



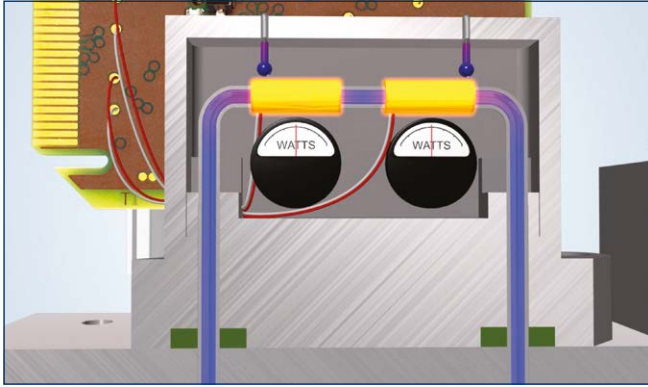
EL-FLOW[®] Prestige

World's most versatile Mass Flow Meters / Controllers for Gases



› Cutting edge technology

EL-FLOW Prestige is the latest generation of Bronkhorst® Mass Flow Meters/Controllers for gases. Nearly all core components have been redesigned and many improvements and innovations have been incorporated. With this series, Bronkhorst introduced the 'Differential Temperature Balancing' technology, ensuring a superb sensor stability. Power efficient micro-processors with innovative multistage control loops have been applied to achieve enhanced dynamic behavior. The metal housing is of robust yet compact design.



Differential Temperature Balancing technology

› Adaptable to your process

The control performance of EL-FLOW Prestige Mass Flow Controllers is factory adjusted to swiftly respond to setpoint changes, without overshoot. If the upstream pressure of the system's gas supply is not constant, for example due to a drop in pressure in gas cylinders or due to cross-talk between different flow controllers, it is possible to perform a static and/or dynamic pressure correction. Moreover, the MFCs can be tuned for extra fast response (settling times $\tau_{98\%}$ down to 500 msec) or extra smooth control, depending on the requirements of the user's process. The dynamic behavior can also be tuned on site easily, by adjusting the controller speed settings via FlowTune™, or by using our software tool FlowSuite™. This free tool can also be used for device diagnostics or alarm and counter settings.

› Select the I/O options of your preference

Numerous input/output options can be offered through the programmable sub-D 9-pin connector. 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™, CANopen®, PROFIBUS DP, PROFINET, Modbus-RTU/ASCII, EtherCAT®, EtherNet/IP, Modbus-TCP and FLOW-BUS. The latter is an RS485 based fieldbus, specifically designed by Bronkhorst for their mass flow metering and control solutions. For the convenience of customers working with LabVIEW™ (graphical software by National Instruments) Bronkhorst provides a certified plug & play instrument driver for instruments with FLOW-BUS™ interface.

› Customise your flow device

- ◆ User configurable control characteristics
- ◆ 100 unique gases selectable from embedded database
- ◆ Analog I/O or digital communication (RS232 / RS485 / fieldbus)
- ◆ Various on-board alarm and counter functions
- ◆ Wide choice of seals and process adapters
- ◆ Normally Closed / Normally Opened control valve function
- ◆ Optional, integrated shut-off valve

› Enjoy the benefits!

- ◆ Innovative sensor: gradient insensitive, accurate temperature correction, high linearity
- ◆ Pressure insensitive: static and dynamic pressure correction (option)
- ◆ Ingenious laminar flow element: perfect flow split
- ◆ Improved control valve: reliable, reproducible, outstanding dynamic behavior
- ◆ Upgraded electronics: versatile flow control algorithms, embedded intelligence

› Reduce your cost of ownership

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. Like previous Bronkhorst instruments, EL-FLOW Prestige offers high flexibility due to the multi-gas/multi-range functionality. This functionality, now extended to 100 gases, 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 dismantling and recalibration. Furthermore, original equipment manufacturers (OEMs) are able to drastically reduce the variety of spare instruments kept on stock and thus reduce the cost of ownership.



Example of an FG-201CV with one of the many available fieldbus options

› Technical specifications

Measurement / control system

| | |
|--|---|
| Accuracy (incl. linearity) (based on actual calibration, according SEMI E69) | standard: $\pm 0,5\%$ Rd plus $\pm 0,1\%$ FS $(\pm 0,8\%$ Rd plus $\pm 0,2\%$ FS for ranges 3...5 ml _r /min; $\pm 1\%$ Rd plus $\pm 1\%$ FS for ranges < 3 ml _r /min) |
| Repeatability | 0-20% < $\pm 0,04\%$ FS; 20-100% < $\pm 0,2\%$ Rd |
| Turndown | 1:150; in analog mode 1:50 |
| Multi Gas/Multi Range gases | embedded gas data for 100 unique gases (see FAQ section on our website) plus any mixture of maximum 5 of these gases. |
| Settling time | fast: < 500 msec standard: < 1 sec slow: < 2 sec |
| Operating temperature | -10...70°C |
| Temperature sensitivity | zero: < 0,02% FS/°C; span: < 0,025% Rd/°C |
| Pressure sensitivity | standard: < 0,15% Rd/bar typical N ₂ ; with pressure correction: < 0,02% Rd typical N ₂ |
| Accuracy of integrated pressure sensor (PI option) | $\pm 0,25\%$ FS at ambient temperature |
| Leak integrity, outboard | tested < 2×10^{-9} mbar l/s He |
| Attitude sensitivity | max. error at 90° off horizontal 0,07% FS at 1 bar, typical N ₂ |
| Warm-up time | 30 min. for optimum accuracy |

Mechanical parts

| | |
|-------------------------|---|
| Material (wetted parts) | stainless steel 316L or comparable, degreased for use on oxygen (O ₂) |
| Process connections | compression type or face seal couplings |
| Seals | standard: Viton®; options: EPDM, Kalrez® (FFKM), FDA and USP Class VI approved compounds (model FG-201CS excluded) |

Electrical properties

| | | | |
|---|---|----------------|----------------|
| Power supply | +15...24 Vdc | | |
| Max. power consumption (controllers based on normally closed valve, pin 5 not used) | Supply | at voltage I/O | at current I/O |
| Meter | 15 V | 69 mA | 92 mA |
| | 24 V | 45 mA | 63 mA |
| Controller | 15 V | 202 mA | 225 mA |
| | 24 V | 128 mA | 146 mA |
| Extra power consumption for fieldbus (if applicable) | Meter/Controller | | |
| | 15 V < 75 mA 24 V < 50 mA | | |
| Analog output/command | 0...5 (10) Vdc or 0 (4)...20 mA (sourcing output) | | |
| Digital communication | standard: RS232 options: DeviceNet™, CANopen®, PROFIBUS DP, Modbus RTU/ASCII, FLOW-BUS, EtherCAT®, PROFINET, Modbus/TCP, EtherNet/IP | | |

Electrical connection

| | |
|---|--|
| Analog, RS232 | 9-pin D-connector (male); |
| PROFIBUS DP | bus: 9-pin D-connector (female); power: 9-pin D-connector (male); |
| DeviceNet™, CANopen® | 5-pin M12-connector (male); |
| EtherCAT®, Modbus-TCP, PROFINET, EtherNet/IP | 2 x RJ45 modular jack (in/out) |
| FLOW-BUS, Modbus-RTU/ASCII | RJ45 modular jack |
| CE | EMC 2014/30/EU, RoHS 2011/65/EU, |
| IEC 61010-1 | 2010 |
| Ingress protection (housing) | IP40 |

Technical specifications and dimensions subject to change without notice.

› Models and flow ranges (based on N₂)

Mass Flow Meters

| Model | Flow range (N ₂) | Pressure rating |
|----------|--|------------------------|
| FG-110C | 0,014...0,7 ml _r /min up to 0,18...9 ml _r /min | 100 bar(g)/1500 psi(g) |
| FG-110CP | 0,014...0,7 ml _r /min up to 0,18...9 ml _r /min | 100 bar(g)/1500 psi(g) |
| FG-111B | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 100 bar(g)/1500 psi(g) |
| FG-111BP | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 100 bar(g)/1500 psi(g) |
| FG-111AC | 0,2...10 l _r /min up to 2...100 l _r /min | 100 bar(g)/1500 psi(g) |

Mass Flow Controllers

| Model | Flow range (N ₂) | Pressure rating |
|-----------|--|------------------------|
| FG-200CV | 0,014...0,7 ml _r /min up to 0,18...9 ml _r /min | 64 bar(g)/1000 psi(g) |
| FG-200CVP | 0,014...0,7 ml _r /min up to 0,18...9 ml _r /min | 10 bar(g)/150 psi(g) |
| FG-210CV | 0,014...0,7 ml _r /min up to 0,18...9 ml _r /min | 100 bar(g)/1500 psi(g) |
| FG-210CVP | 0,014...0,7 ml _r /min up to 0,18...9 ml _r /min | 100 bar(g)/1500 psi(g) |
| FG-201CV | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 64 bar(g)/1000 psi(g) |
| FG-201CVP | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 10 bar(g)/150 psi(g) |
| FG-211CV | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 100 bar(g)/1500 psi(g) |
| FG-211CVP | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 100 bar(g)/1500 psi(g) |
| FG-201AV | 0,2...10 l _r /min up to 2...100 l _r /min | 64 bar(g)/1000 psi(g) |
| FG-211AV | 0,2...10 l _r /min up to 2...100 l _r /min | 100 bar(g)/1500 psi(g) |

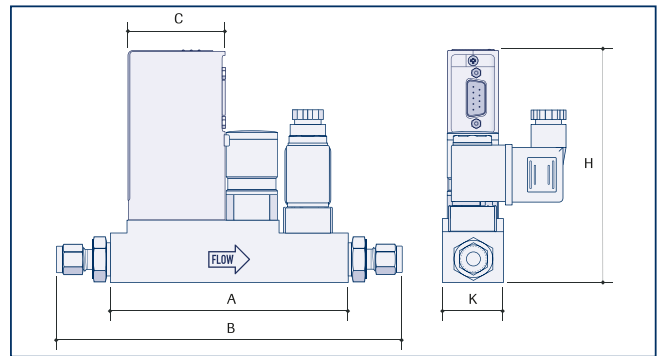
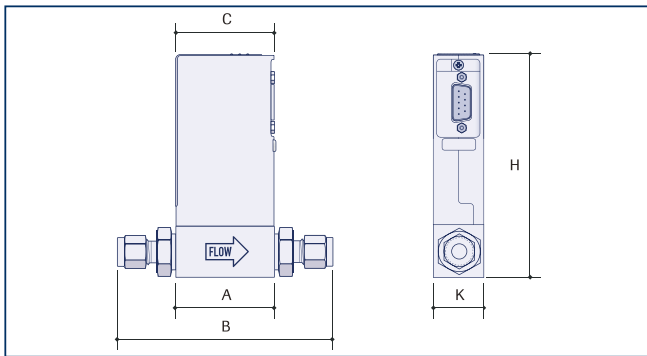
Mass Flow Controller with integrated shut-off valve

| | | |
|-----------|--|----------------------|
| FG-201CS | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 10 bar(g)/150 psi(g) |
| FG-201CSP | 0,14...7 ml _r /min up to 0,4...20 l _r /min | 10 bar(g)/150 psi(g) |



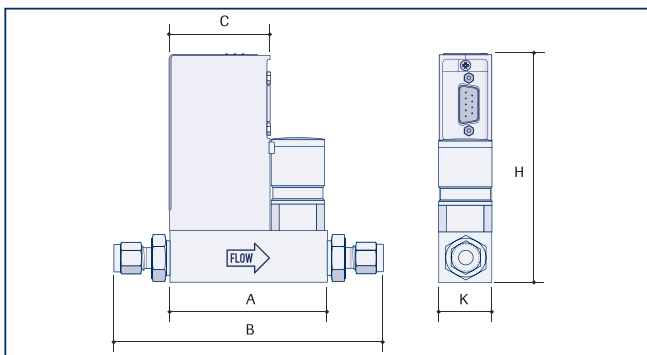
FG-111AC Mass Flow Meter

➤ **Dimensions (in mm) and weights (in kg)**



| Model | A | B | C | H | K | Weight (kg) |
|-------------------|----|-----|----|-----|----|-------------|
| FG-110C (1/8"OD) | 47 | 98 | 50 | 112 | 25 | 0,5 |
| FG-111B (1/4"OD) | 69 | 126 | 50 | 112 | 25 | 0,6 |
| FG-111AC (1/4"OD) | 69 | 126 | 50 | 124 | 25 | 0,7 |
| FG-110CP (1/8"OD) | 47 | 98 | 50 | 130 | 25 | 0,6 |
| FG-111BP (1/4"OD) | 69 | 126 | 50 | 130 | 25 | 0,7 |

| Model | A | B | C | H | K | Weight (kg) |
|--------------------|-----|-----|----|-----|----|-------------|
| FG-201CS (1/4"OD) | 120 | 177 | 50 | 118 | 30 | 1,3 |
| FG-201CSP (1/4"OD) | 120 | 177 | 50 | 136 | 30 | 1,5 |



| Model | A | B | C | H | K | Weight (kg) |
|--------------------------------|----|-----|----|-----|----|-------------|
| FG-200CV / FG-210CV (1/8"OD) | 77 | 128 | 50 | 112 | 25 | 0,7 |
| FG-201CV / FG-211CV (1/4"OD) | 77 | 134 | 50 | 112 | 25 | 0,7 |
| FG-201AV / FG-211AV (1/4"OD) | 77 | 134 | 50 | 124 | 25 | 0,9 |
| FG-200CVP / FG-210CVP (1/8"OD) | 77 | 128 | 50 | 130 | 25 | 0,8 |
| FG-201CVP / FG-211CVP (1/4"OD) | 77 | 134 | 50 | 130 | 25 | 0,8 |



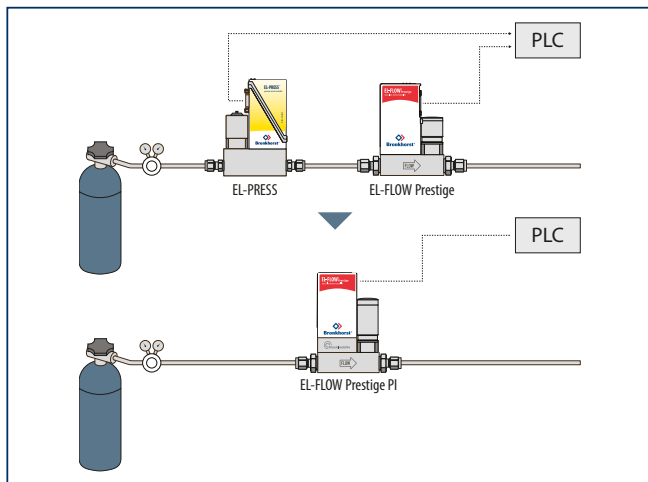
FG-201CS Mass Flow Controller with integrated shut-off valve

› Real-time temperature and pressure compensation

Efficiency and yield in a process require a stable gas flow. This gas flow can be accurately measured and controlled by EL-FLOW Prestige Mass Flow Controllers (MFCs). Various external factors can have influence on the measurement accuracy and control stability of MFCs, e.g. temperature fluctuations and line-pressure fluctuations. EL-FLOW Prestige instruments feature accurate temperature compensation, correcting the flow measurement for temperature changes. Compensation of pressure changes can either be achieved by an external pressure transmitter in combination with customized IO option 'H1P' (via Pin 5), or by using the new 'Pressure Insensitive' option.

› Static pressure compensation

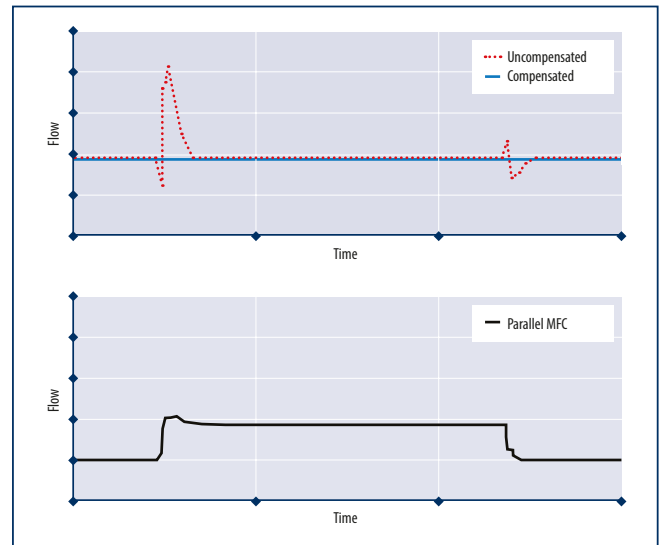
By static pressure compensation we refer to the correction for slow pressure changes, for example the slowly reduced pressure from a gas cylinder. By integrating a pressure sensor to the mass flow controller or by using an external pressure transmitter in combination with the above mentioned H1P function, the on-board conversion algorithm will perform real-time calculation of the actual fluid properties. For thermal mass flow measurement as applied by Bronkhorst, the density, viscosity, thermal conductivity and heat capacity are used in the calculation. Under influence of pressure and temperature, these properties change. An extensive, physical properties database is stored on the instrument's pc-board. Using actual process temperature and pressure, the instrument applies the best available information for signal processing, resulting in highest accuracy of flow measurement, no matter the exact operating conditions. The yield of your process will benefit from the stability of the compensated flow control.



Simplified setup

› Dynamic pressure compensation

This optional functionality compensates flow controllers for rapid pressure changes. These can occur when a higher-flow mass flow controller on the same supply line changes setpoint, resulting in an undesired effect which is also known as 'cross-talk'. The moment that these rapid pressure changes are identified by the pressure sensor, the valve control will be adjusted accordingly so that the flow remains stable. The picture below visualizes the cross-talk effect of two parallel MFCs.



Dynamic compensation, insensitive to pressure changes

› Benefits of on-board pressure compensation

- ◆ Higher yield due to improvement of accuracy and control stability
- ◆ Ease of installation since there is no need for exactly providing/meeting the process conditions the instrument was ordered for
- ◆ Cost and/or space savings; high performance pressure regulators are no longer required



FG-201CVP Pressure Insensitive Mass Flow Controller

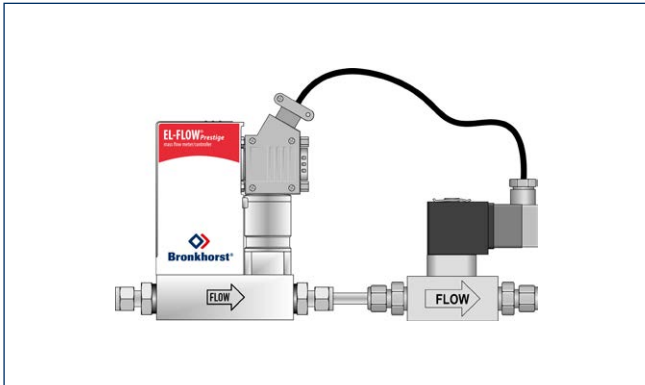
› Customized Input/Output configurations

Besides the obvious I/O-options for measured and setpoint values via analog signals, RS232 or fieldbus communication, EL-FLOW Prestige features a programmable pin (pin 5) at the 9-pin sub-D connector for customized I/O configurations.

This functionality can be used for advanced operations such as digital frequency/pulse output, alarm output/reset, processing an external setpoint signal, valve purge/close and analog valve output. Some options are specified in the model number identification, however, numerous other settings can be programmed on request. Please contact your local distributor to discuss your requirements.

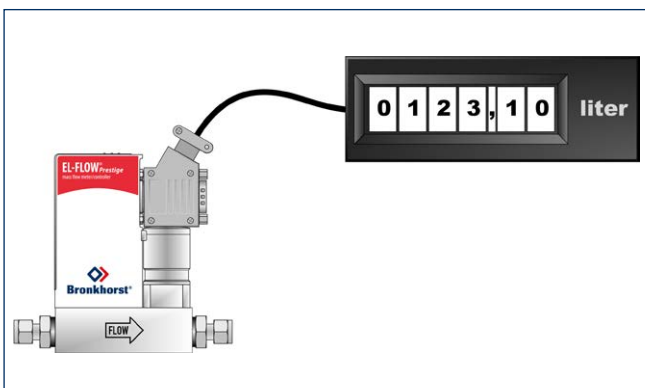
› The following typical examples give an impression of the possibilities for customized I/O solutions

Shut-off valve activation



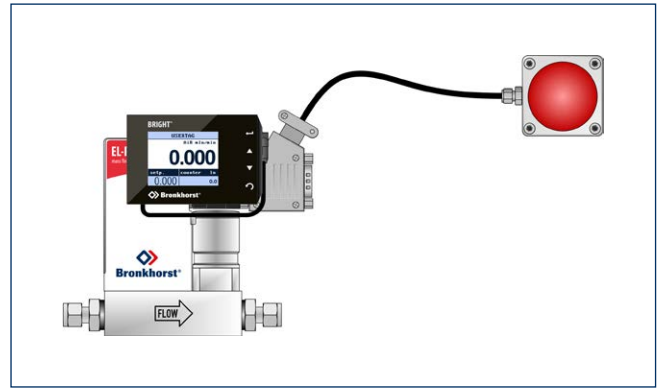
The digital output of the programmable pin 5 (9-pin sub-D connector) can be used to activate a shut-off valve. For instance, a shut-off valve can be programmed to close when the MFC's setpoint is zero, to ensure that the gas line is absolutely closed. Alternatively the valve may be activated upon a certain alarm value or when a preset counter value has been reached. This functionality makes the use of valve terminals superfluous.

Digital pulse output



The programmable pin 5 (9-pin sub-D connector) can be set for a pulse output per quantity, as defined by the user. This pulse can be fed directly to remote totalizing counters, digital readout devices or control instrumentation.

External reset counter

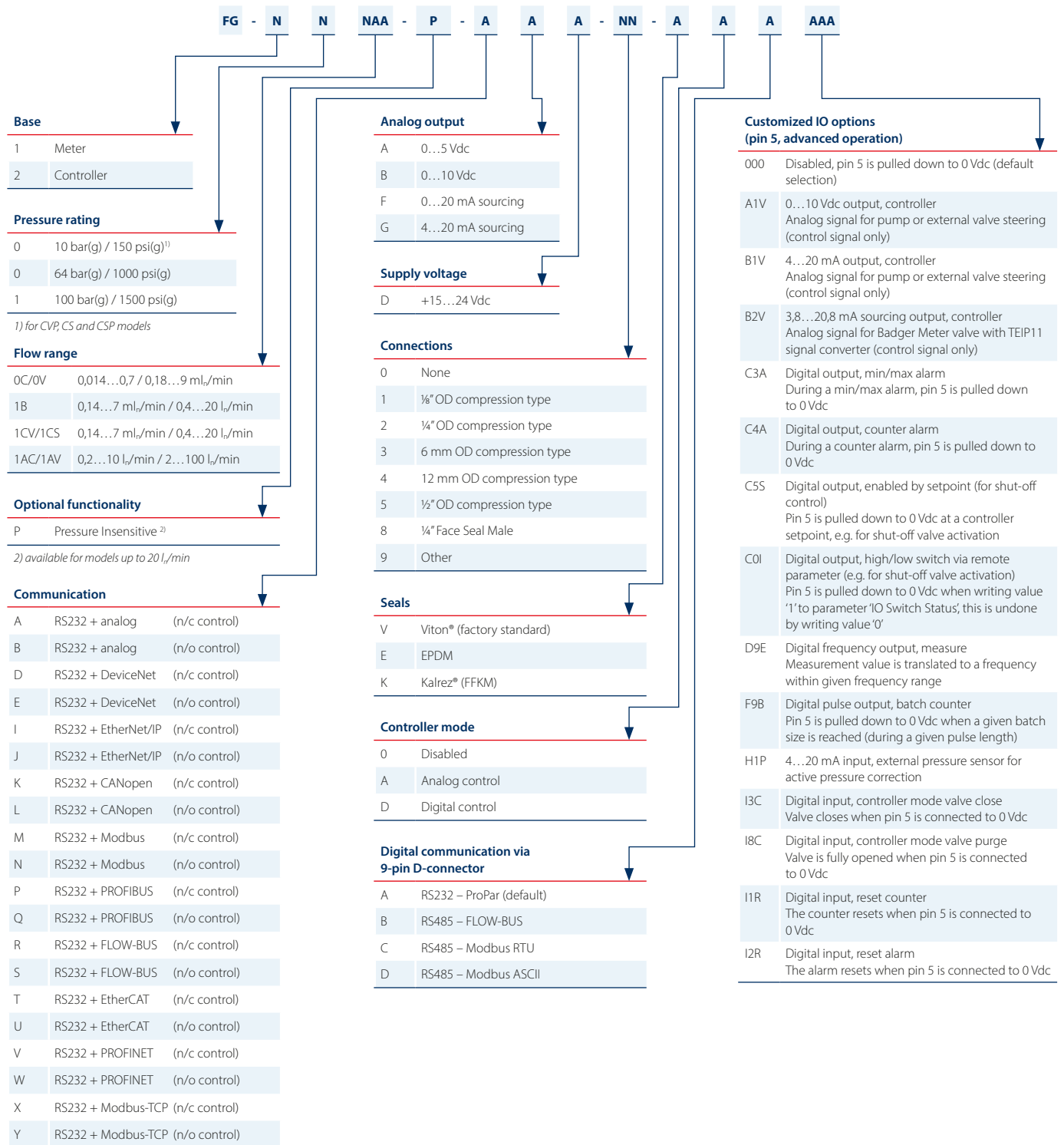


EL-FLOW Prestige instruments offer alarm and counter functions as a standard feature. To reset the counter value, e.g. locally displayed by a BRIGHT R/C-module, the user should operate the push-buttons. Alternatively, using the digital input option of the programmable pin 5, an external input signal can be sent to the instrument to reset the counter.



EL-FLOW Prestige model FG-110C Mass Flow Meter

Model number identification



Warranty

All instruments and accessories are warranted for a period of 3 years from delivery date.

Round the clock support

Bronkhorst is a worldwide organization with its Head Office located in Ruurlo, The Netherlands. Our Customer Service Department offers 'seven days a week' support to customers in every part of the world. Our specialist teams are available to you to fulfill the needs of pre- and aftersales support, on-site inspection & calibration and start-up assistance.





www.bronkhorst.com

Bronkhorst High-Tech designs and manufactures innovative instruments and subsystems for low-flow measurement and control for use in laboratories, machinery and industry. Driven by a strong sense of sustainability and with many years of experience, we offer an extensive range of (mass) flow meters and controllers for gases and liquids, based on thermal, Coriolis and ultrasonic measuring principles. Our global sales and service network provides local support in more than 40 countries. Discover Bronkhorst®!

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

Tel. +31 573 458800
info@bronkhorst.com



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