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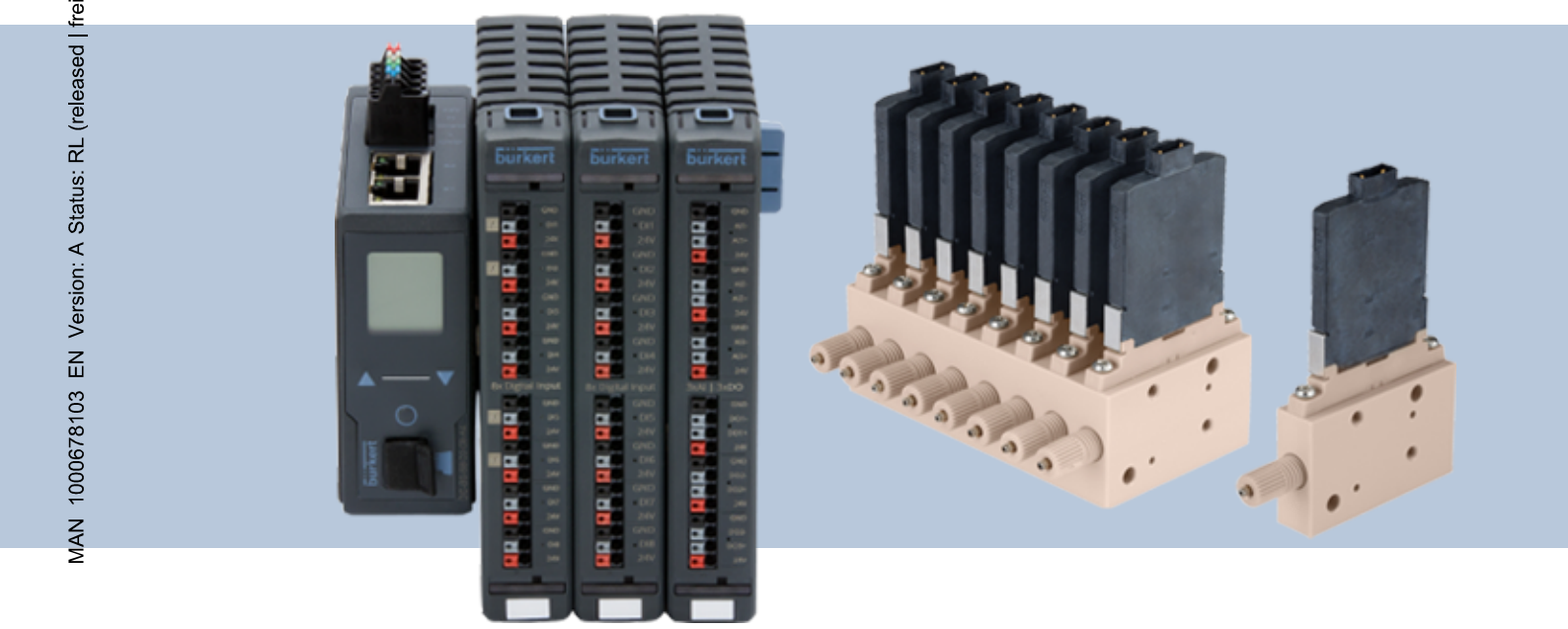
Type 5120

LDO

Dosing head and electronics for precise time-pressure dosing



Operating Instructions

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Technical documentation 2511/01_GBen_00815470_962963339_18014399472482443 / Original DE

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1 About this document

The document is an important part of the product and guides the user to safe installation and operation. The information and instructions in this document are binding for the use of the product.

- Before using the product for the first time, read and observe the whole safety chapter.
- Before starting any work on the product, read and observe the respective sections of the document.
- Keep the document available for reference and give it to the next user.
- Contact the Bürkert sales office for any questions.

Further information concerning the product at Products.

- Enter the article number from the type label in the search bar.

The illustrations in these instructions may vary depending on the product variant.

1.1 Symbols

DANGER!

Warns of a danger that leads to death or serious injuries.

WARNING!

Warns of a danger that can lead to death or serious injuries.

CAUTION!

Warns of a danger that can lead to minor injuries.

NOTICE!

Warns of property damage on the product or the installation.

Indicates important additional information, tips and recommendations.

Refers to information in this document or in other documents.

- Indicates a step to be carried out.

✓ Indicates a result.

Menu Indicates a software user-interface text.

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1.2 Terms and abbreviations

The terms and abbreviations are used in this document to refer to following definitions.

Device	Type 5120 dosing head and electronics for precise time-pressure dosing
LDO	Liquid Dosing Open Loop

1.3 Manufacturer

Bürkert Fluid Control Systems

Christian-Bürkert-Str. 13–17

74653 Ingelfingen

GERMANY

The contact addresses are available at Contact.

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2 Safety

2.1 Intended use

The system is designed for dosing liquids. The permitted media are listed in chap. Technical data [▶ 15] **.**

Prerequisites for safe and trouble-free operation are proper transport, storage, installation, commissioning, operation and maintenance.

The instructions are part of the device. The device is intended exclusively for use within the scope of these instructions. Uses of the device that are not described in these instructions, the contractual documents or the type label can lead to severe personal injury or death, damage to the device or property and dangers for the surrounding area or the environment.

- Only trained and qualified personnel may install, operate and maintain the device. See qualification of persons in Safety instructions [▶ 8]
- Use the device only in conjunction with third-party devices and components recommended and authorized by Bürkert.
- Use the device only when it is in perfect condition.
- Install the electronic components (see below) in a suitable control cabinet or body. The control cabinet or body must have a minimum degree of protection of IP54.
  - Fieldbus gateway type ME43
  - I/O module type ME44
  - Backplane type BPX3
- Do not use the device outdoors.
- Do not use the device in potentially explosive atmosphere.

2.2 Safety instructions

Qualification of personnel working with the device

Improper use of the device can lead to serious personal injury or death. To avoid accidents when working with the device, the following minimum requirements must be met:

- Carry out work on the device within the scope of these instructions in a safety-compliant manner.
- Detect and avoid dangers when working on the device.
- Understand the instructions and implement the information contained therein accordingly.

Responsibility of the operator

The operator is responsible for observing the location-specific safety regulations, also in relation to personnel.

- Observe the general rules of technology.
- Install the device according to the regulations applicable in the respective country.
- The operator must make hazards arising from the location of the device avoidable by providing appropriate operating instructions.

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Medium under pressure

Medium under pressure can seriously injure people. In the event of overpressure or pressure surges, the device or lines can burst. Pneumatic lines that are defective or not securely fastened can come loose and swing around.

- Before working on the device or system, switch off the pressure. Vent or empty the lines.
- Adhere to the permitted pressure ranges of the medium.
- Comply with the permitted temperature ranges of the medium.

Electric shock due to electrical components

Touching live parts can result in severe electric shock.

- Switch off voltage before working on the device or system. Secure against reactivation.
- Adhere to any applicable accident prevention and safety regulations for electrical devices.

Hot surfaces and fire hazard

The surface of the solenoid valve can become hot during continuous operation.

- Wear suitable protective gloves.
- Keep highly flammable substances and media away from the device.
- Do not exceed the permitted duty cycle.
- Do not obstruct heat dissipation required for operation.

Electrostatically sensitive components and assemblies

The device contains electronic components that are susceptible to the effects of electrostatic discharging (ESD). Components that come into contact with electrostatically charged persons or objects are at risk. In the worst case scenario, these components will be destroyed immediately or fail after start-up.

- Meet the requirements specified by EN 61340-5-1 to minimise or avoid the possibility of damage caused by a sudden electrostatic discharge.
- Do not touch electronic components when the supply voltage is connected.

Changes and other modifications, spare parts and accessories

Changes to the device, incorrect installation or use of non-approved devices or components create hazards that can lead to accidents and injuries.

- Do not make any changes to the device.
- Do not mechanically load the device.
- Observe the operating instructions of the device or component used.
- Only use the devices in conjunction with devices and components recommended or approved by Bürkert.

Spare parts and accessories that do not meet Bürkert's requirements may impair the operational safety of the device and cause accidents.

- To ensure operational safety, only use original parts from Bürkert.

Operation only after proper transport, storage, installation, start-up or maintenance.

Improper transport, storage, installation, start-up or maintenance endanger the operational safety of the device and can cause accidents. This can lead to serious personal injury or death.

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- Only carry out works which are described in these instructions.
- Only carry out works using suitable tools.
- Have all other works carried out by Bürkert only.

Working on the device

Working on the device that has not been powered down, unauthorised switching on or uncontrolled start-up of the system can cause accidents. This can lead to serious personal injury or death.

- Only work on the device when it is not in use.
- Ensure that the device or system cannot be switched on unintentionally.
- Only start the process in a controlled manner following disruptions. Observe sequence:
  1. Apply supply voltage or pneumatic supply.
  2. Charge the device with medium.

Technical limit values and media

Failure to observe the following safety measures can lead to accidents. This can damage the device, cause leaks and seriously injure people.

- Comply with limit values. See Technical data [▶ 15] and information on the type label.
- Only the media listed in chapter Technical data [▶ 15] should be fed into the medium ports.
- Check regularly for any medium leakages.
- If the medium is hazardous, secure the environment against risks.
- Observe the safety data sheet for the media used.
- Do not remove the connecting clips between the coil and the fluid body under any circumstances.

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3 Product description

Type 5120 offers a standardised solution for liquid dosing in an open control loop based on the time-pressure dosing principle.

The core components of this system consist of a dosing electronics assembly with communication gateway and a dosing head with dosing needles.

The system enables precise control of the dosing time with a resolution of less than 0.1 ms, which lead to remarkable accuracy, especially if small amounts of liquid in the µl range are involved.

Type 5120 is an integral system platform in which both the control and the fluidics can be easily customised and expanded.

The system is available in various configurations. The available variants are described in the data sheet type 5120.

3.1 Product overview

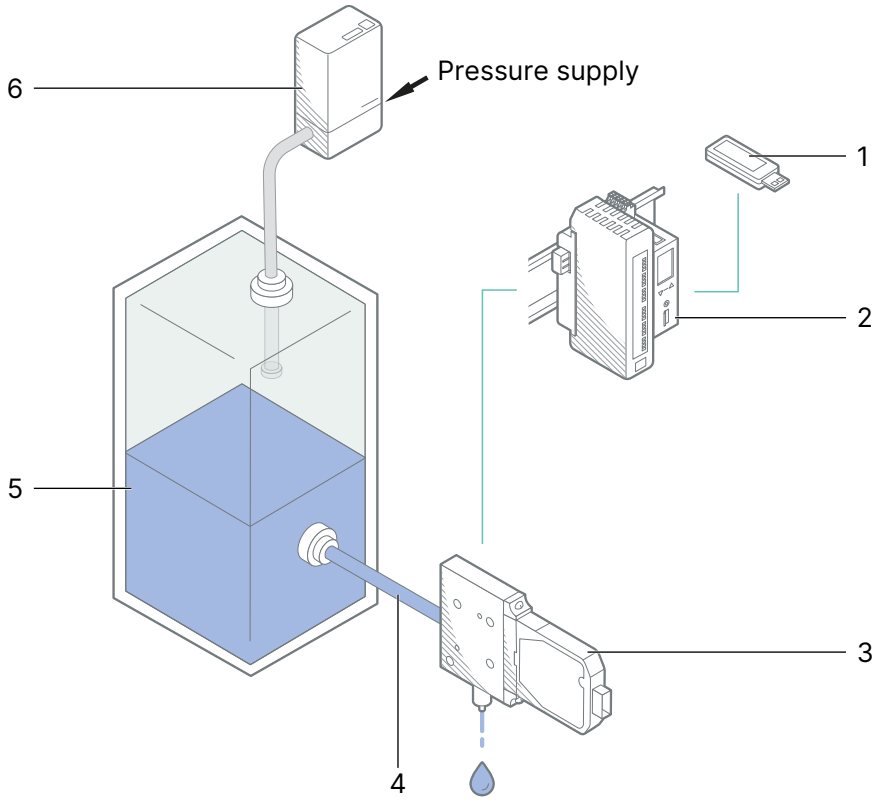

Fig. 1: Example of a type 5120 dosing system with media container and pressure supply

1	büS stick type 8923	2	Electronic unit
3	Dosing head	4	Lines and fittings type TVU003
5	Media container (not part of type 5120)	6	Pressure controller for precise time-pressure dosing (LFPC) type 8763 (not part of type 5120)

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The medium to be dosed is located in a suitable media container, which is pressurised to a defined pressure and kept stable by a precision pressure controller. This pressure allows the medium to be dispensed through a needle when a dosing valve is opened. The dosing quantity is determined by the pressure in the container and the activation time of the valve. The pressure and time parameters can be adjusted to optimise the dosing accuracy or change the dosing quantity.

The system is available in various configurations. The available variants are described in the data sheet type 5120.

3.2 Operation modes

The dosing system has the following operation modes:

- Impulse
- Dosing

3.2.1 Impulse operation mode

In the impulse operation mode, a fixed time is predetermined as the impulse at the output of the channel and is activated by the rising edge of a trigger signal. An internal timer allows the output of a high-precision signal with an accuracy of ±10 µs.

3.2.2 Dosing operation mode

A specific dosing quantity is dispensed in the dosing operation mode. The dosing quantity is determined by a dosing duration that was determined in a previous adjustment.

3.2.3 Behaviour of outputs in the impulse and dosing operation modes

The following graphic shows the relationship between the behaviour of the digital output and the rising edge of the trigger signal. As soon as the trigger signal reaches a rising edge, the impulse is started. During the impulse duration, the digital output remains active and ignores further trigger signals until the impulse has ended.

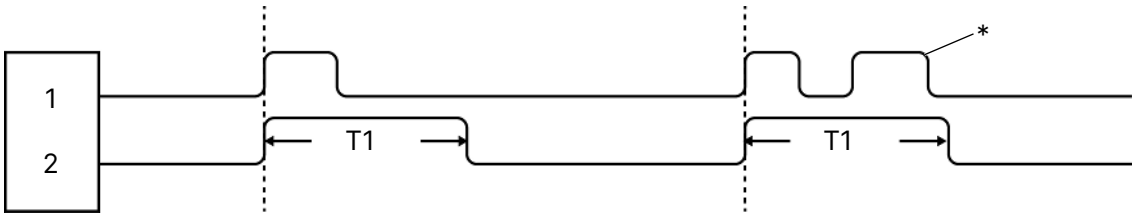

Fig. 2: Digital output/trigger signal

1	Trigger signal	T1	Impulse duration
2	Digital output	*	During the impulse duration, other trigger signals are ignored.

The respective digital output can be activated using the Manual override button. The following graphic illustrates this behaviour.

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Button Manual override

Select operation mode > **Independent input** “on” > the button is displayed in the device overview.

The manual override function can be used to keep an output active for longer than the specified impulse time, which is useful for flushing processes, for example.

Active dosing is cancelled by manual override, causing the output to deactivate as well. During the active impulse time, other transmitted triggers are ignored.

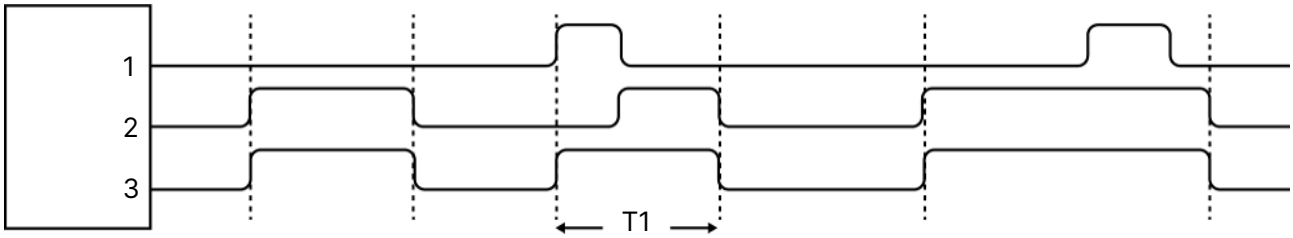

Fig. 3: Manual override (Man. Set)

1	Trigger signal	2	Manual override
3	Digital output	T1	Impulse duration

The respective output can be deactivated using the **Cancel dose** button, which can be used to cancel an impulse, for example. The following graphic shows this reset-dominant behaviour.

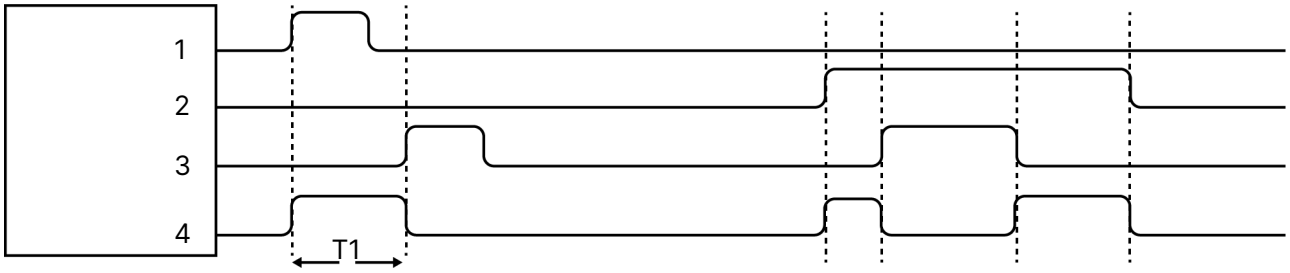

Fig. 4: Cancel dosing (Man. Reset)

1	Trigger signal	2	Manual override
3	Cancel dosing	4	Digital output
T1	Impulse duration		

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The following graphic shows the timing of the individual output signals in relation to each other. When the trigger is activated, the time delay until the respective output is activated can be up to 10 ms. This time difference varies between different channels.

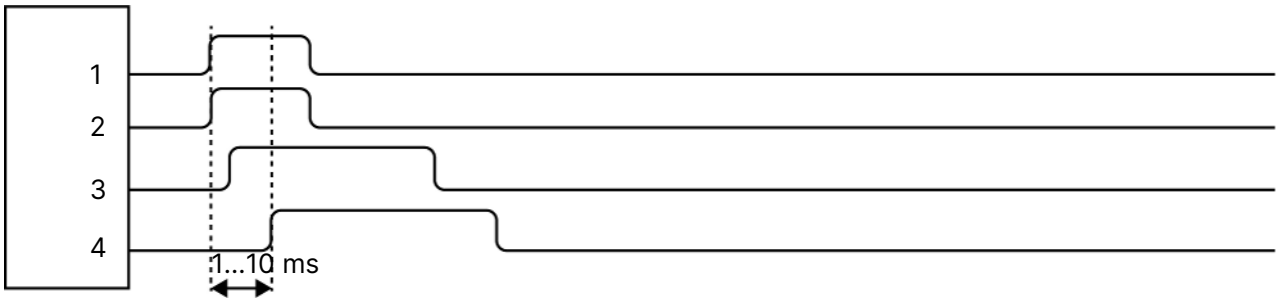

Fig. 5: Timing

1	Trigger signal 1	2	Trigger signal 2
3	Digital output 1	4	Digital output 2

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4 Technical data

4.1 Standards and directives

This product complies with the legal requirements applicable at the time of placing on the market and has been developed and tested in accordance with the relevant European directives/regulations and harmonized standards. The conformity is documented and, if necessary, supported by evidence. The EU Declaration of Conformity can be found behind the respective type on the home page country.burkert.com

4.2 Operating conditions

Altitude	Up to 2000 m above sea level
Ambient temperature	+10...+50 °C
Storage temperature	–10...+65 °C
Max. duty cycle	See data sheet for solenoid valve type 6650
Degree of protection	
Fieldbus gateway type ME43	IP20[1)]
I/O module type ME44	IP20[1)]
Solenoid valve type 6650	IP65[1)]
Media (for solenoid valve type 6650)	
Permitted media	Aggressive, neutral, gaseous and liquid media which do not attack the body and seal materials. See resistance chart at country.burkert.com
Viscosity	0.5...10 mPas
Medium temperature	+15...+50 °C
Medium pressure	vac...7 bar

4.3 Performance data

The performance data refer to DI water and constant ambient conditions.

Qualified dosing volume	
Minimum volume	5 µl (smaller volumes are possible with decreasing accuracy)

1) When cables or plugs and sockets are connected correctly.

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Maximum volume	28 ml per 10 s at 1 bar (higher values are possible with longer activation times or higher pressure)
Accuracy of the dosing quantity	< 1% CV (coefficient of variation) > 5 µl (see data sheet for details)
Dosing repeatability	< 0.2% (after teach-in and under constant environmental conditions, see data sheet for details)
Minimum time between dosing quantities	25 ms
Maximum dosing pressure	3 bar (up to 7 bar on request)
Activation time of the resolution	0.1 ms
Maximum release delay (based on CANopen)	10 ms

4.4 Electrical data

Operating voltage	24 V ⎓ ±5% (including residual ripple)

Power consumption

Fieldbus gateway type ME43	< 2 W
I/O module type ME44	3 W
Solenoid valve type 6650	5.7 W inrush power 0.7 W holding power at power reduction (the power reduction can be parameterised in the I/O module and is enabled at the factory)

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4.5 Communication

4.5.1 Industrial Ethernet: EtherCAT

Ethernet interface X1, X2	X1: EtherCAT IN X2: EtherCAT OUT
Acyclic communication (CoE)	SDO
Type	Complex Slave
FMMUs	8
Sync managers	4
Transmission speed	100 Mbit/s
Data transport layer	Ethernet II, IEEE 802.3

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

4.5.2 Industrial Ethernet: EtherNet/IP

Pre-defined standard objects	Identity Object (0x01) Message Router Object (0x02) Assembly Object (0x04) Connection Manager (0x06) DLR Object (0x47) QoS Object (0x48) TCP/IP Interface Object (0xF5) Ethernet Link Object (0xF6)
DHCP	supported
BOOTP	supported
Transmission speed	10 and 100 Mbit/s
Duplex modes	Half duplex, full duplex, auto-negotiation
MDI modes	MDI, MDI-X, Auto-MDI-X
Data transport layer	Ethernet II, IEEE 802.3
Address Conflict Detection (ACD)	supported
DLR (ring topology)	supported
CIP reset service	Identity Object Reset Service Type 0 and Type 1

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4.5.3 Industrial Ethernet: Modbus TCP

Modbus function codes	1, 2, 3, 4, 6, 15, 16, 23 (depending on configuration)
Transmission speed	10 and 100 Mbit/s
Data transport layer	Ethernet II, IEEE 802.3

4.5.4 Industrial Ethernet: PROFINET IO

Topology recognition	LLDP, SNMP V1, MIB2, Physical Device
Minimum cycle time	4 ms
IRT	not supported
MRP media redundancy	MRP client is supported
Other supported functions	DCP, VLAN Priority Tagging, Shared Device
Transmission speed	100 Mbit/s
Data transport layer	Ethernet II, IEEE 802.3
PROFINET IO specification	V2.42
Application Relations (AR)	The device can simultaneously process up to 2 IO ARs, 1 Supervisor AR, and 1 Supervisor DA AR.

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5 Structure of the dosing system

Risk of injury or material damage when working on the device or system.

- Read and observe the chapter Safety [▶ 8] before working on the device or system.

5.1 Required accessories

Additional components that are not included in the scope of delivery of the system are required to operate a time-pressure dosing system:

- Oil-free pressure supply, e.g. pump or compressor, compressed air network if available
- Pressure controller for precise time-pressure dosing (recommendation: pressure controller type 8763 from Bürkert)
- Media container
- Hoses and hose connections (recommendation: accessories type TVU003 from Bürkert)
- Bürkert Communicator software
  The software can be downloaded free of charge at country.burkert.com.
- USB-büS-interface set type 8923[2)]
  Information on the USB-büS-Interface set can be found at country.burkert.com

A suitable measuring device, such as a precision scale, should be provided for testing and teaching in the system.

5.2 System setup overview

The system setup is described using a system in maximum extension. It is possible to connect single or 8-fold dosing heads to several dosing points.

The system setup is divided into the following steps:

1. Install the electronic unit.
2. Mount the dosing needle.
3. Install the dosing head.
4. Fluidic port for media container to dosing head

Ensure a clean working environment during installation.

2) May be included in the scope of delivery – depending on the product variant ordered

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5.3 Installing the electronic unit

5.3.1 Mounting the fieldbus gateway on the backplane

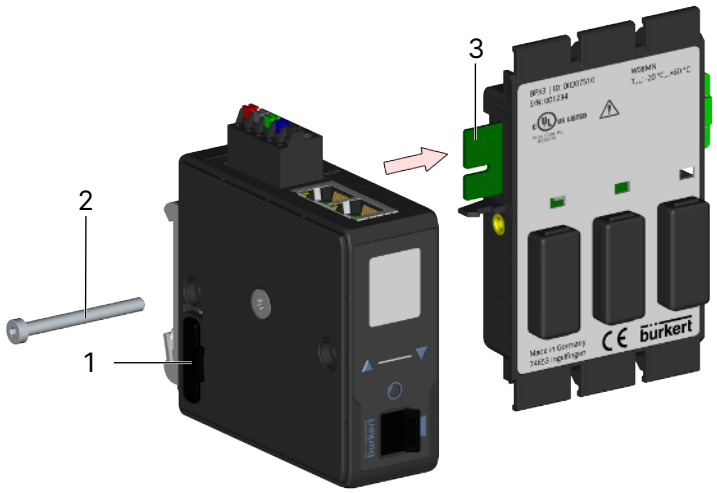

Fig. 6: Mounting the fieldbus gateway on the backplane

1	Extension socket	2	M4 socket head screw
3	Expansion plug		

- Keep the unused extension socket covered to protect it from damage.
- Align the extension socket of the fieldbus gateway with the expansion connector of the backplane and plug the gateway onto the backplane.
- Screw the M4 Gateway socket head screw to the backplane. Observe tightening torque of 0.75 Nm.

If the electronic unit is to be mounted on the standard rail with the electrical connection facing downwards, rotate the standard rail clip by 180°:

- Loosen the screw on the standard rail clip of the ME43.
- Turn the standard rail clip by 180°.
- Tighten locking screw with a torque of 2 Nm.

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5.3.2 Mounting I/O module on backplane

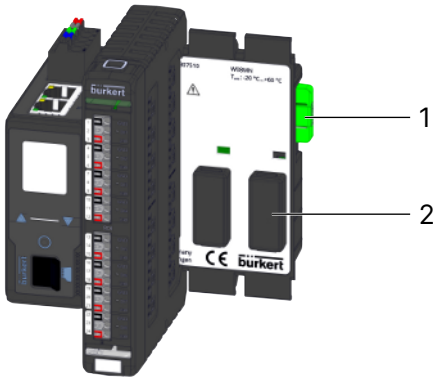

Fig. 7: Mounting the DO module type ME44 on the backplane

1	Terminating resistor	2	Mode slot with cover

- Keep unused module slots covered to protect them from damage.
- Push the DO module onto the backplane until the module clicks into place.
- Insert the terminating resistor into the slot.

5.3.3 Mounting the electronic unit on the standard rail

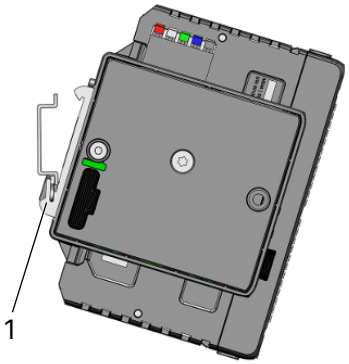

Fig. 8: Mounting the electronic unit on the standard rail

1	Standard rail clip

- Hook the standard rail clip into the lower guide of the standard rail.
- Swivel the electronic unit towards the standard rail and snap it into the upper guide of the standard rail.

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5.4 Mounting the dosing needle

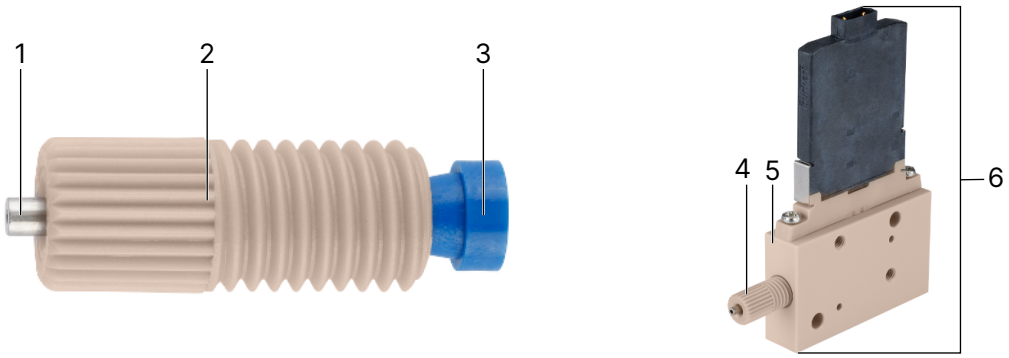

Fig. 9: Dosing needle

1	Precision pipe for dosing needle	2	Fitting with UNF thread 1/4"...28
3	Collet type TVU003 1/8"	4	Dosing needle
5	Distribution block	6	Dosing head

- Insert the precision tube for the dosing needle into the collet.
- Guide fitting over precision pipe.
- Screw the dosing needle on the outlet side[3)] of the distribution block into the dosing connection and tighten hand-tight.

3) Output side: vertical centre drill hole

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5.5 Attach the dosing head

The dosing head can be attached to a suitable location using the mounting holes provided.

Ideally, mount so that the needles are pointing vertically downwards and are exactly above the cavities to be filled.

5.5.1 Dimensions of dosing head 1-fold

Note:
Dimensions in mm

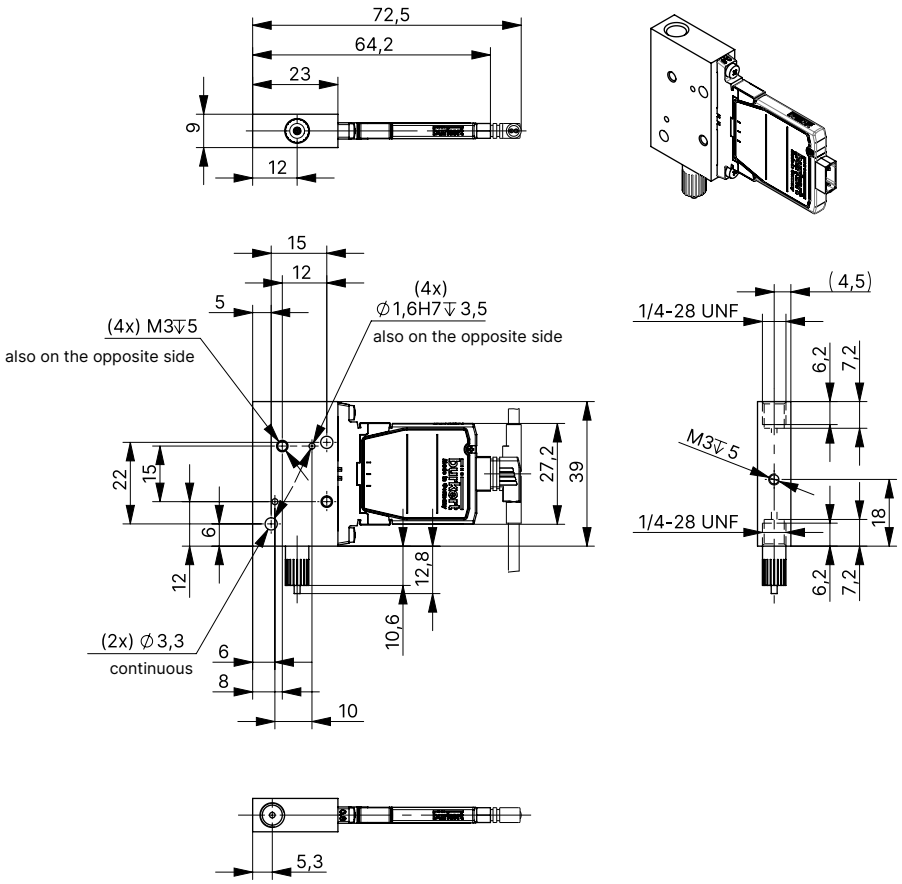

Fig. 10: Dimensions of dosing head 1-fold

5.5.2 Dimensions of dosing head 8-fold

Note:
Dimensions in mm

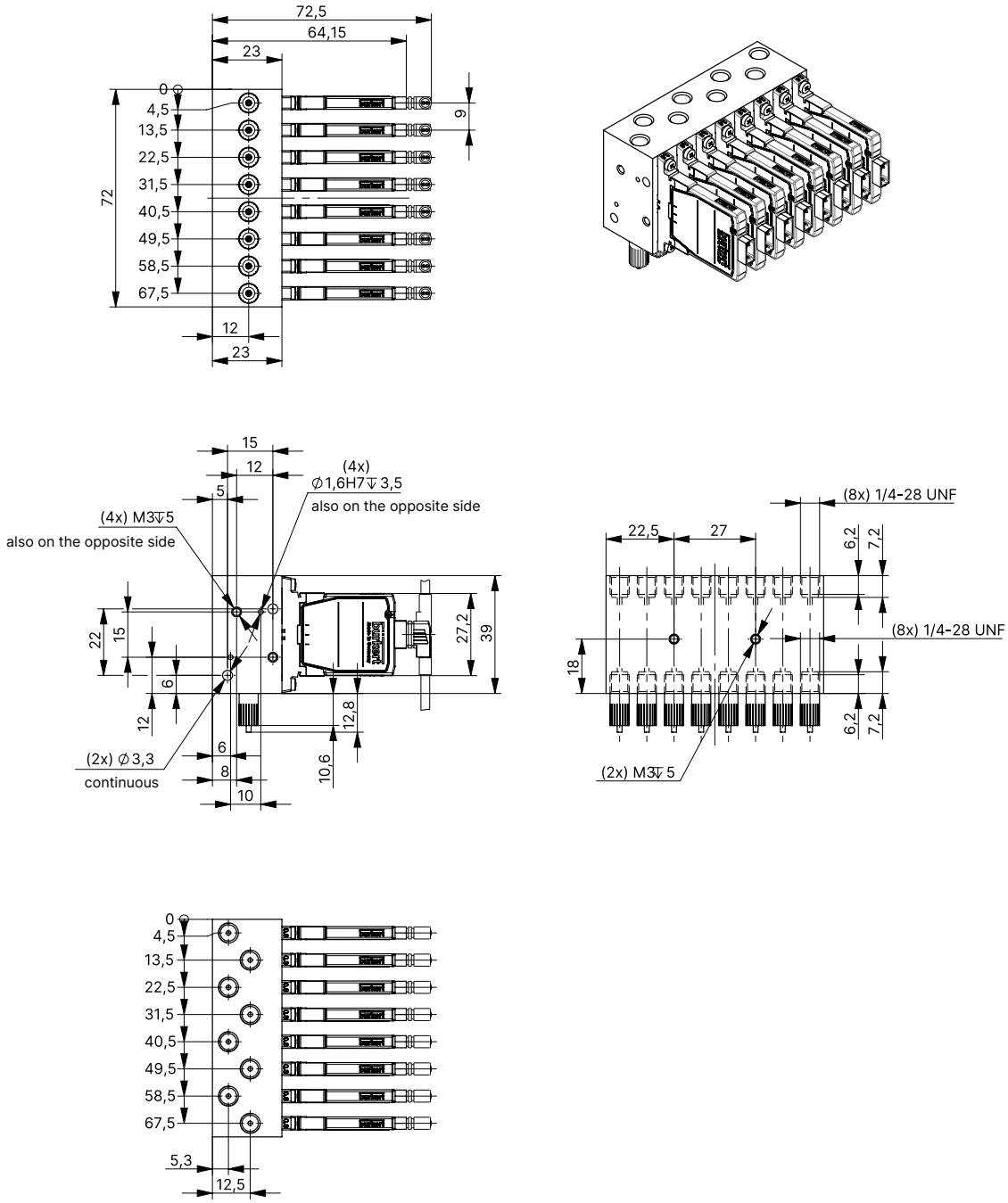

Fig. 11: Dimensions of dosing head 8-fold

5.6 Fluidic connection for media container to dosing head

The pressure supply and pressure controller are not part of the dosing set. Bürkert recommends pressure controller type 8763.

- The pressure supply to the media container must be above the liquid.
  The pressure supply (e.g. through a hose) should not be immersed in the medium. Otherwise, no ventilation can take place and gas is introduced into the medium.
- For precise dosing, the pressure must be constantly regulated.
- Do not pressurise the system until the fluidic build-up is complete.
- The liquid to be dosed must be pressurised, otherwise dosing is not possible.

The following illustrations serve as a guide, based on an exemplary test setup. Deviations may occur depending on the system setup, physical properties of the liquid to be dosed and environmental influences.

Further information on the design of the dosing system can be found at Performance specifications [▶ 49]

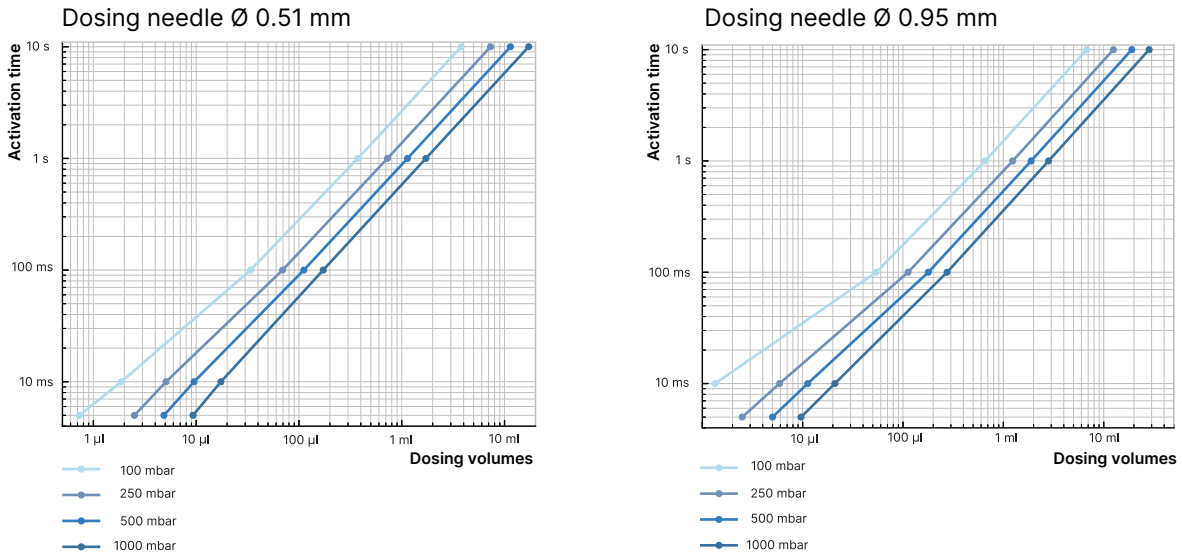

Fig. 12: Design of the dosing system depending on the dosing volume

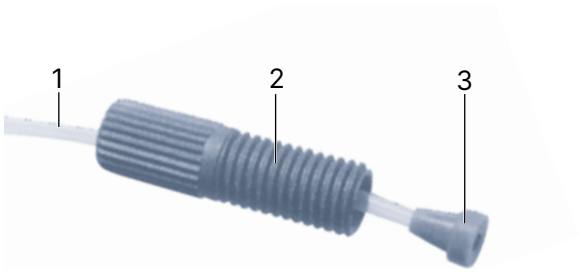

Fig. 13: Hose connection

1 Hose (1/8" outer diameter)	2 Fitting with UNF thread 1/4"...28
3 Collet	

- ▸ Route the hose from the media container to the dosing head.
- ▸ Push the collet onto the hose, guide the hose completely through the collet.

- Guide the fitting over the hose as shown.
- Screw the unit into the fluidic port on the inlet side[4] of the distribution block and tighten hand-tight, **do not crush under any circumstances**.
  The collet and the hose form a reliable seal without the use of other materials.

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4) Input side: hole vertically offset upwards or downwards

6 Electrical connection

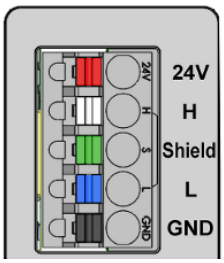
Risk of injury or material damage when working on the device or system.

- Read and observe the chapter Safety [▶ 8] before working on the device or system.

6.1 Connect the fieldbus gateway electrically.

Further information on the electrical connection can be found in the operating instructions for the fieldbus gateway type ME43 under country.burkert.com.

- Connect the connection terminal according to the pin assignment.
  To do this, press the terminal down with a slotted electronic screwdriver (e.g. 1.8 x 0.3 x 60 mm), plug in the cable and then remove the screwdriver from the terminal.
  Possible cable cross-section: ≤1.5 mm²

Plug view	Terminal colour	assignment
	Red	Supply voltage 24 V DC ⎓
	White	CAN_H (büS connection)
	Green	Shielding
	Blue	CAN_L (büS connection)
	Black	GND

Tab. 1: Pin assignment of 5-pin connection terminal

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6.2 Establish connection to the fieldbus

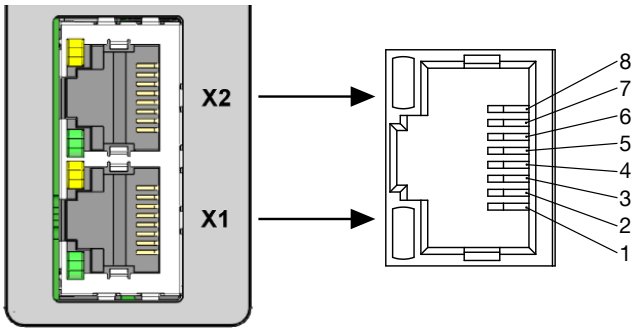
The fieldbus gateway is designed to be connected to a fieldbus communication protocol.

However, this is not necessary for the LDO application, as the gateway also works via büS without the fieldbus protocol. However, error messages are then indicated in the Bürkert Communicator.

The error messages can be ignored or deactivated (see chap. Fieldbus gateway messages [▶ 29]).

The connection to a fieldbus only needs to be established if the dosing system is operated with a higher-level programmable logic controller.

The procedure for integrating the gateway into the PLC network is described in the type ME43 operating instructions under country.burkert.com.

Plug view	Pin	assignment
	1	TX+
	2	TX–
	3	RX+
	4	not assigned
	5	
	6	RX–
	7	not assigned
	8	

Tab. 2: Industrial Ethernet, pin assignment of push-in connector interfaces X1 and X2

The X1 and X2 interfaces for RJ45 push-in connectors are equivalent.

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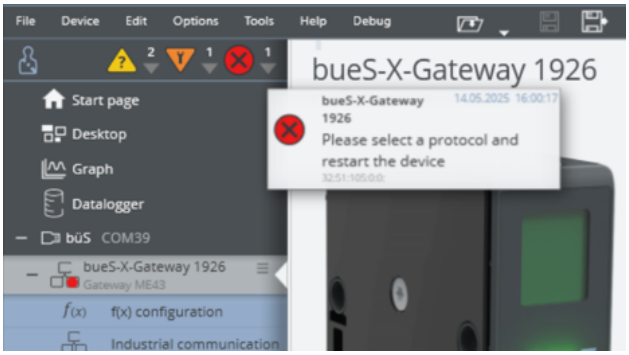
6.2.1 Fieldbus gateway messages

If the fieldbus gateway is not connected to a fieldbus, error messages are displayed in the Bürkert Communicator. However, the messages are **not relevant** for the function of the dosing system.



Please select a protocol and restart the device

büS event: büS is NOT operational

Initialize f(x)

Initialization of industrial communication

Deactivate error messages

User level: installer

Menu
Fieldbus gateway
> General settings
> Parameter
> Administrate device functions
> Window "Administrate device functions" Industrial communication: Off 

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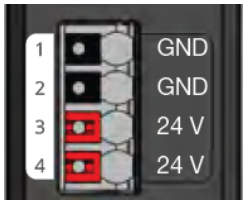
6.3 Commissioning the I/O module, connecting the solenoid valve

6.3.1 Electrical pin assignment of I/O module

- Connect the I/O module to the power supply using suitable strands according to the following table.
  To do this, press the terminal down with a slotted electronic screwdriver (e.g. 1.8 x 0.3 x 60 mm), plug in the cable and then remove the screwdriver from the terminal.

Further information on the electrical connection can be found in the operating instructions for the I/O module type ME44 under country.burkert.com.

	Pin assignment of AUX power		External circuit
	1	GND	Mass
	2	GND	Mass
	3	24 V	AUX power supply voltage 24 V ⎓ +20%/–15%
	4	24 V	AUX power supply voltage 24 V ⎓ +20%/–15%

	Pin assignment of digital outputs		External circuit
	5	GND	Mass
	6	DO1...DO8	Digital output +

6.3.2 Circuit diagram of I/O module

The circuit diagram is pressed onto the outside of the DO module.

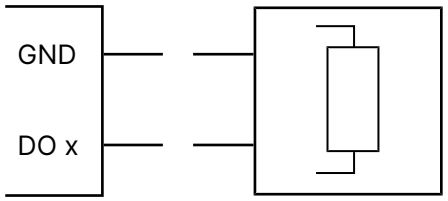


Fig. 14: Circuit diagram of DO module

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6.3.3 Connecting the solenoid valve

NOTICE!

The solenoid valve is not suitable for continuous operation without an intended power reduction.
The power reduction can be parameterised in the I/O module and is enabled at the factory.

All valves in the block assembly must have the same polarity. The marking (+) on the valve and the numbers 1 and 2 on the push-in connector serve as orientation.
A type-specific push-in connector is available as accessories (see data sheet of type 6650).

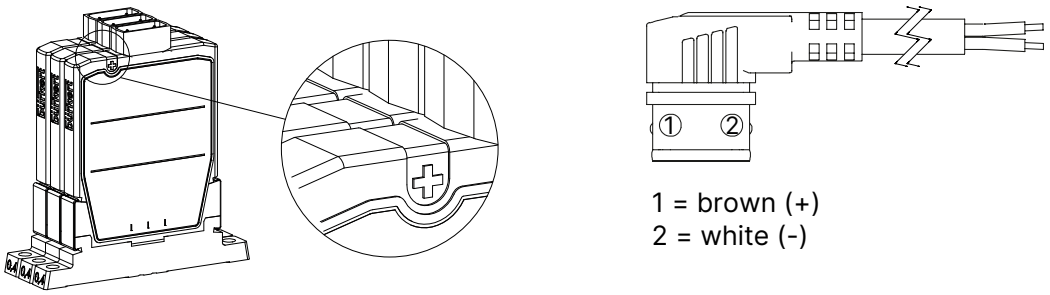
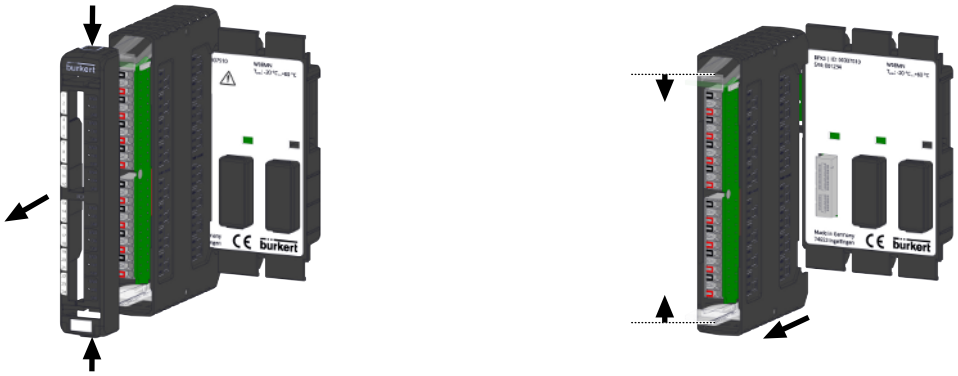


Fig. 15: Polarity for block assembly, push-in connector

- Connect the solenoid valve wires to the respective terminals.
  To do this, press the terminal down with a slotted electronic screwdriver (e.g. 1.8 x 0.3 x 60 mm), plug in the cable and then remove the screwdriver from the terminal.

For I/O modules that are difficult to access

If the I/O module is difficult to access, it can be removed from the backplane for electrical connection:



- Press the upper and lower catches of the connection panel (blue squares) simultaneously and pull the panel off the I/O module.
- Press the upper and lower unlocking devices of the I/O module towards the centre of the device and pull the module off the backplane.
- Replace the connection panel on the I/O module and snap it into place.

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7 Commissioning

Risk of injury or material damage when working on the device or system.

- Read and observe the chapter Safety [▶ 8] before working on the device or system.

7.1 Install Bürkert Communicator

Required components

- Bürkert Communicator software
  The software can be downloaded free of charge at country.burkert.com.
- USB-büS-interface set type 8923
  Information on the USB-büS-Interface set can be found at country.burkert.com

Installation of the Communicator

- Install Communicator on a PC.
  Note: Do not connect the büS stick to the PC during installation.

Detailed information on operating the Communicator can be found in the software operating instructions under country.burkert.com.

For information on user levels and activating password protection, see Appendix [▶ 49]

7.2 Connect Communicator to büS/CANopen device

- Set the terminating resistor (on the büS stick or external terminating resistor).
- Use the USB-büS-Interface set to establish the connection between the device and the PC.

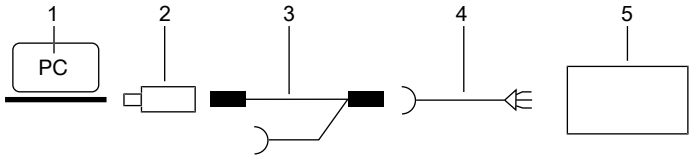

Fig. 16: Connecting the device to the PC

1	PC	2	büS stick
3	büS cable with connection socket for power supply unit	4	büS adapter cable, M12 to cable with strand
5	Device with connection terminal		

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7.3 Connecting the Communicator to the büS/CANopen network

- Do not set an additional terminating resistor (check the slide switch on the büS stick!).
- Use the USB-büS-Interface set to establish the connection between the network and the PC.

7.4 Add interface

- Click on the icon in the menu bar of the Communicator.
- Select the appropriate interface in the **Connection manager** viewlet.
- To adjust the properties of the connection, click on the pencil icon.
  - Ensure that the set baud rate corresponds to the network.
  - When connecting to a CANopen network, select **Don't send heartbeats (more PLC-friendly)** if necessary. This means that the Communicator is not recognised by the programmable logic controller.

✓ The device is displayed in the navigation area on the left-hand side of the user interface.

7.5 Make base settings, impulse operation mode

In the impulse operation mode, a fixed time is predetermined as the impulse at the output of the channel and is activated by the rising edge of a trigger signal. An internal timer allows the output of a high-precision signal with an accuracy of ±10 µs.

See also chapter Behaviour of outputs in the impulse and dosing operation modes [▶ 12]

The base settings are made in the “Channel” menu.

The settings are described below using the example of **Channel 1**.

The user level for all settings is: Installer

Labelling of the factory settings:

Menu	Description
DO module	
> **Digital outputs**	
> **Parameter**	
> **Channel 1**	

Tab. 3: Path to the “Channel” menu for the base settings

7.5.1 Setting the operation mode

Menu	Description
> **Channel 1**	
> **Operating mode**	Setting the operation mode **Impulse**.

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7.5.2 Setting the set-point value source

Menu	Description
> Channel 1	
> Setpoint source	Determines how the impulse duration is defined.
> Fixed ◉	Enter a fixed value in the menu **Impulse duration**.
> büS	Information is provided via the büS network.
> Impulse duration	Time at which the output is activated.
1.0000 s ◉	The dosed quantity can be changed by adjusting the impulse duration.

7.5.3 Switch independent input on or off

Menu	Description
> Channel 1	
> Independent input	
> Off ◉	A bit from the bit field is used as the input value.
> On	Activate if a separate input value is to be used for this channel.

7.5.4 Enter channel name

Menu	Description
> Channel 1	
> Channel name	Channel name for the partner configuration.

7.5.5 Define error handling

Menu	Description
> Channel 1	
> Error handling	The error handling determines which state the digital output will take on in the event of an error.
> Error value	
> Off ◉	The digital output remains off or is deactivated.
> On	The digital output remains on or is enabled.
> Short circuit detection	Error handling in the event of a short circuit.
> Off	
> On ◉	A short circuit cancels an active impulse.

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7.5.6 Activate/deactivate inversion

Menu	Description
> Channel 1	
> Inversion	Reverse the circuit function of the output.
> Off ◉	
> On	

7.5.7 Activate/deactivate power reduction

Observe the performance data of the valve used! The following settings apply to the solenoid valve type 6650. The performance data may differ for other valves.

NOTICE!

Function failure due to overheating

If the power reduction is deactivated and the duty cycle is too long, the solenoid may overheat.

- For duty cycles > 50 s (> 60 s for single installation), only operate solenoid valves with enabled power reduction.

Important information on power reduction in the type 6650 operating instructions under country.burkert.com.

Menu	Description
> Channel 1	
> Power reduction	Energy is saved because a parametrisable PWM signal is activated instead of a permanent “on” signal.
> Status	
> Inactive	
> Active ◉	
> Power reduction after	
0.30 s ◉	
> Duty cycle	
35 % ◉	Value for the reduced output power.

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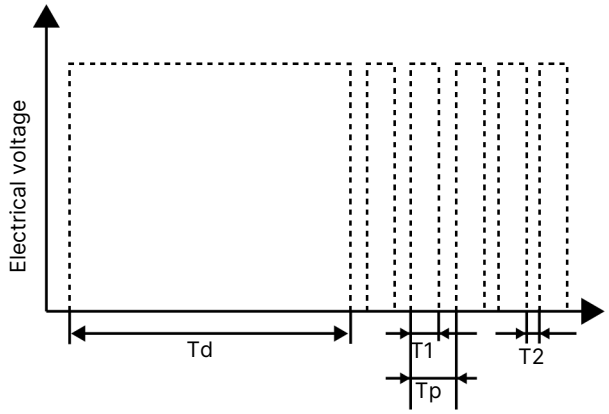

Fig. 17: Timing of the output signal of individual channels based on the trigger signal

Td	Time until the power reduction is active	T1	Impulse duration
Tp	Period duration (PWM 20 kHz)	T2	Off time duration

The principle of power reduction

With rapidly successive short impulses smaller than [Td], the absorbed energy can be higher.

Further information can be found in the operating instructions for the solenoid valve type 6650 under country.burkert.com.

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7.6 Make base settings, “Dosing” operation mode

The dosing operation mode requires adjustment before use. To carry out the adjustment, the dosing quantity must be measured. A suitable measuring device, such as a precision scale, should be provided for this purpose.

The entire calibration process is carried out in the Communicator. Once the adjustment has been initiated, the user will be guided step by step through the adjustment process with instructions displayed on the screen.

Based on the relationship between the impulse duration and the resulting dosing quantity determined during adjustment, further target values can be extrapolated. For optimal results, the adjustment should be as close as possible to the desired dosing quantity in the application.

See also Behaviour of outputs in the impulse and dosing operation modes [▶ 12]

The base settings are made in the “Channel” menu.

The settings are described below using the example of Channel 1.

The user level for all settings is: Installer

Labelling of the factory settings: ◉

Menu	Description
DO module	
> Digital outputs	
> Parameter	
> Channel 1	

Tab. 4: Path to the “Channel” menu for the base settings

7.6.1 Setting the operation mode

Menu	Description
> Channel 1	
> Operating mode	Setting the operation mode **Dosing**.

7.6.2 Setting the set-point value source

Menu	Description
> Channel 1	
> Setpoint source	Determines how the dosing quantity is defined.
> Fixed ◉	Enter a fixed value in the menu **Dosing amount**.
> büS	Information is provided via the büS network.
> Dosing amount	The accuracy can be improved by adjustment.
1,000 ml ◉	

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7.6.3 Perform adjustment

A suitable measuring device, such as a precision scale, should be provided for testing and teaching in the system.

The adjustment is an iterative process. The accuracy of the dosing can be improved by repetition.

Menu	Description
> Channel 1	
> **Adjustment**	Manual adjustment of the dosing of this channel.
> **Adjust dosing**	A wizard guides the user step by step through the adjustment process using instructions on the screen.

- **Repeat adjustment** if the measured dosing quantity does not match the target dosing quantity. Input the measured value under **Measured amount**.
- **Save adjustment** if the measured dosing quantity matches the target dosing quantity.

7.6.4 Switch independent input on or off

Menu	Description
> Channel 1	
> Independent input	
> Off ◉	A bit from the bit field is used as the input value.
> On	Activate if a separate input value is to be used for this channel.

7.6.5 Enter channel name

Menu	Description
> Channel 1	
> **Channel name**	Channel name for the partner configuration.

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7.6.6 Define error handling

Menu	Description
> Channel 1	
> Error handling	The error handling determines which state the digital output will take on in the event of an error.
> Error value	
> Off ◉	The digital output remains off or is deactivated.
> On	The digital output remains on or is enabled.
> Short circuit detection	Error handling in the event of a short circuit.
> Off	
> On ◉	A short circuit cancels an active impulse.

7.6.7 Activate/deactivate inversion

Menu	Description
> Channel 1	
> Inversion	Reverse the circuit function of the output.
> Off ◉	
> On	

7.6.8 Activate/deactivate power reduction

Observe the performance data of the valve used! The following settings apply to the solenoid valve type 6650. The performance data may differ for other valves.

NOTICE!

Function failure due to overheating

If the power reduction is deactivated and the duty cycle is too long, the solenoid may overheat.

- For duty cycles > 50 s (> 60 s for single installation), only operate solenoid valves with enabled power reduction.

Important information on power reduction in the type 6650 operating instructions under country.burkert.com.

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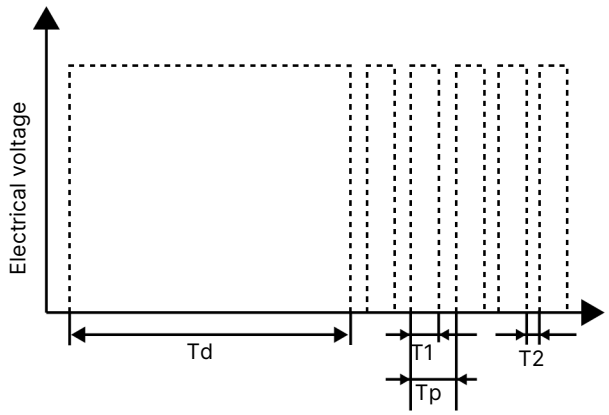
Menu	Description
> Channel 1	
> Power reduction	Energy is saved because a parametrisable PWM signal is activated instead of a permanent “on” signal.
> Status	
> Inactive	
> Active ◉	
> Power reduction after	
0.30 s ◉	
> Duty cycle	
35 % ◉	Value for the reduced output power.



Duty cycle = T1/Tp

Fig. 18: Timing of the output signal of individual channels based on the trigger signal

Td	Time until the power reduction is active	T1	Impulse duration
Tp	Period duration (PWM 20 kHz)	T2	Off time duration

The principle of power reduction

With rapidly successive short impulses smaller than [Td], the absorbed energy can be higher.

Further information can be found in the operating instructions for the solenoid valve type 6650 under country.burkert.com.

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7.7 Fluidic start-up

Requirements

- The pressure supply to the media container must be above the liquid.
  The pressure supply (e.g. through a hose) should not be immersed in the medium. Otherwise, no ventilation can take place and gas is introduced into the medium.
- For precise dosing, the pressure must be constantly regulated.
- Do not pressurise the system until the fluidic build-up is complete.
- The liquid to be dosed must be pressurised, otherwise dosing is not possible.

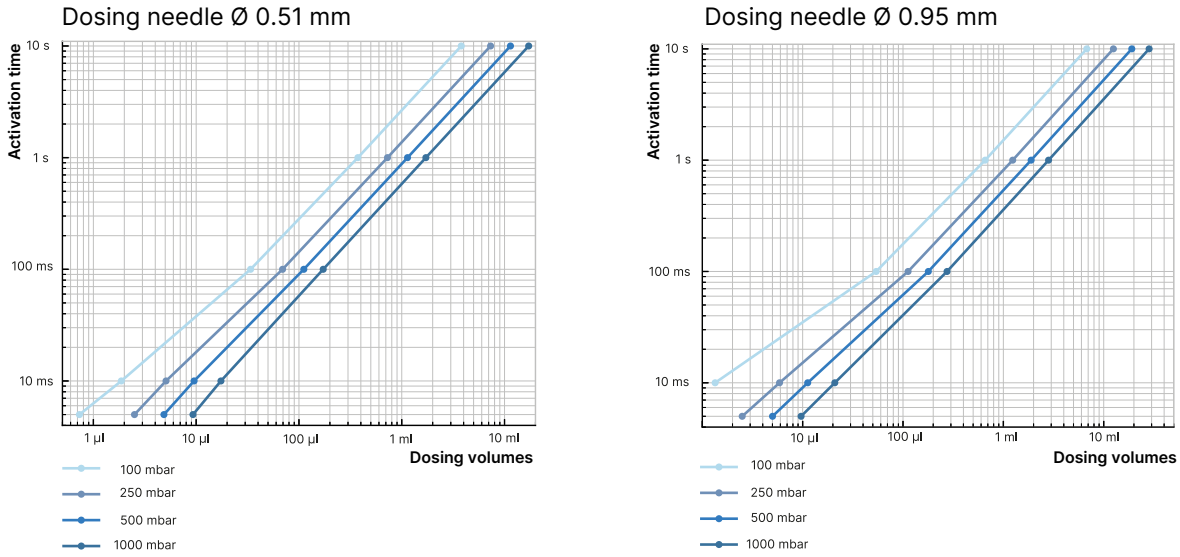

Fig. 19: Design of the dosing system depending on the dosing volume

Start-up

- ▸ Completely coil the system; no air bubbles should remain in the hose. Air bubbles distort the dosing result.
- ▸ Open the dosing valve(s) to coil the channels with liquid. Open and close the dosing valve(s) several times.
  The Manual override button can be used to normally close contact with the valves.
- ▸ Finish the flushing process by closing the valve. Only end the coil when a continuous jet of liquid without air bubbles emerges from the needle tip.

Button Manual override

Select operation mode > Independent input “on” > the button is displayed in the device overview.

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8 Setting and operation

Risk of injury or material damage when working on the device or system.

- Read and observe the chapter Safety [▶ 8] before working on the device or system.

8.1 Note on setting and operating

Detailed information on setting and operating the various components of the dosing system can be found in the operating instructions for the corresponding components.

The operating instructions can be found at country.burkert.com by specifying the type number of the component.

Type number	Components
ME43	Fieldbus gateway
ME44	I/O module
6650	Solenoid valve

8.2 Pressure and temperature settings

The dosing quantity is directly dependent on the pressure: **The higher the pressure, the more is dosed in the same time, and vice versa.** Therefore, it is important to adjust the pressure according to the requirements of the application.

Temperature stability also plays a decisive role in dosing accuracy. **The more stable the temperature is kept, the better and more consistent the dosing results are over several doses.**

To achieve optimum results, both pressure and temperature should be carefully monitored and kept constant.

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9 Maintenance

Risk of injury or material damage when working on the device or system.

- Read and observe the chapter Safety [▶ 8] before working on the device or system.

9.1 Replacing the dosing needle

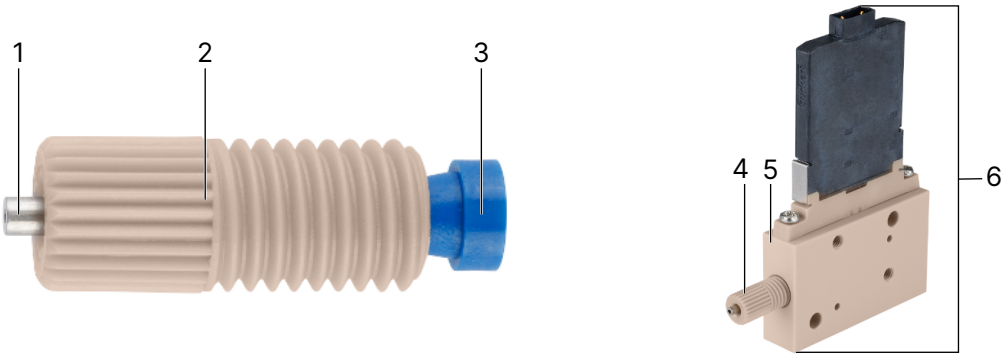

Fig. 20: Dosing needle

1	Precision pipe for dosing needle	2	Fitting with UNF thread 1/4"...28
3	Collet type TVU003 1/8"	4	Dosing needle
5	Distribution block	6	Dosing head

- Screw the dosing needle out of the distribution block.
- Separate the precision pipe, fitting and collet.
- Assemble the new precision pipe, fitting and collet as shown.
- Screw the dosing needle on the outlet side[5)] of the distribution block into the dosing connection and tighten hand-tight.

5) Output side: vertical centre drill hole

9.2 Replacing the dosing valve

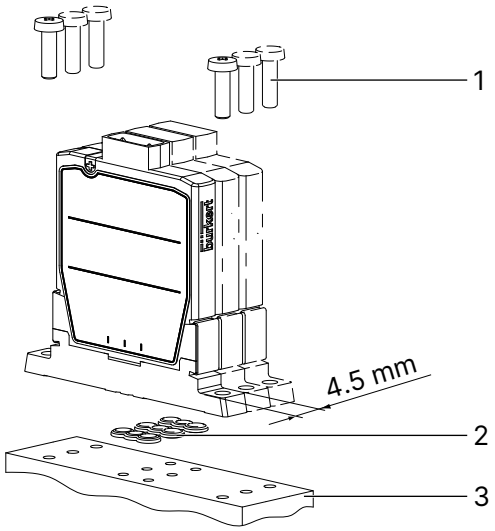

Fig. 21: Replacing the dosing valve

1 Flange screws	2 Sealing gasket
3 Distribution block	

- Loosen the 2 flange screws for each valve.
- Remove the valve from the distribution block.
- Ensure that the sealing gasket is correctly seated on the new valve.
- Screw the new valve onto the distribution block. Tightening torque 0.35...±0.1 Nm.
- Check the valve for tightness.

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10 Troubleshooting

10.1 System does not dose

Cause	Solution
Pressure not sufficient.	▸ Check pressure supply.
Dosing needle clogged.	▸ Screw the dosing needle out of the block.
	▸ Clean the precision pipe.
	▸ Refit the dosing needle and check the function.
System leaking.	▸ Check the fittings and retighten if necessary (observe the specified tightening torques).
Hoses defective.	▸ Check hoses for leaks and kinks.
	▸ Replace hoses if necessary.
No liquid in the system.	▸ Check the liquid level.

10.2 Fluctuating dosing volumes

Cause	Solution
Air bubbles in the system.	▸ Check the hoses for air bubbles.
	▸ Tighten the fittings.
Unstable media pressure provided by container pressure regulator.	▸ Use precision pressure regulator (e.g. Bürkert Type 8763).
Fluctuating viscosity of the medium due to excessive temperature changes.	▸ Minimize the influence of ambient temperature through insulation and air conditioning. Keep line lengths short.

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11 Uninstallation

Risk of injury or material damage when working on the device or system.

- Read and observe the chapter Safety [▶ 8] before working on the device or system.

11.1 Note on disassembly

Detailed information on disassembling the various components of the dosing system can be found in the operating instructions for the corresponding components.

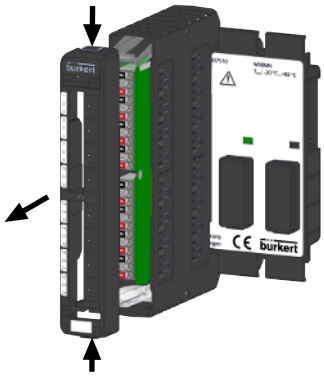
The operating instructions can be found at country.burkert.com by specifying the type number of the component.

Type number	Components
ME43	Fieldbus gateway
ME44	I/O module
6650	Solenoid valve

11.2 Detach system from standard rail

- Remove 5-pin spring-loaded terminal.
- Disconnect all cables from the system.
- Press the system upwards and release it from the upper guide of the standard rail.
- Remove the system from the standard rail.

11.3 Disassembling the I/O module from the backplane



- Press the upper and lower catches of the connection panel (blue squares) simultaneously and pull the panel off the I/O module.
- Press the upper and lower unlocking devices of the I/O module towards the centre of the device and pull the module off the backplane.
- Replace the connection panel on the I/O module and snap it into place.

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11.4 Disassembling the fieldbus gateway from the backplane

- Loosen the M4 socket head screw that secures the fieldbus gateway to the backplane.
- Disconnect the fieldbus gateway from the backplane.

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12 Logistics

12.1 Transport and storage

- Protect the device against moisture and dirt in the original packaging during transportation and storage.
- Avoid UV radiation and direct sunlight.
- Protect connections from damage with protective caps.
- Observe permitted storage temperature.

12.2 Return

No work or tests will be carried out on the device until a valid Contamination Declaration has been received.

- To return a used device to Bürkert, contact the Bürkert sales office. A return number is required.

12.3 Disposal

Environmentally friendly disposal

- Follow national regulations regarding disposal and the environment.
- Collect electrical and electronic devices separately and dispose of them as special waste.

Further information at country.burkert.com

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13 Appendix

13.1 Performance specifications

13.1.1 General definition

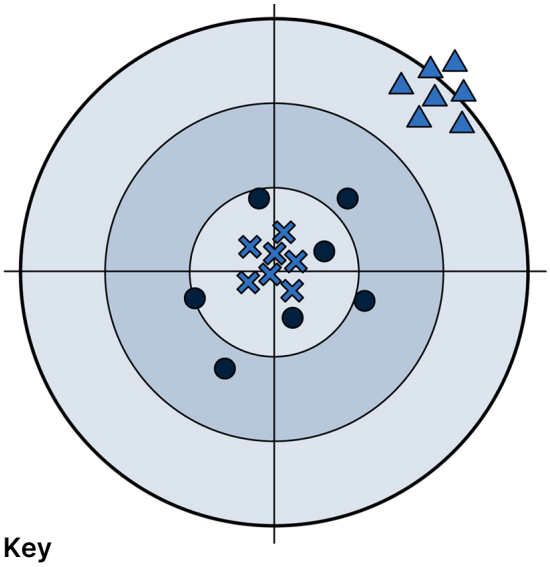
Dosing accuracy

Good dosing quality requires the right amount of liquid (dosing accuracy) in the right place (target accuracy) at the right time. The dosing accuracy includes both the precision and the correctness (or deviation) of a dosing series performed by a valve.

Precision describes the degree of agreement between several consecutive doses of a valve. It is significantly influenced by the system design, such as valve type, pressure regulation, hose diameter and needle. The CV value (coefficient of variation) is usually given as a dimension for precision.

Correctness (or deviation) describes the difference between the mean value of several doses and the target dosing quantity. This deviation is a systematic error and can be fully compensated for by adjustment.

After a teach-in and under constant conditions, the dosing system has a high repeatability. This means that extremely good dosing accuracy can be achieved in many cases. This applies to all dosing points and enables high accuracy of the overall system. The following figure illustrates the relationship between precision and accuracy.



Key

- High precision, low accuracy
- Low precision, high accuracy
- High dosing accuracy: high precision and high accuracy

Target accuracy

Target accuracy describes how precisely a target is hit over a certain distance between the dosing needle and the target. Typically, a microtiter plate with a cavity size of 3.7 x 3.7 mm (384-well) can be accurately hit from a vertical distance of ≤ 50 mm.

13.1.2 Reading example for the design of the dosing system

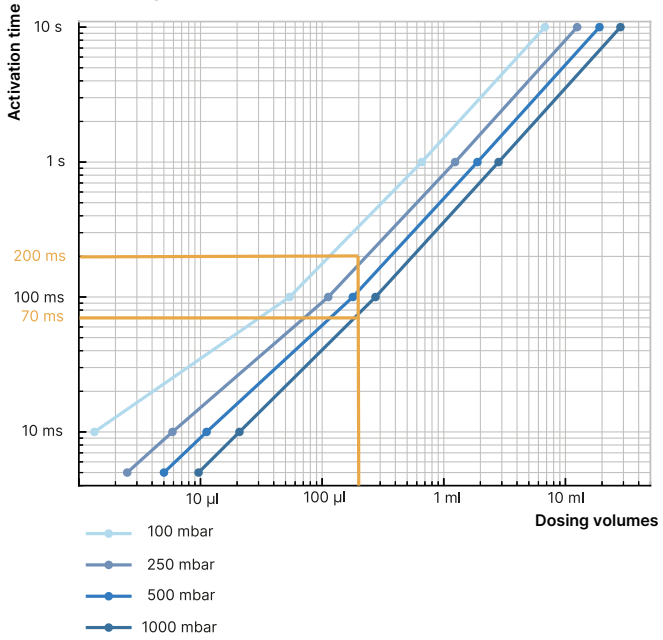
The following example shows how to use the diagrams (see “6.3. Diagrams for designing the dosing system depending on the dosing volume” on page 10) to correctly design your own dosing system.

In this example, a target dosing quantity of 200 µl has been selected. To find the parameters, follow the 200 µl line vertically to the intersection of the pressure curve that seems most suitable for the application. From this intersection point, follow the horizontal lines to the “Activation time” axis and obtain the corresponding required activation time.

This time depends on the pressure and the needle diameter. If a needle other than 0.95 mm is used, refer to the corresponding diagram.

In this example, the activation time for 200 µl at an inlet pressure of 250 mbar and a dosing needle with a diameter of 0.95 mm is approximately 200 ms. If the inlet pressure is increased to 1,000 mbar, the time is reduced to around 70 ms.

Dosing needle Ø 0.95 mm, Type 6650, DN0.8



13.1.3 Diagrams for designing the dosing system depending on the dosing volume

The diagrams are used to design the system. Different dosing needles are available depending on the application. The reading example describes how to read the diagrams depending on the requirements.

The following diagrams are plotted double-logarithmically to show the large volume range from microlitres to millilitres. All results shown are real measured values that were determined with a defined reference setup.

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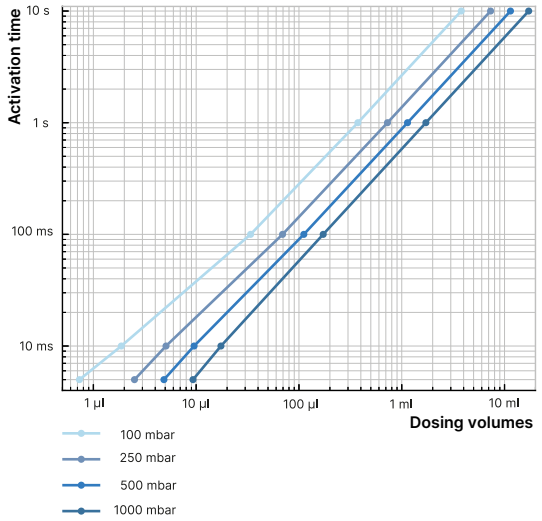
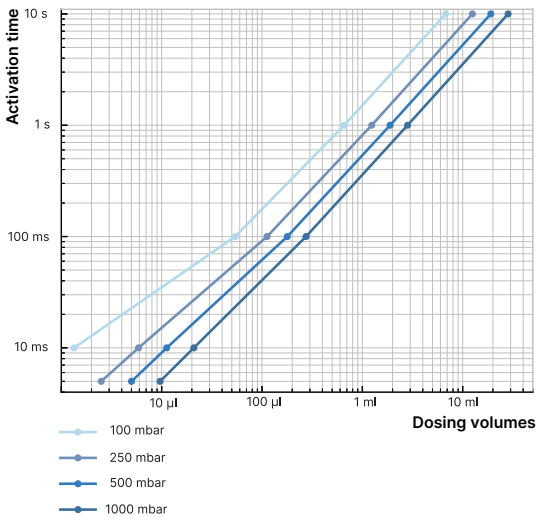
Dosing needle Ø 0.51 mm



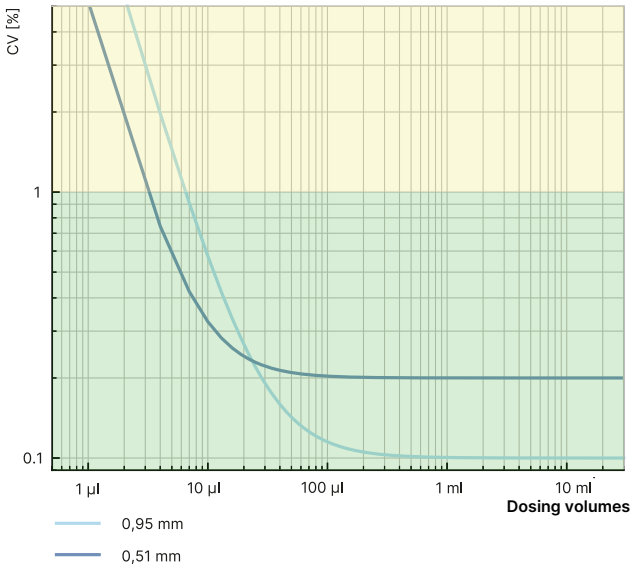
Dosing needle Ø 0.95 mm



13.1.4 Dosing accuracy diagram

The achievable accuracy is often an additional criterion for selecting the right components. The coefficient of variation (CV) is used to indicate the accuracy. It describes the ratio of the standard deviation to the mean value over several doses.

The following diagram shows typical accuracy values depending on the needle and the dosing quantity. For larger quantities, the dosing needle with a diameter of 0.95 mm is generally better suited, for which CV values in the range of 0.1% are characteristic. For quantities < 20 µl, the dosing needle with a diameter of 0.51 mm typically offers higher accuracy over several doses.



In addition to the accuracy of the individual dosing points, sample dispersion is another important criterion in systems with multiple dosing points. This scattering of the dosing points can be fully compensated for by calibrating the dosing point with a so-called teach-in.

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13.1.5 Reference setup

The data shown in the diagram refer to a standardised measurement setup. The pressure is precisely regulated in a media container. A precision pressure controller keeps the pressure constant and enables repeatable conditions. The pressure values for the tests are in the range from 100 mbar to 1,000 mbar. The dosing heads are supplied via hoses with an inner diameter of 1.6 mm and a length of 500 mm. All measurements on the reference system are carried out under laboratory conditions at +23 °C.

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13.2 User levels in the Bürkert Communicator

The Bürkert Communicator has the following user levels **User**, **Advanced user** and **Installer**.

After installation of the Bürkert Communicator, the user level **Installer** is active and password protection is deactivated.

NOTICE!

Security risk due to deactivated password protection and default password

Unauthorised persons can make changes to the system.

- Enable password protection.
- Use user-defined password.

Symbol	User level	Description
	User	Lowest user level, read authorisation, can change few values. No password
	Advanced user	Can change certain values and perform simple calibrations. Standard password: 5678
	Installer	Has all authorisations for operating the Bürkert Communicator. Standard password: 1946

Tab. 5: The active user level is indicated by an icon in the top left-hand area of the screen.

13.2.1 Enabling password protection

Setting a password enables password protection.

NOTICE!

Security risk due to standard passwords.

The default passwords are publicly accessible and therefore not secure. Unauthorised persons can log in to the web server and make changes to the system.

- Use user-defined passwords.

- Select Options > Password manager....
- Enter user-defined passwords.
- Save

13.2.2 Activating or deactivating user level

Activate the password-protected user level:

- Click on the user level icon (top left of the screen).
- Enter password.

✓ The user level with password protection is active.

Deactivate the password-protected user level:

- Click on the user level icon.

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▸ Logout

✓ The user level without password protection is active.

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