



Instruction Manual



FLUICAL[®] **Portable Calibrator** **for gas flow and pressure**

Doc. no.: 9.17.058C Date: 15-05-2018



ATTENTION

**Please read this Instruction Manual carefully before installing and operating the instrument.
Not following the guidelines could result in personal injury and/or damage to the equipment.**



Disclaimer

The information in this manual has been reviewed and is believed to be wholly reliable. No responsibility, however, is assumed for inaccuracies. The material in this manual is for information purposes only.

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Symbols



Important information. Disregarding this information could cause injuries to people or damage to the instrument or installation.



Helpful information. This information will facilitate the use of the instrument and/or contribute to its optimal performance.



Additional info available on the internet or from your local sales representative.

Receipt of equipment

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

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



Check the packing list to ensure that you received all of the items within the scope of delivery. Do not discard spare or replacement parts with the packaging material and inspect the contents for damage.

Refer to [Removal and return instructions](#) about return shipment procedures.

Equipment storage

The equipment should be stored in its original package in a cupboard warehouse or similar. Care should be taken not to subject the equipment to excessive temperatures or humidity.

Warranty

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

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

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

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

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 avoid 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.

If required, replace fuses with the same type and rating for continued protection against fire hazard.

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

One or more warning signs may be present on different parts of the product. These signs have the following meaning:



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. Other components that are not safety related 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 relevance of a replacement component, contact Bronkhorst for information.

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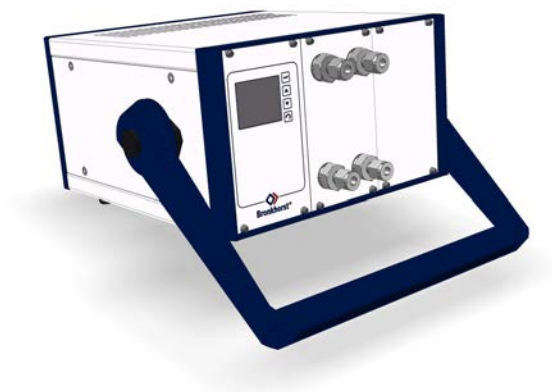
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1 Introduction

1.1 Scope of this manual

This manual contains general product information, installation and operating instructions and troubleshooting tips for the **FLUICAL® Portable Calibrator**.



1.2 Intended use

The **Portable Calibrator** is designed to accurately measure and/or control mass flow rates and/or pressure in a fluidic system using the media and operating conditions (e.g. temperature, pressure) as specified at ordering time.

The gas(es) used in the fluidic system in which the instrument is mounted must be clean and dry. The equipment is suited for general purpose indoor (dry) applications, like laboratories and machine enclosures.



The end user is considered to be familiar with the necessary safety precautions, and to comply with the appropriate protective measures as described in the Material Safety Data Sheets of the media to be used in the system (if applicable).



The wetted materials incorporated in the Portable Calibrator 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 be sure to 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 suitability, intended use, cleaning and corrosion resistance of the used materials against the applied media lies solely with the end user. Bronkhorst High-Tech B.V. cannot be held liable for any damage resulting from improper use, use for other than the intended purpose or use of other media and/or conditions than specified on the purchase order.

1.3 Product description

The **FLUICAL® Portable Calibrator** (Portable Calibrator) is a compact modular system for checking the calibration of (analog or digital) mass flow meters/controllers and/or pressure meters/controllers. Design and construction of the device enable on site deployment, without the need to remove the device under test (DUT) from its operating environment.

The Portable Calibrator incorporates one or more mass flow meter/controller modules and/or one or more pressure meter/controller modules, selected and configured according to the customer's wishes.

Calibration of the DUT can be checked by comparing the flow or pressure readings of the DUT with the certified readings of the internal instruments. Each incorporated instrument is calibrated using measurement standards traceable to the Dutch Metrology Institute (VSL).

The integrated readout and control unit provides a user interface for reading measurement values and controlling setpoints. The instruments and the readout and control module(s) are part of an internal FLOW-BUS network, that can be expanded with more instruments via a standard FLOW-BUS connection (RJ-45), to support readout and control via the Portable Calibrator.

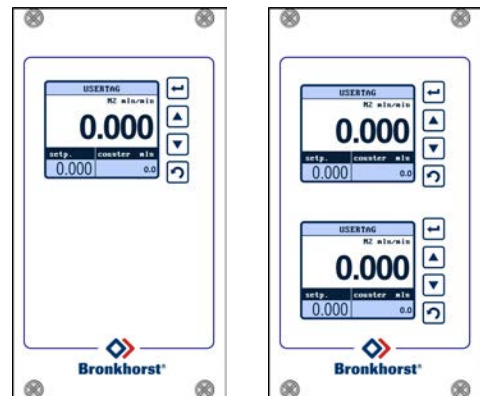
External digital communication is possible via the standard FLOW-BUS connection or an optional RS232 interface connection (9-pin D-sub).

1.3.1 Front modules

The Portable Calibrator has 3 or 6 front modules. The housing type, number of modules and module types are specified at ordering time.

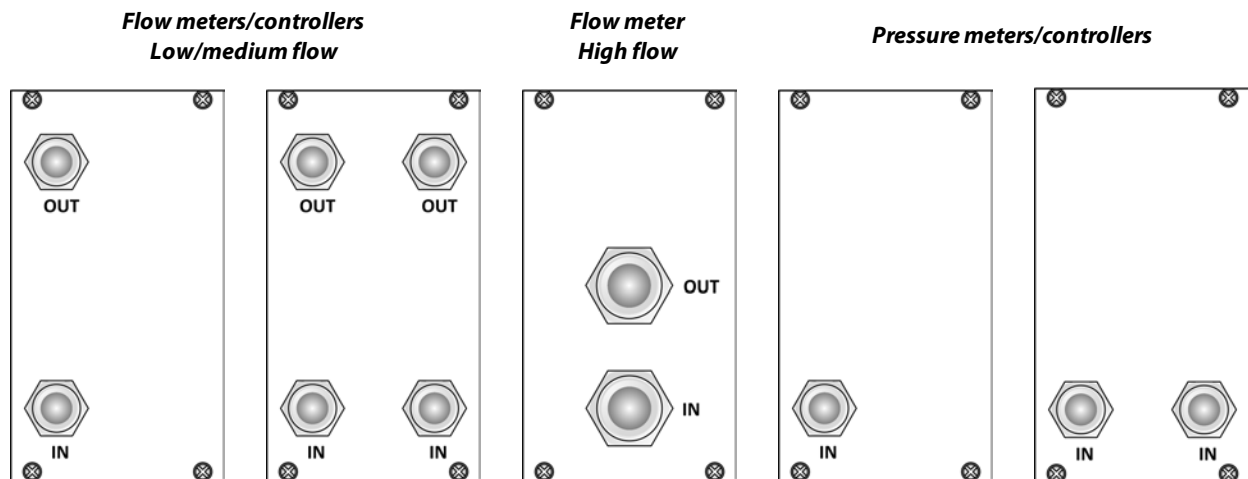
Readout and control module

Seen from the front, the leftmost position is always occupied by the power supply module. Depending on the customer preference, it provides 0, 1 or 2 readout and control modules.



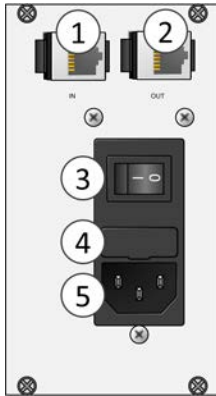
Instruments

Depending on the housing type, up to 2 or 5 calibration modules can be installed. Each calibration module contains 1 or 2 flow or pressure channels. Any combination of the following calibration modules can be installed:



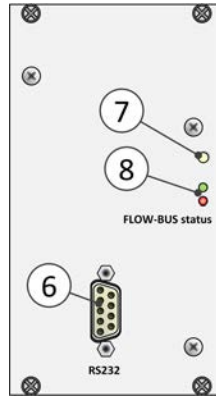
1.3.2 Rear modules

Main connection panel



1. FLOW-BUS in
2. FLOW-BUS out
3. Main power switch
4. Fuse
5. Main power connector

RS232 connection panel (optional)



6. RS232 connection (9-pin D-sub)
7. Multifunctional switch
8. FLOW- BUS status indicators (LED)

See also section [RS232 interface \(optional\)](#).

1.4 Documentation



This document contains all necessary documentation for basic operation and maintenance of the Portable Calibrator. This section lists all documentation that is relevant to (parts of) the Portable Calibrator. Documents with a check mark in the column labeled 'www' can be downloaded from <http://www.bronkhorst.com/en/downloads>.

This section lists only the generic documentation that is relevant to the Portable Calibrator. Technical specifications are subject to specific agreements with the (end) customer and are documented separately.

Type	Document name	Document no.	www
Manuals	Instruction Manual FLUICAL® Portable Calibrator (this document)	9.17.058	
	Instruction manual FLOW-BUS interface	9.17.024	✓
	Instruction manual RS232 interface	9.17.027	✓
	Instruction manual FlowPlot	9.17.030	✓
Technical documentation	Hook-up diagram	9.16.210	
	Dimensional drawing (½ 19" housing)	7.05.878	
	Dimensional drawing (19" housing)	7.05.879	
Certificates	EU Declaration of Conformity (E-8000)	9.06.066	✓
	EU Declaration of Conformity (instruments)	9.06.021	✓
	Calibration certificates (1 per incorporated instrument)	n/a	



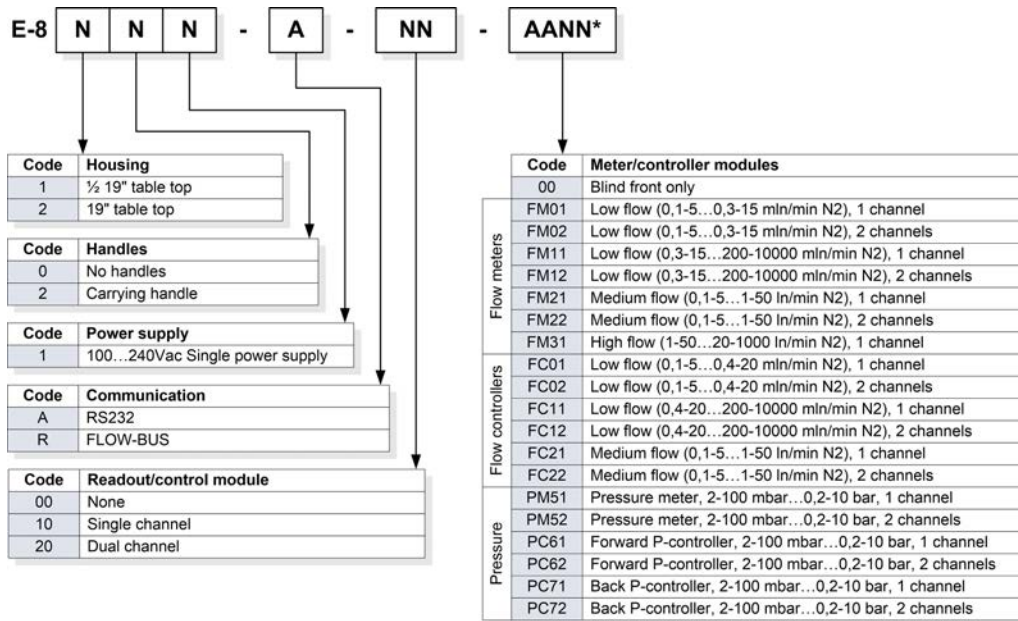
A full list of instrument parameters can be found in the Instruction manual RS232 interface (document no 9.17.027). However, most Bronkhorst® instruments only support a limited set of parameters.



Be aware that some unsupported parameters might be ignored by the device or might even have harmful (side) effects if used.

1.5 Model key

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



*) 1-5x, depending on number of modules

2 Installation

This chapter describes the steps to take in order to prepare the Portable Calibrator for first time use.

2.1 Functional properties

The product model number is stated on the label on one of the rear panels of the Portable Calibrator. See section [Model key](#) to evaluate the specific features. Before installing and using the Portable Calibrator, check if the specifications match your requirements, e.g.:

- Flow/pressure rate(s)
- Media to be used in the instrument
- Upstream and downstream pressure(s)
- Operating temperature
- Power rating

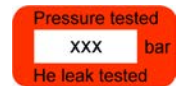


2.2 Operating conditions

Test pressure



Bronkhorst® instruments are pressure tested to at least 1.5 times the specified working process conditions and outboard leak tested to at least $2 * 10^{-9}$ mbar l/s Helium. The tested pressure is specified on the instrument with a red sticker. If this sticker is missing or if the specified pressure is insufficient, the instrument must not be used and should be returned to the factory.



Before installation, make sure that the tested pressure is in accordance with the safety factor of your application. The tested pressure must always be higher than the maximum operating pressure.

Disassembling the instrument and/or replacing parts of it will invalidate the pressure test specification.

Sealing material compatibility



The Portable Calibrator is fitted with specific sealing material(s), compatible with the media specified at ordering time. Be sure that the sealing materials are compatible with the media and conditions used in the system. Bronkhorst High-Tech B.V. cannot be held responsible for any damage resulting from the use of other media and/or conditions than specified on the purchase order.

2.3 Mounting



For optimal performance, please observe the following:

- The Portable Calibrator should be placed on an stable, even and horizontal surface.
 - When mounting the device in another position, adjusting the zero-point of the incorporated flow meters/controllers (if applicable) is strongly recommended (see [Adjusting zero point](#)).
 - For pressure meters/controllers, deviations in accuracy are generally negligible in other mounting positions.
- Avoid installation in close proximity of mechanical vibration and/or heat sources.

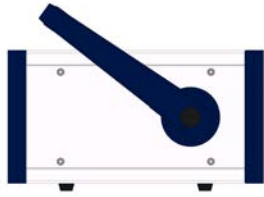


Do not obstruct the ventilation holes of the housing. If heat cannot be discharged properly, prolonged operation can cause abnormal temperature rise, reducing accuracy of the instruments and shortening the life span of the power supply unit.

Adjusting carrying handle (if applicable)

To enhance accessibility of the controls when operating the equipment, the carrying handle can be used as a mounting stand for tilted positioning. To rotate the carrying handle, depress both latching buttons at the side of the cabinet and move the handle to the desired position. By releasing the buttons, the handle is locked in place.

Horizontal position:



Depress buttons to rotate handle:



Tilted position:



2.4 Fluidic connections

- In the front panel, the ingoing and outgoing connections of a flow channel are always placed above each other (bottom: in, top: out).
- Install the Portable Calibrator in the process line, in accordance with the indications on the front panel.
- Tighten connections according to the instructions of the supplier of the fittings (if applicable).



For reliable performance, make sure the fluid stream is uncontaminated. If necessary, use filters to ensure a moisture, oil and particle free gas stream. If back flow can occur, the use of a downstream filter and check valve is also recommended. Select a suitable filter size, to avoid a too high pressure drop.



Check the fluidic system for leaks before applying pressure, especially if toxic, explosive or other dangerous fluids are used.

2.5 Electrical connection

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



Never power the instrument simultaneously from **two different power sources** (e.g. fieldbus connection and Plug-in Power Supply). Doing so will damage the printed circuit board irreparably.



The device contains electronic components that are susceptible to damage by **electrostatic discharge**. Proper handling procedures must be taken during installation, removing and connecting the electronics.

The device described in this manual carries the CE-mark and is **compliant with the concerning EMC requirements**. However, compliance with the EMC requirements is not possible without the use of proper cables and connector/gland assemblies. Bronkhorst recommends the use of their standard cables. These cables have the right connectors and if loose ends are used, these are marked to help prevent wrong connection. When using other cables, cable wire diameters should be sufficient to carry the supply current, and voltage loss must be kept as low as possible. When in doubt, contact your distributor.

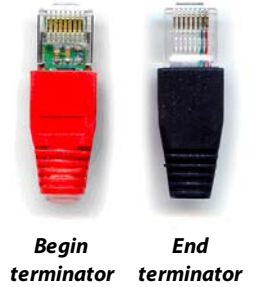
When connecting the product to other devices, be sure that the integrity of the shielding is not affected; **always use shielded cabling for signals and communication and do not use unshielded wire terminals**.

2.6 FLOW-BUS network termination

To achieve reliable data transfer in the (internal) FLOW-BUS system, the network must be terminated properly with the included special termination resistors.

If the Portable Calibrator is used as a stand alone device, the resistors must always be installed in the FLOW-BUS connections in the rear panel (see section [Rear modules](#)).

The FLOW-BUS connections can also be used to expand the internal FLOW-BUS network. The use of 2 separate resistors enables flexible extension of the FLOW-BUS network, through one or both FLOW-BUS connections. Whichever the case, the resistors must always be installed on the beginning and the end of the fieldbus network.



Consult the **FLOW-BUS manual** (document no. 9.17.024) for more information about setting up and operating a FLOW-BUS network and proper use of the termination resistors.

3 Operation

3.1 Powering up and powering down



- It is recommended to turn on power before applying pressure and to switch off power after removing pressure.
- For best performance, allow the Portable Calibrator to warm up and stabilize for at least 30 minutes before starting measurement and/or control. This may be done with or without media flow.



Be sure to apply the specified operating pressure(s). Avoid pressure shocks and bring the fluidic system gradually up to the level of operating conditions; open and close the fluid supply gently.

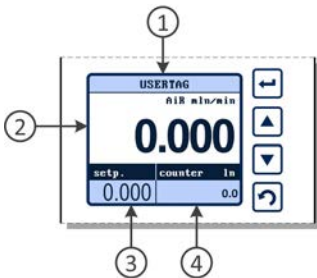
3.2 First use



In systems for use with corrosive, reactive or explosive media, purging the fluidic system for at least 30 minutes with a dry, inert gas (like Nitrogen or Argon) is absolutely necessary before use. After use with these media, complete purging is also required before exposing the system to air.

3.3 User interface





The image below shows the screen display, immediately after powering up.



The following screen areas can be distinguished:

1. Top line
2. Measure readout
3. Custom readout 1 (only for instruments with control function)
4. Custom readout 2

The navigational buttons have the following functionality:

- 
 - Enter selected menu
 - Enter edit mode
 - Confirm selection/changes
- 
 - Navigate up in menu
 - Change character or list item
- 
 - Navigate down in menu
 - Change character or list item
- 
 - Return to previous menu
 - Leave edit mode without making changes
 - Select display info

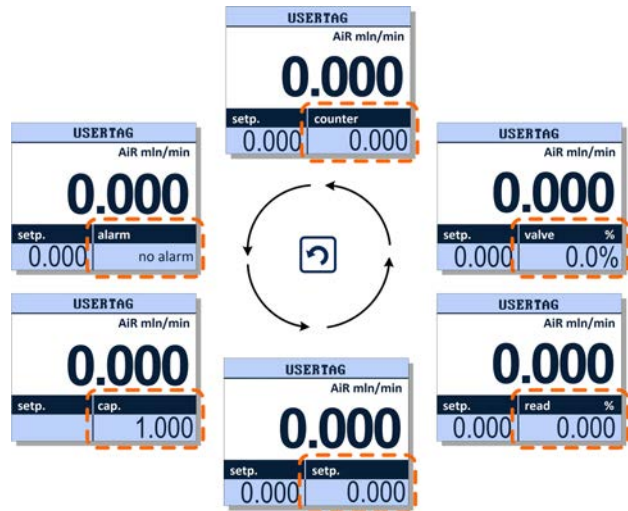
3.3.1 Main screen

3.3.1.1 Selecting display information

The *Custom readout 2* area can show different parameters. Depending on the instrument type, the following parameters may be available (editable parameters are marked with an *):

- setpoint*
- percentage reading
- actuator/valve percentage
- counter*
- alarm*
- capacity
- temperature
- density
- instrument*

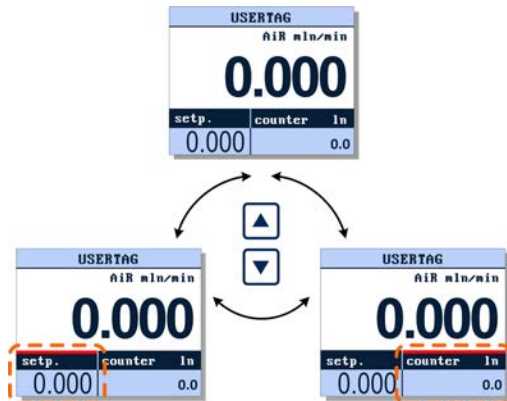
To change the displayed parameter, press from the main screen. Cycle through the available parameters by pressing the button repeatedly.



3.3.1.2 Selecting screen area

Depending on the instrument type and the settings of the readout and control unit, none, one or both of the custom readout areas can display an editable parameter. If an area contains an editable parameter, it can be selected and edited in place. Selection is made visible by a red line above the concerning area.

- To cycle through the editable screen areas, press or repeatedly
- To enter edit mode for the selected area, press
- When edit mode is active, press at any time to leave edit mode without making changes



3.3.1.3 Editing setpoint



- The setpoint of a controllable instrument can be changed if the parameter is displayed in the custom readout area.
- Instruments without a control function have no editable setpoint and can only be monitored (Custom readout 1 not available).

If the setpoint is configured to be entered as a character string, follow these steps to change its value:

1. Select a readout area that displays the setpoint:
2. Press to enter edit mode (the first character position is highlighted):
3. Press or to select the required character:
4. Press to advance to the next character position:



On confirmation of the last digit, the entered value is stored and edit mode is left (whereupon the character highlight is removed).

If the setpoint is configured to be entered step-wise, follow these steps to change its value:

1. Select a custom readout area that displays a setpoint:
2. Press to enter edit mode (the current value is highlighted):
3. Press or to change the parameter value (hold the button to scroll fast):
4. Press to store the current value and leave edit mode:



The setpoint input method (string or step-wise) can be set in the [Settings](#) menu (Settings > Setup > Customize > Setpoint)

3.3.1.4 Resetting counter

1. In the main screen, select the *Custom readout 2* area:
2. Press to enter edit mode:
3. Press or to change the value to 'yes':
4. Press to confirm the selected option and reset the counter:



3.3.1.5 Resetting alarm



Before resetting the alarm, be sure to eliminate the cause. Resetting the alarm without changing the conditions that caused it will re-activate the alarm immediately.

When an alarm occurs, a message blinks in the top line of the main screen. If the alarm is configured to be reset automatically, the blinking stops as soon as the alarm conditions no longer apply. If the alarm is configured to be reset manually, follow these steps to reset it:



1. *Custom readout 2* area is selected automatically:
2. Press to enter edit mode:
3. Press or to change the value to 'yes':
4. Press to confirm the selected option and reset the alarm:






3.3.2 Menu navigation



The configurable parameters of the instrument and settings of the readout and control unit are organized in a menu structure.

Items





Menus can contain items of 3 different types:

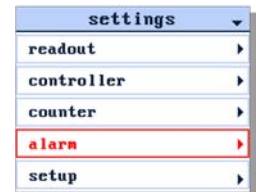
Sub menu	An arrow pointing to the right indicates a sub menu	
Parameter with list selection	An arrow pointing down indicates a parameter that can be changed by selecting a value from a list	
Character string parameter	<ul style="list-style-type: none"> • First line: unit (if applicable) • Second line: current parameter value 	

Not all parameters can be edited; some parameter values are protected, or display a value that is directly linked to the value of another parameter:

Normal display	Parameter can be edited	
Dimmed	Parameter is read-only	

Navigation

- Inside menus and sub menus, the selected item is highlighted in red
 - Press  or  to navigate to the required menu item
 - Arrows pointing up and/or down in the top line indicate the menu contains more items than can be displayed.
-
- Press  to enter the selected sub menu or to enter edit mode
 - Press  to return to the previous screen or menu or to leave edit mode without making changes



3.3.2.1 Password protection

1. By default, some items are accessible only after entering a password:
2. Enter the password (if the password contains less than 8 characters, fill the remaining positions with spaces):
3. If the password is correct, the selected (sub) menu is displayed on confirmation of the last character position:
4. If the password is incorrect, access is denied:



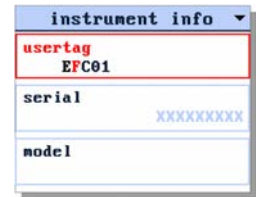
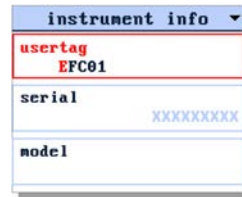
The default password is 'abc' (without quotes) and is case sensitive.



To avoid unauthorized access, change the default password immediately after installation. See [Changing password](#) for instructions.

3.3.2.2 Editing string

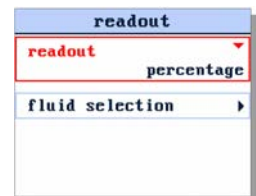
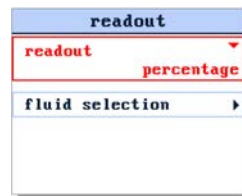
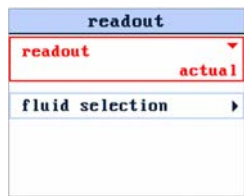
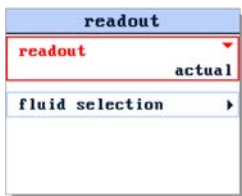
1. Select the parameter to be edited:
2. Press \leftarrow to enter edit mode (the first character position is highlighted):
3. Press \uparrow or \downarrow to select the required character/digit:
4. Press \leftarrow to advance to the next character position:



On confirmation of the last character/digit, the entered value is stored and edit mode is left (whereupon the character highlight is removed).

3.3.2.3 Editing list selection

1. Select the parameter to be edited:
2. Press \leftarrow to enter edit mode (the selected value is highlighted):
3. Press \uparrow or \downarrow to scroll through the available options:
4. Press \leftarrow to confirm the selected option and leave edit mode (the highlight is removed):



3.3.3 Settings menu

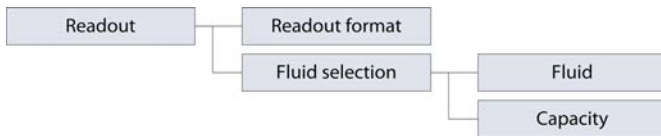
The *Settings* menu provides access to the user configurable instrument parameters, and contains settings for customizing display behavior of the readout and control unit. The menu is divided into the following sections (available as sub menus):

Sub menu	Description
Readout	Readout settings and fluid selection
Controller	Instrument controller characteristics
Counter	Counter settings
Alarm	Alarm settings
Setup	Device identification, display customization and bus configuration
Advanced	Sensor filter settings and special functions

1. Start in the main screen:
2. Press  to enter the *Settings* menu:



3.3.3.1 Readout



In the *Readout* sub menu, the following parameters can be edited:

Parameter	Description	Supported values
Readout format	Display format of measured value in main screen	<ul style="list-style-type: none"> • actual • percentage
Fluid	Selected (metered) fluid	As ordered
Capacity	Maximum readout/control value (100%) for selected fluid	As ordered

3.3.3.2 Controller



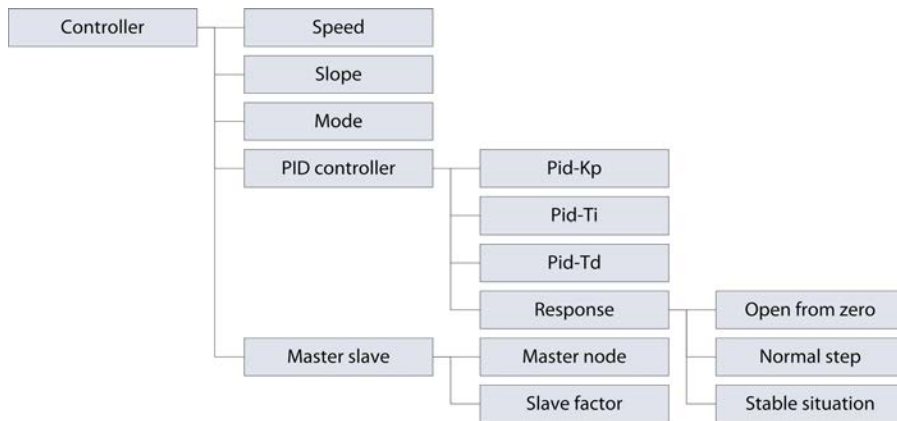
For a basic description of the PID controller algorithm, see *Digital parameters*, sub section <%=TARGETTITLE%>.



Because controlling characteristics are optimized during manufacture, Bronkhorst strongly advises not to change these parameters. If changing controller settings is absolutely necessary, it should be performed by or under supervision of trained service personnel only.



Mode and Master slave are not part of the controlling characteristics; these parameters can be changed if necessary, e.g. for purging instruments and piping or setting up a master/slave relationship between instruments.



In the *Controller* sub menu, the following parameters can be edited:

Parameter	Description	Supported values
Speed	Controller speed factor	0.001...99.999
Slope	Controller adjustment speed	0.0...3000.0 seconds
Mode	Control mode	see table below
Pid-Kp	PID controller proportional action	
Pid-Ti	PID controller integration action	
Pid-Td	PID controller differentiation action	
Open from zero	Open from zero response	0...255
Normal step	Normal step response	0...255
Stable situation	Stable situation response	0...255
Master node	Node address of master instrument	0...128
Slave factor	Percentage of measurement value of master instrument	0...100.0%

The following control modes are available:

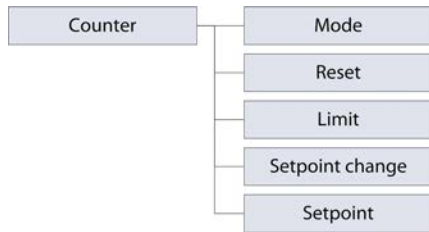
Value	Description
rs232	Normal operation via RS232
bus/rs232	Normal operation via fieldbus or RS232
analog input	Normal analog operation
setpoint 0 perc.	Setpoint set to 0%
setpoint 100 perc.	Setpoint set to 100%
control idle	Controller disabled, valve frozen in current position
actuator 0 perc.	Controller disabled, valve closed
actuator 100 perc.	Controller disabled, valve fully open
actuator steering	Controller disabled, valve opening equal to setpoint (percentage)
fb slave	Acting as slave of other instrument on FLOW-BUS
analog slave	Acting as slave of other instrument on analog input
fb ana slave	Acting as slave of other instrument on FLOW-BUS, slave factor set by analog input signal

The *Master slave* item is only available if one of the slave control modes is selected. Availability of *Master node* and *Slave factor* depends on the selected mode:

Control mode	Master node	Slave factor
fb slave	✓	✓
analog slave		✓
fb ana slave	✓	

3.3.3.3 Counter

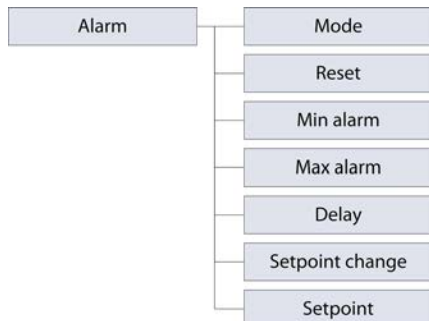
Bronkhorst® flow meters have a built-in counter function, which can be used to monitor and/or control the amount of media flowing through the instrument. The flow can be stopped or changed when a certain limit is reached. Until the counter is reset, the counter setpoint overrules the regular setpoint.



In the *Counter* sub menu, the following parameters can be edited:

Parameter	Description	Supported values
Mode	Selected counter mode	<ul style="list-style-type: none"> • off • up to limit • up
Reset	Reset method	<ul style="list-style-type: none"> • automatic • manual
Limit	Counter limit or batch size	Setpoint range
Setpoint change	Specifies whether or not to change setpoint after reaching counter limit	<ul style="list-style-type: none"> • yes • no
Setpoint	New setpoint after reaching counter limit (until counter reset)	Setpoint range

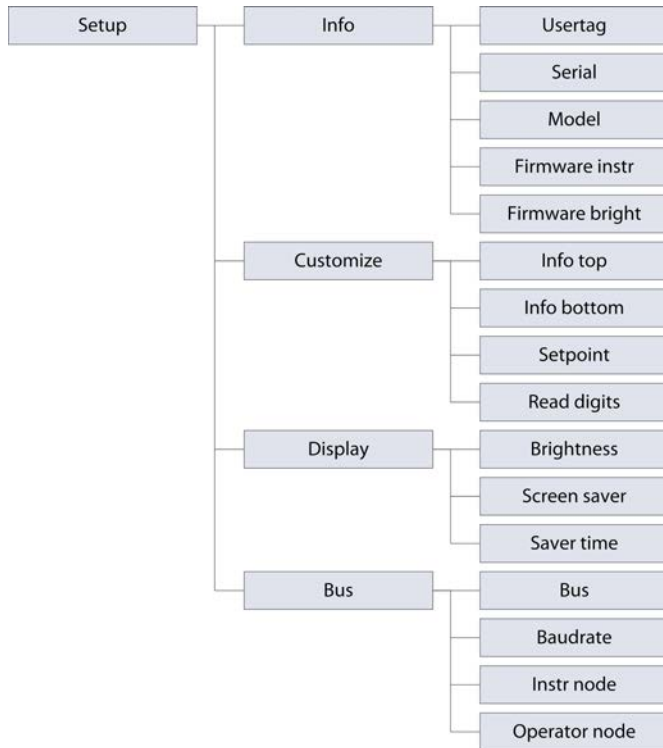
3.3.3.4 Alarm



In the *Alarm* sub menu, the following parameters can be edited:

Parameter	Description	Supported values
Mode	Alarm type	<ul style="list-style-type: none"> • off • min/max • response • power-up
Reset	Reset method; reset alarm automatically if alarm conditions no longer apply, or manually via user interface	<ul style="list-style-type: none"> • automatic • manual
Min alarm	Minimum limit	0...100%
Max alarm	Maximum limit	0...100%
Delay	Number of seconds to wait before triggering alarm action (after alarm situation was activated)	0...255
Setpoint change	Specifies whether or not to change setpoint after an alarm situation is activated	<ul style="list-style-type: none"> • yes • no
Setpoint	New setpoint until alarm reset	Setpoint range

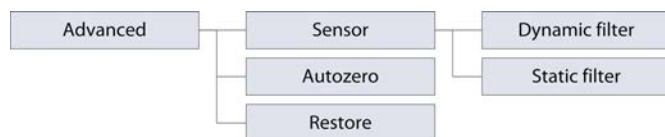
3.3.3.5 Setup



The following parameters are available in the *Setup* sub menu:

Parameter	Description	Supported values
Usetag	Custom instrument name	text (16 positions)
Serial	Instrument serial number	n/a (read only)
Model	Instrument model number	n/a (read only)
Firmware instr	Firmware version instrument	n/a (read only)
Firmware bright	Firmware version readout and control unit	n/a (read only)
Info top	Information to show in top line of display	<ul style="list-style-type: none"> • usetag • serial number
Info bottom	Information to show in <i>Custom readout 2</i> area	<ul style="list-style-type: none"> • setpoint • valve • disabled
Setpoint	Specifies if setpoint is edited as digits or step-wise	<ul style="list-style-type: none"> • cursor • step
Read digits	Number of digits to show in main screen	0...5
Brightness	Screen brightness	0...9
Screen saver	Enable or disable screen saver	<ul style="list-style-type: none"> • dimmer • off
Saver time	Number of minutes of inactivity before screen saver becomes active	1...99
Bus	Fieldbus type	n/a (read only)
Baudrate	Communication speed	fieldbus dependent
Instr node	Primary node address	1...128
Operator node	Node address of operator module	1...128

3.3.3.6 Advanced





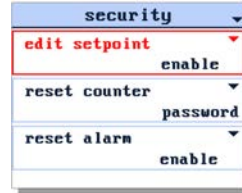
In the *Advanced* sub menu, the following parameters can be edited:

Parameter/function	Description	Supported values
Dynamic filter		0...1
Static filter		0...1
Autozero	Adjust zero point (only for flow meters/controllers)	
Restore	Restore factory settings	

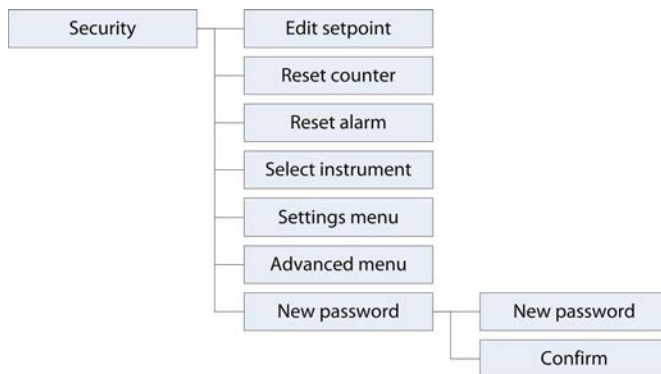
3.3.4 Security menu

To enter the *Security* menu, follow these instructions:

1. Start in the main screen:
2. Press and hold  and  simultaneously for 5 seconds:
3. Enter the password to enter the *Security* menu:



In the *Security* menu, access to some delicate items can be restricted. The password that is used for password protected items can also be changed here.



The following items can be restricted:

Item	Description
Edit setpoint	Setpoint edit mode
Reset counter	Manually resetting counter in <i>Custom readout 2</i> area
Reset alarm	Manually resetting alarms in <i>Custom readout 2</i> area
Select instrument	Selecting another instrument in fieldbus system (<i>Custom readout 2</i> area)
Settings menu	Availability of <i>Settings</i> menu
Advanced menu	Availability of <i>Advanced</i> sub menu in <i>Settings</i> menu

For each of these items, one of the following access modes can be set:

- **Enabled:** item is available without restrictions
- **Disabled:** item is not available
- **Password:** item is password protected



The password protection of the Security menu itself cannot be removed, nor can the menu be disabled.

3.3.4.1 Changing password

1. Open the *Security* menu and select the *New password* item:
2. Press **[←]** to enter the *New password* sub menu:
3. Press **[←]** to enter edit mode and enter the new password:
4. After confirming the last character, select the *Confirm* item:



5. Press **[←]** to confirm the new password:



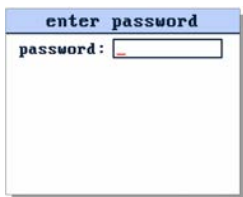
The new password is applied only after confirmation; the password is active throughout the entire readout and control program.

3.3.4.2 Resetting password

If the password is lost (after changing it), it can be reset by entering an encrypted key. This reset key can be obtained by sending a so-called 'bht key' to your local Bronkhorst representative. After entering the reset key, the password will be reset to the default value ('abc').

To get a *bht key* from the readout and control unit, follow these instructions:

1. Press **[↑]** and **[↓]** simultaneously for 5 seconds, until the 'enter password' screen appears:
2. Again, press **[↑]** and **[↓]** simultaneously for 5 seconds, until the *Reset password* screen appears:
3. Write down the *bht key* and send it to your local Bronkhorst representative by e-mail. After validation, you will receive a reset key.



When you have received your reset key, return to the *Reset password* screen and proceed as follows:

4. Enter the reset key:
5. On confirmation of the last character position, the password is reset:
6. Press any key to return to the main readout screen



3.4 RS232 interface (optional)

The optional RS232 interface provides access to the internal FLOW-BUS network of the Portable Calibrator and the digital parameters of the incorporated instruments.

Digital Bronkhorst® instruments can be operated via RS232 using the free FlowWare software tools for Windows. These tools provide a graphical interface to the ProPar protocol (used by FLOW-BUS), for monitoring and changing instrument parameters.

The FlowWare toolkit provides the following functionality:

- **FlowPlot, FlowView:** monitoring and operating digital instruments
- **FlowTune™:** definition and selection of fluids
- **FlowFix:** selection of the active fluid and configuration of the fieldbus connection (if applicable)

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/products

The RS232 interface panel on the rear side of the housing is equipped with two LEDs and a push button switch (see product description), which can be used to monitor the FLOW-BUS status of the RS232 interface and start several functions.



The LEDs and push button only apply to the RS232 interface itself; to monitor the incorporated instruments of the Portable Calibrator, use FlowPlot or the integrated readout and control modules.

3.4.1 LED indications

- (green) Mode: operation mode indication
- (red) Error: error/warning messages

The tables below list the different LED indications:

● Green		
Pattern	Time	Indication
off	continuous	Power off or program not running
on	continuous	Normal operation mode
short flash	0.1 sec on, 2 sec off	FLOW-BUS installation mode; device is busy searching a free node address

● Red		
Pattern	Time	Indication
off	Continuous	No error
on	Continuous	Critical error; the device needs servicing before it can be used
short flash	0.1 sec on, 2 sec off	Node occupied; re-install the device
blink	0.2 sec on, 0.2 sec off	Communication error; check communication settings of all FLOW-BUS devices in the fieldbus setup. Possibly the last node address setting of one of the devices is incorrect.

● Green and ● red (alternating)		
Pattern	Time	Indication
wink	0.2 sec on, 0.2 sec off	Wink mode; by sending a command to the <i>Wink</i> parameter, the device flashes its LEDs to indicate its position in a (large) system.

3.4.2 Multifunctional switch

Some special functions of the RS232 interface can be started manually using the multifunctional switch near the LED indicators.

The available functions are presented in a repeating sequence of patterns, where each pattern indicates a special function. To select a function, press and hold the switch until the LEDs show the pattern of the function to be started. By releasing the switch, the selected function is started immediately.

Available functions in normal operating mode

- Indications in this sequence are continuous

● (green)	● (red)	Time span	Function
●	●	0...1 sec	No action
●	●	1...4 sec	Auto install to bus ; let the device obtain a free node address from the FLOW-BUS system (only if the stored node address is occupied)
●	●	4...8 sec	Reset and restart the device

Available functions during powering-up

- In order to access this sequence, press and hold the switch while powering-up the instrument
- Indications in this sequence are flashing (0.2 sec on, 0.2 sec off)

● (green)	● (red)	Time span	Function
●	●	0...4 sec	No action
●	●	4...8 sec	Restore factory settings (except communication settings)
●	●	8...12 sec	Auto install to bus ; let the device obtain a free node address from the FLOW-BUS system
●	●	12...16 sec	Activate configuration mode <ul style="list-style-type: none"> • In configuration mode, the green LED blinks 2 seconds on and 0.1 second off • Configuration mode remains active after powering-down and can be deactivated by selecting this function again at the next start-up

3.5 Adjusting zero point

The zero point (the signal that corresponds to zero flow) of a Bronkhorst® flow meter/controller is factory adjusted at approximately 20 °C and atmospheric pressure. If the ambient conditions or mounting position are significantly different, the instrument might detect a flow when actually there is none. In that case, the instrument needs to be adapted to the new conditions by re-adjusting the zero point.


Zeroing an instrument requires that:

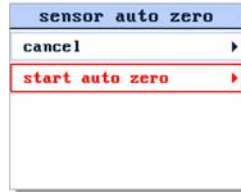
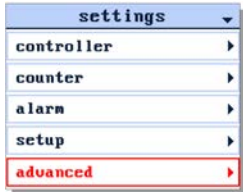
- the ambient conditions (temperature, pressure) match those of the operating environment of the instrument
- the instrument is filled homogeneously with the operational media
- there is absolutely no fluid flow through the instrument; preferably, this is done by closing a valve immediately behind the outlet of the instrument (control valve, shut-off valve)

Once started, the procedure takes approximately 10 seconds to complete (longer if the output signal is unstable).

3.5.1 Via user interface

The readout and control unit provides an automatic function for re-adjusting the zero-point of a flow meter, which automatically steps through the required parameter settings. This *Autozero* function can be found in the *Advanced* section of the *Settings* menu. To start the *Autozero* function, follow the instructions below:

1. In the *Settings* menu, select the *Advanced* item:
2. Enter the *Advanced* sub menu and select the *Autozero* item:
3. Enter the *Autozero* sub menu and select *Start auto zero*:
4. Press  to start the procedure and wait until it is finished:



3.5.2 Digital procedure



FlowPlot provides an easy way to adjust the zero point of an instrument via RS232; the *Auto zero* function automatically performs the procedure described below.

To adjust the zero point using digital communication (RS232 or fieldbus), set parameter values in the following sequence:

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







On completion of the procedure, parameter *Control Mode* changes back to its original value. If the procedure was successful, parameter *Calibration mode* changes to 0 (idle). If the procedure fails, *Calibration Mode* changes to 255.

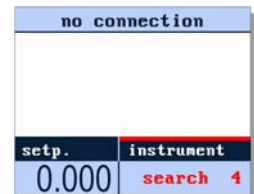
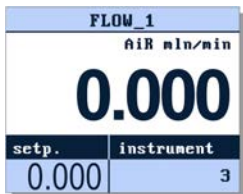



After performing the procedure, remember to set parameter *Init Reset* to value 0 to lock secured parameters

3.6 Selecting instrument

The readout and control module can be connected to 1 instrument at any time. To connect it to another instrument in the same network, follow these instructions:

1. In the main screen, press  repeatedly to select the 'instrument' item:
2. Press  or  repeatedly to activate the *Custom readout 2* area:
3. Press  to enter edit mode:
4. Press  or  to search for the next node address with an instrument:



5. When an instrument is found, its readings are shown on the display:
6. If necessary, repeat step 4 until the desired instrument is found:
7. Press  to acknowledge the selection and leave edit mode:

PRESS_1	
AIR bar a	
1.000	
setp.	instrument
1.000	10

PRESS_2	
AIR bar a	
2.000	
setp.	instrument
2.000	11

PRESS_2	
AIR bar a	
2.000	
setp.	instrument
2.000	11



In large networks, searching for the next available instrument might take quite long. While searching (step 4), navigation is disabled and the display does not show any specific instrument information; this is normal behavior.



Do not connect more than 3 readout and control modules to the same instrument.

4 Maintenance

4.1 General

Bronkhorst® instrumentation needs no regular maintenance if 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 required. After cleaning, re-calibration of the instrument is recommended.



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

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



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

4.2 Calibration

The individual instruments in the Portable Calibrator are factory calibrated, where applicable. Bronkhorst certifies that the instruments meet the rated accuracy. Calibration is performed using measurement standards traceable to the Dutch Metrology Institute (VSL).

Periodical inspection, recalibration or verification of the accuracy may be subject to individual requirements of the end user.

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 behavior can be checked by applying fluid pressure.



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

5.1 Errors and warnings



In case of problems during operation, error and warning information for the individual instruments can be found by connecting the instrument to FlowDDE and FlowPlot. FlowDDE puts all errors and warnings on the console screen; FlowPlot provides several specific alarm and counter indicators.



See [LED indications](#) for an explanation of the LED indications of the RS232 interface (if applicable).

5.2 Replacing fuses



See the images in the [product description](#) for the location of the fuse inside the electrical cabinet.




Fuses may only be replaced by qualified service personnel.

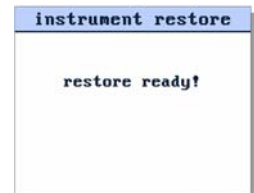
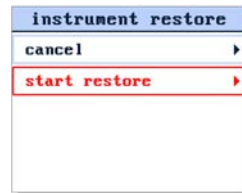
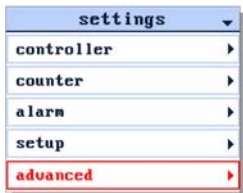
When replacing fuses, observe the following:

1. Before replacing a fuse, switch off the equipment and disconnect it from the electrical power source;
2. Before replacing a fuse, determine and solve the cause of the blow;
3. Always replace fuses with the same type (current, speed, dimensions). If you are unsure about the applicability of a replacement fuse, contact your Bronkhorst representative for support.

5.3 Restoring factory settings

In case changes to the configuration of an instrument leads to non-recoverable erroneous behavior, the instrument can be reset to the pre-configured factory settings. The easiest way to do this is with the automatic *Restore* function of the readout and control unit (if installed). The *Restore* function can be found in the *Advanced* section of the *Settings* menu. To enter the menu and start the *Restore* function, follow the instructions below:

1. In the *Settings* menu, select the *Advanced* item:
2. Enter the *Advanced* sub menu and select the *Restore* item:
3. Enter the *Restore* sub menu and select *Start restore*:
4. Press  to start the procedure and wait until it finishes:



Alternatively, if an RS232 interface is installed, the factory settings of an instrument can be restored via with the *Restore settings* function in FlowPlot.



Changes made to the network settings (bus address, baud rate, parity) will **not** be restored by a factory reset.

5.4 Common issues

Symptom	Possible cause	Action
No (fieldbus) communication	No power supply	<ul style="list-style-type: none"> • Check power supply • Check cable connection • Check cable hook-up
	Other	Restart device. If problem persists, contact Bronkhorst.
No output signal	No power supply	<ul style="list-style-type: none"> • Check power supply • Check cable connection • Check cable hook-up
	Inlet pressure or differential pressure too low	Increase inlet pressure
	Piping, filters and/or control valve clogged or blocked	Flush fluidic system with clean, dry air. If problem persists, contact Bronkhorst.
	Sensor failure	Return equipment to factory
Control behavior unstable	Measurement disturbed by vibrations	If possible, avoid installation in close proximity of mechanical vibration
	Inlet pressure unstable	Eliminate pressure fluctuations, e.g. by installing a pressure regulator
	Wrong controller settings	Adjust settings (e.g. with FlowPlot)
No flow (sending a setpoint has no effect)	No fluid supply	Check upstream components for obstruction, e.g.: <ul style="list-style-type: none"> • fluidic lines • valves • filters
	Inlet pressure or differential pressure out of bounds	Set inlet pressure to a value within specifications
Flow rate rises, but never reaches setpoint	Piping, filters and/or control valve clogged or blocked	Flush fluidic system with clean, dry air. If problem persists, contact Bronkhorst.
	Inlet pressure too low	Increase inlet pressure
	Outlet pressure too high	Check outlet pressure
	Process outlet blocked	Check process outlet and downstream piping
Measured value or output signal much lower than setpoint	Inlet pressure or differential pressure too low	<ul style="list-style-type: none"> • Increase inlet pressure • Use instrument in conditions it was designed for
	<ul style="list-style-type: none"> • Piping, filters and/or control valve clogged or blocked • Sensor blocked or contaminated 	Flush fluidic system with clean, dry air. If problem persists, contact Bronkhorst.
	Supplied fluid type does not match configured fluid type	Supply equipment with other fluid or change fluid type in instrument configuration
Measured value or output signal indicates a flow, while there is none	Ambient conditions differ significantly from conditions stated on instrument label	<ul style="list-style-type: none"> • Use instrument in conditions it was designed for • Adjust zero point (see Adjusting zero point)
	System leakage	Check the system for leakage. Follow vendor instructions when installing third party components (e.g. adapters, tubing, valves)
Continuous maximum measured value or output signal	Inlet pressure too high	Check inlet pressure
	Sensor failure	Return equipment to factory

5.5 Service

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



<http://www.bronkhorst.com>

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



sales@bronkhorst.com

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



support@bronkhorst.com

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



+31 859 02 18 66

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

6 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 fluidic lines
2. If toxic or dangerous fluids have been used, the instrument 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 distributor for local arrangements.)