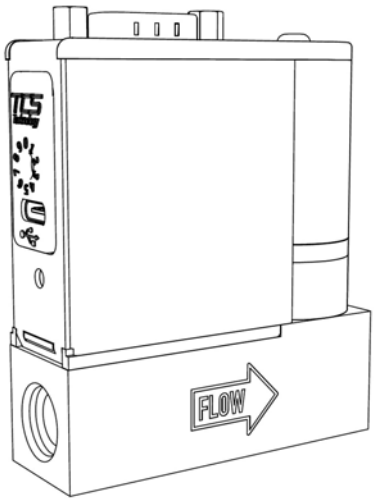
Instruction Manual

# FLEXI-FLOW™ Compact

Doc. no.: 9.17.158 rev. B Date: 14-04-2022




**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.**

Bronkhorst®

## Copyright



## Disclaimer

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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.

- *Check the packing list to ensure that you received all items included in the scope of delivery*
- *Do not discard spare or replacement parts with the packaging material*

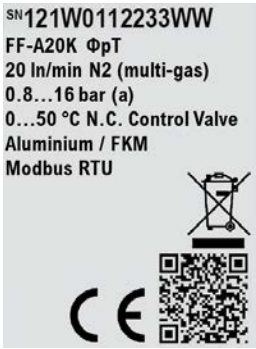
Refer to Removal and return instructions 19 about return shipment procedures.

## 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.

## 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) is the key to the original purchase order and can be found on the product.




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**

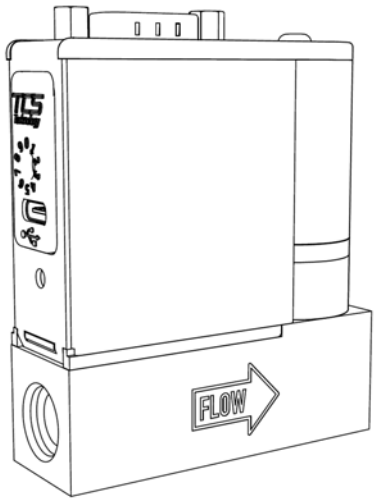
Bronkhorst High-Tech B.V.
Nijverheidsstraat 1A
NL-7261 AK Ruurlo
The Netherlands

# Table of contents

# 1 General information

## 1.1 Scope of this document

This document contains general product information, installation and basic operating instructions and troubleshooting tips for the **FLEXI-FLOW™ Compact**.




## 1.2 Intended use

The FLEXI-FLOW™ has been developed to accurately measure and/or control mass flow rates and pressures of clean and dry gases in a fluid system.

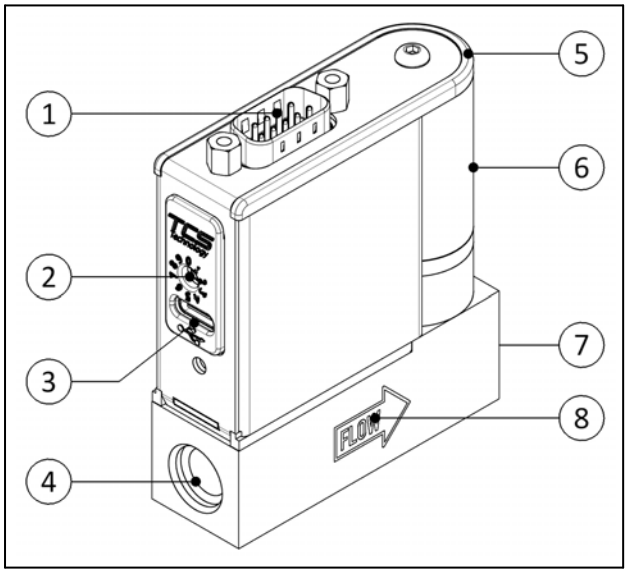
The product is suited for general purpose indoor (dry) applications, like laboratories and machine enclosures, applying media and operating conditions as specified in the FLEXI-FLOW™ Compact datasheet[9] .

Any other use is considered not intended.

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

Bronkhorst High-Tech B.V. cannot be held liable for any damage and/or injury resulting from unintended, improper or unsafe use.

## 1.3 Product overview




1. Power and signal connector (9-pin D-sub)
2. Address selector (rotary switch)
3. Support interface (USB-C)
4. Fluid inlet
5. Status indication light
6. Control valve (optional)
7. Fluid outlet
8. Flow direction

## 1.4 Product features

### 1.4.1 Configuration via USB-C or Bluetooth

**Support interface (USB-C)**
The support interface[7] can be used to configure and/or monitor the instrument in its operating environment, without the need to disconnect the power supply and fieldbus connection.
At the same time, the power supply on the USB connection is sufficient to allow configuration of the instrument before it is integrated in the process environment.

**Bluetooth**
The instrument can be configured via a wireless Bluetooth connection, again without the need to disconnect the power and fieldbus connection.
The required power can be supplied through the power connector or the USB-C- connector.
The FLEXI-FLOW™ Compact is delivered with Bluetooth disabled; it can be enabled using FlowSuite.

- *For operation, the instrument always needs to be powered through the power connector.*
- *Bluetooth configuration requires powering the instrument through the power connector or support interface.*
- *To minimize heat build-up in the instrument, it is recommended to keep the support interface connected only when needed for configuration and/or monitoring purposes.*

### 1.4.2 Instrument status (NAMUR)

With the status indication light[7], the FLEXI-FLOW™ Compact shows its current status[14], using a color range based on the NAMUR NE 107 standard. The colors provide easily recognizable signals to the operator regarding corrective actions, malfunctions, maintenance indications, etc.

*Comprehensive diagnostic information based on the NAMUR status is available in FlowSuite.*

### 1.4.3 Multi-parameter functionality

The FLEXI-FLOW™ Compact works in much the same way as any regular digital Bronkhorst® instrument. Upon delivery, the FLEXI-FLOW™ Compact is configured as a (mass) flow controller. An integrated temperature sensor and 2 pressure sensors provide additional real-time measurement data, allowing the main instrument function to be switched between flow control and pressure control[15].

### 1.4.4 On-board FLUIDAT® database

A built-in database with properties of 22 commonly used gases provides the basis for up to 8 fluid presets, which can be stored in the instrument using FlowSuite or a custom-built (PLC) program.

A compensation algorithm (FLUIDAT® On Board) continuously adjusts the gas flow based on the currently measured temperature and pressure and the properties of the selected gas (mixture).

### 1.4.5 Multi-modular systems

The FLEXI-FLOW™ Compact can be supplied as a system with up to 8 modules which are linked fluidically by means of a manifold-like construction. The modules can be controlled individually on FLOW-BUS or Modbus, or through a gateway[36] in other fieldbus systems. The gateway and the instruments behind it are powered through a single cable.

*For information about FLEXI-FLOW™ Compact based multi-modular systems and possible applications, contact your Bronkhorst representative.*

### 1.4.6 Default valve state

When a controlling instrument is not powered or cannot communicate with the fieldbus network (if applicable), all electrical valves operated by the instrument (whether integrated or external) automatically return to their default state. The default state is closed for 'normally closed' valves (n/c) and fully open for 'normally open' valves (n/o). Taking into account the typical process conditions under which the instrument is used (such as the processed media and ambient conditions; see also Intended use[7]), the default state is generally considered safe.

Check the serial number label or the technical specifications[9] to see which valve type is used on your instrument (if applicable).

## 1.5 Documentation

- *This document contains basic information for installation, commissioning and maintenance of the FLEXI-FLOW™ Compact.*
- *At some points it refers to documentation associated with important components or features. These references are listed in the table below.*
- *All documents listed here can be found on the FLEXI-FLOW™ product page (www.bronkhorst.com/flexi-flow or scan the QR code).*

| Type | Document name | Document no. |
|---|---|---|
| Manuals | Instruction Manual FLEXI-FLOW™ Compact (this document) | 9.17.158 |
| | Quick Start Guide FLEXI-FLOW™ Compact | 9.17.157 |
| | Instruction Manual FLOW-BUS interface | 9.17.024 |
| | Instruction Manual Modbus interface | 9.17.035 |
| Technical documentation | Datasheet (technical specifications) | |
| | Hook-up diagram Modbus RTU / FLOW-BUS | 9.16.275 |
| | Dimensional drawing | 7.15.225 |
| Compliance | EU Declaration of Conformity FLEXI-FLOW™ | 9.06.132 |
| | EU Declaration of Conformity RoHS | 9.06.124 |
| | Manufacturer Declaration REACH | 9.06.056 |
| | Manufacturer Declaration WEEE | 9.06.128 |
| | Conflict Minerals Compliance Policy | 9.06.065 |

## 1.6 Safety notes

***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 handled 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 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 or equipment usage 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.*
- *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.*
- *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 as unintended and improper use[7] , 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.*

**Product related safety warnings**

*Before operating the FLEXI-FLOW™, make sure that the equipment has been installed and configured by an authorized engineer and that the installation is approved for use.*

*To ensure and maintain a safe working area, regularly inspect electrical and fluid lines and connections:*
- *Prior to each use, check cabling for proper connection, damage and wear. If necessary, replace cables and/or connectors.*
- *Before, during and after operation, check fluid lines and connections for leaks, damage and wear. Re-tighten fluid connections as necessary, replace connectors as needed.*

*During operation, fluid connections may not be loosened or disconnected under any circumstances.*

*When pressurizing, prevent pressure shocks by gradually bringing the fluid system to the required operating pressure.*

*Bronkhorst does the utmost to ensure that you receive a clean product. This does not, however, relieve the user of the responsibility to ensure that the equipment and the system in which it is incorporated meet the requirements implied by the intended use of the product. The responsibility for cleaning the equipment to meet such requirements lies exclusively with the user.*

- *Depending on the properties of the process medium and the (expected) time until the next use, it is advisable to flush the fluid system with a suitable (cleaning) fluid after use.*
- *If the equipment has been used to process corrosive, reactive or hazardous media (e.g. toxic or flammable), cleaning the fluid system is imperative before it is exposed to air.*
- *If the equipment is not used for an extended period, the fluid system should be dry after use and after cleaning. If not, it should be purged with a dry, inert gas for a recommended minimum period of 30 minutes.*

- *Prior to powering down the FLEXI-FLOW™, the fluid system should be depressurized.*
- *When depressurizing, prevent pressure shocks by shutting off the fluid supply gradually.*

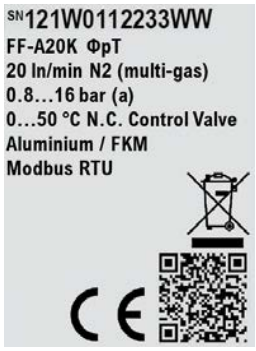
*Inexpertly servicing instruments can lead to serious personal injury and/or damage to the instrument or the system it is used in. Servicing must therefore be performed by trained and qualified personnel. Contact your Bronkhorst representative for information about cleaning and calibration. Bronkhorst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

- *Before disconnecting or disassembling any fluid system related parts, always make sure the fluid system is depressurized.*
- *When depressurizing, prevent sudden pressure changes by shutting off the fluid supply gradually.*

# 2 Installation

## 2.1 Product specifications

Before installing the FLEXI-FLOW™, check that the functional and technical properties of the product match your requirements (the image on the right is an example; it does not necessarily reflect the actual specifications of your instrument).

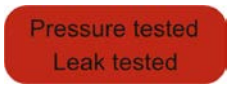



If you have a question about the product or if you find the product does not meet the specifications as ordered, do not hesitate to contact your Bronkhorst representative (see the first pages of this document). To enable us to help you quickly and effectively, have the serial number ready whenever seeking contact with your Bronkhorst representative about a specific item. The serial number is the key to the original purchase order and can be found on the serial number label, in the instrument properties in FlowSuite and by reading the according digital parameter (see parameter section Device identification 32 ).

### 2.1.1 Pressure rating

*At the factory the FLEXI-FLOW™ has been pressure tested and tested with helium for outboard leakage. The test pressure includes a safety factor, so that it is always higher than the specified maximum operating pressure (pressure rating).*

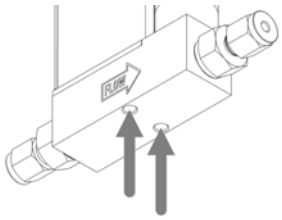
- *The test pressure is specified with a red label; if this label is missing, the device must not be used and should be returned to the factory.*
- *Before installation, make sure that the pressure rating is within the limits of the normal process conditions of your application.*




## 2.2 Mounting

*For optimal performance, observe the following guidelines:*

- *Avoid installation in close proximity of mechanical vibration and/or heat sources.*
- *Use the equipment in an environment with a stable ambient pressure and temperature.*
- *For stable fixation to a rigid and stable surface or construction, use the threaded mounting holes in the bottom of the instrument base. Consult the dimensional drawing 9 for the exact size and locations.*



### 2.2.1 Piping requirements

- *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 maximum pore size of 20 µm and a surface area that minimizes the pressure drop.*
- *If back flow could occur, the use of a check valve is also recommended.*

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

### 2.2.2 Fluid connection

- Connect the FLEXI-FLOW™ to the fluid system in accordance with the product overview 7 .
- Tighten fluid connections according to the instructions of the manufacturer of the fittings. The use of Swagelok® RS-type stainless steel adapters is recommended.
- Make sure connector sizes match; do not mix metric (mm) and imperial (inch) sizes.
- Make sure all connectors and tubing are free from dirt and debris.

*Instructions for connecting and disconnecting Swagelok® fittings can be found in the Installer's Pocket Guide for Swagelok® Tube Fittings (doc. no MS-13-151)*

*This document can be downloaded from the Swagelok® website (**www.swagelok.com**)*

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

*Check the fluid system for leak tightness after any modification and before applying full operating pressure, especially when using hazardous media (e.g. toxic or flammable).*

### 2.2.3 Preventing pressure shocks

*FLEXI-FLOW™ instruments can handle pressure shocks in the system well, but are not insensitive to pressure fluctuations. For optimal control stability, observe the following guidelines:*

- *Provide a stable (pressure controlled) inlet pressure; put sufficient buffer volume between the pressure regulator and the instrument. As a rule of thumb, install pressure regulators at a distance of at least 25 times the pipe diameter from the inlet or outlet of the instrument.*
- *When using multiple instruments and/or control valves, prevent interference by putting piping with sufficient buffer volume between components.*

## 2.3 Electrical connection

- Electrical connections should be made according to the hook-up diagram[9] , using the supplied cables (insofar as included) or compatible, with respect to required supply current, voltage loss, cable length, cable and gland diameters and operating conditions.
- 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 matches the power rating of the instrument (see technical specifications[9] ) 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.

*To prevent damage as a result of reversed polarity, the use of a 2A fuse in the direct +Us line is recommended.*

*Always turn off electrical power before connecting or disconnecting equipment electrically.*

*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.*

## 2.4 Fieldbus connection

The power connector also provides the selected fieldbus interface (FLOW-BUS or Modbus RTU).

*Always check the total power consumption of your instruments before connecting them to a fieldbus system. Do not exceed the maximum power of the power supply unit.*

- *For fieldbus related wiring details, consult the according hook-up diagram* [9] .
- *For information about setting up a fieldbus network with Bronkhorst® instruments, consult the according fieldbus manual* [9] .
- *If you need assistance with setting up a fieldbus network, contactyour Bronkhorst representative for information.*

# 3 Operation

## 3.1 General procedures

*Before operating the FLEXI-FLOW™, make sure that the equipment has been installed and configured by an authorized engineer and that the installation is approved for use.*

*To ensure and maintain a safe working area, regularly inspect electrical and fluid lines and connections:*
- *Prior to each use, check cabling for proper connection, damage and wear. If necessary, replace cables and/or connectors.*
- *Before, during and after operation, check fluid lines and connections for leaks, damage and wear. Re-tighten fluid connections as necessary, replace connectors as needed.*

*During operation, fluid connections may not be loosened or disconnected under any circumstances.*

*Gas condensation in the instrument can seriously affect its performance and reliability.*
- *If possible, ensure that the ambient temperature is stable and at least equal to the temperature of the process gas.*
- *Always use a clean and dry process gas (preferably with a purity of at least 99.5 %).*

### 3.1.1 Powering up

*To maintain control of the fluid system and ensure a safe situation, it is recommended to turn on power before applying fluid pressure and to switch off power only after the fluid system is depressurized.*

*When pressurizing, prevent pressure shocks by gradually bringing the fluid system to the required operating pressure.*

- When powering up, the instrument needs a couple of seconds to start up the electronics and perform a self-test.
- During initialization, the indication light cycles through all NAMUR status colors[8] .
- After successful initialization, the indication light lights up green to indicate that the instrument is ready to be used.

### 3.1.2 First use

*Bronkhorst does the utmost to ensure that you receive a clean product. This does not, however, relieve the user of the responsibility to ensure that the equipment and the system in which it is incorporated meet the requirements implied by the intended use of the product. The responsibility for cleaning the equipment to meet such requirements lies exclusively with the user.*

### 3.1.3 After use

- *Depending on the properties of the process medium and the (expected) time until the next use, it is advisable to flush the fluid system with a suitable (cleaning) fluid after use.*
- *If the equipment has been used to process corrosive, reactive or hazardous media (e.g. toxic or flammable), cleaning the fluid system is imperative before it is exposed to air.*
- *If the equipment is not used for an extended period, the fluid system should be dry after use and after cleaning. If not, it should be purged with a dry, inert gas for a recommended minimum period of 30 minutes.*

### 3.1.4 Powering down

- *Prior to powering down the FLEXI-FLOW™, the fluid system should be depressurized.*
- *When depressurizing, prevent pressure shocks by shutting off the fluid supply gradually.*

### 3.1.5 Understanding instrument status

The status indication light[7] uses different colors to reflect the current status of the instrument:

| | |
|---|---|
| Green | Normal operation |
| Red | Failure |
| Yellow | Out of specification |
| Blue | Maintenance required |
| Orange | Check function |

- The colors are based on the NAMUR NE 107 standard and are a simplified representation of the instrument's diagnostic data[17] .
- After powering up or restarting the instrument, the indication light cycles through all status colors once.
- After the startup cycle, the indication lights assumes the color associated with the current instrument status.

**Bluetooth**
- When Bluetooth is active, the indication light flashes blue once every 3 seconds.
- If the instrument has a Bluetooth connection, the indication light flashes blue twice every 3 seconds.
- Bluetooth communication is not reflected by the indication light.
- Bluetooth indications are not related to the blue NAMUR indication.

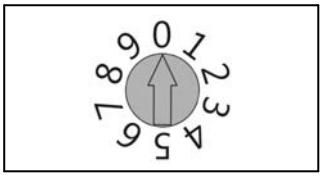
**Zeroing**
- During zero point adjustment[16] , the indication light blinks blue (1 second on, 1 second off).
- The zeroing indication is not related to the blue NAMUR indication.

## 3.2 Special procedures

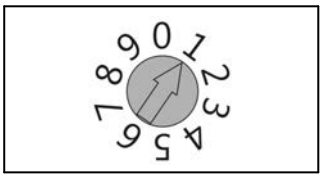
### 3.2.1 Address selection

**Manual address selection**
Assuming the default baud rate and parity match the fieldbus settings, the fieldbus address can be quickly set using the manual address selector[7] :

- With value 0, the instrument uses the digital address setting




- Values from 1 to 9 override the digital setting




**Digital network settings**
FlowSuite can be used to set the fieldbus address, baud rate and parity digitally (through the support interface or with Bluetooth). This can even be done before connecting the instrument to the fieldbus.

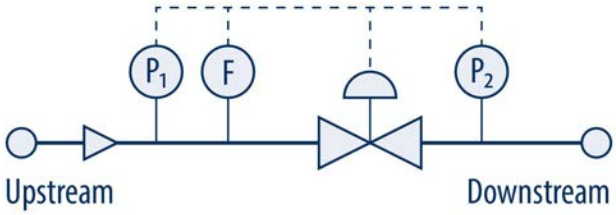
See also parameter section Network configuration[27] for digital parameter settings and default values.

- *A USB connection on the support interface provides sufficient power for instrument configuration only.*
- *Bluetooth configuration requires powering the instrument through the power connector or support interface.*

### 3.2.2 Switching control function

**Communication channels**
The so called multi-parameter functionality enables simultaneous measurement of flow, inlet pressure and outlet pressure, using 3 different communication channels:

| Communication channel | Measurement and control variable |
|---|---|
| 1 | Flow (F) |
| 2 | Inlet/upstream pressure (P1) |
| 3 | Outlet/downstream pressure (P2) |



- Channel 1 is the main communication channel, providing all parameters for normal operation of the FLEXI-FLOW™ Compact as a regular flow controller.
- Channels 2 and 3 provide access to additional pressure measurement and control features, as well as alarm definitions.
- Bronkhorst® software automatically adds the additional communication channels to the array as regular instruments.

**Switching control function**

- A setpoint can be given on any of the 3 communication channels. However, the instrument uses only one setpoint at any given time.
- Use parameter *Control Function* 22 to set the main instrument function (flow controller or pressure controller).
- See section Multi-parameter addressing 35 for available parameters.

### 3.2.3 Enabling Bluetooth

- Bluetooth can be enabled using FlowSuite.
- When pairing the instrument can be recognized by its serial number.
- The first time the instrument is paired with FlowSuite, a six-digit passkey must be created.
- Subsequently, the instrument can only be paired by entering the passkey that is stored in the instrument.

### 3.2.4 Adjusting zero point

**Zero-stability**

The zero point of a Bronkhorst® flow meter/controller (the measurement signal that indicates the absence of a flow) is factory adjusted at approximately 20 °C and atmospheric pressure (ambient conditions), with the instrument positioned upright. Under normal circumstances (i.e. at stable process conditions), the zero point will remain stable. However, over time several factors can induce a slight deviation of the measured value from the zero point, causing the instrument to detect a flow when in reality there is none. Readjusting the zero point eliminates this deviation.

- *After installation or relocation, always check the zero point.*
- *If the instrument still detects a (steady) flow while all valves are closed and the fluid system is leak tight, adjusting the zero point is recommended.*

**Prerequisites**

Zeroing an instrument requires that:

- the ambient conditions (temperature, pressure) match those of the operating environment of the instrument
- the instrument is filled homogeneously and pressurized with the operational media, according to the typical process conditions
- there is absolutely no flow through the instrument; preferably, this is achieved by closing a valve immediately after the outlet of the instrument (control valve, shut-off valve)

*Blocking the flow through the instrument is essential; zeroing an instrument while there is still a flow will lead to measurement errors.*

**Procedure**

*FlowSuite provides a quick and easy way to adjust the zero point of an instrument; the* Autozero *function automatically performs the procedure described here.*

To adjust the zero point using digital communication, set parameter values in the following sequence (see section Parameters 21 for more information about instrument parameters):

| Sequence # | Parameter | Value | Action |
|---|---|---|---|
| 1 | Setpoint | 0 | stop flow (close control valve) |
| 2 | Init Reset | 64 | unlock secured parameters |
| 3 | Control Mode | 9 | enable calibration mode |
| 4 | Calibration Mode | 0 | reset calibration mode |
| 5 | Calibration Mode | 9 | start zeroing |

The status indication light[7] starts blinking blue (1 second on, 1 second off), indicating that the procedure is in progress. On completion, the indication light assumes the color of the current instrument status[8] .

If the procedure is successful, parameter *Calibration Mode* changes to 0 (idle). If the procedure fails, *Calibration Mode* changes to 255.

After zeroing, parameter *Control Mode* returns to its initial value. The output signal should be 0 % (parameter *Measure* = 0).

*After performing the procedure, remember to set parameter* Init Reset *to value 0 to lock secured parameters.*

## 3.3 Maintenance

*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.*

The FLEXI-FLOW™ needs no regular maintenance if operated properly, with clean, non-corrosive media, compatible with the wetted materials, avoiding pressure and thermal shocks and vibrations.

- *Before disconnecting or disassembling any fluid system related parts, always make sure the fluid system is depressurized.*
- *When depressurizing, prevent sudden pressure changes by shutting off the fluid supply gradually.*

### 3.3.1 Cleaning

**Fluid path**

- The instrument's fluid path (the wetted parts) may be purged with a clean, dry and inert gas.
- In case of severe contamination, cleaning the wetted parts may be necessary. This requires the instrument to be returned to the factory.

**Exterior parts**

The instrument's exterior can be cleaned with a soft, lint free cloth, preferably dry, or, if necessary, moistened with a mild water soluble cleaning agent.

- *Moisten the cloth only slightly, to prevent liquid from penetrating the instrument's interior and causing damage to the electrical parts.*
- *Only use a water soluble cleaning agent, never an oil based liquid like paint thinner or white spirit, as these might damage parts made of synthetic materials.*

### 3.3.2 Calibration

The FLEXI-FLOW™ has been factory calibrated. Periodical inspection, recalibration or verification of the accuracy may be subject to individual requirements of the user. Whenever necessary, contact your Bronkhorst representative for information and/or making arrangements for recalibration.

Bronkhorst certifies that the instrument meets the rated accuracy. Calibration has been performed using measurement standards traceable to the Dutch Metrology Institute (VSL).

## 3.4 Troubleshooting

**General problems**

- *Electronic problems can be traced by restarting the equipment.*
- *If the equipment starts up normally, the measurement and control behavior can be checked by applying fluid pressure.*
- *To track down problems in the fluid system, depressurize the fluid system and disconnect the suspected unit from the process line. Dirt or clogging might be quickly detected by visual inspection of disassembled fluid connections.*

*If you suspect leakage, do not disassemble the device for inspection, but contact your Bronkhorst representative for service or repairs.*

### 3.4.1 Zooming in on NAMUR status

**Errors and warnings**

*Detailed error and warning information can be found by connecting the instrument to a Windows computer running FlowSuite. FlowSuite's diagnostic function makes comprehensive diagnostic information accessible based on the NAMUR status[14] .*

### 3.4.2 Common issues

| Symptom | Possible cause | Corrective action |
|---|---|---|
| No communication | No power supply | • Check power supply<br>• Check cable connection<br>• Check cable hook-up |
| | Invalid node address | Change node address (see Network configuration 27 ) |
| | Invalid baud rate | Make sure instrument baud rate matches master/application baud rate |
| | Other | Reset instrument and/or restart master. If problem persists, contact your Bronkhorst representative |
| No output signal | No power supply | • Check power supply<br>• Check cable connection<br>• Check cable hook-up |
| | Invalid control mode (instrument accepts no setpoint) | Check control mode (see Special parameters 33 ) |
| | Valve(s) in default state (normally closed) | Check if connected valves are in default state; solve cause if necessary (see Default valve state 8 ) |
| | Inlet pressure or differential pressure too low | Increase inlet pressure |
| | Piping, filters and/or control valve clogged or blocked | Clean fluid system (flush with clean, dry air) |
| | Sensor failure | Contact your Bronkhorst representative |
| Control behavior unstable | Measurement disturbed by vibrations | • If possible, avoid installation in close proximity of mechanical vibration<br>• Reduce sensitivity to vibrations by using a mass block, shock absorbers, and flexible tubing |
| | Inlet pressure unstable | Install pressure regulator or increase buffer volume between controlling instruments |
| | Inlet and/or outlet pressure too high or too low | Adjust pressure and/or set instrument pressure in accordance with actual process pressure |
| | Wrong process gas selected | Select correct process gas |
| | Wrong controller settings | Adjust settings (e.g. with FlowSuite) |
| | Control valve damaged | Contact your Bronkhorst representative |
| No flow (sending a setpoint has no effect) | No fluid supply | Check upstream components for obstruction, e.g.:<br>• fluid lines<br>• valves<br>• filters |
| | Wrong control mode selected | • Check parameter Control mode 34<br>• Make sure instrument accepts setpoint from actual setpoint source (bus) |
| | Valve(s) in default state (normally closed) | Check if valves are in default state; solve cause if necessary (see Default valve state 8 ) |
| | Inlet pressure or differential pressure out of bounds | Set inlet pressure to a value within specifications |

| Symptom | Possible cause | Corrective action |
|---|---|---|
| Flow rate never reaches setpoint | • Piping, filters and/or control valve clogged or blocked<br>• Sensor obstructed or contaminated | Flush fluid system with clean, dry air or non-aggressive cleaning liquid (e.g. ethanol or isopropyl alcohol) |
| | Inlet pressure or differential pressure too low | • Check/increase inlet pressure<br>• Use instrument in conditions it was designed for |
| | Outlet pressure too high | • Check/decrease outlet pressure<br>• Use instrument in conditions it was designed for |
| | Process outlet blocked | Check process outlet and downstream piping |
| | Process gas condensation | Decrease inlet pressure or increase gas temperature |
| | Supplied fluid type does not match selected fluid type | Supply equipment with other fluid or change fluid type in instrument configuration |
| Pressure signal gradually decreasing without setpoint change | Process gas condensation | Decrease inlet pressure or increase gas temperature |
| Measured value or output signal indicates flow, while there should be none | Fluid system leakage | • Check fluid system for leakage<br>• Follow mounting instructions when installing third party components (e.g. adapters, tubing, valves) |
| | Zero point adjustment performed incorrectly | Readjust zero point, following instructions in Adjusting zero point 16 |
| Continuous maximum measured value or output signal | Inlet pressure too high | Check inlet pressure |
| | Valve fully open | • Close valve<br>• In case of normally open valve: check if valve is in safe state; resolve cause if necessary (see Default valve state 8 ) |
| | Sensor failure | Contact your Bronkhorst representative |
| Fluid system leakage | Bad connection between parts (e.g. ferrules, nuts, tubing, piping, valves) | Follow mounting instructions issued by third party components (e.g. adapters, tubing, valves) |

## 3.5 Returns

### 3.5.1 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.)

### 3.5.2 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 19. 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.

# 4 Communication interface

## 4.1 Fieldbus communication

The power connector is equipped with a FLOW-BUS or Modbus RTU communication interface as ordered (see hook-up diagram 9 ).

**FLOW-BUS**
Digital Bronkhorst® instruments can be monitored and operated using the free **FlowWare** software tools for Windows. These tools provide a graphical interface to the ProPar 22 protocol (used by FLOW-BUS), for monitoring and editing parameter values.

The FlowWare toolkit provides functionality for monitoring and operating digital instruments (FlowSuite, FlowPlot) and selection of the active fluid and configuration of the fieldbus connection (if applicable). For instruments that support the definition and use of multiple fluids, FlowTune™ can be used to define and store fluids in the instrument and select the active fluid.

Digital instrument parameters are made accessible by **FlowDDE**, a Dynamic Data Exchange server (DDE) that handles communication between the instrument and (dedicated) client software in Windows (e.g. FlowPlot). FlowDDE can also be used by other client applications, such as Microsoft Office or custom made software, built with third party development software like LabVIEW or a SCADA platform.

*The FlowWare tools and associated documentation can be downloaded from the product pages on the Bronkhorst website:* ***www.bronkhorst.com/flexi-flow***

**Modbus**
In a Modbus system instruments can be monitored and operated using third party software as a master device, such as LabVIEW, ModScan, or a Modbus PLC.

## 4.2 Parameters

*A summary of all digital parameters in this section can be found in the back of this manual.*

This section describes the most commonly used parameters for digital operation of the FLEXI-FLOW™. Descriptions are grouped by category in tables as shown below:

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| [type] | RW 🔑 | [x]…[y] | [DDE par] | [Pro]/[Par] | [address]/[register] |

*In this manual, parameter names are printed in italics (reverted to* normal *where embedded in italics, like in this tip).*

**Type**

| | |
|---|---|
| Unsigned char | 1 byte unsigned integer (0…255) |
| Unsigned int | 2 byte unsigned integer, MSB first (0…65535) |
| Unsigned long | 4 byte unsigned integer, MSB first (0…4294967295) |
| Float | 4 byte floating point, IEEE 32-bit single precision, MSB first |
| Unsigned char [x] | x byte text string |

**Access**

| | |
|---|---|
| R | Parameter value can be read |
| W | Parameter value can be written |
| 🔑 | Parameter is secured and only accepts values if parameter *Init Reset* is set to 'unlocked' first |

**Range**
Some parameters only accept values within a certain range:

| | |
|---|---|
| [x] | Minimum value |
| [y] | Maximum value |

**FlowDDE**
Parameter number within FlowDDE

**FLOW-BUS**
FLOW-BUS uses the ProPar protocol, where parameters are identified by a unique combination of a process number and a parameter number:
[Pro] Process number
[Par] Parameter number

- *For more information about setting up a FLOW-BUS network with Bronkhorst® instruments, consult the FLOW-BUS manual (see Documentation[9] ).*
- *For more detailed information on the ProPar protocol, consult the RS-232 manual (see Documentation[9] ).*

**Modbus**
In the Modbus protocol, parameters are accessed by specifying their unique decimal register number or corresponding PDU address (Protocol Data Unit). The PDU address is the hexadecimal translation of the register number minus 1, e.g. register number 1 corresponds to PDU address 0x0000, register number 11 corresponds to PDU address 0x000A:
[address] Hexadecimal PDU address
[register] Decimal register number

Modbus address blocks are two bytes big. Larger data types use up to 8 subsequent address blocks, resulting in a maximum variable length of 16 bytes. Values longer than the maximum length are truncated.

*For more detailed information about setting up a Modbus network with Bronkhorst® instruments, consult the Modbus manual (see Documentation[9] ).*

### 4.2.1 Measurement and control

**Measure**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | R | 0…41942 | 8 | 1/0 | 0x0020/33 |

This parameter indicates the flow metered by the instrument. The value of 32000 corresponds to 100%, the maximum measured value output is 131.07%, which translates to 41942.

**Setpoint**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | RW | 0…32767 | 9 | 1/1 | 0x0021/34 |

This parameter is used to set the required flow rate for the controller. Within the setpoint range, value 32000 corresponds to 100%

*To convert* Measure *and* Setpoint *to actual mass or volume flows, use parameters* Capacity *and* Capacity Unit *(see Fluid set[28] )*

**Control Function**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0, 1, 2 | 432 | 115/10 | 0x0E6A/3691 |

- This parameter determines whether the instrument works as a flow controller or a pressure controller.
- Use the setpoint on the associated communication channel to control the flow or pressure.
- The selected function is effective immediately.
- The instrument remembers the selected value on restart (persistent setting).

Available functions:

| Value | Description |
|---|---|
| 0 | Flow (channel 1) |
| 1 | Upstream pressure (channel 2) |
| 2 | Downstream pressure (channel 3) |

**Temperature**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | R | -250…500 | 142 | 33/7 | 0xA138…0xA139/41273…41274 |

This parameter returns the internal temperature in the instrument housing in °C, which is an approximation of the actual media temperature.

#### 4.2.1.1 Advanced measurement and control

**Fmeasure**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | R | -3.4E+38… 3.4E+38 | 205 | 33/0 | 0xA100…0xA101/ 41217…41218 |

Floating point variant of *Measure*. *Fmeasure* shows the measured value in the capacity unit for which the instrument is set. The instrument uses parameters *Capacity*, *Capacity 0%*, *Capacity Unit* and *Sensor Type* to calculate *Fmeasure*.

**Fsetpoint**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 206 | 33/3 | 0xA119…0xA11A/ 41241…41242 |

Floating point variant of *Setpoint*. *Fsetpoint* shows the setpoint in the capacity unit for which the instrument is set. Like *Fmeasure*, *Fsetpoint* is dependent of *Capacity*, *Capacity 0%*, *Capacity Unit* and *Sensor Type*.

**Setpoint Slope**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | RW | 0…30000 | 10 | 1/2 | 0x0022/35 |

The value of this parameter represents the time it would take to adjust the setpoint if it were changed from 0 to 100%. This feature can be used to smooth 'nervous' controller behavior, e.g. to reduce setpoint overshoot or undershoot.
The supported range corresponds to 0…3000 seconds. Default value = 0.

Example:
If *Setpoint Slope* = 100 it will take 10 seconds to adjust the setpoint if it is changed from 0 to 100%. A setpoint change of 20% will take (20%/100%)*10 seconds = 2 seconds.

**Valve Output**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned long | RW | 0… 16777215 | 55 | 114/1 | 0xF208…0xF209/61961…61962 |

This parameter represents the controller output signal for control valve operation.

### 4.2.2 Alarms

*Alarm settings are most easily accessible using FlowSuite, FlowPlot or FlowView or a Bronkhorst® readout and control unit.*

The built-in alarm functionality can be used to handle different alarm types:
- system errors and warnings
- min/max alarms
- response alarms
- batch alarms
- master/slave alarms

The alarm type can be set with parameter *Alarm Mode*. When an alarm is activated, the type can be read out using parameter *Alarm Info*. An automatic setpoint change can be set using the parameters *Alarm Setpoint Mode* and *Alarm New Setpoint*. It is also possible to set an alarm delay, to prevent overreaction to small disturbances, using parameter *Alarm Delay Time*. The methods by which an alarm can be reset are controlled by *Reset Alarm Enable*.

**Alarm Mode**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…3 | 118 | 97/3 | 0x0C23/3108 |

Available modes:

| Value | Description |
|---|---|
| 0 | Alarm off |
| 1 | Alarm on absolute limits |
| 2 | Alarm on limits related to setpoint (response alarm) |
| 3 | Alarm at power-up(e.g. after power-down) |

**Alarm Info**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | R | 0…255 | 28 | 1/20 | 0x0034/53 |

This parameter provides information about the event type(s) that triggered an alarm situation. The value is a bitwise summation of the issued alarm types; convert the value to binary to see which types are issued. The following alarm types can be issued:

| Bit | Value | Type | Description |
|---|---|---|---|
| 0 | 1 | Error | Error flag raised |
| 1 | 2 | Warning | Warning flag raised |
| 2 | 4 | Minimum alarm | *Measure* < *Alarm minimum limit* |
| 3 | 8 | Maximum alarm | *Measure* > *Alarm maximum limit* |
| 4 | 16 | Batch counter alarm | Batch counter reached its limit |
| 5 | 32 | • This bit only: Power-up alarm | Alarm possibly caused by a power dip |
| | | • If combined with bit 2 or 3: Response alarm | Difference between *Measure* and *Setpoint* too big |
| 6 | 64 | Master/slave alarm | Setpoint out of limits (caused by *Slave factor*) |
| 7 | 128 | Hardware alarm | Hardware error |

**Alarm Delay Time**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…255 | 182 | 97/7 | 0x0C27/3112 |

This value represents the time in seconds the alarm action will be delayed when an alarm limit has been exceeded. This value also delays the alarm off action if an alarm limit is no longer exceeded.
Default value = 0.

**Alarm Maximum Limit**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | RW | 0…32000 | 116 | 97/1 | 0x0C21/3106 |

Maximum limit for *Measure* to activate the maximum alarm situation (after *Alarm Delay Time*). Range 0…32000 represents 0… 100% signal. *Alarm Maximum Limit* must be greater than *Alarm Minimum Limit*.
Default value: 0.

**Alarm Minimum Limit**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | RW | 0…32000 | 117 | 97/2 | 0x0C22/3107 |

Minimum limit for *Measure* to activate the minimum alarm situation (after *Alarm Delay Time*). Range 0…32000 represents 0… 100% signal. *Alarm Minimum Limit* must be smaller than *Alarm Maximum Limit*.
Default value: 0.

**Alarm Setpoint Mode**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…1 | 120 | 97/5 | 0x0C25/3110 |

Specifies whether or not to change the setpoint after an alarm situation is activated.

| Value | Description |
|---|---|
| 0 | No setpoint change (default) |
| 1 | Change setpoint to *Alarm new setpoint* |

**Alarm New Setpoint**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | RW | 0…32000 | 121 | 97/6 | 0x0C26/3111 |

New (safe) setpoint during an alarm until reset. Range 0…32000 represents 0…100% setpoint.
Default value: 0

**Reset Alarm Enable**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…15 | 156 | 97/9 | 0x0C29/3114 |

Available reset methods. The value is a bitwise summation of the enabled methods; convert the value to binary to see which methods are enabled.
Default value: 15 (all bits/methods enabled)

The following methods are supported:

| Bit | Value | Description |
|---|---|---|
| 0 | 1 | By hardware switch (if present) |
| 1 | 2 | Externally (obsolete) |
| 2 | 4 | By parameter *Reset* |
| 3 | 8 | Automatically (when alarm conditions no longer apply) |

### 4.2.3 Counter

- *Counter settings are most easily accessible using FlowSuite, FlowPlot or FlowView or a Bronkhorst® readout and control unit.*
- *When the instrument is powered down, it remembers the state of the counter. If the counter is active when the instrument is powered down, it is activated when powered up and then continues to count from the value at the time of power down.*

**Counter Mode**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…2 | 130 | 104/8 | 0x0D08/3337 |

Available modes:

| Value | Description |
|---|---|
| 0 | Counter off (default) |
| 1 | Counting up continuously |
| 2 | Counting up until limit reached (set by *Counter Limit*) |

**Counter Unit**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[4] | RW | see table below | 128 | 104/7 | 0xE838…0xE839/59449…59450 |

This parameter contains the name of the counter readout unit.

*Counter Unit* supports the following values:

| Mass | Normal volume (1.01325 bar(a), 0 °C) | Standard volume (1.01325 bar(a), 20 °C) | Custom volume (*Capacity Unit Pressure*, *Capacity Unit Type Temperature*) |
|---|---|---|---|
| ug, mg, g, kg | uln, mln, ln, mm3n, cm3n, dm3n, m3n | uls, mls, ls, mm3s, cm3s, dm3s, m3s | ul, ml, l, mm3, cm3, dm3, m3 |

**Counter Value**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0… 10000000 | 122 | 104/1 | 0xE808…0xE809/59401…59402 |

Current counter value in units selected with parameter *Counter Unit*.

**Counter Limit**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…9999999 | 124 | 104/3 | 0xE818…0xE819/59417…59418 |

Counter limit/batch size in units selected with parameter *Counter Unit*.
Default value: 0.

**Counter Setpoint Mode**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…1 | 126 | 104/5 | 0x0D05/3334 |

Specifies whether or not to change the setpoint after reaching the counter limit.

| Value | Description |
|---|---|
| 0 | No setpoint change (default) |
| 1 | Change setpoint to *Counter new setpoint* |

**Counter New Setpoint**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned int | RW | 0…32000 | 127 | 104/6 | 0x0D06/3335 |

New (safe) setpoint when a counter limit is reached until reset. Range 0…32000 represents 0…100% setpoint.
Default value: 0

**Reset Counter Enable**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…15 | 157 | 104/9 | 0x0D09/3338 |

Available reset methods. The value is a bitwise summation of the enabled reset methods; convert the value to binary to see which methods are enabled.
Default value: 7 (bits/methods 0, 1 and 2 enabled)

The following methods are supported:

| Bit | Value | Description |
|---|---|---|
| 0 | 1 | By hardware switch (if present) |
| 1 | 2 | Externally (obsolete) |
| 2 | 4 | By parameter *Reset* |
| 3 | 8 | Automatically (e.g. when counter value is reset) |

**Totalizer Unit**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[4] | RW | See parameter *Counter Unit* | 394 | 104/18 | 0xE890…0xE891/59537…59538 |

This parameter contains the name of the totalizer readout unit.

**Totalizer Value**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0… 10000000 | 393 | 104/17 | 0xE888…0xE889/59529…59530 |

Current totalizer value in units as selected with parameter *Totalizer Unit*.

## 4.2.4 Network configuration

*Changes made to the network settings will **not** be restored by a factory reset.*

*If the manual address selector[7] is set to a value other than 0, it overrides the digital address setting.*

**Fieldbus 1 Address**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…255 | 199 | 125/10 | 0x0FAA/4011 |

**Fieldbus 1 Baud Rate**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned long | RW | 0…1.0E10 | 201 | 125/9 | 0xFD48…0xFD49/64841…64842 |

**Fieldbus 1 Parity**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…2 | 335 | 125/12 | 0x0FAC/4013 |

The following values are supported:

| Value | Description |
|---|---|
| 0 | No parity |
| 1 | Odd parity |
| 2 | Even parity |

**Default settings**
Network configuration is done ex factory as ordered. The table below shows the supported configurations for the available interface protocols (default settings are printed in bold):

| Protocol | FLOW-BUS | Modbus RTU |
|---|---|---|
| Address | **3**…125 | **1**…247 |
| Baud Rate | **187500** | 9600<br>**19200**<br>38400<br>56000<br>57600<br>115200<br>128000<br>256000 |
| Parity | **0** | 0, 1, **2** |

*Although each communication channel*[15] *acts as an individual instrument, all three communication channels of the FLEXI-FLOW™ are accessible on the same node address.*

## 4.2.5 Fluid set

**Fluid Set Index**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…7 | 24 | 1/16 | 0x0030/49 |

With this parameter, any of the pre-configured fluids (up to 8) can be selected. Each fluid has its specific (configurable) properties, such as *Fluid Name*, *Capacity*, etc.
Default value: 0 (fluid 1).

Note that the selected value is equal to the fluid number minus 1 (value 0 corresponds to fluid 1, value 1 to fluid 2, etc.)

**Fluid Name**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[10] | RW | - | 25 | 1/17 | 0x8188…0x818C/33161…33165 |

This parameter contains the name of the selected fluid.

**Capacity 100%**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 1E-10…<br>1E+10 | 21 | 1/13 | 0x8168…0x8169/33129…33130 |

- This parameter represents the 100 % readout/control value (span) for the selected fluid, expressed in the selected *Capacity Unit*.
- *Capacity 100%* is scaled when *Inlet Pressure*, *Fluid Temperature* or *Fluid Name* is changed for the selected fluid.

**Capacity Unit**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[7] | RW | see below | 129 | 1/31 | 0x81F8…0x81FB/33273…33276 |

This parameter represents the unit in which the *Capacity 0%/100%* parameters are expressed.
Available units:

| Mass flow | Normal volume flow (1.01325 bar(a), 0 °C) | Standard volume flow (1.01325 bar(a), 20 °C) | Custom volume flow (*Capacity Unit Type Pressure*, *Capacity Unit Type Temperature*) |
|---|---|---|---|
| ug/h, ug/min, ug/s,<br>mg/h, mg/min, mg/s,<br>g/h, g/min, g/s,<br>kg/h, kg/min, kg/s | uln/h, uln/min, uln/s,<br>mln/h, mln/min, mln/s,<br>ln/h, ln/min, ln/s,<br>ccn/h, ccn/min, ccn/s,<br>mm3n/h, mm3n/m,<br>mm3n/s,<br>cm3n/h, cm3n/m, cm3n/s,<br>m3n/h, m3n/min, m3n/s,<br>scfh, scfm, scfs,<br>sccm, slm | uls/h, uls/min, uls/s,<br>mls/h, mls/min, mls/s,<br>ls/h, ls/min, ls/s,<br>ccs/h, ccs/min, ccs/s,<br>mm3s/h, mm3s/m, mm3s/s,<br>cm3s/h, cm3s/m, cm3s/s,<br>m3s/h, m3s/min, m3s/s | ul/h, ul/min, ul/s,<br>ml/h, ml/min, ml/s,<br>l/h, l/min, l/s,<br>cc/h, cc/min, cc/s,<br>mm3/h, mm3/m, mm3/s,<br>cm3/h, cm3/m, cm3/s,<br>m3/h, m3/min, m3/s,<br>cfh, cfm, cfs |

*Because of the maximum string length (7 characters), some unit names are abbreviated. For instance mm3n/m means $mm^3n/min$.*

**Capacity Unit Type Temperature**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | -273.15…<br>3.4E+38 | 245 | 33/10 | 0xA150…0xA151/41297…41298 |

This parameter defines a reference temperature for conversion of the measured mass flow to a volume flow. See also parameters *Capacity Unit* and *Counter Unit*.

**Capacity Unit Type Pressure**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 246 | 33/11 | 0xA158…0xA159/41305…41306 |

This parameter defines a reference pressure for conversion of the measured mass flow to a volume flow. See also parameters *Capacity Unit* and *Counter Unit*.

### 4.2.5.1 Advanced fluid set parameters

*Note that the parameters described in this section do not contain any actual measurement values, but only fixed reference values, which can be used for capacity calculations, etc.*

**Inlet Pressure**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 178 | 113/13 | 0xF168…0xF169/61801…61802 |

Inlet pressure of the selected fluid in bar(a)

**Outlet Pressure**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 179 | 113/14 | 0xF170…0xF171/61809…61810 |

Outlet pressure of the selected fluid in bar(a).

**Fluid Temperature**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | -250…500 | 181 | 113/16 | 0xF180…0xF181/61825…61826 |

Temperature of the selected fluid in °C.

**Density**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 170 | 33/21 | 0xA1A8…0xA1A9/41385…41386 |

Density of the selected fluid in kg/m$^3$

**Heat Capacity**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 250 | 113/18 | 0xF190…0xF191/61841…61842 |

Heat capacity of the current fluid in J/kg·K

**Thermal Conductivity**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 251 | 113/20 | 0xF1A0…0xF1A1/61857…61858 |

Thermal conductivity of the current fluid in W/m·K

**Viscosity**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 252 | 113/21 | 0xF1A8…0xF1A9/61865…61866 |

Dynamic viscosity of the current fluid in Pa·s

### 4.2.5.2 Fluid mixture parameters

**Mix Fraction Type**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…2 | 346 | 126/4 | 0x0FC4/4037 |

Set the fraction type of the mixture:

| Value | Description |
|---|---|
| 0 | Volume fraction |
| 1 | Mass fraction |
| 2 | Mole fraction |

**Mix Volume Temperature**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | -250…500 | 347 | 126/5 | 0xFE28…0xFE29/65065…65066 |

Temperature of the mixture in °C. The value of this parameter is only relevant if *Mix Fraction Type* = 0.

**Mix Volume Pressure**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…3.4E+38 | 348 | 126/6 | 0xFE30…0xFE31/65073…65074 |

Pressure of the mixture in bar(a). The value of this parameter is only relevant if *Mix Fraction Type* = 0.

**Mix Component Index**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…4 | 349 | 126/7 | 0x0FC7/4040 |

Index of the current component in the mixture (max. 5 components).

**Mix Component Fraction**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…1 | 350 | 126/8 | 0xFE40…0xFE41/65089…65090 |

Mix fraction of the current mix component (*Mix Component Index*). The value range corresponds to 0…100%. The sum of the all mix fractions must be equal to 1.
If the value is 0, the next component slots are ignored.

**Mix Component Fluid Name**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[10] | RW | - | 351 | 126/9 | 0xFE48…0xFE4C/65097…65101 |

This parameter contains the fluid name of the current mix component (*Mix Component Index*). This parameter may contain one of two value types:
- Gas name, e.g. 'N2', 'He', 'C3H6 #2'.
- CAS Registry Number, e.g. '7727-37-9', '7440-59-7', '115-07-1'

If the parameter contains no name, the next component slots are ignored.

### 4.2.6 Master/slave configuration (FLOW-BUS)

Normally, there is no communication between the instruments in a fieldbus system. The FLOW-BUS protocol, however, provides a feature to set up a master/slave relationship between two instruments. The typical behavior of a slave instrument is to automatically set its own setpoint relative to the output (measurement value) of its master.

The output value of any instrument in a FLOW-BUS network is automatically available to all other instruments without extra wiring. A slave instrument can also be a master to other instruments.

To setup a master/slave relationship between instruments, first determine which instrument should be the master and which should be the slave, then set *Control Mode* of the slave instrument to 'FLOW-BUS Slave' (value 2; also see parameter *Control Mode* 34 ).

The slave instrument polls the output value of its master periodically and uses the slave factor to set its own flow relative to the master's.

*To prevent damage to the instruments an/or the system(s) they are connected to, be sure to avoid circular references between devices on the same fieldbus. The FLOW-BUS system does not have a protection mechanism.*

**Master Node**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 1…128 | 158 | 33/14 | n/a |

Sets the master node for the instrument.
Note that this parameter is only effective in a FLOW-BUS network with RS-485 communication.

**Slave Factor**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Float | RW | 0…500 | 139 | 33/1 | 0xA108…0xA109/41225…41226 |

The controller output from the master instrument is multiplied by *Slave Factor*/100 % to get the slave instrument setpoint. In systems other than FLOW-BUS via RS-485, *Slave Factor* is effective only if *Control Mode* is set to 'Analog slave', and the analog output signal of the master instrument is redirected to the input of the slave instrument.

Example:
- master output = 80 %
- *Slave Factor* = 50

⇨ slave instrument setpoint = 80 % x 50 %/100 % = 40 %

## 4.2.7 Digital input and output

**IO Switch Status**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned long | RW | 0, 1 | 288 | 114/31 | 0xF2F8…0xF2F9/62201…62202 |

This parameter is only functional for FLEXI-FLOW™ models that are equipped with an (internal) shut-off valve.
On FLEXI-FLOW™ models that are equipped with an internal shut-off valve, *IO Switch Status* is used to actuate the valve.

Depending on the valve type, actuation leads to closing or opening the valve:

| Value | Description | Normally open | Normally closed |
|---|---|---|---|
| 0 | Inactive | open | closed |
| 1 | Active | closed | open |

- *Immediately after powering-up,* IO Switch Status *is inactive.*
- *In the event of communication faults, the shut-off valve will fall back to its* default state 8 .

## 4.2.8 Device identification

**User Tag**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[16] | RW | - | 115 | 113/6 | 0xF130…0xF137/ 61745…61752 |

With this parameter, the instrument can be given a custom tag name, with a maximum of 16 characters.

**Customer Model**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[16] | RW | - | 93 | 113/4 | 0xF120…0xF127/ 61729…61736 |

This parameter is used to add extra information to the model number information, such as a customer-specific model number.

**Serial Number**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[20] | R | - | 92 | 113/3 | 0xF118…0xF11F/ 61721…61728 |

Instrument serial number for identification.

**BHT Model Number**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[35] | RW | - | 91 | 113/2 | 0xF110…0xF117/ 61713…61720 |

This parameter shows the Bronkhorst® instrument model type information.

**Firmware Version**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[16] | R | - | 105 | 113/5 | 0xF128…0xF12A/ 61737…61739 |

Revision number of the firmware

**Identification Number**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW 🔑 | 0…255 | 175 | 113/12 | 0x0E2C/3629 |

Bronkhorst® (digital) device type identification number.

**Device Type**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char[6] | R | - | 90 | 113/1 | 0xF108…0xF10A/ 61705…61707 |

Device type information string; this parameter contains an abbreviation referring to the identification number.

## 4.2.9 Operational history

| Name | Type | Access | Range | FlowDDE | FLOW-BUS | Modbus* |
|---|---|---|---|---|---|---|
| BHT1: Production Date | String | RW 🔑 | | 94 | 118/1 | 0xF608 [8] |
| BHT2: Operation Time | Unsigned int | R | | 95 | 118/2 | 0x0EC2 [1] |
| BHT3: Flow Time | Unsigned long | R | | 96 | 118/3 | 0xF618 [2] |
| BHT4: Actuation Count | Unsigned int | R | | 97 | 118/4 | 0x0EC4 [1] |
| BHT5: Mode Change Count | Unsigned char | R | | 98 | 118/5 | 0x0EC5 [1] |
| BHT6: Watchdog Reset Count | Unsigned char | R | | 99 | 118/6 | 0x0EC6 [1] |
| BHT7: Power Cycle Count | Unsigned char | R | | 100 | 118/7 | 0x0EC7 [1] |
| BHT8: Normal Reset Count | Unsigned char | R | | 101 | 118/8 | 0x0EC8 [1] |
| BHT9: NVRAM Error Count | Unsigned long | R | | 102 | 118/9 | 0xF648 [2] |
| BHT12: NVRAM Write Count | Unsigned long | R | | 330 | 118/12 | 0xF660 [2] |

*) numbers in square brackets denote the number of blocks/registers a parameter occupies

## 4.2.10 Special parameters

**Init Reset**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 82/64 | 7 | 0/10 | 0x000A/11 |

*Init Reset* is used to unlock secured parameters (marked with a 🔑 symbol) for writing. It supports the following values:

| Value | Description |
|---|---|
| 64 | unlocked, secured parameters can be read and written to |
| 82 | locked, secured parameters are read-only |

At power-up, *Init Reset* is always set to 'Locked' (value 82).

**Reset**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | R | 0…7 | 114 | 115/8 | 0x0E68/3689 |

This parameter is used to reset the program, counter or alarms (alarms are reset on all channels).

| Value | Description |
|---|---|
| 0 | No reset |
| 1 | Reset counter |
| 2 | Reset alarm |
| 3 | Reset counter |
| 4 | Reset and disable counter |
| 5 | Reset firmware program (soft reset) |
| 6 | Reset *Alarm info* error bit |
| 7 | Reset *Alarm info* warning bit |

- *Resetting alarms or the counter can be disabled by* Reset Alarm Enable *or* Reset Counter Enable *respectively.*
- Reset *value 2 resets alarms on all three communication channels, unless resetting is disabled for 1 or more channels.*

**Wink**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char [27] | W | 0…9* | 1 | 0/0 | 0x0000/1 |

Sending any text string value between 1 and 9 to this parameter makes the status indication light flash white for that number of seconds. This can be useful in order to identify a specific device in a large fieldbus network.

*) Modbus requires the following values:

| No. of seconds | Wink value |
|---|---|
| 1 | 12544 |
| 2 | 12800 |
| 3 | 13056 |
| 4 | 13312 |
| 5 | 13568 |
| 6 | 13824 |
| 7 | 14080 |
| 8 | 14336 |
| 9 | 14592 |

**Control Mode**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0…255 | 12 | 115/1 | 0x0024/37 |

*Control Mode* is used to select different control modes of the instrument and determines from which source(s) it accepts a setpoint. The following control modes are available:

| Value | Mode | Instrument action | Setpoint source |
|---|---|---|---|
| 0 | BUS/RS232 | Controlling | Fieldbus/RS-232 |
| 2 | FLOW-BUS Slave | Acting as slave instrument on FLOW-BUS | FLOW-BUS master output x *Slave Factor*/100% |
| 3 | Valve Close | Controller disabled, valve closed | |
| 4 | Controller Idle | Controller disabled, valve frozen in current position | |
| 7 | Setpoint 100% | Controlling, setpoint fixed to 100% | |
| 8 | Valve Fully Open | Controller disabled, valve fully opened | |
| 9 | Calibration Mode | Calibration mode enabled (factory only) | |
| 12 | Setpoint 0% | Controlling, setpoint fixed to 0% | |
| 18 | RS232 | Controlling, safe state deactivated | Fieldbus/RS-232 |

| Value | Mode | Instrument action | Setpoint source |
|---|---|---|---|
| 20 | Valve Steering | Controller disabled, setpoint redirected to *Valve output* | |
| 22 | Valve Safe State | Force instrument in safe state8 | |

- Default value: 0
- If *Control mode* is changed to value 9, the instrument returns to the default control mode at the next power-up or restart. All other values are retained.

**Calibration Mode**

| Type | Access | Range | FlowDDE | FLOW-BUS | Modbus |
|---|---|---|---|---|---|
| Unsigned char | RW | 0, 9, 255 | 58 | 1/4 | 0x0E61/3682 |

After enabling calibration mode by means of parameter *Control Mode*, this parameter is used to start the autozero function of the flow sensor. The following modes are supported:

| Value | Description |
|---|---|
| 0 | Idle (no action) |
| 9 | Start zeroing |
| 255 | Error (result of previous calibration mode) |

## 4.3 Multi-parameter addressing

This section lists all parameters that are available on all 3 communication channels15, including their FLOW-BUS and Modbus addresses. Classification is consistent with section Parameters21. See the according subsections for detailed parameter descriptions.

**General address derivation using offset**

In a Modbus system, parameters of communication channels 2 and 3 can be accessed by applying an offset to the Modbus PDU address of the channel 1 parameter:

- For address range 0x0000…0x0FFF, add 0x20 to the Modbus PDU address for channel 2, or 0x40 for channel 3.
- For address range 0x8000…0xFFFF, add 0x100 to the Modbus PDU address for channel 2, or 0x200 for channel 3.

On FLOW-BUS, parameters of communication channels 2 and 3 can be accessed by applying an offset to the process number of the channel 1 parameter:

- Add 1 to the process number for channel 2
- Add 2 to the process number for channel 3

**Measurement and control**

| Name | Channel 1 | | Channel 2 | | Channel 3 | |
|---|---|---|---|---|---|---|
| | FLOW-BUS | Modbus | FLOW-BUS | Modbus | FLOW-BUS | Modbus |
| Measure (8) | 1/0 | 0x0020 | 2/0 | 0x0040 | 3/0 | 0x0060 |
| Setpoint (9) | 1/1 | 0x0021 | 2/1 | 0x0041 | 3/1 | 0x0061 |
| Setpoint Slope (10) | 1/2 | 0x0022 | 2/2 | 0x0042 | 3/2 | 0x0062 |
| Temperature (142) | 33/7 | 0xA138 | 34/7 | 0xA238 | 35/7 | 0xA338 |
| Fmeasure (205) | 33/0 | 0xA100 | 34/0 | 0xA200 | 35/0 | 0xA300 |
| Fsetpoint (206) | 33/3 | 0xA118 | 34/3 | 0xA218 | 35/3 | 0xA318 |

**Fluid set**

*Communication channels 2 and 3 do not support the definition of fluid sets. Instead, the fluid set parameters on channels 2 and 3 are merely used to define capacity parameters for conversion of measurement and control data.*

| Name | Channel 1 | | Channel 2 | | Channel 3 | |
|---|---|---|---|---|---|---|
| | FLOW-BUS | Modbus | FLOW-BUS | Modbus | FLOW-BUS | Modbus |
| Capacity (21) | 1/13 | 0x8168 | 2/13 | 0x8268 | 3/13 | 0x8368 |
| Capacity Unit (129) | 1/31 | 0x81F8 | 2/31 | 0x82F8 | 3/31 | 0x83F8 |
| Capacity Unit Type Temperature (245) | 33/10 | 0xA150 | 34/10 | 0xA250 | 35/10 | 0xA350 |
| Capacity Unit Type Pressure (246) | 33/11 | 0xA158 | 34/11 | 0xA258 | 35/11 | 0xA358 |
| Density (170) | 33/21 | 0xA1A8 | 34/21 | 0xA2A8 | 35/21 | 0xA3A8 |

**Alarms**

| Name | Channel 1 | | Channel 2 | | Channel 3 | |
|---|---|---|---|---|---|---|
| | FLOW-BUS | Modbus | FLOW-BUS | Modbus | FLOW-BUS | Modbus |
| Alarm Info (28) | 1/20 | 0x0034 | 2/20 | 0x0054 | 3/20 | 0x0074 |
| Alarm Maximum Limit (116) | 97/1 | 0x0C21 | 98/1 | 0x0C41 | 99/1 | 0x0C61 |
| Alarm Minimum Limit (117) | 97/2 | 0x0C22 | 98/2 | 0x0C42 | 99/2 | 0x0C62 |
| Alarm Mode (118) | 97/3 | 0x0C23 | 98/3 | 0x0C43 | 99/3 | 0x0C63 |
| Alarm Setpoint Mode (120) | 97/5 | 0x0C25 | 98/5 | 0x0C45 | 99/5 | 0x0C65 |
| Alarm New Setpoint (121) | 97/6 | 0x0C26 | 98/6 | 0x0C46 | 99/6 | 0x0C66 |
| Alarm Delay Time (182) | 97/7 | 0x0C27 | 98/7 | 0x0C47 | 99/7 | 0x0C67 |
| Reset Alarm Enable (156) | 97/9 | 0x0C29 | 98/9 | 0x0C49 | 99/9 | 0x0C69 |

## 4.4 Gateway (multi-modular systems)

On communication platforms other than FLOW-BUS or Modbus, Bronkhorst® instruments can be controlled through a gateway. 1 gateway can accommodate up to 8 Bronkhorst® instruments.

*When communicating through a gateway, parameter addressing might differ from what is described in this document.*

- *For information about parameter addressing when using a Bronkhorst® gateway in a PROFIBUS DP or PROFINET system, consult the according fieldbus manual* 9 .
- *For information about parameter addressing on third party gateways, consult the gateway manual.*

*Not all parameters described in this document are necessarily available with all digital interface types. For information about parameter access and availability for Bronkhorst® instruments in a specific fieldbus network, consult the according fieldbus manual* 9 .

# Parameter index

## Parameters