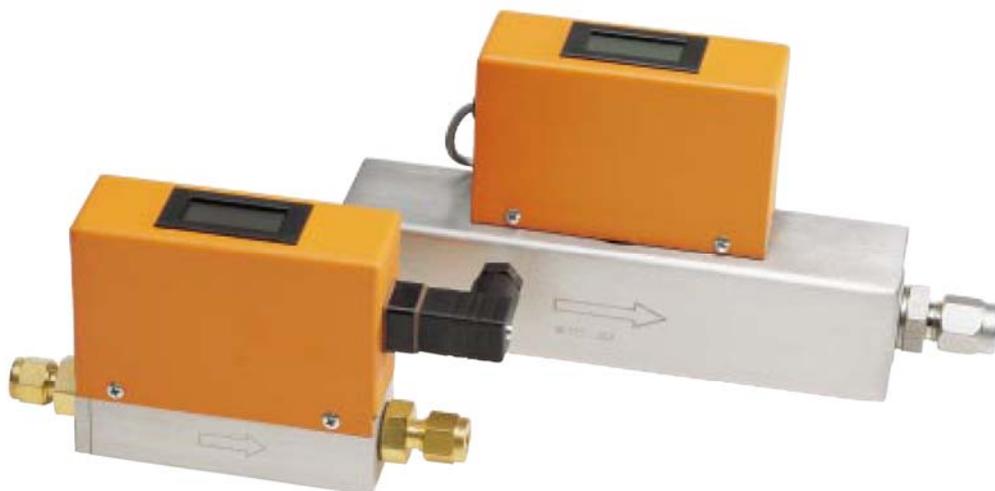


Operating Instructions
for
Direct Flow Mass Flow Meter
for gases

Model: DMW



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2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.

The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EWG-machine guidelines.

as per PED 97/23/EG

In acc. with Article 3 Paragraph (3), "Sound Engineering Practice", of the PED 97/23/EC no CE mark.

Diagram 6, Pipe, Group 1 dangerous fluids

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition.

Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:

The standard delivery includes:

- Mass Flow meter for gases, model: DMW
- Operating Instructions

4. Regulation Use

Any use of the Direct Mass Flow Meter for gases, model: DMW, which exceeds the manufacturer's specifications may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.

5. Operating Principle

The new model DMW-... direct mass flow meter has been specially designed for use in gas measuring technology. An inexpensive analogue output is fitted. The model DMW is available in three versions: with or without integrated 3 1/2-digit LCD display or with an 8-digit counter.

The direct stream procedure is ideally suited for measurements from 5 L_N/min (max.) up to 7.50 Nm³/min air (model: DMW-B*876). In case of small flow rates the measurement is executed via a bypass-system (DMW-A/C).

In contrast with most variable area flow meters the mass flow meter DMW-... has no moving parts, and no temperature pressure correction is required. The meter may be installed in any position and the pressure loss is negligible. The simple mechanical construction ensures the highest degree of reliability when used with aggressive gases, and as well under rugged industrial conditions.

5.1. Operating Principle DMW-A/-C

The flow sensor is operating on a principle of heat transfer by sensing the delta-T along a heated section of a capillary tube. The delta-T is directly proportional to the gas mass flow. The heat transfer function between gas mass flow and temperature difference can be described by the equation:

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

ΔT = temperature difference

C_p = specific heat

K = constant factor

Φ_m = mass flow

When using a flow regulator a control valve is integrated directly into the instrument. The central valve is a N/C solenoid valve. The baffle plate of the valve is being actuated from the magnetic field of the solenoid. For adjustment of the k_v -value the valve orifice can be changed. Standard seal material is FPM. Please check compatibility of sealing material on appropriate resistant tables.

5.2. Operating Principle DMW-B/-D

The flow sensor consists of two stainless steel probes that are positioned in the flow path; a heater probe and a temperature probe. A constant difference in temperature (ΔT) is created between the two and the energy required to maintain the ΔT is dependent of the mass flow rate. This can be described by the following equation:

$$P = P_0 + C \cdot \Phi_m^n$$

P = total heater power

P_0 = heater power offset at zero flow

C = constant

Φ_m = mass flow

n = dimensionless number (typ. 0.5)

Using a flow controller a directly operating control valve is integrated.

The integrated control valve is a normally closed solenoid valve. The plunger is lifted by the magnetic field of the coil.

For adapting the suitable k_v -value the orifice of the valve is changeable.

The typical sealing material is FPM. The compatibility of the material with your operating media may be seen in suitable resistant tables.

6. Mechanical Connection

- Ensure that the piping is absolutely clean and free of damage.
 - It is recommended to install an inlet filter, and if backflow can occur, also an outlet filter.
 - During installation of the instrument pay attention to the arrow marking on the body which defines the flow direction.
 - Do not install small diameter piping on high flowrates.
 - Do not use abrupt angles or create other disturbances directly on the inlet of the instrument.
 - Use only metric fittings.
 - NPT-fittings will destroy the thread of the body.
 - On instruments with **special design** with low pressure loss Δp an inlet pipe straight will be supplied together with the unit and must be mounted at the inlet.
 - The recommended inlet pipe straight is 10x the nominal pipe diameter.
 - Please leakproof the system before commissioning.
-
- If explosive and/or corrosive gases are to be used, purge the system with a dry, inert gas, for at least 30 minutes. This is also required to remove these gases from the system.



The preferred installation of our instruments is horizontal. Please consult the factory for recommendations if high flow rate controllers must be installed in alternative positions.

7. Electrical Connection

- All instruments carry the CE-mark. Therefore they have to comply with the EMC requirements as are valid for these instruments.
- When connecting the instrument to other devices (e.g. power supply), ensure that the operating voltage corresponds with the one on the name plate and the function of the shielding is impacted. Do not use unshielded wire terminals.
- Ensure that the electrical supply of the unit is in agreement with its operational data.
- Make certain that the Power Supply lines are powerless.
- To prohibit damage or destruction to electronics and sensor, all units are provided with polarity protection.



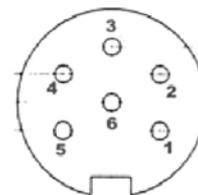
Attention! In case of a polarity-reversal, the power supply circuit gets short-circuited.

- Connect the sensor according to the connection diagram shown here.

Terminal pin assignment

PIN	DMW-A/B DMW-C/D with Poti	DMW-C/D
1	+ V _s	+ V _s
2	GND (Power)	GND (Power)
3	GND (Signal)	GND (Signal)
4	+ Signal	+ Signal
5	N/C	+ setpoint
6	N/C	N/C

6 pol (DIN 45322)



Note: Wiring for units with cable connection and flying leads is printed on the cable.

8. Commissioning

- After switching on power, allow for at least 30 seconds to warm-up and stabilise.
- After this time the instrument works with an accuracy of 4% FS.
- After additional 30 minutes the optimal stability is reached and the instrument now has its optimum accuracy of 3% FS. This may be done with or without gas flow.
- Be sure that the specified pressure(s) has/have been applied.
- Pressure surges, which may occur during system pressurisation must be avoided.
- The control valve (in conjunction with the regulator) is not suitable for complete shut-off.
- When starting up, always bring the instrument gradually up to the level of operating conditions.

8.1. Trouble shooting

<u>Problem:</u>	<u>Check:</u>
No output signal	- no power supply - connections of the cable - pressure - for inline stoppage
Oscillation of the controller	- pressure; valve
Flow although input signal is zero	- seals of the valve
Setpoint > actual flow	- inlet outlet pressure; kv-value of the valve

9. Technical Information

Measuring system:	Direct stream and Bypass
Measuring range:	3...100 %
Gas type:	all gases, depending on the material compatibility
Accuracy (with calibration for air):	±3 % f.s. incl. non-linearity (better upon request)
Repeatability:	±0.5 % f.s. (better upon request)
Time constant (63.2%):	$\tau = 0.7$ s (standard, better upon request)
Display:	3 1/2-digit LCD (flow rate); 8-digit LCD (counter)
Pressure sensitivity:	0.2 % / bar typically (air)
Temperature coefficient:	±0.1 %/°C
Temperature range:	0...70 °C
Pressure:	10 bar; higher upon request
Leakage rate:	$< 2 \times 10^{-9}$ mbar L/s He
Preheating time:	30 min for optimal accuracy; 30 s for accuracy ±4 % f. s.
Mounting position:	any, flow rate in arrow direction
Inlet section:	10 x D (DMW-A) without limitation for other types
kvs-values controller:	0.066; 0.35; 1.0 (DMW-C/D)

Materials

Sensor:	Stainless steel 316L
Casing:	Stainless steel 1.4305 or Aluminium (anodised)
Filter /rings:	Stainless steel /PTFE
Seal:	FPM, EPDM or Kalrez
Power supply:	24 V _{DC} ±10 %

Max. current values

DMW-A/C:	75 mA max.
DMW-B/D:	current input 250 mA max. without flow 75 mA max. 100 % flow rate 175 mA max. + 250 mA max.
With valve control: Signal input (with controller only):	Poti, 0 ...5 V _{DC} or 4 ...20 mA

Signal output:	0...5 V _{DC} or 4 ...20 mA active
Connector:	round pin plug/ opposite plug, 6-pole DIN 45322
Protection:	IP 40; IP 65 (option)
Special design (upon request):	»Low pressure loss« version, dry and oil-free; “fast response“ version; digital design with Bus connection
real gas calibration (upon request):	for example: H ₂ , Helium, CO ₂ , Methane, Propane, Butane, Argon (No oxygen)

10. Order Codes

Order Details mass flow meter (Example: DMW-A71 12 G2 F 3 2)

Measuring system	Measuring tube	Sensor housing		Measuring range [LN/min air]*	Connection
		Aluminium	Stainless steel		
Bypass flow meter	small	DMW-A71...	DMW-A21...	..12.. = 5.0...100.0 mL _N /min ..22.. = 10.0...200.0 mL _N /min ..52.. = 0.025...0.500 ..13.. = 0.050...1.000 ..23.. = 0.100...2.000 ..53.. = 0.25...5.00 ..14.. = 0.50...10.00	..G2.. = G 1/4 IG
Direct stream flow meter	4 mm	DMW-B70...	DMW-B20...	..14.. = 0.50...10.00 ..24.. = 1.00...20.00	..G2.. = G 1/4 IG
Direct stream flow meter	8 mm	DMW-B71...	DMW-B21...	..24.. = 1.00...20.00 ..54.. = 2.5...50.0 ..15.. = 5.0...100.0	..G2.. = G 1/4 IG
Direct stream flow meter	16 mm	DMW-B72...	DMW-B22...	..15.. = 5.0...100.0 ..25.. = 10.0...200.0 ..45.. = 20...400	..G4.. = G 1/2 IG
Direct stream flow meter	32 mm	DMW-B73...	DMW-B23...	..16.. = 50...1000 ..26.. = 100...2000	..G4.. = G 1/2 IG
Direct stream flow meter	56 mm	DMW-B75...	DMW-B25...	..26.. = 0.10...2.00 m ³ _N /min ..46.. = 0.20...4.00 m ³ _N /min ..56.. = 0.25...5.00 m ³ _N /min	..G6.. = G 1 IG
Direct stream flow meter	84 mm	DMW-B78...	DMW-B28...	..56.. = 0.25...5.00 m ³ _N /min ..66.. = 0.30...6.00 m ³ _N /min ..76.. = 0.30...7.50 m ³ _N /min	..G6.. = G 1 IG

*L_N = Norm liter at 1013 mbar and 0 °C

L_S = Standard liter at 1013 mbar and 20 °C (others upon request)

Measuring ranges also available in m³_N/min, m³_N/h, L_N/h or others.

Seal	Indication/ protection	Output
..F.. = FPM ..E.. = EPDM ..P.. = Kalrez	..3.. = without indication, IP 40 ..6.. = without indication, IP 65 ..D.. = flow rate indication, IP 40 ..Z.. = counter, IP 40	..2 = 0 - 5 V _{DC} ..4 = 4 - 20 mA

Order Details mass flow controller (Example: DMW-C71 12 G2 F 3 2)

Measuring system	Measuring tube	Sensor housing		Measuring [LN/min air]	Connection
		Aluminium	Stainless steel		
Bypass flow meter	small	DMW-C71...	DMW-C21...	..12.. = 5.0...100.0 mL _N /min ..22.. = 10.0...200.0 mL _N /min ..52.. = 0.025...0.500 ..13.. = 0.050...1.000 ..23.. = 0.100...2.000 ..53.. = 0.25...5.00 ..14.. = 0.50...10.00	..G2.. = G 1/4 IG
Bypass flow meter	medium	DMW-C72...	DMW-C22...	..14.. = 0.50...10.00 ..24.. = 1.00...20.00 ..54.. = 2.50...50.0	..G4.. = G 1/2 IG
Direct stream flow meter	4 mm	DMW-D70...	DMW-D20...	..14.. = 0.50...10.00 ..24.. = 1.00...20.00	..G2.. = G 1/4 IG
Direct stream flow meter	8 mm	DMW-D71...	DMW-D21...	..24.. = 1.00...20.00 ..54.. = 2.5...50.0 ..15.. = 5.0...100.0	..G2.. = G 1/4 IG
Direct stream flow meter	16 mm	DMW-D72...	DMW-D22...	..15.. = 5.0...100.0 ..25.. = 10.0...200.0 ..45.. = 20...400	..G4.. = G 1/2 IG
Direct stream flow meter	32 mm	DMW-D73...	DMW-D23...	..45.. = 20...400 ..16.. = 50...1000	..G4.. = G 1/2 IG

Plug-in power supply	Seal	Indication/ Protection	Input/ Output
Input: 90-264 V AC Output: 24 VDC – 500 mA Model ZUB-SNT035L	..F.. = FPM ..E.. = EPDM ..P.. = FFKM	..3.. = without indication, IP 40 ..6.. = without indication, IP 65 ..D.. = flow rate indication, IP 40 ..Z.. = counter, IP 40	..2 = 0 - 5 VDC ..4 = 4 - 20 mA ..6 = Poti/ 0 - 5 VDC (to 100 L/min) ..8 = Poti/ 4 - 20 mA (to 100 L/min)

11. Maintenance

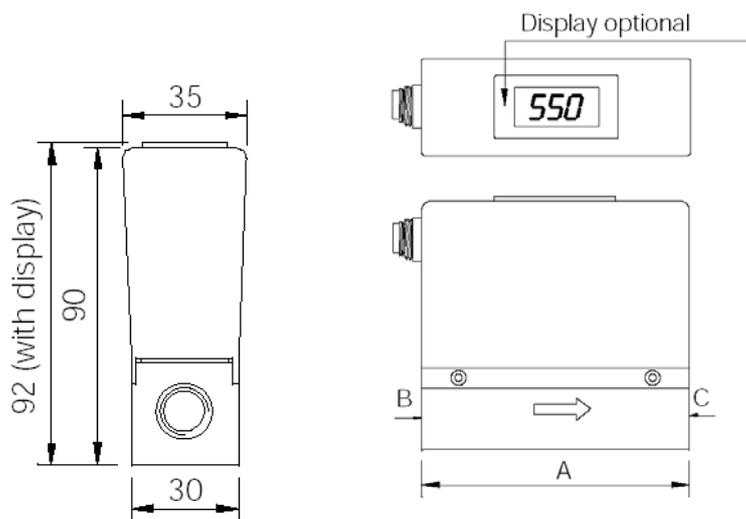
No routine maintenance is required to be performed on the instruments. Inlet filters should periodically be cleaned ultrasonically.

In such a case, the unit must be cleaned well, and a new calibration becomes inevitable; send this unit under consideration of safety instructions and cleaning at the latest every 24 months to your supplier.

12. Dimensions

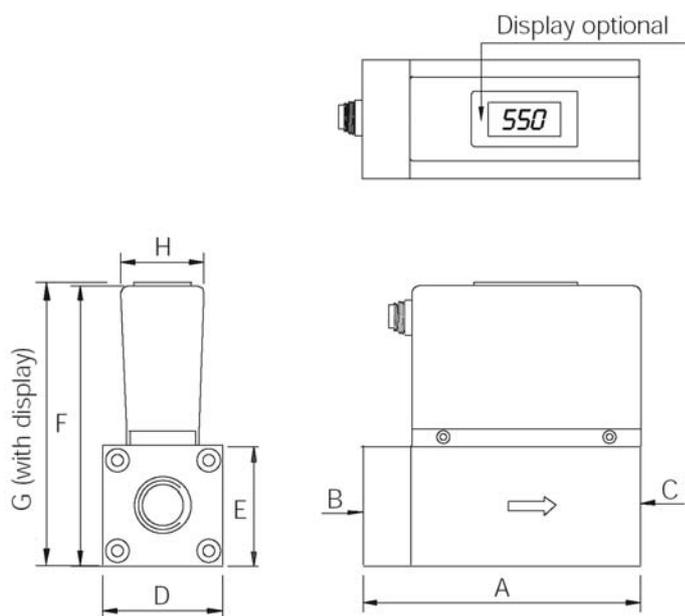
DMW-A..., DMW-B*0..., DMW-B*1..., DMW-B*2...

Model	B	C	F	G
DMW-A...	G ¼	G ¼	95	96
DMW-B*0...	G ¼	G ¼	95	96
DMW-B*1...	G ¼	G ¼	95	96
DMW-B*2...	G ½	G ½	99	100



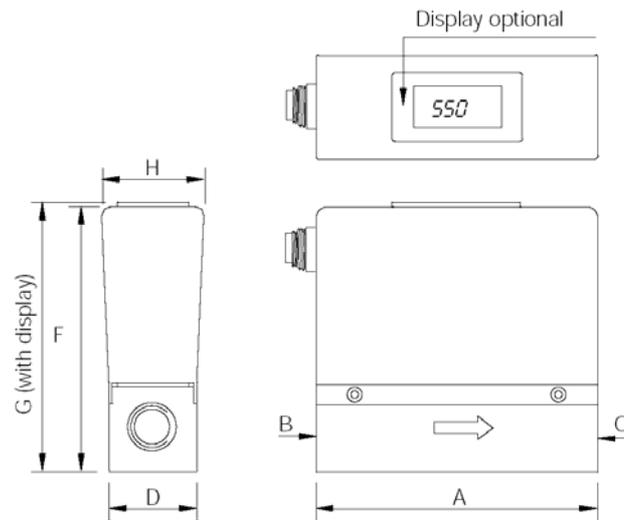
DMW-B*3..., DMW-B*5..., DMW-B*8...

Model	A	B	C	D	E	F	G	H
DMW-B*3	116	G ½	G ½	50	50	123	124	35
DMW-B*5	130	G 1	G 1	70	70	143	144	35
DMW-B*8	160	G 1	G 1	100	100	172	173	35



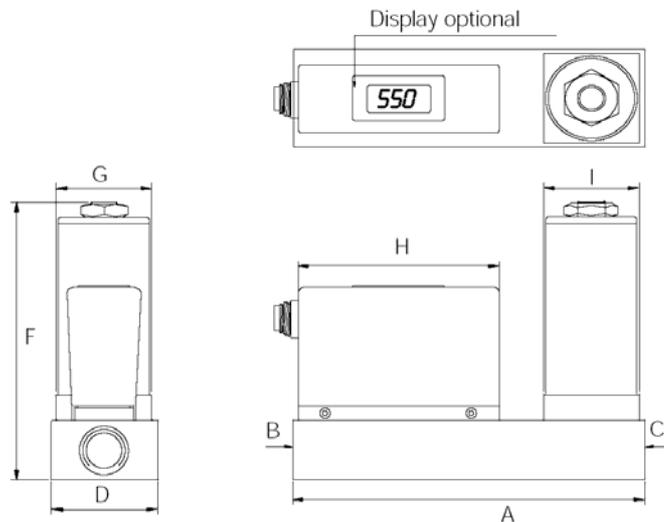
DMW-C*1..., DMW-C*2..., DMW-D*0..., DMW-D*1...

Model	A	B	C	D	F	G	H
DMW-C*1...	95	G ¼	G ¼	30	95	96	35
DMW-C*2...	95	G ½	G ½	30	97	98	35
DMW-D*0...	95	G ¼	G ¼	30	95	96	35
DMW-D*1...	95	G ¼	G ¼	30	95	96	35



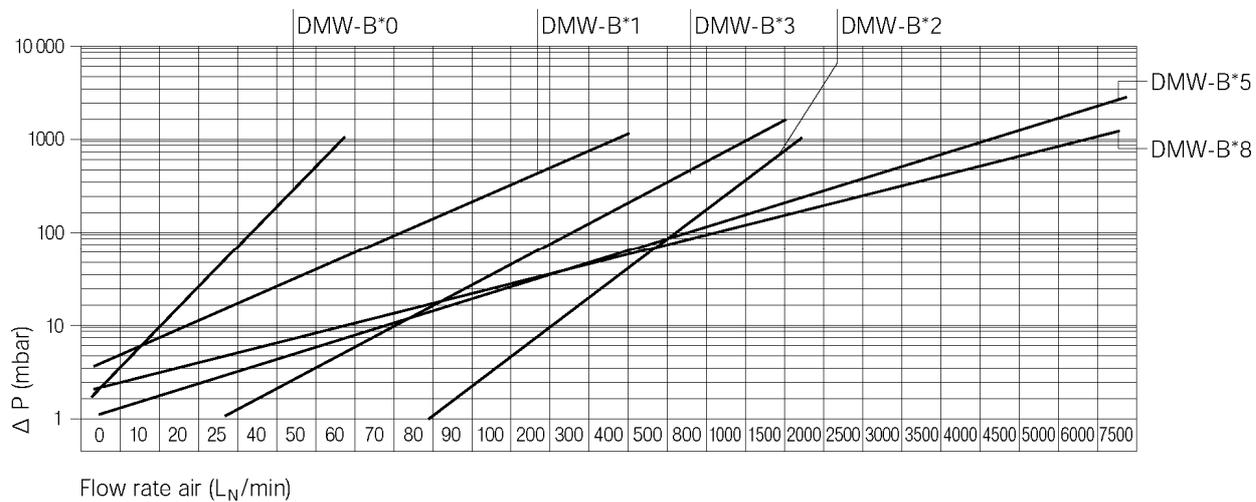
DMW-D*2..., DMW-D*3...

Model	A	B	C	D	F	G	H	I
DMW-D*2...	145	G ½	G ½	50	131	45	95	44
DMW-D*3...	-	G ½	G ½	Dimensions upon request				



13. Pressure Loss Diagram

For model DMW-C71... and DMW-C-21... all <50 mbar



14. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Flow Meter Model: DMW

which relates to this certificate, conforms to the standards listed below:

EN 50081-1	
EN 55022	Class B
EN 50082-2	
EN 61000-4-2	8 kV/AD4 kV C
ENV 50140	10 V/m
EN 61000-4-4	2 kV/5 kHz
EN 50141	10 V

also fulfils the following EWG guidelines:

89/336/EEC **EMC Directive**

2004/108/EC **EMC Directive**

Hofheim, 16. Jan. 2007



H. Peters
General Manager



M. Wenzel
Proxy Holder