



MASS-STREAM™ Instruction Manual

D-5100 Analog Mass Flow Meters / Controllers

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ATTENTION

Before installing and operating the instrument it is strongly recommended that this instruction manual should be read carefully. Not following the guidelines could result in personal injury and/or damage to the equipment.

SCOPE OF THIS INSTRUCTION MANUAL

This instruction manual of M+W Instruments GmbH covers the installation of the analog Mass-Stream™ instrument model series D-5100 for mass flow measurement and control of gasses and gas mixes

The information in this manual has been reviewed and is believed to be wholly reliable. No responsibility, however, is assumed for inaccuracies. The material in this manual is for information purposes only, and is subject to change without notice.

Warranty

The M+W Instruments GmbH grants a warranty on its products according to the General Terms and Conditions. The warranty is limited to the mass flow meters and controllers and its components. The correct use of the device under the observation of all specified operation conditions is the precondition for the warranty.

ATTENTION!

The warranty is solely limited to the mass flow meters and controllers and its components. No warranty claims are accepted in case of a faulty operation of the instrument, like a wrong electrical hook-up for example.

Any liability is explicitly excluded for any secondary damage, caused by the instrument's failure or the malfunction of any component. All wear parts, like seals for example, are also excluded from the warranty.

The products of M+W Instruments GmbH 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 they are not subjected to abuse or physical damage. The products of other manufacturers are warranted for a period of one year.

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 paragraph A-V and B-II of the Terms and Conditions of sales of the M+W Instruments GmbH.

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.

M+W Instruments GmbH prepays outgoing freight charges when any party of the service is performed under warranty, unless otherwise agreed upon beforehand. However, if the product has been returned collect to M+W Instruments GmbH, these costs are added to the repair invoice. Import and/or export charges, foreign shipping methods/carriers are paid for by the customer.

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The dimensional drawings and hook-up diagram of the Mass-Stream™ instruments D-5100 are available for download on our website www.mw-instruments.com.

1 ANALOG INSTRUMENTS

All necessary settings for this instrument are already performed at M+W Instruments GmbH. Following the next steps carefully is the quickest way to get the instruments operational in your own system.

1.1 General

The analog instruments of M+W Instruments GmbH are measurement devices for thermal mass flow and control of gasses and gas mixes. The flow signal is measured in a capillary sensor for gas flow rates from 0.005...0.1 I_n^*/min up to 2.5...50 I_n^*/min and controlled when a control valve is applied.

[* n = normal conditions: At normal conditions the volume is regarded at a temperature of 0°C and a pressure of 1013.25 mbar (a)]

As an option ex work the device can be equipped with an integrated 3½ digit LCD flow rate indication or with an integrated 8 digit counter.

Output signal / setpoint: 0...5 Vdc OR 4...20 mA

Power Supply: +15 Vdc OR +24 Vdc (please check on instrument label)

ATTENTION!

The input and output signals are NOT galvanically isolated!

Scope of Delivery

Immediately upon receipt of the incoming goods the package needs to be checked for any possible damages and the goods have to comply with the scope of delivery listed on the packing note. In case of any damages the supplier and the freight forwarder have to be contacted without delay.

In the event of any discrepancies please get in touch with your local distributor (see www.bronkhorst.com) or contact us directly:

M+W Instruments GmbH
Dorfstr. 1
D-85391 Leonhardsbuch
Tel.: +49 8166 9921 0
Fax: +49 8166 9921 22
Email: sales@mw-instruments.com

When the instrument needs to be returned please include a description of the damage in a closed envelope.

ATTENTION!

All instruments for return must have a fully filled-in “Declaration of Decontamination“.

This declaration has to be attached to the shipping documents, allowing free access on the outside of the package.

The declaration of decontamination is available on our accompanying CD with each instrument shipment or it can be downloaded from our website www.bronkhorst.com.

Please mention the instrument’s model code and the serial number on your order, as well as your VAT number when needed.

1.2 Installation

To avoid personal injury and/or damage to the equipment only trained and qualified personnel shall perform the installation of the instruments:

- Read the instrument's name plate before installation and check the electrical connection, flow range, media to be measured, inlet and outlet pressure as well as input and output signals.
- The instruments contain electronic components which are sensitive to electronic discharges (ESD). Contact with electronically charged persons or objects could possibly endanger these components or even result in their failure.
- While installing the instrument take care of the arrow marking on the instrument's flow body, determining the flow direction.
- Ensure that the gas is absolutely clean and dry. The mounted laminar discs are an essential part of the calibration and not an inline filter.
- All piping needs to be absolutely clean and without any damage.
- It is recommended to install an inlet filter in front of the instrument. In case of an applied inline filter it needs to regularly checked and appropriately cleaned.
- Avoid piping with small diameter at high flow rates. When possible no abrupt angles or other disturbances shall be mounted directly in front of the instrument.
- All devices have Withworth pipe threads – type RP – according to ISO228-1 (cylindrical G-threads in inches according to BSPP). The mounting of NPT-fittings will destroy the inlet threads in the instrument's body.
- Using an inlet pipe with sufficient piping diameter is recommended. The length of the inlet pipe should be at least 10 times the piping diameter.
- Before the first start-up check that the system has absolutely no leakage. If toxic, explosive and/or corrosive gases are to be used, ensure to purge the system long enough with a dry, inert gas. This is also required to remove these kinds of gases from the system.
- The instruments' preferred mounting position is horizontally.

All instruments described in this manual carry the CE-mark. Therefore they have to comply with the EMC requirements valid for these instruments. However compliance with the EMC requirements is not possible without the use of proper cables and connector/gland assemblies.

In case the instrument is connected to other devices (e.g. power supply) ensure that the operating voltage complies with the supply voltage given on the name plate and that the function of the shielding is not affected. M+W Instruments GmbH recommends using standard cables following the CE-requirements and could supply them when needed.

1.3 Operation and Maintenance

When the power is switched on a warm-up period of at least 30 sec is required allowing the instrument's thermal stabilisation. Afterwards the instrument will work with an accuracy of approximately 4% FS. It takes around 30 minutes until the optimal stability is reached and the instrument will work with an accuracy of < 3% FS. This is supposed to be performed with or without gas flow. To avoid creating gradients it is recommended that gas and ambient temperature are kept at the same level (max ΔT approx. $\pm 2...3$ °C). Otherwise the accuracy of this thermal measurement could be affected in an unpredictable manner.

Be sure that the specified pressures have been applied. Pressure surges, as may occur during the system pressurisation, must be avoided. The control valve cannot be used as a shut-off valve. When starting up, always bring the instrument gradually up to the level of operating conditions.

There are no regular maintenance checks required for the instrument's operation. It has to be ensured that a possible mounted inline filter is checked and cleaned on a regular basis. We recommend having the calibration checked every 24 months by the supplier or an authorized service partner.

1.4 Specifications of analog MASS-STREAM™ Instruments D-5100

Measurement System	
Accuracy (based on calibration with Air)	± 3% FS including non-linearity (± 1% FS on request)
Repeatability	< ± 0.5% FS
Pressure sensitivity	± 0.3% RD / bar typical (Air)
Temperature sensitivity	± 0.3% RD / °C (Air)
Response time sensor (τ 63%)	appr. 0.7 sec
Leak integrity (outboard)	< $2 \cdot 10^{-7}$ mbar l/sec He
Mechanical Parts	
Sensor	Stainless steel SS316 (AISI 316L, 1.4404)
Instrument body	Aluminium EN AW-6082-T6 (AL 50ST/51ST) anodised OR Stainless steel SS316 (AISI 316L, 1.4404)
Laminar flow element	Stainless steel SS316 (AISI 316L, 1.4404)
Protection	IP40
Operating Limits	
Measuring range	5...100% (1:20)
Temperature	0...50 °C
Humidity	max. 70% rel. which may not condensate
Pressure	0...10 bar(g) for aluminium body 0...20 bar(g) for stainless steel body
Warm-up time	30 min for optimum accuracy within 30 sec for accuracy ± 4% FS
Electrical Properties	
Supply voltage	+15 Vdc OR 24 Vdc ± 10%
Current peak values	Inrush current: max. 75 mA Controller: add 250 mA
Output signal	0...5 Vdc active OR 4...20 mA active
Instrument connector	6-pin round DIN (male) optional for controllers: 15-pin sub-D (male)

1.5 Hook-up with 6DIN Connector, 6-pin round

See hook-up document no. 9.16.089 of the shipment's accompanying documentation.

Mass flow meter D-51•0:

1	+ power	4	+ output signal
2	0 power	5	n/c
3	0 output signal	6	n/c

Mass flow controller D-51•1:

1	+ power	4	+ output signal
2	0 power	5	+ setpoint signal
3	0 output signal	6	n/c

1.6 Hook-up with 15-pin sub-D Connector

Typ M for mass flow controller D-51•1:

1	n/c	9	n/c
2	+ output signal	10	n/c
3	n/c	11	n/c
4	n/c	12	0 output signal
5	0 power	13	n/c
6	n/c	14	n/c
7	+ power	15	shield
8	+ setpoint signal		

Typ B for mass flow controller D-51•1:

1	0 power	9	0 power
2	+ output signal	10	0 power
3	0 power	11	n/c
4	n/c	12	n/c
5	+ power	13	n/c
6	n/c	14	shield
7	n/c	15	n/c
8	+ setpoint signal		

Please pay attention to the label with the hook-up fitted at the cable.

Be sure that the integrity of the shielding is not affected when connecting the system to other devices (e.g. to PLC). Only shielded wire terminals can be used.

2 BY-PASS MEASUREMENT PRINCIPLE AND CALIBRATION

The instrument's by-pass flow sensor is operating on a principle of heat transfer by sensing the ΔT along a heated section of the capillary tube. The ΔT is directly proportional to the gas mass flow. The heat transfer function between gas mass flow and temperature difference can be described by the following formula:

$$\Delta T = K \cdot C_p \cdot \Phi_m$$

ΔT ... Temperature difference

K ... Constant factor

C_p ... Specific heat

Φ_m ... Mass flow

The calibration is processed with a mass flow controller which functions as a reference. The controller and the gas inlet pressure forward a defined gas flow, thus a signal of the sensor can be allocated to each specific mass flow.

Each instrument is calibrated according to the customer's operation conditions within the specified accuracy limits. These customer specific information can be found on the instrument label and the calibration certificate.