Instruction Manual

Controlled Evaporator and Mixer (CEM)

Doc. no.: 9.17.126 rev. C Date: 01-08-2023

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.
Keep this document for future reference.

Bronkhorst®

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Disclaimer

The illustrations in this document serve to provide general notices regarding correct operation. The illustrations are simplified representations of the actual situation and may differ from the actual product.

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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.

Receipt of equipment

Check the outside packaging box for damage incurred during shipment. If the box is damaged, the local carrier must be notified at once regarding his liability. At the same time a report should be submitted to your Bronkhorst representative.

Carefully remove the equipment from the box. Verify that the contents of the package was not damaged during shipment. Should the equipment be damaged, the local carrier must be notified at once regarding his liability. At the same time a report should be submitted to your Bronkhorst representative.

If the product is damaged, it should not be put into service. In that case, contact your Bronkhorst representative for service.

- *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 (data sheet) for information about required storage conditions.

Warranty

Bronkhorst® products are warranted against defects in material and workmanship for a period of three years from the date of shipment, 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 this period may be repaired or replaced at no charge. Repairs are normally warranted for one year or the balance of the original warranty, whichever is the longer.

See also section 9 (Guarantee) of the Conditions of sales:
www.bronkhorst.com/int/about/conditions-of-sales/

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. The costs of unstamped returns are added to the repair invoice. Import and/or export charges as well as costs of foreign shipping methods and/or carriers are paid by the customer.

General safety precautions

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to prevent possible injury. Read the operating information carefully before using the product.

Before operating, make sure the line cord is connected to a properly grounded power receptacle. Inspect the connecting cables for cracks or breaks before each use.

The equipment and accessories must be used in accordance with their specifications and operating instructions, otherwise the safety of the equipment may be impaired.

Opening the equipment is not allowed. There are no user serviceable parts inside. In case of a defect please return the equipment to Bronkhorst High-Tech B.V.

One or more warning signs may be attached to the product. These signs have the following meaning:

General warning; consult the instruction manual for handling instructions

Surface may get hot during operation

Shock hazard; electrical parts inside

To maintain protection from electric shock and fire, replacement components must be obtained from Bronkhorst. Standard fuses, with applicable national safety approvals, may be used if the rating and type are the same. Non-safety related components may be obtained from other suppliers, as long as they are equivalent to the original component. Selected parts should be obtained only through Bronkhorst, to maintain accuracy and functionality of the product. If you are unsure about the suitability of a replacement component, contact your Bronkhorst representative for information.

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1 Introduction

1.1 Scope of this manual

This manual contains general product information, installation and operating instructions and troubleshooting tips for the Bronkhorst® **Controlled Evaporator and Mixer** (CEM).

1.2 Intended use

The Bronkhorst® CEM is designed for mass flow control of vapours created from liquid and gas, using the media and operating conditions (e.g. temperature, pressure) as specified at ordering time.

The equipment is suited for general purpose indoor (dry) applications, like laboratories and machine enclosures.

The wetted materials incorporated in the Controlled Evaporator and Mixer are compatible with media and conditions (e.g. pressure, temperature) as specified at ordering time. If you are planning to use the product (including any third party components supplied by Bronkhorst, such as pumps or valves) with other media and/or other conditions, always check the wetted materials (including seals) for compatibility. See the technical specifications of the product and consult third party documentation (if applicable) to check the incorporated materials.

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

The user is responsible for taking the necessary safety measures to prevent damage and/or injury while working with the equipment and process media (as described in the associated Material Safety Data Sheets).

Where appropriate, this document recommends or prescribes safety measures to be taken with respect to media usage or working with the described equipment under the specified conditions. However, this does not relieve the user of aforementioned responsibility, not even if such is not explicitly recommended or prescribed in this document.

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 process conditions than specified at ordering time.

1.3 Product description

The CEM comprises a control valve (also called 'mixing valve'), a mixing chamber and a heat exchanger (see product overview), to add a liquid to a carrier gas and transform the mix into a vapour.

A complete CEM system is a modular setup with the CEM itself as the core component. To feed it with liquid and gas, the CEM is complemented with a liquid flow meter with control function (e.g. a mini CORI-FLOW or LIQUI-FLOW) and a gas flow controller (e.g. an EL-FLOW Select). The liquid flow meter uses the mixing valve of the CEM to control the liquid flow rate.

The gas serves as a mixing component and as a means of transport for the vapour, and is therefore also referred to as 'carrier gas'. The mixing valve atomizes the liquid and adds it to the carrier gas, creating an aerosol, which is heated by the CEM until it transforms into a vapour. To monitor the internal temperature of the heat exchanger, the CEM incorporates a PT100 temperature sensor. An internal safety switch prevents overheating of the heat exchanger, by interrupting the control signal as soon as the temperature exceeds 200 °C.

To control the liquid and gas supply flows and the CEM temperature, Bronkhorst offers an E-8000 readout and control unit. This module contains a temperature controller for the heat exchanger and provides a user interface to operate the instrumentation. The E-8000 module also serves as a power supply unit and can be optionally equipped with a fieldbus interface for the CEM.

1.4 Product overview

W-10x / W-20x

1. Control valve
2. Mixing chamber
3. Liquid inlet
4. Heat exchanger
5. Bleed outlet
6. Control valve actuator connector
7. Gas inlet
8. Power and signal connector
   a. Signal
   b. Power
9. Vapour outlet

W-30x

1.5 Documentation

The CEM comes with all necessary documentation for basic operation and maintenance. Some parts of this manual refer to other documents, which can be downloaded from the Bronkhorst website.

In addition to the CEM itself, a complete CEM system comprises other instruments and peripherals, which are not described in this manual. Consult the according manuals for installation and operation instructions.

*The documentation listed in the following table is available on the **CEM** product pages under **www.bronkhorst.com/products***

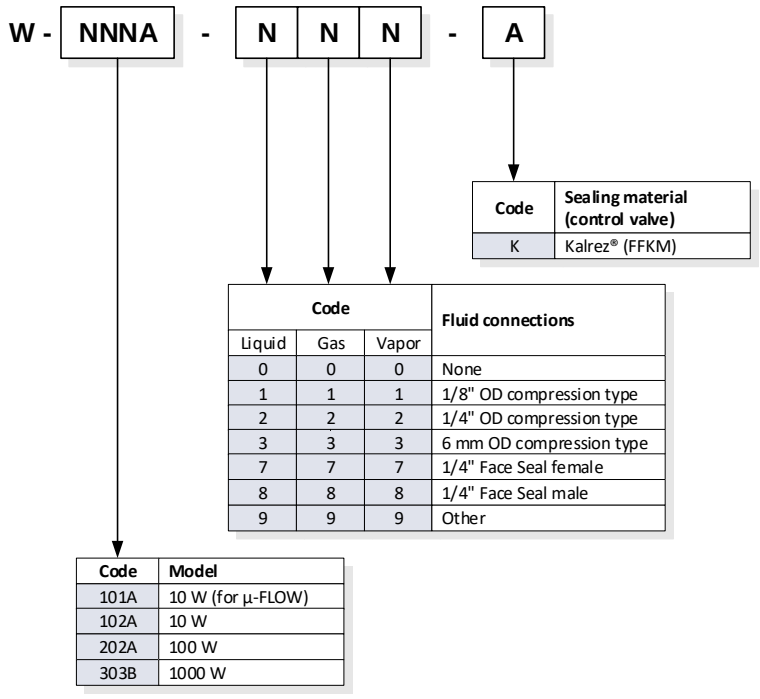
Type	Document name	Document no.
Brochures	CEM Brochure	9.60.038
Manuals	Instruction Manual Controlled Evaporator and Mixer (this document)	9.17.126
	Instruction manual E-8000	9.17.076
Hook-up diagrams	Hook-up diagram CEM W101A-W102A-W202A	9.16.086
	Hook-up diagram CEM W303B 120V	9.16.116
	Hook-up diagram CEM W303B 230V	9.16.115
Dimensional drawings	Dimensional drawing W-101A	7.05.585
	Dimensional drawing W-102A-W202A	7.05.574
	Dimensional drawing W-303B 115V-230V	7.05.902

*The documentation listed in the following table can be downloaded from **www.bronkhorst.com/downloads** :*

Type	Document	Document no.
General documentation	EU Declaration of Conformity	9.06.058

1.6 Model key

The model key on the serial number label contains information about the technical properties of the instrument as ordered. The actual properties of your instrument can be retrieved with the diagram below.



Code	Sealing material (control valve)
K	Kalrez® (FFKM)

Code			Fluid connections
Liquid	Gas	Vapor	
0	0	0	None
1	1	1	1/8" OD compression type
2	2	2	1/4" OD compression type
3	3	3	6 mm OD compression type
7	7	7	1/4" Face Seal female
8	8	8	1/4" Face Seal male
9	9	9	Other

Code	Model
101A	10 W (for µ-FLOW)
102A	10 W
202A	100 W
303B	1000 W

2 Installation

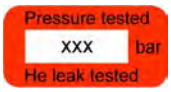
2.1 Functional properties

Before installing the CEM, check the serial number label to see if the functional properties match your requirements:

- Instrument type (technical properties; see Model key)
- Flow rates (gas and liquid)
- Media to be used in the instrument
- Power supply

Test pressure

*Bronkhorst® instruments are pressure tested to at least 1.5 times the specified operating pressure and outboard leak tested to at least 2 * 10^{-9} mbar l/s Helium.*



- *The test pressure is stated on a red label on the device; if this label is missing or if the test pressure is insufficient, the device must not be used and should be returned to the factory.*
- *Before installation, make sure that the pressure rating is within the limits of the normal process conditions and that the tested pressure is in accordance with the safety factor of your application.*
- *Disassembling and/or replacing fluid system related parts of the device will invalidate the test pressure and leak test specification.*

2.2 Mounting

The CEM must be mounted vertically, with the control valve on top and the vapour outlet pointing down (as shown in the product overview).

For optimal performance, please observe the following:

- *Use the mounting holes on the rear to attach the CEM to a rigid and stable construction. Check the dimensional drawing for the exact positions and size of the mounting holes*
- *Avoid installation in close proximity of mechanical vibration and/or heat sources.*

2.3 Electrical connection

Electrical connections must be made with standard cables or according to the applicable hook-up diagrams. Make sure that the power supply is suitable for the power ratings as indicated on the serial number label or in the technical specifications of the instrument, and that double or reinforced insulation is used for the power supply.

In order to be able to comply with all applicable guidelines and regulations, it is essential 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 **CE mark** on the equipment indicates 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.

Caution: when using the CEM without a Bronkhorst® readout and control unit (E-8000), observe the following guidelines:

- *The heat exchanger is not suitable for constant AC power supply*
- *The heat exchanger should be incorporated in a temperature control circuit*
- *The CEM does not contain a fuse. Consult the hook-up diagram for the recommended fuse type to be used for the temperature control circuit*
- *The safety switch inside the heat exchanger is not part of the AC power supply circuit*

The recommended maximum cable length between the CEM and the control unit is 5 m. The internal electrical resistance of the cable causes a deviation of the readout signal of the temperature sensor of the CEM (approximately 0.1 °C/m).

2.4 System assembly

2.4.1 Assembly tips

Tubing length
Because of the low flow rates in the CEM system, filling (and refreshing) the internal volume of the tubing can take a fair amount of time. It will also take some time for the vapour flow to stabilize after flow setpoints are changed (response delay). Fill time and response delay are affected mainly by the length and inside diameter of the tubing and the supported flow ranges of the flow meters/controllers.

By minimizing tubing lengths between the flow meters/controllers and the CEM, the filling/response time can be kept as short as possible. It can also reduce the impact of external disturbances (temperature, pressure and vibrations).

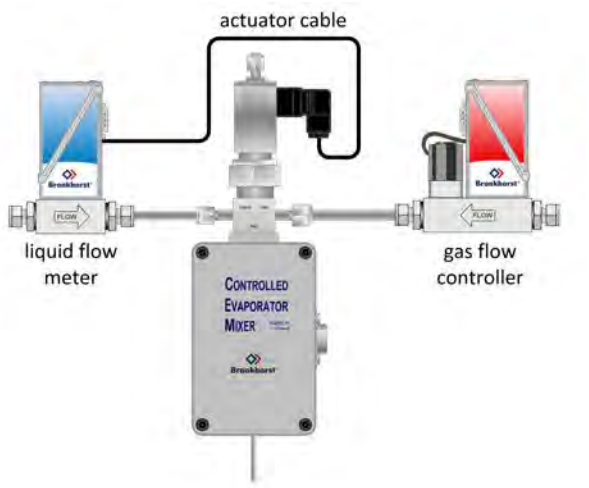
Tubing diameter and flexibility
- *Use tubing with a minimal diameter that still supports the required media flow; this will help keep the filling and refreshing time of the fluid lines as short as possible.*
- *Preferably use hard tubing (as opposed to flexible), to prevent internal volume changes and reduce the impact of ambient pressure fluctuations.*

Insulation
Applying insulation material on the liquid and gas tubing can minimize the influence of ambient temperature gradients on the supply side of the CEM. Alternatively, mount the entire system in a thermal enclosure to minimize temperature influences from the environment.

Heat tracing
The ambient conditions or adding extra gases to the vapour after the CEM outlet can cause the vapour to condensate before it reaches the process. To prevent this, apply heat tracing tape or use heated tubing.

2.4.2 Basic assembly

- Connect the outlet of the liquid flow meter to the liquid inlet of the CEM (mind the FLOW arrow on the instrument base)
- Connect the outlet of the gas flow controller to the gas inlet of the CEM (mind the FLOW arrow on the instrument base)
- Connect the vapour outlet directly to the process/reactor/chamber
- Connect an actuator cable from the liquid flow meter to the mixing valve (refer to the hook-up diagrams of the flow meter and the CEM to connect the required signals)



- *Check the fluid system for leaks before applying full process pressure, especially if toxic, explosive or other dangerous fluids are used*
- *Do not apply pressure until all required electrical connections are made*

2.4.3 Working under vacuum

Depending on the used media and ambient conditions (temperature and pressure), draining and purging under vacuum can shorten the time that is needed to have all components of the fluid system clean and dry.

For draining and purging under vacuum, extending the fluid system with some additional tubing and valves is strongly recommended. This will facilitate easy and flexible deployment of the vacuum process, without sacrificing the accuracy and reliability of the instrumentation of the CEM system.

- *To prevent leakage from the main fluid path and the process to the vacuum lines, the vacuum lines should be separated from the main line with leak proof shut-off valves*
- *Additional components needed to enable vacuumising of the system may also require additional steps to be taken when performing operational procedures (bleeding, purging, starting vapour production, stopping vapour production)*
- *If necessary, contact your Bronkhorst representative for more information and assistance*

2.5 Fluid supply

The recommendations in this section will help reduce risks of clogging and improve vapour flow stability.

2.5.1 Carrier gas

The carrier gas must be clean and dry. Impurities or particles in the gas can cause unwanted chemical reactions with the liquid and/or clogging of the fluid system.

- If the presence of particles in your process media cannot be ruled out, installing a particle filter in the carrier gas supply line (upstream from the flow controller) is strongly recommended.
- If necessary, install a de-humidifier in the carrier gas supply line (upstream from eventual filters). Humidity in the carrier gas can cause chemical reactions in the mixing valve in combination with certain liquids.
- Purging the fluid system before each use will reduce the presence of contaminants and remove moisture from the gas lines. See Purging for instructions.

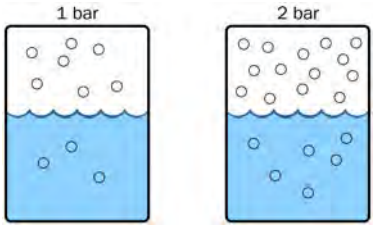
2.5.2 Liquid purity

- If the presence of particles in your process media cannot be ruled out, installing a particle filter in the liquid supply line (upstream from the flow controller) is strongly recommended.
- Select a suitable filter size, to minimize the pressure drop, to prevent a degassing effect and instability of the liquid supply.
- For hydrophobic liquids use a hydrophobic filter.

Note that a filter will not stop dissolved matter like minerals and chemical stabilizers.

2.5.3 Minimizing gas dissolution

Typically, the CEM will be supplied with liquid from a pressurized container. However, pressurizing a liquid with a gas makes a portion of the gas dissolve in the liquid. The higher the gas pressure, the more gas will be dissolved in the liquid (Henry's Law: the solubility of a gas in a liquid is directly proportional to the partial pressure of the gas above the liquid). When the temperature rises or the pressure drops further down the line, the gas will come out of solution and form bubbles in the liquid, which makes it unstable.



Henry's Law

Gas entrapment by dissolution can be minimized by taking one of the following measures:

- *Use a container or vessel with a membrane to pressurize the liquid; the membrane separates the gas from the liquid, so it cannot dissolve.*
- *Use a pump to feed the liquid. Note, however, that some pumps have a large internal volume, which lengthens the start-up time of the system. Also, some pump types (e.g. gear pumps) can cause cavitation, which introduces gas bubbles, exactly what was to be prevented.*

If direct pressurization of the liquid with a gas is inevitable, these measures can keep gas dissolution to a minimum:

- *Use a gas with a low solubility to pressurize the liquid (for instance Helium)*
- *Keep the gas pressure on the liquid as low as possible*
- *Relieve the gas pressure from the liquid when the CEM system is not in use*

2.5.4 Liquid vessel size

The liquid vessel should be large enough to provide a stable flow for a sufficient amount of time between refills. Purging or flushing the fluid system can consume a relatively large amount of liquid; take this into account when selecting a suitable vessel size. The table below gives an indication of the liquid consumption, based on different flow rates:

Flow rate		Liquid consumption	
g/h	mg/min	g per work week (40 hours)	g per week (24x7 hours)
0.1	1.6	4	16.8
1	16	40	169
10	160	400	1680
100	1600	4000	16800

2.6 Media compatibility

The wetted parts of the CEM are made of SS316 (heater) and SS304 (mixing valve). The standard sealing material for the mixing valve is Kalrez®, which is compatible with a wide range of chemicals.

Before deploying the CEM with any other media than specified at ordering time, be sure that the media are compatible with the wetted materials and sealing material. Accumulation of corrosion matter on the tubing interior can easily destabilize the flow, especially with (extremely) low flows.

3 Operation

In systems for use with corrosive or reactive media, purging for at least 30 minutes with a dry, inert gas (like Nitrogen or Argon) is absolutely necessary before use. After use with corrosive, reactive or hazardous media (e.g. toxic or flammable), purging is also necessary before the fluid system is exposed to air.

See section Purging for general purging instructions.

After correct installation and taking all necessary safety precautions, the CEM is ready to be used.

3.1 Powering up

- *It is recommended to turn on power before applying pressure and to switch off power after removing pressure*
- *Follow the guidelines in the manuals for the flow meters/controllers with regard to warming up*

When applying pressure, avoid pressure shocks and bring the fluid system gradually up to the level of operating conditions; open and close the fluid supply gently.

After powering up, the control valve will act according the last known setpoint. When setpoint is 0, this means the valve closes (normally open) or stays closed (normally closed). The valve stays closed until the instrument receives a new valid setpoint from the active setpoint source.

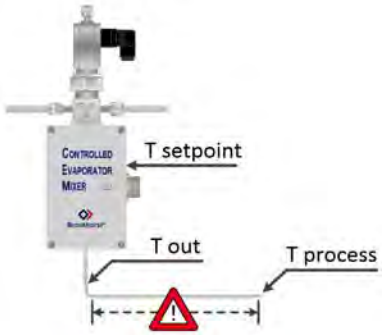
3.2 Required setpoints

The required setpoints for the carrier gas and liquid flows and the temperature of the heat exchanger can be obtained from FLUIDAT® on the Net, using the flow rates of the used instruments.

*FLUIDAT® on the Net can be accessed via **www.fluidat.com**. Free registration on the FLUIDAT® website gives access to all available fluids and functionality.*

Basically, the temperature setpoint that FLUIDAT® calculates for the CEM ensures that the heater will evaporate the liquid and that the vapour temperature at the outlet will still be high enough to prevent condensation. As a result, the required temperature setpoint will almost always be higher than the required evaporation temperature.

Further down the line, however, tubing length, process and ambient conditions can cause the vapour temperature to drop to a point where condensation might occur. See section Assembly tips how to prevent this.



3.3 Starting vapour production

- *To prevent liquid from flowing into the gas flow controller, make sure that the liquid pressure is never higher than the gas pressure*
- *Always make sure to have a gas flow, before feeding the CEM with liquid. Follow the instructions in the exact order as mentioned below:*

1. Set the setpoints of both flow controllers to 0%
2. Enter the required temperature setpoint for the heat exchanger
3. Pressurize the liquid and gas supply lines to the required values
4. Bleed the mixing valve
5. Change the gas flow setpoint to the required value (this may be done while the heat exchanger is warming up)
6. Wait until
   a. the carrier gas flow has stabilized and
   b. the temperature of the heat exchanger has reached its setpoint
7. Start adding liquid to the carrier gas flow, by gradually increasing the liquid flow setpoint to the required value

3.4 Stopping vapour production

Do not switch off the heat exchanger before stopping the liquid flow; a too low temperature in the heat exchanger can prevent the liquid from vaporizing, which might choke its fluid line.
To stop the vapour flow, follow the instructions below:

1. Change the liquid flow setpoint to 0%
2. Change the CEM temperature setpoint to 0 °C
3. Change the carrier gas flow setpoint to 0%

3.5 Bleeding mixing valve

- *In order to ensure stable and reliable control behaviour, the liquid tubing and dead space of the mixing valve should be kept free of gas, by bleeding the mixing valve from time to time*
- *Bleeding is recommended at the following occasions:*
  - *prior to first use of the CEM system*
  - *when restarting the system after purging*
  - *periodically, to remove accumulated gas (if any) from the liquid tubing and mixing valve*
- *If possible, prevent accumulation of gas bubbles in the liquid tubing during operation (see Minimizing gas dissolution)*
- *Install a shut-off valve as close to the bleed outlet as possible and connect a clear transparent tube to the valve outlet; being able to see gas bubbles in the liquid will ease monitoring the progress of the bleeding procedure*

- *Make sure to connect the bleed outlet to an appropriate draining facility, especially if the system is used to vaporize dangerous liquids.*
- *Take appropriate safety measures, as described in the Material Safety Data Sheet(s) of the media to be processed (if applicable).*

To bleed the mixing valve, follow this procedure:

1. Change the liquid flow setpoint to 0% (this closes the mixing valve)
2. Pressurize the liquid inlet
3. Open the bleed outlet (slowly) until liquid starts to escape
4. Optionally, tap the valve assembly and/or liquid inlet of the mixing valve to let gas bubbles accumulate and migrate to the mixing valve
5. Close the bleed outlet as soon as all gas has escaped through the mixing valve

3.6 Purging

Purging the fluid lines of the CEM system is sometimes necessary, to prevent clogging of the tubing and instrumentation or (cross) contamination of process media. Purging the entire fluid system is advised at the following occasions:

- before changing fluid types
- before and after using corrosive, reactive or flammable media
- before and after a shutdown period of more than one week
- every 3 months

Always use a dry, inert gas (like Nitrogen or Argon) to purge the fluid system.

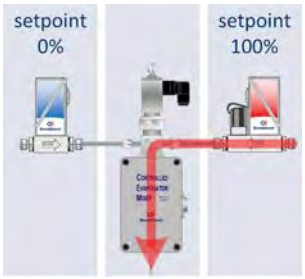
The purge times mentioned in the instructions below are rough indications; depending on the media properties (density, viscosity, volatility, etc.), longer or shorter times might be recommendable.

Step 1: Preparation

a. Set all setpoints to 0% (liquid flow, carrier gas flow, CEM temperature)
b. Connect a purging gas supply facility to the inlets of **both flow controllers** (liquid and gas)
c. Pressurise the purging gas supply line

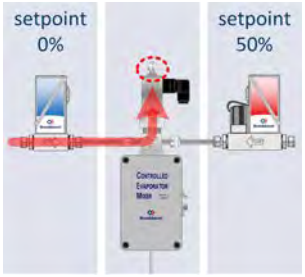
Step 2: Gas tubing

a. Change the carrier gas flow setpoint to 100%
b. Purge for at least 30 minutes



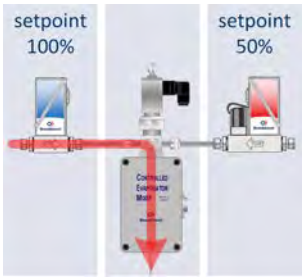
Step 3: Mixing valve

a. Change the carrier gas flow setpoint to 50%
(this will help prevent liquid from flowing into the gas tubing and gas flow controller)
b. Open the bleed outlet on top of the mixing valve
(because the liquid setpoint is 0%, remaining liquid and purging gas leaves the system through the bleed outlet)
c. Purge for 10 to15 minutes
d. Close the bleed outlet



Step 4: Liquid tubing

a. Change the liquid flow setpoint to 100%
b. Purge for at least 30 minutes



Step 5: Finishing

a. Set the carrier gas flow setpoint to 0%
b. De-pressurise the purging gas supply line
c. Set the liquid flow setpoint to 0%

3.7 Digital parameters

Using an E-8000 control module, the heating element of the CEM can be operated digitally via RS-232 or fieldbus. This section describes the parameters that are used to monitor and control the heating element.

Consult the E-8000 manual for installation information and a description of the user interface.

Measure

Type	Access	Range	FlowDDE	FLOW-BUS	Modbus
Unsigned int	R	0…32000	8	1/0	0x0020/33

This parameter indicates the temperature measured by the CEM. The value range corresponds to 0…200 °C (the supported temperature range of the CEM control module).

Setpoint

Type	Access	Range	FlowDDE	FLOW-BUS	Modbus
Unsigned int	RW	0…32000	9	1/1	0x0021/34

This parameter sets the required temperature of the heater. Like *Measure*, its value range corresponds to 0…200 °C. Note that the heater has no cooling functionality; a setpoint evaluating to a lower temperature than the actual heater temperature effectively switches the heater off.

Fmeasure

Type	Access	Range	FlowDDE	FLOW-BUS	Modbus
Float	R	0…200	205	33/0	0xA100…0xA101/ 41217…41218

Fmeasure returns the measured temperature in °C.

Fsetpoint

Type	Access	Range	FlowDDE	FLOW-BUS	Modbus
Float	RW	0…200	206	33/3	0xA118…0xA119/ 41241…41242

Fsetpoint sets the required temperature of the heater in °C. Note that the heater has no cooling functionality; a setpoint lower than the actual heater temperature effectively switches the heater off.

Capacity

Type	Access	Range	FlowDDE	FLOW-BUS	Modbus
Float	R	200	21	1/13	0x8168…0x8169/33129…33130

This parameter returns the maximum readout and control value (100%), expressed in units corresponding to parameter *Capacity Unit*. For the CEM control module, this parameter is fixed to 200 (°C); it might come in handy when scaling the value of parameter *Measure* (1 °C = 32000/200).

Capacity Unit

Type	Access	Range	FlowDDE	FLOW-BUS	Modbus
Unsigned char[7]	R	n/a	129	1/31	0x81F8…0x81FB/33273…33276

This parameter returns the capacity unit in which *Fmeasure* and *Fsetpoint* are expressed. For the CEM control module, this parameter is fixed to °C.

4 Maintenance

No regular maintenance is required if the CEM is operated properly, with clean media, compatible with the wetted materials, avoiding pressure and thermal shocks and vibrations. Units may be purged with a clean, dry and inert gas.

In case of severe contamination, cleaning the inside of the device may be necessary, by flushing the conduits with an appropriate cleaning fluid.

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 trained staff available.

5 Troubleshooting and service

For a correct analysis of the proper operation of an instrument, it is recommended to disconnect the unit from the process line and check it without applying fluid supply pressure. In case the unit is dirty or clogged, this can be ascertained immediately by loosening the fittings and performing a visual inspection.

Energizing and de-energizing the instrument can indicate if there is an electronic failure. After energizing, control behaviour can be checked by entering a temperature setpoint.

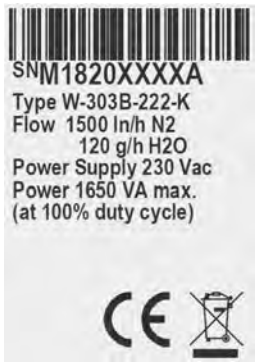
If you suspect leakage, do not disassemble the instrument for inspection, but contact your local distributor for service or repairs.

5.1 Common issues

Symptom	Possible cause	Corrective action
No communication between instruments and readout/control unit	No power supply	• Check power supply • Check cable connection • Check cable hook-up
	Other	Reset instrument(s) and/or restart readout/control unit. If problem persists, contact your Bronkhorst representative
Vapour too dry	Carrier gas flow too high	Decrease carrier gas flow
	Liquid flow too low	Increase liquid flow
Condensation at vapour outlet	Temperature setpoint too low	Increase temperature setpoint
	Carrier gas flow too low	Increase carrier gas flow
	Liquid flow too high	Decrease liquid flow
Heater not warming up	Fuse blown	Replace fuse
	Temperature sensor defective	Contact your Bronkhorst representative
	Heater defective	Contact your Bronkhorst representative
Vapour flow unstable	Pressure fluctuations on fluid inlets	Eliminate pressure fluctuations, e.g. by installing pressure regulator
	Temperature setpoint (much) too high	Decrease temperature setpoint
	Gas inclusion in tubing	Flush liquid lines with processing liquid at high flow rate
Clogging in fluid system	Solid particles in process media	Install filters at media inlets
	Dissolved substances do not evaporate, but remain as solid particles	• Apply higher purity liquid (no dissolved substances) • Increase cleaning cycle frequency
	Liquid burn-in caused by overheating	Apply lower temperature setpoint
	Solid particles formed by chemical reaction	• Apply dry and inert carrier gas • Evacuate fluid system before operation
	Fluid system not clean and dry before operation	Clean and purge fluid system before and after operation and before change of process media

5.2 Service

If you have a question 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 (SN) ready whenever seeking contact with your Bronkhorst representative about a specific item.



For current information about Bronkhorst® and worldwide 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, help and guidance, our Customer Care department is available by e-mail:

aftersales@bronkhorst.com

No matter the time zone, our experts within the Customer Care department are available to answer your request immediately or take appropriate further action. Our experts can be reached at:

+31 859 02 18 66

Bronkhorst High-Tech B.V.
Nijverheidsstraat 1A
NL-7261 AK Ruurlo
The Netherlands

6 Returns

6.1 Removal and return instructions

When returning materials, always clearly describe the problem, and, if possible, the work to be done, in a covering letter.

Instrument handling:

1. Purge all fluid lines (if applicable)
2. If the instrument has been used with toxic or otherwise hazardous fluids, it must be cleaned before shipping
3. Disconnect all external cabling and tubing and remove the instrument from the process line
4. If applicable, secure movable parts with appropriate transport safety materials, to prevent damage during transportation
5. The instrument must be at ambient temperature before packaging
6. Insert the instrument into a plastic bag and seal the bag
7. Place the bag in an appropriate shipping container; if possible, use the original packaging box

Add documentation:

- Reason of return
- Failure symptoms
- Contaminated condition
- Declaration on decontamination

It is absolutely required to notify the factory if toxic or dangerous fluids have been in contact with the device!
This is to enable the factory to take sufficient precautionary measures to safeguard the staff in their repair department.

All instruments must be dispatched with a completely filled in 'Declaration on decontamination'. Instruments without this declaration will not be accepted.

*A safety information document containing a 'Declaration on decontamination' form (document no 9.17.032) can be downloaded from the **Service & Support** section of the Bronkhorst website (**www.bronkhorst.com**).*

Important:
Clearly note, on top of the package, the customs clearance number of Bronkhorst High-Tech B.V.:

NL801989978B01

(only if applicable, otherwise contact your Bronkhorst representative for local arrangements.)

6.2 Disposal (end of lifetime)

If you are a customer within the European Union and wish to dispose of Bronkhorst® equipment bearing the symbol of a crossed out waste disposal bin, you can return it in accordance with the removal and return instructions. Bronkhorst will then take care of proper dismantling, recycling and/or reuse (wherever possible). In the covering letter, mention that you are returning the product for disposal.

In countries outside the EU, disposal of electrical and electronic equipment (EEE) may be subject to local or national directives and/or legislation. If applicable, consult local or national authorities to learn how to handle EEE properly in your area.