <ON/OFF>	Turn the heater on/off
24	MDH:STAT?	Check the current status and temperature of the heater
25	MDP:ACT:ALERT <limit for actuator pressure>	Set the limit for the actuator pressure alert
26	MDP:ACT:ALERT?	Check the limit for the actuator pressure alert
27	MDP:ACT:MODE?	Check if the regulation for the actuator pressure is activated
28	MDP:ACT:MODE <ON/OFF>	De-/activate the regulation for the actuator pressure
29	MDP:ACT:REGU <min volt>,<min bar>,<max volt>,<max bar>	Set the pressure control of the actuator pressure according to your pressure regulator
30	MDP:ACT:REGU?	Check the pressure control set for the actuator pressure
31	MDP:ACT:REGU:TYPE <1/2/3>	Choose the type of the actuator pressure regulator
32	MDP:ACT:STAT?	Check the current status of the actuator pressure
33	MDP:ACT:TARGET <target actuator pressure>	Set the target pressure for the actuator
34	MDP:ACT:TARGET?	Check the target pressure for the actuator
35	MDP:CART:MAX <limit for cartridge pressure>	Set the maximum pressure for the cartridge
36	MDP:CART:MAX?	Check the maximum pressure for the cartridge
37	MDP:CART:MODE?	Check if the regulation for the cartridge pressure is activated

	RS-232C commands	Functions
38	MDP:CART:MODE <ON/OFF>	De-/activate the regulation for the cartridge pressure
39	MDP:CART:REGU <min volt>,<min bar>,<max volt>,<max bar>	Set the pressure control of the cartridge pressure according to your pressure regulator
40	MDP:CART:REGU?	Check the pressure control set for the cartridge pressure
41	MDP:CART:REGU:TYPE <1/2/3>	Choose the type of the cartridge pressure regulator
42	MDP:CART:TARGET <target cartridge pressure>	Set the target pressure for the cartridge
43	MDP:CART:TARGET?	Check the target pressure for the cartridge
44	MDV:ESR?	Check the latest valve relevant error messages
45	MDV:INFO?	Check the valve type and the valve ID
46	MDV:CYCLES?	Check the current value of cycle counter
47	MDV:JET?	Check if the system is currently dispensing
48	MDV:TEMP?	Check the current temperature of the actuator
49	MDV:TRIGGER <setup no.>	Start dispensing with the parameters of the chosen setup
50	MDV:SERVICE <interval>	Set the service interval
51	MDV:SERVICE?	Check the setting of the service interval
52	MDV:SERVICEIN?	Check after how many more shots the service interval ends
53	MDV:STOP	Stop a running dispensing process
54	MDV:OPEN	Open the valve
55	MDV:CLOSE	Close the valve
56	MDV:PLUGOUT	Plug the valve out from the MDC
57	SYS:ESR?	Check the latest error messages
58	SYS:ENTER	Send a ENTER signal to the MDC
59	SYS:FIND	Cause the Status control lamp to flash for ten seconds
60	SYS:INFO?	Check the type and the ID of the MDC
61	SYS:IPC?	Check the amount of the last pulses (and clear the counter to 0)
62	SYS:KLOCK <ON/OFF>	De-/activate the locking function of the keypad
63	SYS:KLOCK?	Check if the locking function of the keypad is activated
64	SYS:PLC:VOLTAGE <5/24>	Set the voltage of the PLC signal
65	SYS:PLC:VOLTAGE?	Check the voltage of the PLC signal
66	SYS:POWER:OFF	Switch off the MDC
67	SYS:RESET <0/1/2/3>	Reset all settings of the MDC to the factory settings
68	SYS:RESTART	Shut down and restart the MDC
69	SYS:READY?	Check if the system is ready for dispensing
70	SYS:PLOCK <ON/OFF>	De-/activate the parameters lock
71	SYS:PLOCK?	Check if the parameter lock is activated
72	SYS:TERM:BAUD <baud rate>	Change the baud rate of the serial interface
73	SYS:TERM:BAUD?	Check the baud rate of the serial interface

15.10 Connection Diagram MDS 1560-V (with electronic pressure regulation)

This diagram shows the connections of an MDS 1560-V in case you use electronic pressure regulators.

PIN No.	Usage
1	GND
2	Analog Output (0 – 10 V) No. 1
3	Analog Input (0 – 10 V) No. 1
4	Analog Output (0 – 10 V) No. 2
5	Analog Input (0 – 10 V) No. 2
6	+24 V Output

M8 6-pin A-coded (for Pressure Regulation):

Article:		Article-No.:
Valve-Cable-1500 5 m		1014500
Connection Cable for Pressure Control Valves MDC 1500		1014937
Pressure regulating valve for actuator pressure MDV 15XX		1014936
Pressure regulating valve for cartridge pressure		1014655

Fig. 54:   Connection Diagram MDS 1560-V (with electronic pressure regulation)

15.11 Connection Diagram MDS 1560-V (with mechanical pressure regulation)

This diagram shows the connections of an MDS 1560-V in case you use mechanical pressure regulators.
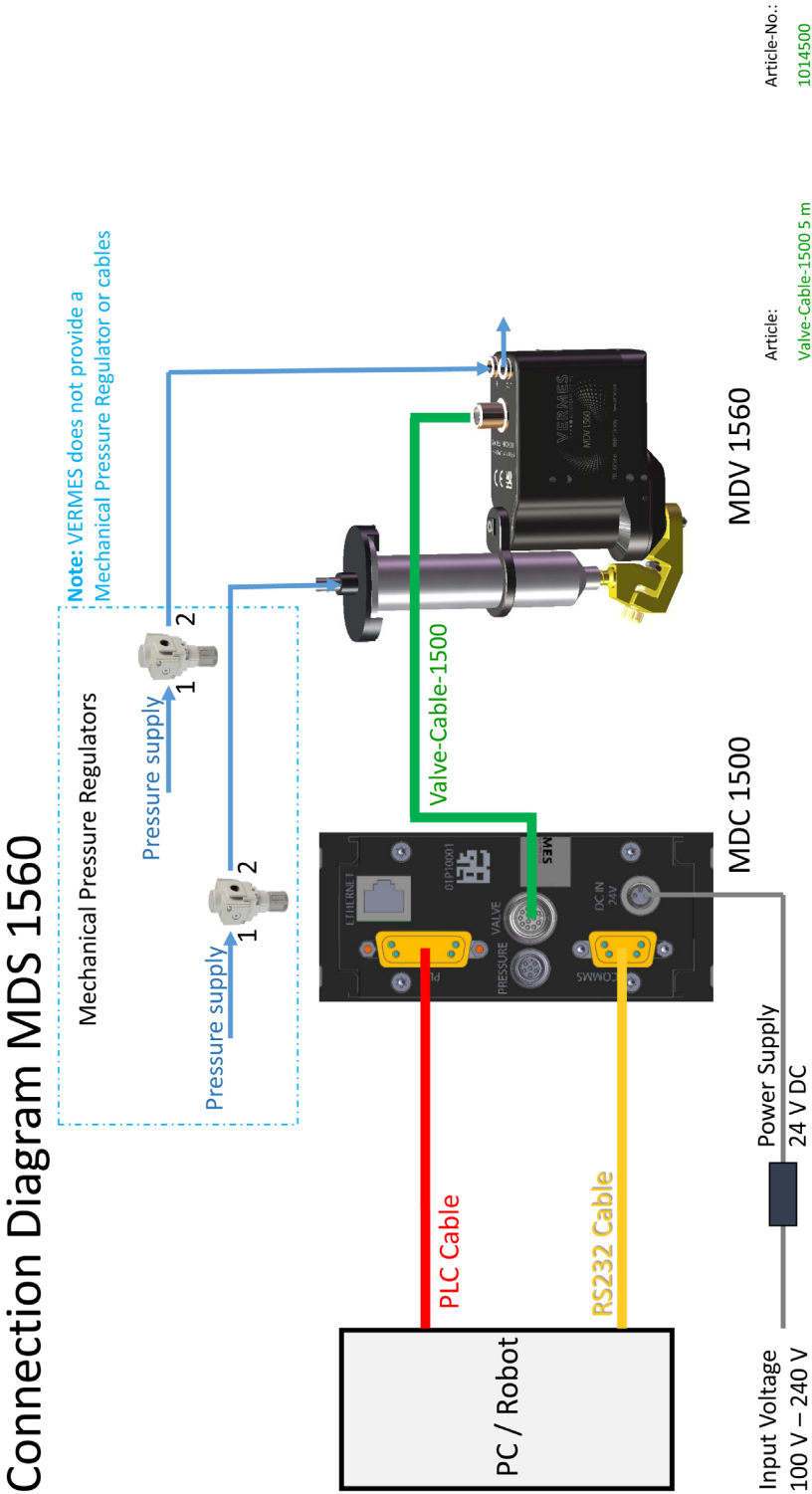
Fig. 55: Connection Diagram MDS 1560-V (with mechanical pressure regulation)

15.12   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 13.1, page 155). The manufacturer is not liable for any damage resulting from inadequate packaging or transport.

16 List of Figures

17 List of tables

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