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.
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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 Bronkhorst 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 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, 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 Bronkhorst representative.

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

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 for a period of three years from the date of shipment, provided they are used in accordance with the ordering specifications and not subject to abuse or physical damage. Products that do not operate properly during this period may be repaired or replaced at no charge. Repairs are normally warranted for one year or the balance of the original warranty, whichever is the longer.

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

The warranty includes all initial and latent defects, random failures, and indeterminable internal causes.

It excludes failures and damage caused by the customer, such as contamination, improper electrical hook-up, physical shock etc.

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

Bronkhorst High-Tech B.V. or affiliated company pre pays 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 user serviceable parts inside. In case of a defect please return the equipment to Bronkhorst High-Tech B.V.

One or more warning signs may be 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 your local Bronkhorst representative for information.
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1 Introduction

1.1 Scope of this manual

This manual covers the EL-FLOW® Prestige series mass flow meters/controllers for gases. This manual includes product information, installation instructions, operation, maintenance and troubleshooting tips.

1.2 Intended use

EL-FLOW® Prestige instruments are designed to accurately measure and/or control gas flow rates of a specified gas at the conditions stated on the serial number label. The gas in the pressurized system in which the instrument is mounted has to be clean and dry. The instruments are suited for general purpose indoor (dry) applications, like laboratories and machine enclosures. The instruments can be used for either (fast) switching gas flow or for controlling a constant flow rate (mass flow controllers only).

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

Responsibility for the use of the equipment with regard to suitability, intended use, cleaning and corrosion resistance of the applied materials against the processed 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 with other media and/or under other conditions than specified on the purchase order.

1.3 Product description

EL-FLOW® Prestige is the next generation of Bronkhorst® Mass Flow Meters/ Controllers using the latest, highly accurate, thermal by-pass sensor technology and featuring excellent control characteristics. Thanks to the advanced sensor technology in combination with a state-of-the-art printed circuit board, the instruments feature improved long-term stability as well as an unsurpassed temperature stability. Furthermore, due to a power efficient microprocessor, the power consumption of the instrument is reduced. The mass flow meters and controllers can be supplied in full scale ranges from 0.7 ml/min up to 100 l/min Air-equivalent at max. 64 or 100 bar (1000 or 1500 psi) pressure rating.

EL-FLOW® Prestige offers high flexibility due to the multi-gas/multi-range functionality. This function, now extended to 100 gases and mixtures thereof, is easily accessible via the FlowTune™ software or PLC; there is no need to disconnect the instrument from your system. For additional gas types the user can calculate accurate fluid properties for conversion by means of our free, online software tool FLUIDAT® on the Net. Users of EL-FLOW® Prestige instruments can rescale their instruments on site, saving time and money for dismounting and recalibration.
Numerous input/output options can be installed through the programmable 9-pin D-sub connector (from factory). In addition to the various analog signal options and the standard RS232 communication, there are such options as RS485 communication, digital frequency/pulse output, alarm output/reset, valve purge/close and analog valve output. Furthermore Bronkhorst offers various integrated fieldbus options: DeviceNet™, PROFIBUS DP, Modbus RTU/ASCII, EtherCAT®, PROFINET and FLOW-BUS.

1.3.1  EL-FLOW® Prestige PI

The EL-FLOW® Prestige PI (pressure insensitive) adds active pressure compensation to the already very accurate controlling characteristics, resulting in even more accurate flow measurement and control stability.

An innovative static compensation algorithm (FLUIDAT On Board) uses the actual fluid temperature and pressure to calculate fluid properties in real time. Density, viscosity, thermal conductivity and heat capacity of the processed media change under the influence of pressure and temperature. The Fluidat On Board algorithm continuously recalculates these properties and uses them to adjust the gas flow.

Dynamic pressure compensation detects rapid and large pressure changes (caused, for instance, by operating multiple flow devices on the same fluid line, also called the Crosstalk Pressure Effect) and adjusts the control signal in such a way that the gas flow remains stable.

The EL-FLOW® Prestige PI is available with a choice from two different pressure sensors (up to 10 bar(g) and up to 100 bar(g)), both of which apply static compensation. The 10 bar type also uses dynamic compensation.
1.4 Documentation

The EL-FLOW® Prestige comes with all necessary documentation for basic operation and maintenance. Some parts of this manual refer to other documents, most of which can be downloaded from the Bronkhorst website. A calibration certificate for each ordered instrument is part of the scope of delivery.

The documentation listed in the following table is available on the [EL-FLOW® Prestige product pages](http://www.bronkhorst.com/products) under www.bronkhorst.com/products

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<td>Quick Installation Guide EL-FLOW® Prestige</td>
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The documentation listed in the following table can be downloaded from [www.bronkhorst.com/downloads](http://www.bronkhorst.com/downloads)

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<td>Manual RS232 interface</td>
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1.5 Model key

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

See section Customized I/O options (pin 5) for more information about the pin-5 configuration options.
2 Starting up

2.1 Functional properties

Before installing the EL-FLOW® Prestige, check the serial number label on the rear side of the instrument to see if the functional properties match your requirements:

- Flow rate
- Media to be used in the instrument
- Input and output signal (see also section Electrical connection)
- Upstream and downstream pressure(s)
- Operating temperature
- Valve type (NC = Normally Closed, NO = Normally Opened)

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 label.

- Before installation, make sure that the tested pressure is in accordance with the safety factor of your application
- If the pressure test label is missing or if the specified pressure is insufficient, the instrument must not be used and should be returned to the factory
- The maximum operating pressure must never exceed the tested pressure
- Disassembling the instrument and/or replacing parts of it will invalidate the pressure test specification.

Sealing material compatibility

The EL-FLOW® Prestige is fitted with specific sealing material(s), compatible with the media specified at ordering time. See section Sealing material compatibility for a compatibility list for the most commonly used media.

Ambient conditions

EL-FLOW® Prestige instruments are suitable for use in conditions between -10 and 70 °C and relative humidity of 10 to 90 % RH, unless specified otherwise. Please note that EL-FLOW® Prestige instruments have an ingress protection of IP-40, implying that the housing and electrical connection do not offer any protection against moist environments.

Make sure that process gases do not condensate in the instrument due to (changing) environmental conditions, condensed process fluids may seriously harm the instrument’s functionality! E.g. do not use moist air as process gas at low temperatures.

2.3 Mounting

For optimal performance, observe the following guidelines:

- Preferably, mount the EL-FLOW® Prestige in an upright position, especially if the operating pressure is higher than 10 bar
- When mounting the instrument in a position with upward or downward flow, adjusting the zero point is recommended
- Avoid installation in close proximity of mechanical vibration and/or heat sources

For stable fixation, the bottom of the instrument base is fitted with mounting holes. See the dimensional drawing for the exact locations.
2.4 Piping requirements

For reliable performance, make sure the fluid stream is uncontaminated. If necessary, use filters to assure a moisture, oil and particle free gas stream (recommended pore size: 5 µm). 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.

- Do not install small diameter piping on high flow rates and avoid abrupt angles or other disturbances within a distance of 10 times the pipe diameter from the inlet or outlet of the device.
- Do not install pressure regulators within a distance of 25 times the pipe diameter.

2.5 Fluidic connection

- Install the EL-FLOW® Prestige in the process line, in accordance with the direction of the FLOW arrow on the base of the instrument.
- Tighten connections according to the instructions of the supplier of the fittings. The use of Swagelok RS-type stainless steel adapters is recommended.

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

2.6 Electrical connection

Electrical connections must be made with standard cables or according to the applicable hook-up diagram (see section Documentation). The factory installed 9-pin D-sub settings are indicated on the serial number label. Make sure that the power supply is suitable for the power ratings as indicated on the serial number label, and that double or reinforced insulation is used for the power supply cabling.

EL-FLOW® Prestige instruments are powered with +15…+24 Vdc, depending on the fieldbus system (if applicable).

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

The device contains electronic components that are susceptible to electrostatic discharge. In order to prevent damage, proper handling procedures must be followed during installation, (dis)connecting and removing the electronics.

The device described in this document 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 local Bronkhorst representative.

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.
2.7 Analog / digital communication

2.7.1 Analog / local communication

If the instrument has a FLOW-BUS, Modbus or DeviceNet™ interface and is configured for digital communication, the 9-pin D-sub connector is protected by a dust cover. To gain access to the analog/local interface, the dust cover can be removed by pushing its lower end.

Use a loose-end cable with a 9-pin D-sub female connector on the instrument side (art. no. 7.03.004, 7.03.536 or 7.03.537) and refer to the hook-up diagram for analog operation to connect the required signals.

2.7.2 Digital RS232 communication

Digital operation over RS232 can be established when using the setup shown here or using a Bronkhorst® E-8000 readout/control unit. See section Basic RS232 operation for more cabling examples. Connecting the instrument with an RS232 cable or an RS232 cable with an RS232 to USB converter to a PC enables the use of the (free) Bronkhorst® FlowWare software for Windows, such as FlowDDE and FlowPlot. Make sure that the serial number label indicates RS232 settings for the 9-pin D-sub connector and apply the proper baud rate settings. If the instrument is not set for RS232 communication, please refer to Basic RS232 operation for switching to RS232 communication settings via the ‘Configuration Mode’.

A PIPS (Plug-in Power Supply, article no. 7.03.422) is available to power a single instrument and can be used instead of the DB9 loose-end cable, as shown in the example above. Detailed information can be found in the PIPS manual (document no. 9.17.055) which can be downloaded from the Accessories and software section on the Bronkhorst® product pages (www.bronkhorst.com/products).

2.7.3 Digital RS485 / fieldbus communication

With digital operation over RS485 or Ethernet a bus system with multiple instruments can be set up:

- For RS485 FLOW-BUS or Modbus operation over the 9-pin D-sub connector or via an additional fieldbus driver (if installed), see section Basic RS485 operation (FLOW-BUS/Modbus).
- For operation via other additional fieldbus systems (e.g. DeviceNet™, EtherCAT®), refer to section Other fieldbus configurations or the specific fieldbus manual.

2.8 Micro switch operation

Using the two colored LEDs and the micro switch on the EL-FLOW® Prestige, several actions can be monitored and started. The green LED is used for status indication. The red LED is used for errors, warnings and messages. The switch can be used to start several actions, such as auto-zero, restoring factory settings and bus initialization actions, if applicable.

- See section Adjusting zero point for background information about and instructions for zeroing.
- See section Micro switch functions for a comprehensive description of the micro switch functionality.

The micro switch on top of the EL-FLOW® Prestige can be operated with a thin, metal or hard plastic pin, e.g. the end of a paperclip.
2.9 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 device 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.

2.10 First use

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

- The very first time the instrument is used, adjusting the zero point is recommended. See Adjusting zero point for background information and instructions.

2.11 Calibration

The EL-FLOW® Prestige is factory calibrated. Bronkhorst certifies that the instrument meets 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.

- Note that the calibration only applies to the primary measurement/control function of the instrument; secondary outputs (like temperature and pressure) are outside the calibration scope.

2.12 Maintenance

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

In case of severe contamination, cleaning the inside of the device may be required. After cleaning, recalibration 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 your local Bronkhorst representative for information about cleaning and calibration. Bronkhorst has a trained staff available.
3 Basic operation

3.1 Mass flow measurement and control

After correct installation of the EL-FLOW® Prestige Mass Flow Meter (MFM) or Mass Flow Controller (MFC) and when all safety precautions have been taken into account the instrument can immediately be used for measuring/controlling the required flow rate in the system by means of the selected communication interface(s).

Here are some general guidelines for mass flow measurement/control:

EL-FLOW® Prestige MFMs/MFCs are most accurate at the specified inlet/outlet pressure, temperature and process gas conditions, however the instrument will function properly in a wide range of varying conditions. It is strongly advised to use the FlowTune™ software available with the instrument to set the correct process conditions if the actual process conditions differ from the conditions for which the instrument is set (see further).

Although EL-FLOW® Prestige MFMs/MFCs have excellent temperature stability, the best accuracy is achieved when temperature differences across the instruments are avoided; make sure that the gas temperature equals the ambient temperature and mount the instruments on a rigid (heat conducting) surface.

Regular EL-FLOW® Prestige MFCs handle pressure shocks in the system well, but are not insensitive to pressure fluctuations. For optimum control stability, provide a stable (pressure controlled) inlet pressure with sufficient buffer volume between the pressure regulator and the MFC and avoid installing multiple MFCs or other control valves in close proximity to another with small volume piping in between.

EL-FLOW® Prestige PI instruments (see EL-FLOW® Prestige PI) and instruments with I/O option H1P enabled (see Customized I/O options (pin 5)) automatically and continuously adjust the flow rate, based on the actual pressure measured by the built-in or external pressure sensor respectively.

When an MFC (either with normally closed (NC) or normally opened (NO) valve) is hooked-up, the control valve stays closed when no setpoint is given. When the MFC receives a setpoint from the active setpoint source, the internal PID controller will immediately open the control valve until the required flow rate is achieved and it will maintain that flow rate until another setpoint is given.
3.1.1 Changing fluid set, range or operating conditions

EL-FLOW® Prestige instruments provide Multi Fluid/Multi Range functionality (MFMR). With this functionality, the properties of a selection of 100 pre-installed gases or any mixture thereof can be used to reconfigure the instrument.

MFMR enabled instruments are calibrated ex factory for a number of standard measuring ranges, which can be configured for use with different fluids. Defining fluids and ranges and selecting the active fluid can be done via RS232 with FlowTune™.

FlowTune™ provides the following key functionality:

- Definition and storage of up to eight different fluids in the instrument
- Storing fluid properties for any gas
- Changing inlet- and/or outlet pressure based on actual process conditions
- Re-ranging the full scale (FS) flow rate within the instrument’s supported flow range
- Changing control speed per fluid set for faster or slower (smoother) flow control

MFMR functionality is available for the full temperature and pressure range of the instrument. FlowTune™ checks the changes for the following limitations:

- Rangeability of the flow sensor for the selected fluid
- Rangeability of the control valve for the selected fluid
- Accuracy indication for the given flow range
- Compatibility of selected gases with the used sealing materials (see Sealing material compatibility)
- Limitations to the operating conditions

After all limitation checks are passed, the entered properties are stored in the instrument, including the required controller settings. When switching to another fluid set, controller settings are automatically adjusted to the new process conditions, so there is no need to change PID controller settings manually.

The FlowTune™ software and the associated documentation can be downloaded from the product pages on the Bronkhorst website: www.bronkhorst.com/products

Note regarding instruments with active pressure compensation:

For EL-FLOW® Prestige PI (see EL-FLOW® Prestige PI) instruments and instruments with I/O option H1P enabled (see Customized I/O options (pin 5)) the inlet pressure entered in FlowTune is used only for flow range/capacity calculations (see Advanced fluid set parameters).

To connect with FlowTune™, use RS232 communication via the 9-pin D-sub connector. In case a connection cannot be established, use the power-up functionality of the multifunctional switch to switch to configuration mode and enable RS232 communication.

After configuring the required parameters, remember to return the instrument to the original communication mode. It is advised to use FlowTune™ only in a non-operational environment. FlowTune™ will force the instrument to Valve Safe State as soon as the connection is made. Be sure to close communication between FlowTune™ and the instrument properly, to restore the normal operating mode.

Using custom fluids or fluid properties

With FlowTune™ fixed fluid properties for any gas or mixture can be stored in the instrument (density, heat capacity, thermal conductivity and dynamic viscosity). Although custom fluid data can be used, Bronkhorst advises to use the FLUIDAT® on the Net website for calculation of fluid properties at the actual process conditions. FLUIDAT® is a collection of routines to calculate physical properties of gases and liquids. These routines are made available at the FLUIDAT® on the Net website.

FLUIDAT® on the Net can be accessed via www.fluidat.com. You can try out FLUIDAT® on the Net with a limited number of fluids. Free registration on the FLUIDAT® website gives access to all available fluids and functionality.
3.1.2 Valve Safe State

When a controlling instrument is not powered, the control valve automatically returns to its 'Safe State', which is closed for a 'normally closed' valve (n/c) and fully open for a 'normally opened' valve (n/o). To protect the system, certain events (such as communication errors) may cause the instrument to switch to Valve Safe State (see also LED indications).

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

3.2 Communication interfaces

Numerous input/output options can be installed on EL-FLOW® Prestige instruments via both the 9-pin D-sub connector on the side of the instrument and the optional fieldbus connector on top of the instrument.

The standard 9-pin D-sub connector provides the following communication interfaces:
- Analog (0…5 Vdc; 0…10 Vdc; 0…20 mA or 4…20 mA)
- Digital RS232 (ProPar) or RS485 (FLOW-BUS or Modbus)

Additionally, the instrument can be provided with one of the following optional digital fieldbus interfaces:
- FLOW-BUS
- Modbus (RTU or ASCII)
- PROFIBUS DP
- DeviceNet™
- EtherCAT®
- PROFINET

The default communication protocol of the instrument (analog, digital RS232 or fieldbus) is specified at ordering time.

3.2.1 Using multiple interfaces

The analog interface is always present on EL-FLOW® Prestige instruments. An interface to any available field bus is optional. Operation via analog interface, RS232/RS485 (side connector) and an optional fieldbus (top connector) can be performed at the same time. When using multiple interfaces, reading of parameters can be done simultaneously. When changing a parameter value, the last value sent by any of the interfaces will be valid.

Control mode

A controller setpoint is accepted from either the analog or digital interface, but not both. Analog or digital operation is selected at ordering time and is indicated on the serial number label. The inactive setpoint source is indicated between brackets (see example below). The parameter Control Mode indicates from which source a controller setpoint is accepted: analog or digital. See section Special parameters for more information regarding the Control Mode parameter.

Factory communication settings

The factory selected communication and side connector pinning settings are indicated on the serial number label. See example below for a description of the communication information:
1. **Model key**

2. **Fieldbus (top connector) (example: none)**

3. **Customized I/O setting (pin 5)**

4. **Analog interface (pin 2, 3) (example: inactive setpoint source, measure always available)**

5. **Digital interface (pin 1, 6) (example: RS232, active setpoint source)**

6. **Side connector digital interface settings (protocol, medium, baud rate, parity) (example: FLOW-BUS (ProPar) communication over RS232 interface with baud rate 115200 Baud and no parity)**

### 3.3 Analog operation

The following analog signals are available for each instrument through the 9-pin D-sub side connector:

- Measured value (analog output): pin 2
- Setpoint (analog input/setpoint): pin 3

The factory selected analog interface (0…5 Vdc; 0…10 Vdc; 0…20 mA or 4…20 mA) can be found in the model key of the instrument and in the pin description on the serial number label.

Pin 5 is used for customized I/O configurations. By default it is disabled and pulled down to 0 Vdc. The factory selected pin 5 configuration can be found in the model key and the pin description on the serial number label. See also section **Customized I/O options (pin 5)**.

💡 *When operating the instrument through the analog interface it is possible to connect the instrument simultaneously to RS232 for reading/changing parameters (e.g. settings or fluid selection).*

### 3.3.1 Cabling

Use a loose-end cable with a 9-pin D-sub female connector on the instrument side (art. no. 7.03.004, 7.03.536 or 7.03.537) and refer to the hook-up diagram for analog operation to connect the required signals.

### 3.4 Basic RS232 operation

Digital RS232 (or bus) operation adds a lot of extra features to the instruments compared to analog operation, such as:

- Multi gas / multi range functionality; up to eight selectable and customizable fluids (Fluid set)
- Direct reading with a readout/control module or host computer
- Device identification and diagnostics (Device identification)
- Adjustable minimum and maximum alarm limits (Alarms)
- (Batch) counter (Counter)

Each instrument process is controlled (internally) by specific parameters. The instrument parameter values are accessible through the available digital interfaces to influence the instrument behavior. In this section it is explained how to operate an instrument using RS232 communication.
Make sure that the serial number label indicates RS232 settings for the 9-pin D-sub connector and apply the proper Baud rate settings. If the instrument is not set for RS232 communication, use the micro switch on top of the instrument to overrule the custom settings and switch to RS232 communication settings: press and hold the micro switch at power-up and wait (12…16 sec) until both • green and • red LEDs flash (0.2 sec on, 0.2 sec off). Release the switch to activate the ‘Configuration Mode’. In the ‘Configuration Mode’ the bus type and baud rate for the 9-pin D-sub side connector are set to RS232 FLOW-BUS (ProPar) at 38400 Baud. The ‘Configuration Mode’ remains active after power down. Use the same procedure to deactivate the ‘Configuration Mode’.

3.4.1 Cabling

3.4.1.1 RS232 communication

Using a Windows computer, the instrument can be monitored and operated via RS232. For operation, the free Bronkhorst FlowWare tools can be used, providing a comprehensive user interface to the digital instrument functions.

This example uses the following components:
- EL-FLOW® Prestige
- RS232 T-part cable (art no. 7.03.366)
- RS232-USB converter (art no. 9.09.122)
- Windows computer (for readout and control)
- Plug-in Power Supply (PiPS, art no. 7.03.422)

Connect the T-part cable with the 9-pin D-sub connector on the side of the instrument and use the RS232/USB converter to connect the other end of the cable with a free USB port of the computer.

For communication with a PLC or other controlling device, a 9-pin D-sub cable with a loose end (part no. 7.03.004, 7.03.536 or 7.03.537) can be used. Consult the RS232 hook-up diagram to connect the required signals.

For RS232 communication at baud rates up to 38400 Baud the maximum allowable cable length is 10 m. For higher baud rates, use a maximum cable length of 3 m.

For more information about communication through the RS232 interface, consult the RS232 manual (document no. 9.17.027).

The FlowWare tools and accompanying documentation can be downloaded from the Accessories and software section on the Bronkhorst® product pages (www.bronkhorst.com/products).
3.4.1.2 RS232 communication powered by fieldbus

The instrument can be connected to a fieldbus system with the optional fieldbus connector on top. At the same time, RS232 communication with a Windows computer is possible via the 9-pin D-sub connector on the side of the instrument.

This example uses the following components:
- EL-FLOW® Prestige with DeviceNet™ interface
- DeviceNet™ M12 cable (art no. 7.03.323)
- DeviceNet™ M12 Y adapter (art no. 7.03.319)
- RS232 cable (art no. 7.03.367)
- RS232-USB converter (art no. 9.09.122)
- Windows computer (for readout and control)

Note that the used fieldbus components in this example are specific to DeviceNet™. For connecting with other fieldbus systems, other cables and adapters are needed.

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 all available fieldbus types except PROFIBUS DP, the fieldbus connection on is used to power and operate the instrument. For PROFIBUS DP, the instrument needs to be powered through the 9-pin D-sub connector on the side of the instrument as shown in RS232 communication.

Consult the according fieldbus manual for more information about setting up a fieldbus network with Bronkhorst® instruments.

If you need assistance with setting up a fieldbus system, contact your local Bronkhorst representative for information.

3.4.1.3 E-8000 power supply, readout and control

Using an E-8000 module, instruments can be powered (100…240 Vac) and operated via RS232. Most digital parameters and functions are accessible via the display interface and the control buttons.

This example uses the following components:
- 2x EL-FLOW® Prestige
- 2x RS232/power supply cable (art no. 7.03.016/7.03.538/7.03.539)
- E-8000 power supply, readout and control module

Consult the E-8000 manual (document 9.17.076) for more information. This manual can be downloaded from the Accessories and software section on the Bronkhorst® product pages (www.bronkhorst.com/products).
3.4.1.4 BRIGHT readout and control

Most digital parameters and functions are accessible via the display interface and control buttons of a BRIGHT readout and control module (type B1 or B2). When a BRIGHT module is installed, no other RS232 connection can be established with the instrument.

This example uses the following components:
- EL-FLOW® Prestige
- BRIGHT readout and control module
- Plug-in Power Supply (PIPS, art no. 7.03.422)

Use the 9-pin D-sub connector on the side of the instrument to plug in the T-part that comes with the BRIGHT module.

Consult the BRIGHT manual (document 9.17.048) for more information. This manual can be downloaded from the Accessories and software section on the Bronkhorst® product pages (www.bronkhorst.com/products).

3.4.2 FlowDDE

Digital Bronkhorst® instruments can be operated via RS232 using the Bronkhorst® FlowDDE server application. Dynamic Data Exchange (DDE) provides a basic level of inter process communication between Windows applications. Together with a client application, either self-made or with a third party SCADA program, it is possible to create an easy way of data exchange between the flow meter/controller and a Windows application. For instance, a cell in a Microsoft Excel spreadsheet can be linked to the measured value of an instrument; FlowDDE updates the cell automatically when the measured value changes.

FlowDDE uses specific parameter numbers for communicating with the instrument. A DDE parameter number is a unique number in a special FlowDDE instruments/parameter database and not the same as the parameter number from the process on an instrument. FlowDDE translates the node-address and process number to a channel number.

DDE-client applications communicate with the FlowDDE server by using DDE messages. Before messages can be exchanged, a DDE link has to be made. A DDE link consists of three parts: the server, the topic and an item. For separation the characters '|' and '!' may be used, so a DDE link in e.g. Microsoft Excel becomes: Server|Topic!Item.

For standard instrument parameters and the FlowDDE server, these are:
- Server: FlowDDE or FlowDDE2
- Topic: ‘C(X)’ for channel number X
- Item: ‘P(Y)’ for parameter number Y

An example of a DDE link in a Microsoft Excel cell is =FlowDDE|'C(1)'!'P(8)’ to read parameter 8 of channel 1.

When not using FlowDDE for communication with the instrument, parameters are addressed by:
- Node address of the instrument
- Process number on the instrument
- Parameter number on the instrument

See section Basic parameters and properties for more information about instrument parameters.

For more information about FlowDDE, including setting up a DDE link, consult the FlowDDE Manual (document no. 9.17.067) or the help file in the application.
3.4.3 Software (DDE applications)

Examples of free Bronkhorst® DDE client applications: FlowPlot and FlowView. Other software programs (third party) supporting DDE are for example MS-Office, LabVIEW, InTouch and Wizcon.

![Bronkhorst® software applications 'FlowView' (left) and 'FlowPlot' (right)](image)

FlowDDE and other Bronkhorst® applications are available on the support CD or can be downloaded from the product pages on the Bronkhorst website: [www.bronkhorst.com/products](http://www.bronkhorst.com/products)

3.4.4 Baud rate setup

EL-FLOW® Prestige instruments support the following baud rates for RS232 communication. The factory selected baud rate is indicated on the serial number label. See section [Network configuration](#) for changing the baud rate settings for the instrument. The default baud rate for RS232 communication is 38400 Baud.

| Mode: Digital | RS232 |
| Interface/medium: | FLOW-BUS (ProPar) |
| Baud rate: | 9600 |
| | 16200 |
| | 38400 |
| | 57600 |
| | 115200 |
| | 230400 |
| | 460800 |
| Node address: | 3 |
| Parity: | None |

Make sure that the instrument’s baud rate corresponds with the baud rate of the application the instrument is communicating with, otherwise no communication can be established.

For RS232 communication, the maximum cable length is 10 m for baud rates up to 38400 Baud. For higher baud rates, use cable lengths of maximum 3 m.

For more information regarding communication through an RS232 interface, see [document 9.17.027: RS232 interface with FLOW-BUS for digital instruments](#).
3.5 Basic RS485 operation (FLOW-BUS/Modbus)

This section is limited to RS485 FLOW-BUS or Modbus communication. See section Other fieldbus configurations for communication through other fieldbus interfaces.

FLOW-BUS or Modbus communication is available if either the FLOW-BUS or Modbus RJ-45 connector on top of the instrument is present, or if the 9-pin D-sub side connector is set for FLOW-BUS or Modbus communication. The serial number label indicates the factory settings of the connector pinning.

FLOW-BUS
FLOW-BUS is a Bronkhorst® designed fieldbus, based on RS485 technology, for digital communication between devices, offering the possibility of host-control by a Windows computer.

Characteristics:
- Baud rate 187500 (default) or 400000 Baud
- +15...24 Vdc supply voltage
- Easy installation and communication with other Bronkhorst® devices
- Automatic node search and bus optimization (gap fixing)
- RS232 communication (ProPar) with Windows computer (local host)
- Connection of up to 120 instruments on a single bus
- Maximum bus length: 600 m

Consult Instruction manual FLOW-BUS interface (document no. 9.17.024) for more information about setting up a FLOW-BUS network.

Modbus
Modbus is a 3-wire, RS485-based fieldbus communication system for parameter value exchange. In this system each instrument/device is equipped with a micro-controller for its own dedicated task. The instrument behaves as a slave, which means all communication (instructions and readout) is initiated by a master device on the Modbus system.

Characteristics:
- Baud rate selectable between 9600 and 256000 Baud (default: 19200 Baud)
- +15...24 Vdc supply voltage
- Connection of up to 247 instruments on a single bus
- Supports RTU and ASCII protocols

Consult Instruction manual Modbus interface (document no. 9.17.035) for more information about setting up a Modbus network.

More detailed information about Modbus can be found at www.modbus.org or any website of the (local) Modbus organization of your country (if available).
3.5.1 Cabling

This section shows cabling examples of some EL-FLOW® Prestige instruments in an RS485 fieldbus system. Note that many other fieldbus configurations are possible, contact your local sales representative for more information. Please check the total power consumption of your instruments and do not exceed the maximum power of the power supply.

FLOW-BUS setup

In the example below an E-8000 power supply/readout control unit with FLOW-BUS is connected to two EL-FLOW® Prestige instruments via the RJ-45 top-connector FLOW-BUS interface. In this example one instrument serves as a local host for RS232 communication with a Windows computer through the 9-pin D-sub connector on the side of the instrument. All other instruments on the FLOW-BUS network are also accessible via the local host. It is even possible to use multiple local host RS232/FLOW-BUS interfaces simultaneously.

The following components are used in this example:

- 2x EL-FLOW® Prestige
- 2x modular Y adapter cable (art. no. 7.03.241)
- 2x RJ-45 patch cable (art.no 7.03.238)
- RJ-45 begin terminator (art. no. 7.03.297)
- RJ-45 end terminator (art. no. 7.03.298)
- E-8000 power supply, readout and control module
- RS232 cable (art.no. 7.03.367)
- RS232-USB converter (art no. 9.09.122)
- Windows computer

Power the instruments in a FLOW-BUS local-host system by hooking-up the power supply directly on the FLOW-BUS line and not by powering instruments through the 9-pin D-sub connector.
Modbus setup
In the example below the Modbus power supply is provided by an E-8000 module. The **EL-FLOW® Prestige** instruments are connected to the fieldbus network via RS485 cables with RJ-45 connector and a multiport connector. The RS485 - USB2.0 adapter can be used to connect the system to a Modbus master device.

The following components are used in this example:
- 3x EL-FLOW® Prestige
- 2x modular Y adapter cable (art. no. 7.03.241)
- 3x RJ-45 patch cable (art. no. 7.03.238)
- RJ-45 begin terminator (art. no. 7.03.297)
- RJ-45 end terminator (art. no. 7.03.298)
- RJ-45 multiport connector (art. no. 7.03.299)
- E-8000 power supply module
- RS485 - USB2.0 adapter (art. no. 7.03.470)

For supported power supply and communication options, refer to the **E-8000 manual** (document no. 9.17.076)

3.5.2 Software
When using a Windows computer to communicate with **EL-FLOW® Prestige** instruments, only the ProPar protocol (used by FLOW-BUS) is supported by Bronkhorst® software. When using Modbus operation, software from third parties, such as LabVIEW, ModScan or a Modbus PLC must be used to serve as Modbus master.

Note: an instrument with 9-pin D-sub side connector set for RS485 FLOW-BUS or Modbus communication will not respond when connecting to an RS232 configuration. If the instrument is not set for RS232 communication, use the micro switch on top of the instrument to override the custom settings and switch to RS232 communication settings: press and hold the micro switch at power-up and wait (12…16 sec) until both ⚫ green and ⚫ red LEDs flash (0.2 sec on, 0.2 sec off). Release the switch to activate the ‘Configuration Mode’. In the ‘Configuration Mode’ the bus type and baud rate for the 9-pin D-sub side connector are set to RS232 FLOW-BUS (ProPar) at 38400 Baud. The ‘Configuration Mode’ remains active after power down. Use the same procedure to deactivate the ‘Configuration Mode’.

3.5.3 Baud rate, node address and parity setup
**EL-FLOW® Prestige** instruments are configured from factory as indicated on the serial number label. If there is a need of changing any of the specified RS485 settings, see the tables below for the supported configurations. The default selections are printed in boldface.
### Mode:

<table>
<thead>
<tr>
<th>Interface/medium:</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol:</td>
<td>FLOW-BUS</td>
</tr>
<tr>
<td>Baud rate:</td>
<td>187500, 400000</td>
</tr>
<tr>
<td>Node address:</td>
<td>3…125</td>
</tr>
<tr>
<td>Parity:</td>
<td>None; Even; Odd</td>
</tr>
</tbody>
</table>

### Changing RS485 settings of the RJ-45 top connector interface

In case the FLOW-BUS or Modbus RJ-45 field bus connector is used for bus communication, the node address can be easily set by using the rotary switches on the side of the instrument. Use the ‘MSD’ (Most Significant Digit) to set the ‘tens’ of the bus-address and the ‘LSD’ (least Significant Digit) to set the ‘unit’ of the bus-address (the example on the right reads ‘63’). Set the rotary switches to ‘00’ for automatic installation. Refer to the corresponding field bus manual, document 9.17.024 (FLOW-BUS) or document 9.17.035 (Modbus) for more details.

For changing the baud rate or parity settings use the RS232 interface to change the corresponding parameters (see section Network configuration).

### Changing RS485 settings of the 9-pin D-sub side connector interface

In case the 9-pin D-sub side connector is set for RS485 communication, the baud rate or node address can be changed by using the micro switch or by changing the settings in the 'Configuration Mode'. Refer to section 3.8 for changing node address and baud rate with the micro switch. Other communication parameters can be changed only in the 'Configuration Mode'. Activate the 'Configuration Mode' by pressing the micro switch at start-up according to the description in the previous. In 'Configuration Mode' the bus type and baud rate are set to RS232 FLOW-BUS (ProPar) at 38400 Baud. Change the appropriate parameters as described in Network configuration. When finished, deactivate the 'Configuration Mode' using the same procedure. Now the instrument is ready to use in the desired configuration with the adjusted baud rate, node address or parity.

⚠️ Any changes made to the instrument communication settings will not be restored after a factory reset.

### 3.6 Other fieldbus configurations

The following fieldbuses are optionally available for the EL-FLOW® Prestige instruments. For all mentioned fieldbus systems the EL-FLOW® Prestige instruments serve as slaves on the master/slave bus system. There is no mutual communication between slaves, only between master and slave.

#### PROFIBUS DP

PROFIBUS DP is a 2-wire, RS485-based industrial data communication standard (fieldbus) which allows automation components (e.g. sensors, actuators and controllers) to exchange information.

Consult Instruction manual PROFIBUS DP interface (document no. 9.17.025) for more information about setting up a PROFIBUS DP network.

#### DeviceNet™

The DeviceNet™ interface offers a direct connection to a DeviceNet™ network, according to the mass flow controller profile specified by the ODVA. The Bronkhorst® DeviceNet™ instrument is a Group 2 Only Server device whose messages comply with the Controlled Area Network (CAN) 2.0A standard and with the DeviceNet™ protocol.

Consult Instruction manual DeviceNet™ interface (document no. 9.17.026) for more information about setting up a DeviceNet™ network.
EtherCAT®
Ethernet for Control Automation Technology (EtherCAT®) is an open high performance Ethernet based fieldbus system.

Consult Instruction manual EtherCAT® interface (document no. 9.17.063) for more information about setting up an EtherCAT® network.

PROFINET
The PROFINET interface is 100% Ethernet compatible and is used for data exchange between I/O controllers (PLC, etc.) and I/O devices (slaves, field devices). PROFINET uses the proven communication model and application view of PROFINIBUS DP.

Consult Instruction manual PROFINET interface (document no. 9.17.095) for more information about setting up a PROFINET network.

3.6.1 Baud rate, node address and parity setup
In the table below for the supported configurations for PROFIBUS DP, DeviceNet™, EtherCAT® and PROFINET are shown. The default selections are printed in boldface.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector:</td>
<td>9-pin D-sub (female)</td>
</tr>
<tr>
<td>Interface/medium:</td>
<td>RS485</td>
</tr>
<tr>
<td>Protocol:</td>
<td>PROFIBUS DP</td>
</tr>
<tr>
<td>Baud rate:</td>
<td>Autodetect (9600) (19200) (45450) (93750) (187500) (500000) (1500000) (3000000) (6000000) (12000000)</td>
</tr>
<tr>
<td>Node address:</td>
<td>0…126</td>
</tr>
<tr>
<td>Parity:</td>
<td>Even</td>
</tr>
</tbody>
</table>

Changing PROFIBUS DP node address
The node address can be easily set by using the rotary switches on the side of the instrument. Use the ‘MSD’ (Most Significant Digit) to set the ‘tens’ of the bus-address and the ‘LSD’ (least Significant Digit) to set the ‘unit’ of the bus-address.

Changing DeviceNet™ node address and data rate
The node address and data rate can be easily set by using the rotary switches on the side of the instrument. Use the ‘MSD’ (Most Significant Digit) to set the ‘tens’ of the bus-address and the ‘LSD’ (least Significant Digit) to set the ‘unit’ of the bus-address. Set the ‘MSD’ rotary switch to ‘P’ to select programmable bus-address. For the data rate setting select ‘1’ for 125000 Baud, ‘2’ for 250000 Baud, ‘5’ for 500000 Baud and ‘P’ for programmable data rate.

Changing EtherCAT® Second Address
EtherCAT® supports the use of a Second Address. Bronkhorst® instruments have 3 rotary switches, with which a Second Address can be set in the range of 0 – 4095 (0xFFF). This value of the rotary switches will be copied to the Configured Station Alias register (address 0x0012:0x0013) at instrument start-up.

3.7 LED indications
The following LED indicators are present on top of the instrument:

- **‘Mode’** LED: green • used for operation mode indication
- **‘Error’** LED: red • used for error/warning messages
- **‘NET’** LED: green/red •/• used for Network status (DeviceNet™only)
- **‘MOD’** LED: green/red •/• used for Module status (DeviceNet™only)
- **‘Status’** LED: green/red | / / used for status indication (EtherCAT® and PROFINET only)

**Ethernet indicators**

RJ-45 connection sockets on EtherCAT® and PROFINET instruments have two integrated LED indicators, with standard Ethernet functionality:

- Amber: Ethernet speed
- Green: Ethernet link/activity

The tables below list the different LED indications:

### Green

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Time</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>continuous</td>
<td>Power-off or program not running</td>
</tr>
<tr>
<td>on</td>
<td>continuous</td>
<td>Normal operation mode</td>
</tr>
<tr>
<td>short flash</td>
<td>0.1 sec on, 2 sec off</td>
<td>Valve Safe State mode; there is no bus communication (PROFIBUS DP, DeviceNet™, EtherCAT® and PROFINET). Valves are in safe state. This LED indication is also active when the instrument is in ‘Initialization Mode’ (parameter Init Reset = 73)</td>
</tr>
<tr>
<td>blink</td>
<td>0.2 sec on, 0.2 sec off</td>
<td>Special function mode; the instrument is busy performing a special function (e.g. auto-zero or self-test)</td>
</tr>
<tr>
<td>long flash</td>
<td>2 sec on, 0.1 sec off</td>
<td>Configuration mode; the 9-pin D-sub (power) connector is set for RS232 communication (ProPar) at baud rate 38400</td>
</tr>
</tbody>
</table>

### Red

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Time</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>continuous</td>
<td>No error</td>
</tr>
<tr>
<td>on</td>
<td>continuous</td>
<td>Critical error; the instrument needs servicing before it can be used</td>
</tr>
</tbody>
</table>
| short flash | 0.1 sec on, 2 sec off | FLOW-BUS: Node occupied; re-install instrument  
PROFIBUS DP: No data exchange between master and slave (automatic recovery)  
Modbus: Data is being received or transmitted  
DeviceNet™: Minor communication error  
EtherCAT*: Instrument is not in OP mode  
PROFINET: No application relation established |
| blink       | 0.2 sec on, 0.2 sec off | FLOW-BUS: Waiting for communication  
PROFIBUS DP: Not used  
Modbus: Not used  
DeviceNet™: No bus power  
EtherCAT*: Not used  
PROFINET: Not used |
| long flash  | 2 sec on, 0.1 sec off | FLOW-BUS: Not used  
PROFIBUS DP: Requested parameter not available  
Modbus: Not used  
DeviceNet™: Serious communication error; manual intervention needed  
EtherCAT*: Configuration error  
PROFINET: Configuration error (e.g. a requested parameter is not available) |
3.8 Micro switch functions

Some special functions of the instrument can be started manually using the multifunctional switch near the indication LEDs. These functions are available in analog as well as in digital operation mode.

The micro switch on top of the EL-FLOW® Prestige can be operated with a thin metal or hard plastic pin, e.g. the end of a paperclip.

3.8.1 Normal operating functions

- In order to access these functions, press and hold the switch while the instrument is in normal operation mode (green LED glowing).
- As long as the switch is held, the LEDs show a repeating sequence of patterns, where each pattern indicates a function.
- All indications in this sequence are continuous.
- Each pattern is shown for a number of seconds; in the table below the column Hold time indicates the time frame within the sequence where the LEDs show the associated pattern.
- To start a function, release the switch when the LEDs show the pattern of the required function.

<table>
<thead>
<tr>
<th>(green)</th>
<th>(red)</th>
<th>Hold time</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>off</td>
<td>off</td>
<td>0…1 sec</td>
<td>No action</td>
</tr>
<tr>
<td>off</td>
<td>off</td>
<td>1…4 sec</td>
<td>Reset alarm</td>
</tr>
<tr>
<td>off</td>
<td>on</td>
<td>4…8 sec</td>
<td>Reset instrument; clear all warnings and error messages and restart the instrument</td>
</tr>
<tr>
<td>on</td>
<td>off</td>
<td>8…12 sec</td>
<td>Auto-zero; re-adjust the zero-point of the instrument (flow meters/controllers)</td>
</tr>
</tbody>
</table>
| on      | on    | 12…16 sec| Enable FLASH mode for firmware update:  
  - the instrument shuts down and both LEDs turn off  
  - at the next power-up, the instrument will be active again |

See Adjusting zero point for background information and instructions on how to adjust the zero point of an instrument. Never perform a zeroing procedure before having taken notice of the instructions.
3.8.2 Power-up functions

- In order to access these functions, press and hold the switch while powering up the instrument.
- As long as the switch is held, the LEDs show a repeating sequence of patterns, where each pattern indicates a function.
- All indications in this sequence are flashing (0.2 sec on, 0.2 sec off).
- Each pattern is shown for a number of seconds; in the table below the column Hold time indicates the time frame within the sequence where the LEDs show the associated pattern.
- To start a function, release the switch when the LEDs show the pattern of the required function.

<table>
<thead>
<tr>
<th></th>
<th>(green)</th>
<th>(red)</th>
<th>Hold time</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td></td>
<td>0…4 sec</td>
<td>No action</td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td></td>
<td>4…8 sec</td>
<td>Restore factory settings (except communication settings)</td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td></td>
<td>8…12 sec</td>
<td>FLOW-BUS: Auto install to bus; let the instrument obtain a free node address from the FLOW-BUS system</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td></td>
<td>12…16 sec</td>
<td>Activate configuration mode&lt;br&gt;• The 9-pin D-sub connector is set to RS232 communication (ProPat) at baud rate 38400&lt;br&gt;• In configuration mode, the green LED blinks (2 seconds on, 0.1 second off)&lt;br&gt;• Configuration mode remains active after powering-down and can be deactivated by selecting this function again at the next start-up</td>
</tr>
</tbody>
</table>

3.8.3 Control mode - readout/change

Reading control mode

- By briefly pressing the switch 2 times with intervals of up to 1 second in normal operation mode, the instrument shows its current control mode with a series of consecutive LED indication patterns.
- The number of flashes corresponds to the current value of parameter Control Mode (see Special parameters).

<table>
<thead>
<tr>
<th>Step</th>
<th>Pattern</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Green</td>
<td>number of flashes indicates the tens of the parameter value</td>
</tr>
<tr>
<td>2.</td>
<td>Red</td>
<td>number of flashes indicates the units of the parameter value</td>
</tr>
</tbody>
</table>

Examples:

- for value 1 (control mode 'Analog input'), the green LED will flash 0 times and the red LED 1 time
- for value 22 (control mode 'Valve Safe State'), the green and red LED will each flash 2 times

Changing control mode

- By briefly pressing the switch 4 times with intervals of up to 1 second in normal operation mode, the instrument enters a state in which the control mode can be changed.
- This is done in 2 steps, each represented by a LED indication pattern (green or red; see table below).
- The number of flashes corresponds to the available values of parameter Control Mode (see Special parameters).
- At the start of each step, the according LEDs starts flashing fast (0.1 second on, 0.1 second off). By pressing and holding the switch, the associated action is started and the flashing slows (0.5 seconds on, 0.5 seconds off).

<table>
<thead>
<tr>
<th>Step</th>
<th>Pattern</th>
<th>Maximum flash count</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Green</td>
<td>2</td>
<td>set tens of parameter value</td>
</tr>
<tr>
<td>2.</td>
<td>Red</td>
<td>9</td>
<td>set units of parameter value</td>
</tr>
</tbody>
</table>
To execute a step, follow these instructions:

- Press and hold the switch (flashing slows)
- To select value 0 (zero), release the switch within 1 second, otherwise:
- Count the number of LED flashes
- Release the switch when the required value is reached
- In case you lose count, keep the switch pressed and wait until the flash count reaches its maximum and restarts

On completion of step 1, the instrument automatically advances to step 2. When both steps have been completed, the instrument returns to its normal operation mode.

If the switch is not pressed within 60 seconds after starting a step, all changes are canceled and the instrument returns to its normal operation mode.

Note that this procedure also sets the default control mode of the instrument to analog or digital, depending on the selected value for parameter Control mode (contrary to changing the control mode digitally). See Changing default control mode for information about setting the default control mode.

### 3.8.4 Network settings - readout/change

**Reading network settings**

- By briefly pressing the switch 3 times with intervals of up to 1 second in normal operation mode, the instrument shows its current node address and baud rate with a series of consecutive LED indication patterns:

<table>
<thead>
<tr>
<th>Step</th>
<th>Pattern</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Green</td>
<td>number of flashes indicates the tens of the node address</td>
</tr>
<tr>
<td>2.</td>
<td>Red</td>
<td>number of flashes indicates the units of the node address</td>
</tr>
<tr>
<td>3.</td>
<td>Green and red (simultaneous)</td>
<td>number of flashes indicates the baud rate</td>
</tr>
</tbody>
</table>

Examples:

- For node address 35, the green LED will flash 3 times and the red LED 5 times
- For node address 116, the green LED will flash 11 times and the red LED 6 times

*On DeviceNet™ the node address is called MAC ID.*

The number of flashes for the baud rate indication is associated with the following baud rates:

<table>
<thead>
<tr>
<th>Number of flashes (index)</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
<th>PROFIBUS DP</th>
<th>DeviceNet™</th>
<th>EtherCAT™</th>
<th>PROFINET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>automatically detected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>187500</td>
<td>9600</td>
<td>9600</td>
<td>125000</td>
<td>100000000</td>
<td>100000000</td>
</tr>
<tr>
<td>2</td>
<td>400000</td>
<td>19200</td>
<td>19200</td>
<td>250000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>38400</td>
<td></td>
<td>45450</td>
<td>500000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>56000</td>
<td></td>
<td>93750</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>57600</td>
<td></td>
<td>187500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>115200</td>
<td></td>
<td>500000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>128000</td>
<td></td>
<td>1500000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>256000</td>
<td></td>
<td>3000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>6000000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>12000000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Changing network settings

- By briefly pressing the switch 5 times with intervals of up to 1 second in normal operation mode, the instrument enters a state in which the node address and baud rate of the instrument can be changed (non-Ethernet based protocols only; for Ethernet based protocols (EtherCAT®, PROFINET), network parameters are configured by the fieldbus master and cannot be set on the instrument).
- Changing network parameters with the multifunctional switch is done in 3 steps, each represented by a LED indication pattern (green, red or both; see table below).
- At the start of each step, the according LED(s) start(s) flashing fast (0.1 second on, 0.1 second off). By pressing and holding the switch, the associated action is started and the flashing slows (05. seconds on, 0.5 seconds off).

<table>
<thead>
<tr>
<th>Step</th>
<th>Pattern</th>
<th>Maximum flash count</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Green</td>
<td>12</td>
<td>set tens of node address</td>
</tr>
<tr>
<td>2.</td>
<td>Red</td>
<td>9</td>
<td>set units of node address</td>
</tr>
<tr>
<td>3.</td>
<td>Green and red (simultaneous)</td>
<td>10*</td>
<td>set baud rate index (number of flashes)</td>
</tr>
</tbody>
</table>

*) maximum count depends on the supported baud rates of the fieldbus. See the baud rate table above for supported baud rates and associated indexes.

To execute a step, follow these instructions:
- Press and hold the switch (flashing slows)
- To select value 0 (zero), release the switch within 1 second, otherwise:
  - Count the number of LED flashes
  - Release the switch when the required value is reached
  - In case you lose count, keep the switch pressed and wait until the flash count reaches its maximum and restarts

On completion of a step, the instrument automatically advances to the next step. When all required steps have been completed, the instrument returns to its normal operation mode. If the switch is not pressed within 60 seconds after starting a step, all changes in the previous steps are canceled and the instrument returns to its normal operation mode.

3.9 Basic parameters and properties

This section describes the most common parameters for digital communication with the instrument.

![Tip](https://example.com/tip.png)

Digital parameters are most easily accessible via FlowPlot or FlowView software or a Bronkhorst® readout and control unit (E-8000 or BRIGHT).

3.9.1 General

This section describes the most commonly used parameters for operating the EL-FLOW® Prestige. Descriptions are grouped by category in tables as shown below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>[type]</td>
<td>RW</td>
<td>[x]…[y]</td>
<td>[DDE par]</td>
<td>[Pro]/[Par]</td>
<td>[address]/[register]</td>
</tr>
</tbody>
</table>

![Tip](https://example.com/tip.png)

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>1 byte unsigned integer (0…255)</td>
</tr>
<tr>
<td>Unsigned int</td>
<td>2 byte unsigned integer, MSB first (0…65535)</td>
</tr>
<tr>
<td>Unsigned long</td>
<td>4 byte unsigned integer, MSB first (0…4294967295)</td>
</tr>
<tr>
<td>Float</td>
<td>4 byte floating point, IEEE 32-bit single precision, MSB first</td>
</tr>
<tr>
<td>Unsigned char [x]</td>
<td>x byte array (text string)</td>
</tr>
</tbody>
</table>
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 of the range
[y] Maximum value of the range

FlowDDE
Parameter number within FlowDDE

FLOW-BUS
Within the FLOW-BUS protocol (ProPar when using RS232), parameters are identified by a unique combination of a process number and a parameter number:
[Pro] Process number
[Par] Parameter number

Consult the RS232 manual (document no. 9.17.027) for detailed information.

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.

Other interface protocols
Consult the specific fieldbus manual for accessing parameters via fieldbus communication (see Documentation).

3.9.2 Measurement and control (basic)

Measure

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>R</td>
<td>0…41942 (65535*)</td>
<td>8</td>
<td>1/0</td>
<td>0x0020/33</td>
</tr>
</tbody>
</table>

This parameter indicates the flow metered by the instrument. The signal of 0…100% is presented in a range of 0…32000. The maximum measured value output is 131.07%, which translates to 41942.
A floating point pendant of the measured value is also available in the capacity unit for which the instrument was set; see section Measurement and control (advanced).

*In case the instrument is prepared for bi-directional measurement, the negative signals with an output range of -73.73…-0.003% are represented by the range of 41943…65535, whereas the positive signals 0…131.07% are still represented by the range of 0…41942. (FlowDDE converts the numbers to negative values automatically).

Setpoint

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0…32000</td>
<td>9</td>
<td>1/1</td>
<td>0x0021/34</td>
</tr>
</tbody>
</table>

This parameter is used to set the required flow rate for the controller. The signals have the same range as Measure, but the setpoint is limited between 0 and 100% (0…32000).
A floating point pendant of the setpoint is also available in the capacity unit for which the instrument was set; see section Measurement and control (advanced).
To convert Measure and Setpoint to actual volume flows, use parameters Capacity and Capacity Unit (see Fluid set).

### 3.9.2.1 Secondary outputs

#### Temperature

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>R</td>
<td>-250…500</td>
<td>142</td>
<td>33/7</td>
<td>0xA138…0xA139/41273…41274</td>
</tr>
</tbody>
</table>

This parameter returns the internal temperature in the instrument housing in °C, which approximates the actual media temperature.

#### Pressure

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0…3.4E+38</td>
<td>143</td>
<td>33/8</td>
<td>0xA140…0xA141/41281…41282</td>
</tr>
</tbody>
</table>

- For regular EL-FLOW® Prestige models, the default value of this parameter is equal to parameter Inlet pressure.
- For the EL-FLOW® Prestige PI this parameter returns the actual (inlet) pressure in bar(a), as measured by the built-in pressure sensor.

### 3.9.3 Device identification

#### User Tag

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[16]</td>
<td>RW</td>
<td>-</td>
<td>115</td>
<td>113/6</td>
<td>0xF130…0xF137/ 61745…61752</td>
</tr>
</tbody>
</table>

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

#### Customer Model

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[16]</td>
<td>RW</td>
<td>-</td>
<td>93</td>
<td>113/4</td>
<td>0xF120…0xF127/ 61729…61736</td>
</tr>
</tbody>
</table>

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

#### Serial Number

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[20]</td>
<td>R</td>
<td>-</td>
<td>92</td>
<td>113/3</td>
<td>0xF118…0xF11F/ 61721…61728</td>
</tr>
</tbody>
</table>

Instrument serial number for identification.

#### BHT Model Number

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[35]</td>
<td>RW</td>
<td>-</td>
<td>91</td>
<td>113/2</td>
<td>0xF110…0xF117/ 61713…61720</td>
</tr>
</tbody>
</table>

This parameter shows the Bronkhorst® instrument model type information.

#### Firmware Version

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[6]</td>
<td>R</td>
<td>-</td>
<td>105</td>
<td>113/5</td>
<td>0xF128…0xF12A/ 61737…61739</td>
</tr>
</tbody>
</table>

Revision number of the firmware
Identification Number

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…255</td>
<td>175</td>
<td>113/12</td>
<td>0x0E2C/3629</td>
</tr>
</tbody>
</table>

Bronkhorst® (digital) device type identification number.

Device Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[6]</td>
<td>R</td>
<td>-</td>
<td>90</td>
<td>113/1</td>
<td>0xF108…0xF10A/61705…61707</td>
</tr>
</tbody>
</table>

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

3.9.4 Alarms and counter

> **Tip**
> Alarm and counter settings are most easily accessible via FlowPlot or FlowView software or a Bronkhorst® readout and control unit (E-8000 or BRIGHT).

For more information about the alarm and counter parameters, see the according sub sections under Advanced parameters and properties.

3.10 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, with the instrument in an upright position. 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 flow through the instrument; preferably, this is achieved by closing a valve immediately after the outlet of the instrument (control valve, shut-off valve)

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

Adjusting the zero point of an instrument can be done by the following methods:

- manually (using the multifunctional switch)
- digitally (via RS232 or fieldbus)
- with the autozero function of a Bronkhorst® readout and control unit (E-8000/BRIGHT)

Once started, the procedure takes approximately 5 seconds to complete (longer if the output signal is unstable), regardless of the preferred method.

3.10.1 Manual procedure

To start the built-in autozero function with the multifunctional switch, follow these instructions:

1. Change the setpoint of the instrument to 0 (zero)
2. Press and hold the multifunctional switch. After 4 seconds, the red LED starts glowing for 4 seconds, after which the green LED starts glowing
3. At that moment (which is after 8 to 12 seconds), release the switch

The green LED starts to blink fast, indicating that the autozero function is being performed. On (successful) completion, the green LED starts to glow continuously, while the output signal is 0% (parameter Measure = 0).
3.10.2 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 here.

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

<table>
<thead>
<tr>
<th>Sequence #</th>
<th>Parameter</th>
<th>Value</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Setpoint</td>
<td>0</td>
<td>stop flow (close control valve)</td>
</tr>
<tr>
<td>2</td>
<td>Init Reset</td>
<td>64</td>
<td>unlock secured parameters</td>
</tr>
<tr>
<td>3</td>
<td>Control Mode</td>
<td>9</td>
<td>enable calibration mode</td>
</tr>
<tr>
<td>4</td>
<td>Calibration Mode</td>
<td>0</td>
<td>reset calibration mode</td>
</tr>
<tr>
<td>5</td>
<td>Calibration Mode</td>
<td>9</td>
<td>start zeroing</td>
</tr>
</tbody>
</table>

The green LED starts to blink fast, indicating that the zeroing procedure is being performed. On completion, the green LED starts to glow continuously, while the output signal is 0% (parameter Measure = 0). At the same time, parameter Control Mode returns to its initial value. If the procedure is 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.
4  Advanced operation

4.1  Sealing material compatibility

EL-FLOW® Prestige instruments are fitted from factory with internal seals compatible with the specified gas type. Before using other media, always check their compatibility with the applied sealing materials. Check the corresponding indication in the model key on the serial number label to see which sealing materials have been incorporated in your specific instrument. When in doubt, do not hesitate to contact your local Bronkhorst representative for more information.

The table below lists compatibility with some commonly used gases:

<table>
<thead>
<tr>
<th>Gas</th>
<th>Sealing material</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viton®</td>
<td>EPDM</td>
<td>Kalrez®/FFKM</td>
</tr>
<tr>
<td>Air</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ar (Argon)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CH4 (Methane)</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>CO (Carbon monoxide)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2 (Carbon dioxide)</td>
<td>max 10 bar(g), 50°C</td>
<td>✓</td>
<td>max 10 bar(g), 50°C (ED compound1 max 30 bar(g))</td>
</tr>
<tr>
<td>C2F6 (Freon-116)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C2H2 (Acetylene)</td>
<td>✓ / ×2</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C2H4 (Ethylene)</td>
<td>max 10 bar(g)1</td>
<td>max 10 bar(g)</td>
<td>max 10 bar(g)</td>
</tr>
<tr>
<td>C2H6 (Ethane)</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>C3H6 #2 (Propylene)</td>
<td>max 10 bar(g)</td>
<td>✓</td>
<td>max 58 bar(g)2</td>
</tr>
<tr>
<td>C3H8 (Propane)</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>Cl2 (Chlorine)</td>
<td>✓</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>He (Helium)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>H2 (Hydrogen)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>H2S (Hydrogen sulfide)</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Kr (Krypton)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NF3 (Nitrogen trifluoride)</td>
<td>×</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>NH3 (Ammonia)</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>NO (Nitric oxide)</td>
<td>×</td>
<td>×</td>
<td>✓</td>
</tr>
<tr>
<td>N2 (Nitrogen)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>N2O (Nitrous oxide)</td>
<td>max 20 bar(g), 50°C</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>O2 (Oxygen)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>SF6 (Sulfur hexafluoride)</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>SiH4 (Silane)</td>
<td>✓ / ×2</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Xe (Xenon)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1) ED: Explosive Decompression resistant
2) Only O-ring seals, not suitable for control valve plunger
3) For higher pressures ED compounds are used

- Do not use process gases/mixtures that are incompatible with the sealing materials the instrument is equipped with
- Do not exceed the indicated maximum operating pressure/temperature. Using the instrument outside the given operating limits may lead to serious damage to the instrument
- The gas(es) used in the fluidic system in which the instrument is mounted must be clean and dry
4.2 Advanced parameters and properties

4.2.1 Measurement and control (advanced)

**Fmeasure**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>R</td>
<td>-3.4E+38...3.4E+38</td>
<td>205</td>
<td>33/0</td>
<td>0xA100...0xA101/41217...41218</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>206</td>
<td>33/3</td>
<td>0xA119...0xA11A/41241...41242</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0...30000</td>
<td>10</td>
<td>1/2</td>
<td>0x0022/35</td>
</tr>
</tbody>
</table>

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.

**Analog Input**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>R</td>
<td>0...65535</td>
<td>11</td>
<td>1/3</td>
<td>0x0023/36</td>
</tr>
</tbody>
</table>

This parameter contains a digital translation of the analog input signal (if applicable).

**Valve Output**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned long</td>
<td>RW</td>
<td>0...16777215</td>
<td>55</td>
<td>114/1</td>
<td>0xF208...0xF209/61961...61962</td>
</tr>
</tbody>
</table>

Digital steering signal for driving the control valve, where 0...16777215 corresponds to 0...100%.

**Sensor Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0...255</td>
<td>22</td>
<td>1/14</td>
<td>0x002E/47</td>
</tr>
</tbody>
</table>

For the EL-FLOW® Prestige the following values are valid:
- 3: Gas flow sensor, controller enabled
- 131: Gas flow sensor, controller disabled
4.2.2 Special parameters

**Init Reset**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>82/64</td>
<td>7</td>
<td>0/10</td>
<td>0x000A/11</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>unlocked, secured parameters can be read and written to</td>
</tr>
<tr>
<td>82</td>
<td>locked, secured parameters are read-only</td>
</tr>
</tbody>
</table>

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

**Reset**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>R</td>
<td>0…7</td>
<td>114</td>
<td>115/8</td>
<td>0x0E68/3689</td>
</tr>
</tbody>
</table>

This parameter is used to reset the program, counter or alarms.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No reset</td>
</tr>
<tr>
<td>1</td>
<td>Reset counter</td>
</tr>
<tr>
<td>2</td>
<td>Reset alarm</td>
</tr>
<tr>
<td>3</td>
<td>Reset counter</td>
</tr>
<tr>
<td>4</td>
<td>Reset and disable counter</td>
</tr>
<tr>
<td>5</td>
<td>Reset firmware program (soft reset)</td>
</tr>
<tr>
<td>6</td>
<td>Reset Alarm info error bit</td>
</tr>
<tr>
<td>7</td>
<td>Reset Alarm info warning bit</td>
</tr>
</tbody>
</table>

*The Reset parameter may be disabled by Reset Alarm Enable or Reset Counter Enable. Make sure the value is accepted by sending value 0 first.*

**Wink**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char [27]</td>
<td>W</td>
<td>0…9*</td>
<td>1</td>
<td>0/0</td>
<td>0x0000/1</td>
</tr>
</tbody>
</table>

Sending any text string value between 1 and 9 to this parameter makes the LED(s) on the instrument (if present) blink for a couple of seconds. This can be useful in order to identify a specific device in a large fieldbus network.

*) Modbus only supports value 14592

**Control Mode**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0…255</td>
<td>12</td>
<td>1/4</td>
<td>0x0024/37</td>
</tr>
</tbody>
</table>

*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:

<table>
<thead>
<tr>
<th>Value</th>
<th>Mode</th>
<th>Instrument action</th>
<th>Setpoint source</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>BUS/RS232</td>
<td>Controlling</td>
<td>Fieldbus/RS232</td>
</tr>
<tr>
<td>1</td>
<td>Analog Input</td>
<td>Controlling</td>
<td>Analog input</td>
</tr>
<tr>
<td>2</td>
<td>FLOW-BUS Slave</td>
<td>Acting as slave instrument on FLOW-BUS</td>
<td>RS485 only: FLOW-BUS master output x Slave Factor/100%</td>
</tr>
<tr>
<td>3</td>
<td>Valve Close</td>
<td>Controller disabled, valve closed</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Mode</td>
<td>Instrument action</td>
<td>Setpoint source</td>
</tr>
<tr>
<td>-------</td>
<td>---------------</td>
<td>--------------------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Controller Idle</td>
<td>Controller disabled, valve frozen in current position</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Setpoint 100%</td>
<td>Controlling, setpoint fixed to 100%</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Valve Fully Open</td>
<td>Controller disabled, valve fully opened</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Calibration Mode</td>
<td>Calibration mode enabled (factory only)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Analog Slave</td>
<td>Acting as slave of other instrument in analog mode</td>
<td>Analog Input x Slave Factor/00%</td>
</tr>
<tr>
<td>12</td>
<td>Setpoint 0%</td>
<td>Controlling, setpoint fixed to 0%</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>FLOW-BUS Analog Slave</td>
<td>Acting as slave of other instrument on FLOW-BUS, slave factor is set by analog input signal</td>
<td>RS485 only; FLOW-BUS master output x Analog Input</td>
</tr>
<tr>
<td>18</td>
<td>RS232</td>
<td>Controlling, safe state deactivated</td>
<td>Fieldbus/RS232</td>
</tr>
<tr>
<td>20</td>
<td>Valve Steering</td>
<td>Controller disabled, setpoint redirected to Valve output</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Analog Valve Steering</td>
<td>Controller disabled, analog input redirected to Valve output</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Valve Safe State</td>
<td>Force instrument in safe state</td>
<td></td>
</tr>
</tbody>
</table>

Immediately after power-up, **Control Mode** is set to ‘Analog input’ or ‘BUS/RS232’ automatically, depending on the (requested) default setting for analog or digital operation. If **Control mode** is set to value 0, 1, 9 or 18, the instrument returns to its default control mode at the next power-up or reset. Other values are retained after power-up or reset.

- See section **Changing default control mode** for more information about the default control mode.
- See section **Control mode - readout/change** for information about changing the control mode using the multifunctional switch.
- Parameter values 3, 8, 20 and 21 can be used regardless if the controller is enabled or not. See also parameter **Sensor Type**
- Control Mode values 2 and 13 are only effective in a FLOW-BUS system; see also section **Master/slave configuration (FLOW-BUS)**.

### 4.2.3 Fluid set

For changing fluid, flow range or operating conditions, using the FlowTune software is strongly advised. FlowTune checks any changes for compatibility of the process conditions with the instrument. When the parameters described in this section are changed manually, no such checks are performed, and the instrument output may become disordered or the instrument may even get damaged if used in conditions the instrument is not suited for. Consult Bronkhorst service personnel when in doubt.

#### Fluid Set Index

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…7</td>
<td>24</td>
<td>1/16</td>
<td>0x0030/49</td>
</tr>
</tbody>
</table>

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).

#### Fluid Name

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[10]</td>
<td>RW</td>
<td>-</td>
<td>25</td>
<td>1/17</td>
<td>0x8188…0x818C/33161…33165</td>
</tr>
</tbody>
</table>

This parameter contains the name of the current fluid.
**Capacity**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>1E-10...1E+10</td>
<td>21</td>
<td>1/13</td>
<td>0x8168...0x8169/33129...33130</td>
</tr>
</tbody>
</table>

This parameter sets the maximum readout/control value (100%) for the current fluid in readout units corresponding to *Capacity Unit*.

**Capacity Unit**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[7]</td>
<td>RW</td>
<td>see below</td>
<td>129</td>
<td>1/31</td>
<td>0x81F8...0x81FB/33273...33276</td>
</tr>
</tbody>
</table>

Available units:

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

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

**Capacity Unit Type Temperature**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>-273.15...3.4E+38</td>
<td>245</td>
<td>33/10</td>
<td>0xA150...0xA151/41297...41298</td>
</tr>
</tbody>
</table>

This parameter is used as a reference for calculation of custom volume flows from the measured mass flow. See also parameters *Capacity Unit* and *Counter Unit*.

**Capacity Unit Type Pressure**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>246</td>
<td>33/11</td>
<td>0xA158...0xA159/41305...41306</td>
</tr>
</tbody>
</table>

This parameter is used as a reference for calculation of custom volume flows from the measured mass flow. See also parameters *Capacity Unit* and *Counter Unit*.

**Controller Speed**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0.2...5</td>
<td>254</td>
<td>114/30</td>
<td>0xF2F0...0xF2F1/62193...62194</td>
</tr>
</tbody>
</table>

This parameter sets the overall controller speed factor for the selected fluid set. *Controller Speed* is set ex factory between value '0.5' (slow) and '2' (fast). The default value is '1'. Slower or faster settings are possible between values 0.2 and 5 at the customer's responsibility.
### 4.2.3.1 Advanced fluid set parameters

#### Inlet Pressure

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>178</td>
<td>113/13</td>
<td>0xF168...0xF169/61801...61802</td>
</tr>
</tbody>
</table>

Inlet pressure of the current fluid in bar(a)

#### Outlet Pressure

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>179</td>
<td>113/14</td>
<td>0xF170...0xF171/61809...61810</td>
</tr>
</tbody>
</table>

Outlet pressure of the current fluid in bar(a), used for capacity calculations

#### Fluid Temperature

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>-250...500</td>
<td>181</td>
<td>113/16</td>
<td>0xF180...0xF181/61825...61826</td>
</tr>
</tbody>
</table>

Temperature of the current fluid in °C, used for capacity calculations

#### Density

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>170</td>
<td>33/21</td>
<td>0xA1A8...0xA1A9/41385...41386</td>
</tr>
</tbody>
</table>

Density of the current fluid in kg/m³

#### Heat Capacity

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>250</td>
<td>113/18</td>
<td>0xF190...0xF191/61841...61842</td>
</tr>
</tbody>
</table>

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

#### Thermal Conductivity

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>251</td>
<td>113/20</td>
<td>0xF1A0...0xF1A1/61857...61858</td>
</tr>
</tbody>
</table>

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

#### Viscosity

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0...3.4E+38</td>
<td>252</td>
<td>113/21</td>
<td>0xF1A8...0xF1A9/61865...61866</td>
</tr>
</tbody>
</table>

Dynamic viscosity of the current fluid in Pa·s
4.2.3.2 Fluid mixture parameters

Mix Fraction Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…2</td>
<td>346</td>
<td>126/4</td>
<td>0x0FC4/4037</td>
</tr>
</tbody>
</table>

Set the fraction type of the mixture:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Volume fraction</td>
</tr>
<tr>
<td>1</td>
<td>Mass fraction</td>
</tr>
<tr>
<td>2</td>
<td>Mole fraction</td>
</tr>
</tbody>
</table>

Mix Volume Temperature

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>-250…500</td>
<td>347</td>
<td>126/5</td>
<td>0xFE28…0xFE29/65065…65066</td>
</tr>
</tbody>
</table>

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

Mix Volume Pressure

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0…3.4E+38</td>
<td>348</td>
<td>126/6</td>
<td>0xFE30…0xFE31/65073…65074</td>
</tr>
</tbody>
</table>

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

Mix Component Index

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…4</td>
<td>349</td>
<td>126/7</td>
<td>0x0FC7/4040</td>
</tr>
</tbody>
</table>

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

Mix Component Fraction

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0…1</td>
<td>350</td>
<td>126/8</td>
<td>0xFE40…0xFE41/65089…65090</td>
</tr>
</tbody>
</table>

Mix fraction of the current mix component (Mix Component Index). The value range corresponds to 0…100%. The sum of all mix fractions must be equal to 1.

If the value is 0, the next component slots are ignored.

Mix Component Fluid Name

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[10]</td>
<td>RW</td>
<td>-</td>
<td>351</td>
<td>126/9</td>
<td>0xFE48…0xFE4C/65097…65101</td>
</tr>
</tbody>
</table>

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.
### 4.2.4 Alarms

Alarm settings are most easily accessible via 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 used 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…3</td>
<td>118</td>
<td>97/3</td>
<td>0x0C23/3108</td>
</tr>
</tbody>
</table>

Available modes:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Alarm off</td>
</tr>
<tr>
<td>1</td>
<td>Alarm on absolute limits</td>
</tr>
<tr>
<td>2</td>
<td>Alarm on limits related to setpoint (response alarm)</td>
</tr>
<tr>
<td>3</td>
<td>Alarm at power-up (e.g. after power-down)</td>
</tr>
</tbody>
</table>

(For DeviceNet®, only modes 0 and 1 are available)

#### Alarm Info

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>R</td>
<td>0…255</td>
<td>28</td>
<td>1/20</td>
<td>0x0034/53</td>
</tr>
</tbody>
</table>

This parameter provides information about the event type(s) that triggered an alarm situation. The value is a bit-wise 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: | 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…255</td>
<td>182</td>
<td>97/7</td>
<td>0x0C27/3112</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0…32000</td>
<td>116</td>
<td>97/1</td>
<td>0x0C21/3106</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0…32000</td>
<td>117</td>
<td>97/2</td>
<td>0x0C22/3107</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…1</td>
<td>120</td>
<td>97/5</td>
<td>0x0C25/3110</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No setpoint change (default)</td>
</tr>
<tr>
<td>1</td>
<td>Change setpoint to Alarm new setpoint</td>
</tr>
</tbody>
</table>

### Alarm New Setpoint

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0…32000</td>
<td>121</td>
<td>97/6</td>
<td>0x0C26/3111</td>
</tr>
</tbody>
</table>

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

### Reset Alarm Enable

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…15</td>
<td>156</td>
<td>97/9</td>
<td>0x0C29/3114</td>
</tr>
</tbody>
</table>

Available reset methods for alarms. Up to 4 different methods can be specified; convert the value to binary to see which methods are enabled.
Default value: 15 (all bits/methods enabled)

The following methods are supported:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Multifunctional switch</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Externally (deprecated)</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>By parameter Reset</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Automatically (when alarm conditions no longer apply)</td>
</tr>
</tbody>
</table>
4.2.5 Counter

Counter settings are most easily accessible via FlowPlot or FlowView or a Bronkhorst® readout and control unit.

### Counter Mode

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…2</td>
<td>130</td>
<td>104/8</td>
<td>0x0D08/3337</td>
</tr>
</tbody>
</table>

Available modes:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Counter off (default)</td>
</tr>
<tr>
<td>1</td>
<td>Counting up continuously</td>
</tr>
<tr>
<td>2</td>
<td>Counting up until limit reached (set by Counter Limit)</td>
</tr>
</tbody>
</table>

### Counter Unit

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char[4]</td>
<td>RW</td>
<td>see table below</td>
<td>128</td>
<td>104/7</td>
<td>0xE838…0xE839/59449…59450</td>
</tr>
</tbody>
</table>

This parameter contains the name of the counter readout unit.

Counter Unit supports the following values:

<table>
<thead>
<tr>
<th>Mass</th>
<th>Normal volume (1.01325 bar(a), 0 °C)</th>
<th>Standard volume (1.01325 bar(a), 20 °C)</th>
<th>Custom volume (Capacity Unit Pressure, Capacity Unit Type Temperature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ug, mg, g, kg</td>
<td>uln, min, ln, mm3n, cm3n, dm3n, m3n</td>
<td>uls, mls, ls, mm3s, cm3s, dm3s, m3s</td>
<td>ul, ml, l, mm3, cm3, dm3, m3</td>
</tr>
</tbody>
</table>

### Counter Value

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0…10000000</td>
<td>122</td>
<td>104/1</td>
<td>0xE808…0xE809/59401…59402</td>
</tr>
</tbody>
</table>

Current counter value in units selected with parameter Counter Unit.

### Counter Limit

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0…9999999</td>
<td>124</td>
<td>104/3</td>
<td>0xE818…0xE819/59417…59418</td>
</tr>
</tbody>
</table>

Counter limit/batch size in units selected with parameter Counter Unit.

Default value: 0.

### Counter Setpoint Mode

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…1</td>
<td>126</td>
<td>104/5</td>
<td>0x0D05/3334</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No setpoint change (default)</td>
</tr>
<tr>
<td>1</td>
<td>Change setpoint to Counter new setpoint</td>
</tr>
</tbody>
</table>
Counter New Setpoint

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned int</td>
<td>RW</td>
<td>0…32000</td>
<td>127</td>
<td>104/6</td>
<td>0x0D06/3335</td>
</tr>
</tbody>
</table>

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

Reset Counter Enable

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…15</td>
<td>157</td>
<td>104/9</td>
<td>0x0D09/3338</td>
</tr>
</tbody>
</table>

Available reset methods for counters. Up to 3 different methods can be specified. The value is a bit-wise 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:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>Micro-switch</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Externally</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>By parameter Reset</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>Automatically (e.g. when counter value is reset)</td>
</tr>
</tbody>
</table>

4.2.6 Network configuration

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

Communication via fieldbus connection (RS485)

Use the following parameters to configure the instrument for communication via the fieldbus connection on top of the instrument (parameter values can be changed via the RS232 interface):

Fieldbus 1 Address

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…255</td>
<td>199</td>
<td>125/10</td>
<td>0x0FAA/4011</td>
</tr>
</tbody>
</table>

Fieldbus 1 Baud Rate

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned long</td>
<td>RW</td>
<td>0…1.0E10</td>
<td>201</td>
<td>125/9</td>
<td>0xFD48…0xFD49/64841…64842</td>
</tr>
</tbody>
</table>

Fieldbus 1 Parity

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…2</td>
<td>335</td>
<td>125/12</td>
<td>0x0FAC/4013</td>
</tr>
</tbody>
</table>

The following values are supported:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No parity</td>
</tr>
<tr>
<td>1</td>
<td>Odd parity</td>
</tr>
<tr>
<td>2</td>
<td>Even parity</td>
</tr>
</tbody>
</table>
Communication via power supply connection (RS232/RS485)
Use the following parameters to configure the instrument for communication via the 9-pin D-sub connector on the side of the instrument:

- If the 9-pin D-sub connector is set for RS485 communication, the instrument will not respond when connected to an RS232 configuration. In that case, use the power-up functionality of the multifunctional switch to switch to configuration mode and enable RS232 communication.
- After configuring the required parameters, use the same procedure to leave configuration mode and restore the original communication settings (otherwise, configuration mode remains enabled after power down).

<table>
<thead>
<tr>
<th>Fieldbus 2 Address</th>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsigned char</td>
<td>RW</td>
<td>0…255</td>
<td>309</td>
<td>124/10</td>
<td>0x0F8A/3979</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fieldbus 2 Baud Rate</th>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsigned long</td>
<td>RW</td>
<td>0…1.0E10</td>
<td>310</td>
<td>124/9</td>
<td>0xFC48…0xFC49/64585…64586</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fieldbus 2 Parity</th>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsigned char</td>
<td>RW</td>
<td>0…2</td>
<td>336</td>
<td>124/12</td>
<td>0x0F8C/3981</td>
</tr>
</tbody>
</table>

The following values are supported:

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No parity</td>
</tr>
<tr>
<td>1</td>
<td>Odd parity</td>
</tr>
<tr>
<td>2</td>
<td>Even parity</td>
</tr>
</tbody>
</table>

4.2.7 Master/slave configuration (FLOW-BUS)

Normally, there is no communication between slave 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 connected to FLOW-BUS is automatically available to all other instruments (without extra wiring). A FLOW-BUS system can have multiple masters and slaves. 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) or 'FLOW-BUS Analog Slave' (value 13), depending on how the setpoint should be calculated (see parameter Control Mode).

The slave instrument polls the output value of its master periodically and multiplies it by the slave factor, thus setting its own flow to a percentage of the master’s.

Setpoints from master instruments can be received via FLOW-BUS only.

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.

<table>
<thead>
<tr>
<th>Master Node</th>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsigned char</td>
<td>RW</td>
<td>1…128</td>
<td>158</td>
<td>33/14</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Set the master node for the instrument
Note that this parameter only is effective in a FLOW-BUS system via RS485.
Slave Factor

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>RW</td>
<td>0…500</td>
<td>139</td>
<td>33/1</td>
<td>0xA108…0xA109/41225…41226</td>
</tr>
</tbody>
</table>

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 RS485, 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%

4.3 Special features

4.3.1 Customized I/O options (pin 5)

EL-FLOW® Prestige instruments offer several customized input/output functions through the 9-pin D-sub side connector as an option. I/O options are factory installed as specified at ordering time, and cannot be changed manually.

The last three characters of the model key on the serial number label indicate the installed I/O configuration (see section Model key). The possible configurations are described in the table below. See the hook-up diagram for custom bus and I/O configurations (document 9.16.118) for an explanation of the codes.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Disabled, pin 5 is pulled down to 0 Vdc (default selection)</td>
</tr>
<tr>
<td>A1V</td>
<td>0…10 Vdc sourcing output, controller Analog signal for pump or external valve steering (control signal only). When the controller output is used for pump or external valve steering (only applicable to mass flow meters with the controller function enabled), make sure to set parameter Valve maximum to 0.3 [A]. For mass flow controllers, the controller output signal represents the valve actuator current. This output is limited to a value below 10 Vdc, due to the maximum valve current restriction.</td>
</tr>
<tr>
<td>B1V</td>
<td>4…20 mA sourcing output, controller Analog signal for pump or external valve steering (control signal only). When the controller output is used for pump or external valve steering (only applicable to mass flow meters with the controller function enabled), make sure to set parameter Valve maximum to 0.3 [A]. For mass flow controllers, the controller output signal represents the valve actuator current. This output is limited to a value below 20 mA, due to the maximum valve current restriction.</td>
</tr>
<tr>
<td>B2V</td>
<td>3.8…20.8 mA sourcing output, controller Analog signal for Badger Meter valve with TEIP11 signal converter (control signal only)</td>
</tr>
<tr>
<td>C3A</td>
<td>Digital output, min/max alarm During a min/max alarm, pin 5 is pulled down to 0 Vdc.</td>
</tr>
<tr>
<td>C4A</td>
<td>Digital output, counter alarm During a counter alarm, pin 5 is pulled down to 0 Vdc.</td>
</tr>
<tr>
<td>C5S</td>
<td>Digital output, enabled by setpoint (for shut-off control) Pin 5 is pulled down to 0 Vdc at a controller setpoint, e.g. for shut-off valve activation. For factory selected analog control (…-A#-C5S): If parameter Control mode is set for analog control by factory, the minimum setpoint at which the device (shut-off valve) connected to pin 5 is activated is 1.9%. This prevents possible noise on the analog input activating the device accidentally.</td>
</tr>
</tbody>
</table>
### Code | Description
--- | ---
COI | For factory selected digital control (…-D#-CS5):
If parameter *Control mode* is set for digital control by factory, the setpoint threshold for activating the device connected to pin 5 is any value > 0.

Note: If the instrument is forced into Valve Safe State, the digital output is not affected, so a (n/c) shut-off valve connected to pin 5 will not close when the (n/c) controller is in Valve Safe State.

Make sure to use 24 Vdc power supply corresponding to the shut-off valve specifications. Cable 7.03.572 (T-part 9-pin D-sub/loose end) or 7.03.603 (T-part 9-pin D-sub/DIN43650C) can be used for this operating option.

#### COI Description

**Digital output, high/low switch via remote parameter (e.g. for shut-off valve control)**

- Pin 5 is pulled down to 0 Vdc when writing value 1 to parameter *IO switch status*, this is undone by writing value 0.

- A device connected to pin 5 (e.g. a shut-off valve) can be activated/deactivated by writing parameter *IO switch status*.

Note: If the instrument is forced into Valve Safe State, the digital output is also affected, so a (n/c) shut-off valve connected to pin 5 will be closed when the (n/c) controller is in 'Valve Safe State'.

Make sure to use 24 Vdc power supply corresponding to the shut-off valve specifications. Cable 7.03.572 (T-part 9-pin D-sub/loose end) or 7.03.603 (T-part 9-pin D-sub/DIN43650C) can be used for this operating option.

D9E | Digital frequency output, measure
Measurement value is translated to a frequency within given frequency range.

- The default frequency range to represent 0…100% flow is 0…10000 Hz. Any other frequency range must be specified on order.

F9B | Digital pulse output, batch counter
Pin 5 is pulled down to 0 Vdc when a given batch size is reached (during a given pulse length).

- By default, a pulse is given at each 1x the *Counter unit* batch value, with a pulse length of 1 second. For instance, when *Counter unit* is set to 'ln', a pulse is given each time 1 ln has passed through the instrument. An alternative pulse length must be specified on order.

Provide a pull-up resistor of 5…10 kOhm to create 15…24 Vdc at pin 5 (according to the applicable hook-up diagram).

H1P* | 4…20 mA input, external pressure sensor for active pressure correction. Signal is translated to parameter *Pressure*.

I3C | Digital input, controller mode valve close
Valve closes when pin 5 is connected to 0 Vdc.

- This option switches between the default *Control mode* and mode 'Valve Close' (value 3). When the default *Control mode* is digital, the default value is 0 (bus/RS232), when the default *Control mode* is analog, the default value is 1 (Analog input).

I8C | Digital input, controller mode valve purge
Valve is fully opened when pin 5 is connected to 0 Vdc.

- This option switches between the default *Control mode* and mode 'Valve Fully Open' (value 8). When the default *Control mode* is digital, the default value is 0 (bus/RS232), when the default *Control mode* is analog, the default value is 1 (Analog input).
### Code Description

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
</table>
| I1R  | Digital input, reset counter  
The counter resets when pin 5 is connected to 0 Vdc. |
| I2R  | Digital input, reset alarm  
The alarm resets when pin 5 is connected to 0 Vdc. |

*) Note regarding active pressure correction:  
This option overrides the built-in active pressure correction of the EL-FLOW® Prestige PI.

### 4.3.2 Changing default control mode

**IO Status**

<table>
<thead>
<tr>
<th>Type</th>
<th>Access</th>
<th>Range</th>
<th>FlowDDE</th>
<th>FLOW-BUS</th>
<th>Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsigned char</td>
<td>RW</td>
<td>0…255</td>
<td>86</td>
<td>114/11</td>
<td>0x0E4B/3660</td>
</tr>
</tbody>
</table>

The instrument is set to accept a setpoint from either an analog or a digital source. Although this setting can be changed with parameter Control Mode, the instrument will always return to its default control mode at every power-up or reset. The default control mode can be set with parameter IO Status; to change it, use the procedures as described below.

Changing from digital operation to analog operation:
1. Set parameter Init Reset to 64 (unlocked)
2. Read parameter IO Status
3. Add 64 to the read value
4. Write the new value to parameter IO Status
5. Set parameter Init Reset to 82 (locked)

Changing from analog operation to digital operation:
1. Set parameter Init Reset to 64 (unlocked)
2. Read parameter IO Status
3. Subtract 64 from the read value
4. Write the new value to parameter IO Status
5. Set parameter Init Reset to 82 (locked)

*The procedures described above do not change the value of parameter Control Mode directly. To apply the new default control mode immediately, change the value of parameter Control Mode manually or reset or restart the instrument.*
5  Troubleshooting and service

To determine if an instrument is working properly, it is recommended to disconnect the unit from the process line and check it without applying fluid 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 whether 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 Bronkhorst representative for service or repairs.

5.1  Errors and warnings

See LED indications for an explanation of the possible LED indications the instrument can give.

In case of problems during operation, error and warning information can be found in FlowDDE and FlowPlot. FlowDDE puts all errors and warnings on the console screen; in FlowPlot, the Alarm & Count tab (Instrument Settings) provides several specific alarm and counter indicators.

5.2  Restoring factory settings

In case changes to the instrument configuration leads to non-recoverable erroneous behavior, the instrument can be reset to the pre-configured factory settings. This can be done with the following methods:

- with the multifunctional switch (see Micro switch functions)
- with the restore function of a Bronkhorst® readout and control unit (BRIGHT, E-8000)
- via RS232 communication, with the Restore settings function in FlowPlot

To restore the factory settings using the multifunctional switch, follow these instructions:

1. Make sure electrical power to the instrument is switched off
2. Press and hold the multifunctional switch, while powering up the instrument. After 4 seconds, the red LED starts flashing (0.2 seconds on, 0.2 seconds off)
3. At that moment (which is after 4 to 8 seconds), release the switch

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

If digital communication with the instrument can not be re-established, see Micro switch functions to overrule the actual 9-pin D-sub communication settings with the configuration mode and use the RS232 communication mode to re-establish communication.
## 5.3 Common issues

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| No power (LEDs not burning) | No power supply | Check power supply  
Check cable connection  
Internal fuse blown due to long lasting shortage | Return to factory |
| Zero output signal | No setpoint accepted, incorrect control mode | Check analog/digital control mode (see section Special parameters)  
No setpoint given, setpoint too low | Give setpoint >2% |
| | Valve in 'Safe State' (normally closed valves) | Remove cause of 'Valve Safe State' (see section Valve Safe State) |
| | Pcb/sensor failure | Return to factory  
Laminar flow element blocked/contaminated | Return to factory |
| Maximum output signal (131.07%) | Flow too high, valve fully open | Close valve  
Pcb/sensor failure | Return to factory  
Valve in 'Safe State' (normally opened valves) | Remove cause of 'Valve Safe State' (see section Valve Safe State) |
| Setpoint cannot be achieved | Pressure difference across instrument insufficient to achieve requested flow rate | Check inlet/outlet pressure  
Valve blocked or damaged | Return to factory  
Stoppage | Remove contamination |
| Flow signal is gradually decreasing without setpoint change | Pressure difference across instrument insufficient to achieve requested flow rate | Check inlet/outlet pressure  
Process gas condensation occurs | Decrease pressure or increase gas temperature |
| Oscillating controller output | Controller adjustment wrong, PID settings too fast | Decrease Controller Speed value  
Inlet/outlet pressure too high or too low | Adjust pressure/set correct instrument pressure with FlowTune™  
Wrong gas selected | Set correct process gas with FlowTune™  
Inlet pressure control is oscillating | Replace pressure regulator or increase buffer volume between controlling instruments (see section Piping requirements)  
'Cross-talk' with other controller instruments in process line | Increase buffer volume between controller instruments (see section Piping requirements) |
| | Valve is damaged | Return to factory |
| Non-zero output signal when valve is closed | Valve is leaking (through valve) | Check valve specifications for leak-tightness through valve  
Non-zero offset signal (occurs at upward/downward placement at higher pressures) | See Adjusting zero point |
5.4 Service

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

👩‍💻 www.bronkhorst.com

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

📧 sales@bronkhorst.com

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

📧 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 Returns

6.1 Removal and return instructions

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

Instrument handling:
1. Purge all fluidic lines (if applicable)
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 local Bronkhorst representative for local arrangements.)

6.2 Disposal (end of lifetime)

Within the scope of the European Union, manufacturers of electrical and electronic equipment (EEE) are bound to comply with the WEEE Directive (Waste Electrical and Electronic Equipment). As a consequence, Bronkhorst is obligated to offer its customers in the EU the possibility to return EEE for disposal once it has reached the end of its lifetime, and take all necessary steps to dismantle it properly and recycle or re-use its components whenever possible.

All Bronkhorst® products that fall under the regime of the WEEE Directive (which is the majority) have an image of a crossed-out wheeled bin printed somewhere on the product (typically the serial number label). If you wish to dispose of Bronkhorst® equipment bearing this symbol, you can simply return it in accordance with the removal and return instructions, and Bronkhorst will take care of proper dismantlement and recycling. In the covering letter, just mention that you are returning the product for disposal. Within the EU, returning products for disposal is of course free of charge (except for shipping and handling costs).

For customers outside the EU, local or national directives and/or legislation may apply to EEE disposal. If applicable, consult local or national authorities to learn how to handle EEE properly in your area.
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- Alarm Minimum Limit
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