



Installation Manual



Liquid Dosing Set (LDS)

Doc. no.: 9.17.146 rev. C Date: 31-08-2021



ATTENTION

Please read this document carefully before installing and operating the product.
Not following the guidelines could result in personal injury and/or damage to the equipment.



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Symbols on the equipment

One or more of the following signs may be attached to the product:



Read the instruction manual before installing and operating the product



General warning; consult the instruction manual for handling instructions (the appearance of this symbol may vary)



Surface may get hot during operation



Shock hazard; electrical parts inside

Symbols in this document



Important information. Disregarding this information could increase the risk of damage to the equipment, or the risk of personal injuries.



Tips, useful information, attention points. This will facilitate the use of the instrument and/or contribute to its optimal performance.



Additional information available in the referenced documentation, on the indicated website(s) or from your Bronkhorst representative.

Warranty

Bronkhorst® products are warranted against defects in material and workmanship, provided they are used in accordance with the ordering specifications and not subject to abuse or physical damage. Products that do not operate properly during the warranty period may be repaired or replaced at no charge.

The warranty includes all initial and latent defects, random failures, and indeterminable internal causes. It excludes failures and damage caused by the customer, such as contamination, improper electrical hook-up, physical shock, etc.

Re-conditioning of products primarily returned for warranty service that is partly or wholly judged non-warranty may be charged for.

Bronkhorst High-Tech B.V. or affiliated company prepays outgoing freight charges when any part of the service is performed under warranty, unless otherwise agreed upon beforehand. However, if the product has been returned collect to our factory or service center, these costs are added to the repair invoice. Import and/or export charges, foreign shipping methods/carriers are paid by the customer.

Receipt of equipment

- Check that the outer packaging and its contents have not been damaged during transport. If the outer packaging or its contents are damaged, the local carrier must be informed immediately regarding his liability, if so required. At the same time a report should be submitted to your Bronkhorst representative.
- Check the packing list to ensure that you received all items included in the scope of delivery.
- Do not discard spare or replacement parts.
- See Removal and return instructions for information about return shipment procedures.

Equipment storage

- The equipment should be stored in its original package in a climate controlled storage location.
- Care should be taken not to subject the equipment to excessive temperatures or humidity.
- See technical specifications for information about required storage conditions.

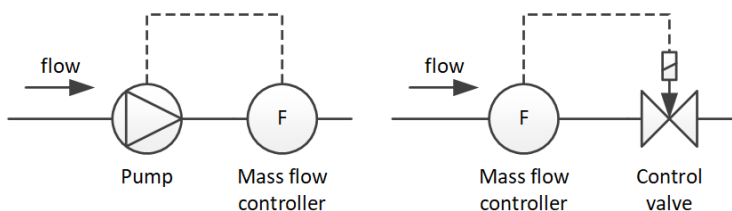
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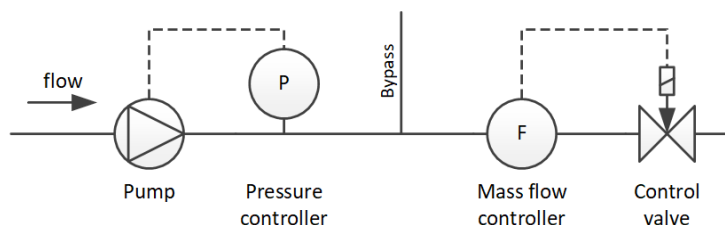
1 Introduction

1.1 Scope of this document

A **Liquid Dosing Set (LDS)** is a conjunction of one or more controlling Bronkhorst® instrument(s) and one or more actuators (pump and/or valve), which are used to generate or limit a liquid flow. In its most basic setup, the controlling instrument can be a mass or volume flow controller, whereas the actuator can be a control valve (in a pressurized fluid system) or a pump (which draws liquid from a storage vessel and provides the necessary forward pressure to the fluid system). Note that the variant with a control valve is basically the same as a common (Bronkhorst®) flow controller.



In a pressure-controlled setup, a stable forward pressure is generated by means of a pump and a pressure controller. Depending on the required dosing method (batch or continuous), a dosing valve or a control valve in conjunction with a flow controller can be used to feed a consistent amount of liquid to a process.



This document contains installation and operating instructions and troubleshooting tips for the core components of the LDS. It does not in any way replace the manuals for the individual components; for correct installation and operation these manuals are indispensable.

Complementing the installation information for the core components, this document also contains advice and background information for the use of additional components that can help optimize the dosing process (some of which may already be included in the scope of delivery).

1.2 Intended use

The LDS has been developed to accurately measure and control flow rates (mass or volume) and/or pressures in a fluid system, applying the media and operating conditions (e.g. temperature, pressure) as specified on the purchase order.

Any other use than mentioned here is considered unintended.

Responsibility for the use of the equipment with regard to its intended use, suitability, cleaning and compatibility of process media with the applied materials lies solely with the end user.

Bronkhorst High-Tech B.V. cannot be held liable for any damage and/or injury resulting from unintended, improper or unsafe use, or use with other media and/or under other conditions than specified.

2 Safety instructions

2.1 General precautions



Please read this document entirely and carefully before installing and operating the product. Not following the guidelines could result in personal injury and damage to the product and the system(s) it is incorporated in or connected with.

The product(s) described in this document may only be used by qualified personnel who are familiar with combined fluid and electrical systems and who recognize the associated hazards (e.g. (high) fluid pressure, electric shock).

The end user is considered to be familiar with the required safety precautions to prevent damage and/or injury while working with the process media (as described in the associated Material Safety Data Sheets) and the equipment.

Where appropriate, this document recommends or prescribes safety measures to be taken with respect to media or equipment usage under the specified conditions. Still, the end user remains responsible for taking the required safety precautions and for the proper use of appropriate (personal) protective equipment, even if such is not explicitly recommended or prescribed in this document.

The equipment and its accessories must be used in accordance with their specifications and intended use. The customer is responsible for conducting a risk analysis for the entire system and take the required safety precautions following applicable laws and regulations. Based on the risk analysis, the customer should describe (and adhere to) standard operating procedures to ensure safe use of the equipment.

Parts of the assembly may be dismantled and/or replaced for maintenance, repair or cleaning purposes only. Individual instruments may not be disassembled or modified in any way or for any purpose. Any unauthorized modification, for any purpose whatsoever, will be considered [unintended and improper use](#), will void warranty and cancel the manufacturer's liability. Unauthorized modifications can undo safety features, compromise system specifications (such as ingress protection rating) and cause failure to comply with applicable laws, regulations and directives.

If the product is defective or otherwise does not meet your requirements, please contact your Bronkhorst representative for assistance or advice.

2.2 Replacement parts

Replacement parts should be obtained from Bronkhorst and should match the original system specifications. The use of alternative components or components with deviating specifications can adversely affect the functionality, accuracy and durability of the entire system and undo provisions for protection against electric shock and fire.

Standard fuses with national safety approval may be used (if applicable), provided that rating and type are the same as those of the original fuses.

Non-safety-related components may be obtained from other suppliers, provided they are equivalent to the original components.

If you are unsure about the suitability of a replacement component, please contact your Bronkhorst representative for information.

2.3 Safety warnings



Always follow local guidelines for safe lifting of heavy and/or large objects.



Do not apply fluid pressure until all required fluid connections and electrical connections have been made.



Check the fluid system for leaks before applying full operating pressure, especially when using hazardous media (e.g. toxic or flammable).



In order to be able to comply with all applicable guidelines and regulations, it is imperative that electrical connections be made by or under supervision of a qualified electrician.



- The equipment described in this document contains electronic components that are susceptible to **electrostatic discharge**.
- When working on the electrical installation, take appropriate measures to prevent damage as a result of electrostatic discharge.



The equipment bears the **CE mark** to indicate that it complies with requirements imposed by the European Union, including **electromagnetic compatibility (EMC)**.

EMC can only be guaranteed by applying appropriate cables and connectors or gland assemblies:

- Cable wire diameters must be sufficient to carry the supply current and minimize voltage loss.
- When connecting the product to other devices, ensure that the integrity of the shielding remains uncompromised; use shielded cables and connectors where possible and/or required.
- Preferably use the supplied cables (if applicable) to make electrical (signal) connections to and between the supplied components. These cables are shielded, have the required wire diameter, and loose ends (if applicable) are marked to facilitate correct connection.

If not all requirements for proper shielding can be met (for example, because a component is not equipped with shielded connectors), take the following measures to ensure the best possible shielding:

- Keep cable lengths at a minimum.
- Route cables as closely as possible alongside metal structures or components.
- Ensure all electrical components are grounded to earth.

When in doubt about the shielding of your cabling and/or electrical connections, contact your Bronkhorst representative.



Always isolate the electrical power before connecting or disconnecting equipment.



- If a separate power switch is included in the scope of delivery, it should be used to switch all components of the assembly on or off simultaneously.
- The power switch should be within easy reach of the operator.
- Because the LDS is not a self contained system, it has no emergency stop facility.
- It is the responsibility of the customer to identify the risks of the system in which the LDS will be incorporated and to take appropriate measures if necessary.



The pressure relief valve is not a safety device, but merely serves to protect critical fluid system components. The end user is responsible for appropriate safety measures to prevent overpressurization of the LDS and the surrounding fluid system (if applicable).



Before operating the LDS, make sure that the equipment has been installed and configured by an authorized service engineer and that the installation is approved for use.



Frequent inspection of all fluid lines and connections before, during and after operation is essential, to ensure and maintain a safe working environment. If necessary, re-tighten fluid connections.



Ensure that the surface temperature of the pump head does never exceed the flash point temperature of the process media.



Before loosening fluid connections or disassembling/reassembling any parts of the system (electrical or fluid related), make sure that:

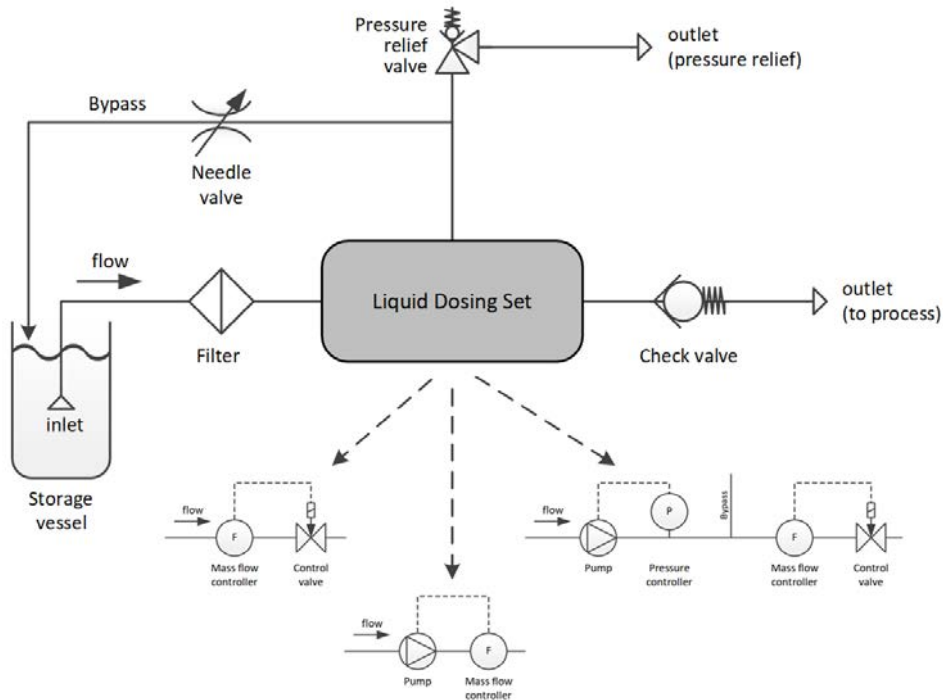
- *the fluid system is brought to atmospheric pressure*
- *the pump is not running (if applicable)*
- *the equipment is isolated from the electrical power source*



Inexpertly servicing instruments can lead to serious personal injury and/or damage to the instrument or the system it is used in. Servicing must therefore be performed by trained and qualified personnel. Contact your Bronkhorst representative for information about cleaning and calibration. Bronkhorst has a trained staff available.

3 Installation

The image below shows a schematic representation of a dosing system with some peripheral facilities to optimize control behavior. Depending on the required system characteristics, some components may be recommendable or even necessary.



3.1 Placement



For optimal performance, observe the following guidelines:

- Place the assembly on an even, level surface with a rigid and stable underground.
- The construction or surface to which the equipment is mounted should be able to support the dimensions and weight of the entire assembly.
- Use the provided mounting holes to fixate the equipment. Consult the according dimensional drawing(s) for the exact sizes and locations of the mounting points.
- Avoid installation in close proximity of mechanical vibration.
- When using vibration dampers, ensure an even load distribution.
- Use the equipment in an environment with a stable ambient pressure and temperature.



Always follow local guidelines for safe lifting of heavy and/or large objects.

3.2 Piping



Use piping or tubing that is suitable for the operating conditions of the application (media, maximum temperature, maximum operating pressure).



Use flexible piping/tubing to connect the LDS with the surrounding fluid system, to neutralize external vibrations and prevent stress on the connections.

3.3 Fluid connections

- Connect the instrumentation to each other and to the fluid system in accordance with the relevant manuals.
- Tighten connections according to the instructions of the manufacturer of the fittings. The use of Swagelok® adapters is recommended.
- Make sure connector sizes match; do not mix metric (mm) and imperial (inch) sizes.
- Make sure all connectors and tubing are absolutely free from dirt and debris.
- Check all pre-installed fluid connections (if any); if necessary, re-tighten connections according to the instructions issued by the manufacturer of the fittings.



Do not apply fluid pressure until all required fluid connections and electrical connections have been made.



Check the fluid system for leaks before applying full operating pressure, especially when using hazardous media (e.g. toxic or flammable).



Fitting instructions can be found in the Installer Pocket Guide for Swagelok® Tube Fittings (doc. no MS-13-151); this document can be downloaded from the Swagelok® website (www.swagelok.com)

3.4 Electrical connection

For specific information about electrical installation of the individual components (controlling instrument, actuator), follow the instructions in the respective manuals.

- Electrical connections must be made with the supplied cabled (insofar as provided) or compatible, in accordance with the hook-up diagrams of the concerning system components.
- When using self-assembled cables, follow the guidelines provided by the connectors' manufacturer.
- For use in a fieldbus system, follow the instructions of the cable supplier for the according fieldbus system.
- Make sure that the power supply is suitable for the power ratings as indicated on the serial number labels of the individual components or in the technical specifications, and that double or reinforced insulation is used for the power supply.
- If a surge protection device is used, make sure its specifications match the power consumption of the application.
- Before powering up, make sure all required cabling is properly connected.
- Inspect cabling and connectors for damage before each use.



In order to be able to comply with all applicable guidelines and regulations, it is imperative that electrical connections be made by or under supervision of a qualified electrician.



- The equipment described in this document contains electronic components that are susceptible to **electrostatic discharge**.
- When working on the electrical installation, take appropriate measures to prevent damage as a result of electrostatic discharge.



The equipment bears the **CE mark** to indicate that it complies with requirements imposed by the European Union, including **electromagnetic compatibility (EMC)**.

EMC can only be guaranteed by applying appropriate cables and connectors or gland assemblies:

- Cable wire diameters must be sufficient to carry the supply current and minimize voltage loss.
- When connecting the product to other devices, ensure that the integrity of the shielding remains uncompromised; use shielded cables and connectors where possible and/or required.
- Preferably use the supplied cables (if applicable) to make electrical (signal) connections to and between the supplied components. These cables are shielded, have the required wire diameter, and loose ends (if applicable) are marked to facilitate correct connection.

If not all requirements for proper shielding can be met (for example, because a component is not equipped with shielded connectors), take the following measures to ensure the best possible shielding:

- Keep cable lengths at a minimum.
- Route cables as closely as possible alongside metal structures or components.
- Ensure all electrical components are grounded to earth.

When in doubt about the shielding of your cabling and/or electrical connections, contact your Bronkhorst representative.



Always isolate the electrical power before connecting or disconnecting equipment.



- If a separate power switch is included in the scope of delivery, it should be used to switch all components of the assembly on or off simultaneously.
- The power switch should be within easy reach of the operator.
- Because the LDS is not a self contained system, it has no emergency stop facility.
- It is the responsibility of the customer to identify the risks of the system in which the LDS will be incorporated and to take appropriate measures if necessary.

3.5 Pump

The pressure drop across the suction line can cause dissolved gas to decompress and form bubbles in the liquid.



- To minimize the pressure drop before the pump and help prevent the formation of gas bubbles on the suction side, use a suction tube with a diameter that is equal to or larger than the diameter of the pump inlet.
- Keep the suction line as short as possible.

3.6 Liquid storage vessel



For a gear pump to work properly, the storage vessel should be positioned at the same level as or somewhat lower than the pump. To help prevent underpressure in the suction line, install the vessel and the pump at the same level if possible.

3.7 Inlet filter

For reliable performance, make sure the fluid stream is uncontaminated. If necessary, use an inlet filter to ensure a particle free media stream. Select a filter with a surface area and pore size that minimize the pressure drop.

Make sure to install the filter before any component that is sensitive to clogging or damage.



Note that a filter will not stop dissolved matter like minerals (for example dissolved lime or sodium chloride) and chemical stabilizers.

3.8 Pressure relief valve

A pressure relief valve can help protect the downstream process and the components of the LDS itself against unexpected pressure surges which can cause overpressurization. Such pressure surges can occur, for example, when valves are opened or closed, components become clogged or the downstream process generates back pressure.

In systems where a pump is used to build up the required pressure to generate a flow, a pressure relief valve should be installed between the pump and the controlling instrument.

In any case, make sure that the outlet of the pressure relief valve is connected to an appropriate draining facility or that the liquid is fed back to the liquid storage vessel (in case of pressureless liquid supply).



The pressure relief valve is not a safety device, but merely serves to protect critical fluid system components. The end user is responsible for appropriate safety measures to prevent overpressurization of the LDS and the surrounding fluid system (if applicable).

3.9 Bypass

If a pump is used to supply pressure a bypass circuit has several benefits and can be advised or even necessary in the following situations:

- In applications with a very **low liquid flow**, the pump might have to run in the lower part of its speed range, which can result in unstable control behaviour. Adding a bypass circuit allows the pump to run at a more efficient speed.
- In continuous dosing applications with a **variable flow rate**, the amount of liquid circulating through the bypass can be adjusted to optimize the pump speed. Depending on the amount and speed of variation in the flow rate, the bypass can be adjusted using a manual or electronically controlled (needle) valve.
- **Fast batch dosing** systems typically operate under pressure control. A continuous flow through a bypass line can help prevent pressure surges caused by starting and stopping the flow with each batch.

Of course, the addition of a bypass pipe can also have disadvantages:

- the fluid system contains a larger volume that needs to be flushed and/or cleaned from time to time.
- for various reasons (e.g. with regard to hygiene or safety), pumping around liquids/ingredients can be undesirable.



- The bypass line should be branched from the main fluid line between the pump and the MFC or from the fluid line between the main line and the [pressure relief valve](#).
- Do not feed the bypass outlet directly into the fluid inlet; instead, lead the bypass stream back into the liquid storage vessel or into a suitable (waste) container.

3.10 Check valves

There are 3 main reasons installing one or more check valves might be advisable or even necessary:

- **Preventing back flow;** (unexpected) back pressure can be caused, for instance, by downstream obstructions (e.g. closing valves, clogging, blockage), or simply because the downstream process has a higher pressure.
- **Creating a small downstream resistance** can improve the control loop, especially in combination with a low back pressure process.
- **A pump is not a shut-off valve.** Particularly if the inlet pressure is higher than atmospheric, fluid can keep flowing if the pump is not running. The cracking pressure of a check valve can help prevent this.

A disadvantage of a check valve is that it can cause control instability at (very) small flow rates, precisely because of the introduction of a resistance.

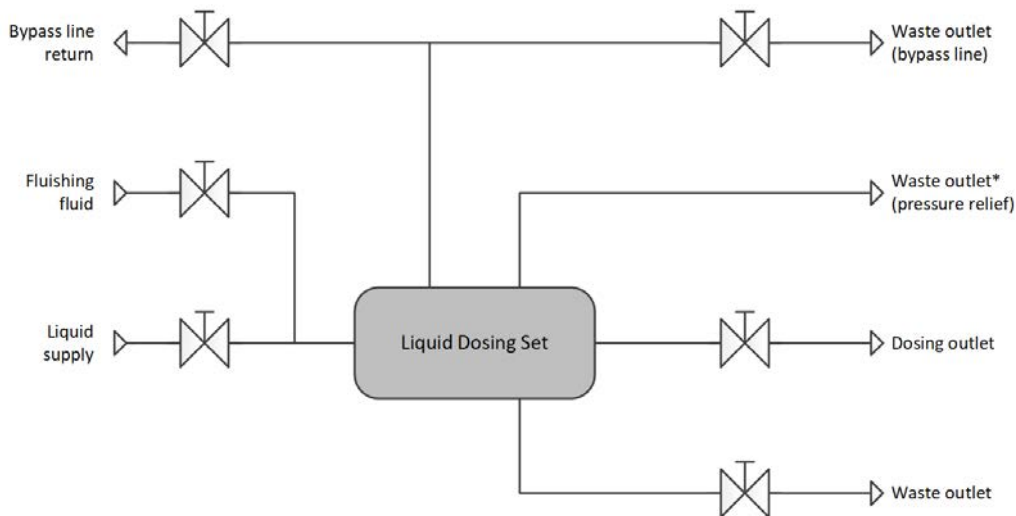


Note that check valves contain moving components, which - depending on the used media and the load on the system - require preventive and/or regular maintenance.

3.11 Isolating components

Depending on the size and complexity of the application and the nature of the used media (specifically its hazards), it may be advisable to install a flushing circuit around the instrumentation, with additional valves to isolate or purge/drain parts of the fluid system. This will allow a service engineer to work in a safe environment when exchanging components or performing other maintenance actions, without the need of flushing the entire fluid system. Following local laws and regulations and/or industry standards, such measures may even be mandatory.

The example below shows a schematic representation of a flushing circuit (to simplify matters, the LDS is shown as a single object).



*) In order to ensure permanent protection of the system components against overpressurization, it is inadvisable to install a shut-off valve in a fluid line with a pressure relief valve. Closing the shut-off valve (whether intentionally or not) would eliminate the function of the pressure relief valve.



When setting up a flushing circuit, observe the following attention points:

- Make sure that the liquid supply line(s) and dosing outlet line can be blocked.
- Make sure that each branch can be flushed and blocked separately.
- Connect liquid outlets to an appropriate drainage facility and/or install return lines to a storage vessel.
- Of course it is not absolutely necessary to use manual shut-off valves as in this example. If so desired, some shut-off valves could be replaced by a 3-way valve or even a capped T-part to serve as a drain point.

4 Operation



Before operating the LDS, make sure that the equipment has been installed and configured by an authorized service engineer and that the installation is approved for use.



Frequent inspection of all fluid lines and connections before, during and after operation is essential, to ensure and maintain a safe working environment. If necessary, re-tighten fluid connections.



For operating instructions regarding the controlling instrument (including instructions for first use), consult the concerning instrument manual.

4.1 Starting up



Before sending a setpoint, make sure all peripheral (isolation) valves are opened, so the pump can draw in the process media and displace it freely.

- If the actuator is a pump, ensure that the suction line is filled with the process media before starting the pump.
- At the factory, the instrumentation has been tested with water and subsequently purged with clean and dry air. Although every effort has been made to deliver the products as clean and dry as possible, the presence of some remaining water droplets in the instruments or intermediate tubing cannot be ruled out entirely.

4.1.1 Filling fluid system

1. Make sure to check all fluid connections for leaks.
2. Make sure all liquid outlets (process outlet, pressure relief valve, drain line, etc.) are connected to the process or a suitable waste/drain facility.
3. Open all peripheral (isolation) valves, in order to let the pump draw in and displace the process media freely.
4. Increase the actuator setpoint gradually (the filling time largely depends on the internal volume of the fluid system; increase the setpoint faster or in larger steps if necessary and if the application allows it).
5. Wait until the entire fluid system is filled with the process liquid.
6. Change the actuator setpoint to 0%.

4.2 Gas free operation

A flow meter can only measure mass flow adequately if the fluid flows through the instrument in a single state. A gas free media stream is essential to the overall performance of the LDS. Sudden pressure drops or temperature shifts can cause dissolved gas to appear and expand as bubbles throughout the fluid system, creating a two-phase flow phenomenon known as 'slug flow'.

Slug flow dramatically decreases flow stability and measurement performance; the expansion of gas bubbles causes an increase of the volumetric flow rate, which, in turn, accelerates the mass flow between the bubbles. This shows as a vigorously fluctuating flow rate, which may eventually cause the instrument to give an error indication.



To minimize the risk of slug flow, observe these recommendations:

- Before using the LDS, make sure that the device's internal fluid system is filled homogeneously with the process media, by flushing it and/or performing one or more evacuation cycles on the downstream side.
- Be sure to replace or clean the inlet filter cartridge (if applicable) before it becomes clogged, as clogging increases the pressure drop and thus the risk of decompression.
- Prevent sudden temperature and pressure fluctuations throughout the fluid system.
- If slug flow keeps recurring in spite of repeated flushing, the application might benefit from the use of a degasser upstream from the LDS (depending on the processed media, the required dosage size and the system pressure). Contact your Bronkhorst representative for more information.

4.2.1 Flushing

After filling the fluid system or as a measure against slug flow (see [Gas free operation](#)), remaining gas bubbles or water droplets (if processing oily liquids) can be removed by flushing the system at a high flow rate:

1. Change the actuator setpoint to 100%.
2. Wait until all gas bubbles (or water droplets) have left the main fluid line(s).
(visually check for bubbles downstream of the LDS; using clear tubing or opening a downstream drain valve can facilitate this).
3. Optional steps (if applicable):
 - a. Force actuation of the pressure relief valve to let gas escape.
 - b. Open the needle valve in the bypass line; close it once the bypass line is free from gas.
 - c. Repeatedly open and close bleed connectors until all gas has escaped the concerning valve(s).
4. Change the actuator setpoint to 0%

4.3 Dry-running prevention (gear pump)



Prevent prolonged dry-running of the pump. A few seconds of dry-running is acceptable when putting the pump into action (e.g. when priming); extended periods can seriously damage the pump and cause the surface temperature to rise beyond the allowable operating temperature.

Be sure that the process fluid is free from any kind of dirt, dust or other particles. Impurities may have a negative effect on the functioning of the pump.

To guarantee safe use and help prevent damage to the pump in the event of a fluid supply interruption, the following alarm parameter settings can be used to program a dry-running prevention function (for dosing sets containing a gear pump, this is already done ex factory):

Parameter	Value	Description	Comment
Alarm Mode	2	alarm on response time	Alarm type
Alarm Minimum Limit	1600	5%	5% below setpoint
Alarm Maximum Limit	1600	5%	5% above setpoint
Alarm Delay Time	30	30	Number of seconds to wait before raising alarm
Alarm Setpoint Mode	1	change setpoint	Action when alarm is raised
Alarm New Setpoint	0	0%	Setpoint after triggering alarm action
Reset Alarm Enable	5	manual	Enabled reset methods: - Multifunctional switch (1) - Digital parameter (4)

These settings ensure that the instrument raises an alarm and stops the pump (setpoint to 0 %) as soon as the measured value is outside the configured bandwidth (between the minimum and maximum limit) longer than the configured delay time (for example because the storage tank is running empty).



Attention points:

- When an alarm is raised, the dosing process can only be restarted after resetting the alarm.
- If the cause is not resolved, the alarm will be raised again. Therefore, always make sure the fluid supply on the media inlet is continuous, before (re)starting the dosing process.
- Setpoints lower than the minimum limit essentially disable the alarm. Depending on the stability of the flow, reducing the bandwidth or the delay time can make the alarm more sensitive.
- Disabling alarms or reprogramming the alarm parameters for another type of alarm (i.e. absolute or power-up) will disable the dry-running prevention function.



Special attention points regarding PROFIBUS DP usage:

- The alarm settings should be programmed into the a-cyclic parameter settings of the concerning instrument(s), but only after loading the GSD file for Bronkhorst® instruments.
- Loading a GSD file into the master software will remove already programmed alarm settings from all instruments on the PROFIBUS DP network.
- At the first power-up after installation to the fieldbus, the settings are copied to the instrument.

4.4

Optimizing pump speed



In a system with a pump and a [bypass](#) line, the pump speed can be optimized to achieve smooth and stable dosing behavior.

- If the pump runs at a too high speed for too long, the surface temperature of the pump head can rise beyond the allowable operating temperature. Closing the needle valve further allows the pump to achieve the required operating pressure at a lower speed.
- If the pump speed is too low, control behavior can get unstable. In that case, open the needle valve further.
- Adjust the needle valve to the point where the pump speed is as low as possible, while the output pressure is stable.



Ensure that the surface temperature of the pump head does never exceed the flash point temperature of the process media.

5 Maintenance



Before loosening fluid connections or disassembling/reassembling any parts of the system (electrical or fluid related), make sure that:

- the fluid system is brought to atmospheric pressure
- the pump is not running (if applicable)
- the equipment is isolated from the electrical power source

Bronkhorst® instrumentation needs no regular maintenance if operated properly, with clean media, compatible with the wetted materials, avoiding pressure and thermal shocks and vibrations. The fluid system may be purged with clean, dry air or an inert gas (at a maximum of 2 bar if the system contains a pump).

In case of severe contamination, cleaning the inside of the fluid system may be required.



Inexpertly servicing instruments can lead to serious personal injury and/or damage to the instrument or the system it is used in. Servicing must therefore be performed by trained and qualified personnel. Contact your Bronkhorst representative for information about cleaning and calibration. Bronkhorst has a trained staff available.

Exterior parts (e.g. casing, cabinet, skid frame) can be cleaned with a soft, lint free cloth, preferably dry, or, if necessary, moistened with a mild detergent solution.



- Moisten the cloth only slightly, to prevent liquid penetrating the equipment and causing damage to the electrical parts inside.
- Only use water soluble cleaning agents, never use oil based liquids like paint thinner or white spirit, as these might damage synthetic materials.

5.1 Fluid system

In order to prevent clogging and maintain functionality and the specified performance, flushing or purging the fluid system with an appropriate (cleaning) fluid is advised at the following occasions:

- before changing fluid types
- before and after using corrosive, reactive or flammable media
- before and after prolonged shutdown periods*
- every 3 months

In the event of serious contamination, flushing the fluid system may even be necessary to restore the specified system performance.

*) As a rule of thumb a period of a few days to a week can be assumed. In practice, the length of this period strongly depends on the properties of the processed medium and the ambient and process conditions. With some media, leaving the installation unused for longer periods of time without flushing will be no problem, while other fluids will already cause trouble after a very short time of inactivity.



Always use a non-aggressive, non-corrosive cleaning liquid or a dry, inert gas (like Nitrogen or Argon) to flush or purge the fluid system.



Prior to exchanging components, the fluid system should always be purged with clean, dry air or an inert gas (at a maximum of 2 bar if the actuator is a pump).

Although the LDS has been tested thoroughly at the factory for leaks in the fluid system, environmental influences (such as excessive vibrations and temperature and humidity fluctuations) can cause wear to pipes and fluid connections over time.



Frequent inspection of all fluid lines and connections before, during and after operation is essential, to ensure and maintain a safe working environment. If necessary, re-tighten fluid connections.

5.2 Periodic checks

The LDS contains mechanical parts that are subject to wear and tear. In order to keep the equipment in optimal shape, it needs regular preventive maintenance. Checking parts (and replacing them if needed) on a regular basis is strongly advised.

The following table lists the most important parts to check (depending upon their presence in the system):

Part	Check or replacement interval	Attention points
Inlet filter	Regularly (depending on operating hours and purity of the processed liquid)	<ul style="list-style-type: none"> • Check filter cartridge for contamination and/or clogging • If necessary, clean or exchange filter cartridge
Flow/pressure meter/controller	Bronkhorst® instruments are maintenance free if operated properly, with clean media, compatible with wetted materials, avoiding pressure and thermal shocks and vibrations. However, incidental checking is advised	<ul style="list-style-type: none"> • Check for contamination, clogging, corrosion • Instrument may be purged with clean, dry and inert gas or non-aggressive cleaning fluid (e.g. ethanol or isopropyl alcohol) • In case of severe contamination, cleaning inside of instrument may be required
Gear pump	Performance check every 10,000 operating hours	Check results on originally supplied pressure/flow curve
	Replacing the pump head is advised every 20,000 operating hours.	Follow service and maintenance instructions issued by Tuthill (original Tuthill replacement parts can be ordered at your Bronkhorst representative)
	It is advised to inspect the pump motor at least once a year	Follow maintenance instructions issued by the manufacturer of the pump motor
Pressure relief valve	Monthly	<ul style="list-style-type: none"> • Check seal on valve cap (must not be broken) • Check relief pressure by forcing actuation (if not actuated for long time, relief pressure might be higher than set pressure) • Check for contamination, clogging, corrosion
Piping/tubing	Every 10,000 operating hours	<ul style="list-style-type: none"> • Check fluid connections for leakage • Check for contamination, clogging, corrosion • Check material for damage

6 Troubleshooting and service

- Electronic problems can be traced by restarting the equipment.
- If the equipment starts up normally, the measuring and/or control behavior can be checked by applying fluid pressure.
- To track down problems in the fluid system, it is recommended to disconnect the suspected unit(s) from the process line and check them without applying fluid pressure. Dirt or clogging might be detected quickly by loosening fluid connections and performing a visual inspection.

6.1 Common issues

Symptom	Possible cause	Action
Pump not running	No power supply	<ul style="list-style-type: none"> • Check power supply • Check cable connection • Check cable hook-up
	Setpoint too low	Give setpoint $\geq 2\%$
	Dry-running prevention activated	<ul style="list-style-type: none"> • Check storage vessel; fill if necessary • Check inlet filter for contamination or blockage; clean or replace cartridge if necessary • Make sure liquid supply is continuous and gas free (see Gas free operation) • See also Dry-running prevention (gear pump)
	Pump motor thermal protection activated (motor temperature too high)	<ul style="list-style-type: none"> • Check pump head for damage or wear • Reduce back pressure • Check system dimensioning (contact your Bronkhorst representative for advice)
Pump speed fluctuating	Inlet filter clogged (increasing pressure drop and risk of decompression of dissolved gas)	Clean or replace filter cartridge
Flow rate negative	Pump cable wiring incorrect (pump runs in opposite direction)	Install pump cable in accordance with hook-up diagram
Pump/media temperature too high	Pump speed too high	<ul style="list-style-type: none"> • Install bypass line with needle valve to optimize pump speed • See also Optimizing pump speed • Contact your Bronkhorst representative for information on modification of the installation
Control behavior unstable	Pump speed too low	<ul style="list-style-type: none"> • Install bypass line with needle valve to optimize pump speed • See also Optimizing pump speed • Contact your Bronkhorst representative for information on modification of the installation
	Gas accumulation in tubing	Flush the system to remove gas (see Gas free operation)
	Inlet filter clogged (increasing pressure drop and risk of decompression of dissolved gas)	Clean or replace filter cartridge
	Wrong controller settings	Contact your Bronkhorst representative
Red LED of liquid flow meter glows continuously	Slug flow (combined gas and liquid flow) in tubing	Flush the system to expel gas (see Gas free operation)
	Hardware error	Return equipment to factory

Symptom	Possible cause	Action
No flow/pressure build-up (changing setpoint has no effect)	No fluid supply	<ul style="list-style-type: none"> • Check fluid inlet • Check upstream components for obstruction
	Bypass valve opened too far	Adjust bypass valve to close it further
Pressure rate rises, but never reaches setpoint	Flow meter clogged	Flush the system with clean, dry air or a non-aggressive cleaning liquid (e.g. ethanol or isopropyl alcohol)
	Outlet pressure too high	Check outlet pressure
	Process outlet blocked	Check process outlet and downstream piping
<ul style="list-style-type: none"> • Dosage volume much lower than setpoint • System cannot keep up with required production speed 	Bypass valve opened too far (pump speed too high)	Adjust bypass valve to close it further
	Supplied fluid type does not match configured fluid type	Supply other fluid or change fluid type in instrument configuration
	Pump gears worn or damaged	Replace gears (see <%TARGETTITLE%>)
Actuation pressure of pressure relief valve too high	Pressure relief valve not actuated for very long time; actuation pressure might be higher than set relief pressure	Force pressure relief valve actuation once



For troubleshooting tips regarding the instrumentation, consult the according manuals.

6.2 Service

If you have questions about a product or if you find the product does not meet the specifications as ordered, do not hesitate to contact your Bronkhorst representative. To enable us to help you quickly and effectively, make sure to have the serial number ready whenever seeking contact with your Bronkhorst representative about a specific item. The serial number (SN; first line on the serial number label) is the key to the original purchase order and can be found on the product.

For current information about Bronkhorst® and service addresses, please visit our website:



www.bronkhorst.com

Do you have any questions about our products? Our Sales Department will gladly assist you selecting the right product for your application. Contact sales by e-mail:



sales@bronkhorst.com

For after-sales questions, our Customer Service Department is available with help and guidance. To contact CSD by e-mail:



aftersales@bronkhorst.com

No matter the time zone, our experts within the Support Group are available to answer your request immediately or ensure appropriate further action. Our experts can be reached at:



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