

1 YEAR
WARRANTY

Ω OMEGA™ User's Guide



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Electromagnetic Flow Meter FMG90B Series



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0 About this operating manual

- The operating manual is aimed at specialists and semi-skilled personnel.
- Before each step, read through the relevant advice carefully and keep to the specified order.
- Thoroughly read and understand the information in the section “Safety instructions”.

If you have any problems or questions, please contact your supplier or contact us directly at:



omega.com

Tel: (203) 359-1660

e-mail: info@omega.com

Hazard signs and other symbols used:



WARNING! / CAUTION! Risk of injury!

This sign indicates dangers that cause personal injuries that can lead to health defects or cause considerable damage to property.



CAUTION! Electric current!

This sign indicates dangers which could arise from handling of electric current.



CAUTION! Material damage!

This sign indicates actions which could lead to possible damage to material or environmental damage.



ADHERE TO OPERATING MANUAL!



NOTICE!

This symbol indicates important notices, tips or information.



NO DOMESTIC WASTE!

The device must not be disposed of together with domestic waste.



Pay attention to and comply with information that is marked with this symbol.



Follow the specified instructions and steps. Adhere to the given order.



Check the specified points or notices.



Reference to another section, document or source.



Item.

1 Device description

The FMG90B series from Omega is a flow sensor without moving parts. The measurement is performed using magnetic induction.

The FMG90B is used for measuring or metering water and electrically conductive fluids. The compact design and independence from the intake and discharge sections allows the FMG90B to be used under a variety of conditions.

Versions:

The FMG90B is available in different inner diameters from 0.12 in to 0.98 in.

Type plate:

You can find the type plate on the back of the FMG90B.

It contains the most important technical data.

1.1 Delivery, unpacking and accessories

All units have been carefully checked for their operational reliability before shipment.

- Immediately after receipt, please check the outer packaging for damages or any signs of improper handling.
- Report any possible damages to the forwarder and your responsible sales representative. In such a case, state a description of the defect, the type and the serial number of the device.
Report any in-transit damage immediately. Damage reported at a later date shall not be recognized.

Unpacking:

- ↪ Carefully unpack the unit to prevent any damage.
- ↪ Check the completeness of the delivery based on the delivery note.

Scope of delivery:

- 1x FMG90B according to the order data.
- 1x Operating manual.

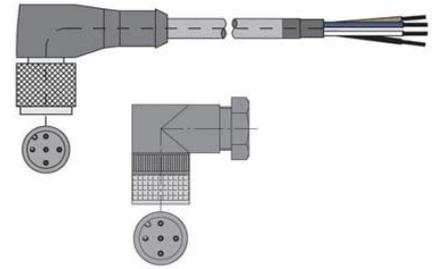


IMPORTANT!

- ↪ Use the type plate to check if the delivered unit corresponds to your order.
- ↪ In particular, for devices with electrical components, check to see if the correct power supply voltage is specified.

Accessories:

- Connection cable with molded M12x1 coupling socket.
- M12x1 coupling socket as component.

**1.2 Intended use**

The magnetic inductive flow sensor FMG90B must only be used for measuring and metering liquids with a minimum conductivity of 20 $\mu\text{S}/\text{cm}$.

**WARNING! No safety component!**

The magnetic inductive flow sensor of the FMG90B series is no safety component in accordance with Directive 2006/42/EC (Machine Directive).

⚡ Never use the FMG90B as a safety component.

The operational safety of the device supplied is only guaranteed by intended use. The specified limits (\rightarrow § 9 "Technical data") may under no circumstances be exceeded.

Before installing the device, check that the wetted materials of the device are compatible with the media being used (\rightarrow § 9 "Technical data").

Measuring tube empty (or partially filled). / Conductivity too low.



The green LED may blink irregularly if the measuring tube of the FMG90B is empty or partially filled or if the conductivity of the fluid being used is too low. Random pulses will be present at the output, but they do not represent an actual flow.

⚡ Ensure that the measuring tube of the FMG90B is always completely filled (\rightarrow § 4.1 "Installation instructions").

⚡ Ensure that the conductivity of the fluid is at least 20 $\mu\text{S}/\text{cm}$.

1.3 Exclusion of liability

We accept no liability for any damage or malfunctions resulting from incorrect installation, inappropriate use of the device or failure to follow the instructions in this operating manual.

2 Safety instructions



Before you install the FMG90B, read through this operating manual carefully. If the instructions contained within it are not followed, in particular the safety guidelines, this could result in danger for people, the environment, and the device and the system it is connected to.

The FMG90B corresponds to the state-of-the-art technology. This concerns the accuracy, the operating mode and the safe operation of the device.

In order to guarantee that the device operates safely, the operator must act competently and be conscious of safety issues.

OMEGA provides support for the use of its products either personally or via relevant literature. The customer verifies that our product is fit for purpose based on our technical information. The customer performs customer- and application-specific tests to ensure that the product is suitable for the intended use. With this verification all hazards and risks are transferred to our customers; our warranty is not valid.

Qualified personnel:

- ⚠ The personnel who are charged for the installation, operation and maintenance of the FMG90B must hold a relevant qualification. This can be based on training or relevant tuition.
The personnel must be aware of this operating manual and have access to it at all times.
- ⚠ The electrical connection should only be carried out by a fully qualified electrician.

General safety instructions:

- ⚠ In all work, the existing national regulations for accident prevention and safety in the workplace must be complied with. Any internal regulations of the operator must also be complied with, even if these are not mentioned in this manual.
- ⚠ Degree of protection according to EN 60529:
Please ensure that the ambient conditions at the site of use does not exceed the requirements for the stated protection rating (→ § 9 "Technical data").
- ⚠ Prevent freezing of the medium in the device with appropriate measures.
- ⚠ Only use the FMG90B if it is in perfect condition. Damaged or faulty devices must be checked without delay and, if necessary, replaced.
- ⚠ When fitting, connecting and removing use only suitable appropriate tools.
- ⚠ Do not remove or obliterate type plates or other markings on the device, as otherwise the warranty is rendered null and void.

Special safety instructions:

- ⚠ Crystallizing liquids:
Liquids which crystallize when dried out can cause a malfunction of the FMG90B.
 - ↳ Make sure that the FMG90B is not run dry.
 - ↳ Prevent the crystallization of the fluid in the device by taking appropriate measures.

Further warnings that are specifically relevant to individual operating procedures or activities can be found at the beginning of the relevant sections of this operating manual.

3 Construction and function

Components:

- ① Housing:
The Housing consists of plastic and has the IP65 degree of protection.
- ② Electrical connection:
The electrical connection is made via 4-pin plug M12x1.
- ③ Operation / flow indicator LED.
- ④ Process connection:
The process connections are available in different sizes.



Construction:

The measuring tube with its grounding sleeves and electrodes passes through the housing and forms the external process connection of the FMG90B.

A magnetic field for the measurement process is generated inside the housing, which also contains the sensor and signal conditioning circuitry.

The two stainless steel electrodes are located in the middle of the measuring tube between the grounding sleeves.

The FMG90B does not need any moving parts to make measurements. The inside of the measuring tube is completely open, allowing the fluid to flow unhindered through the measuring tube.



Function:

The magnetic inductive flow sensor functions according to the induction principle. A DC voltage is generated by the movement of a conductor in a magnetic field:

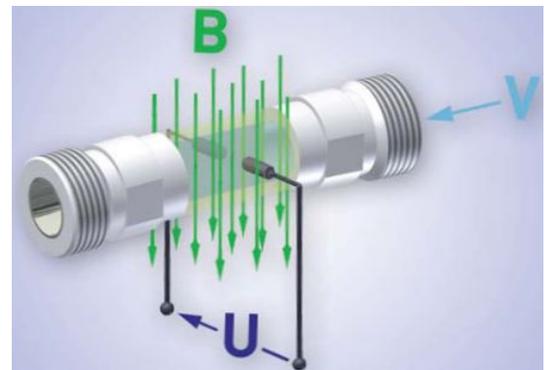
The measuring tube of the FMG90B is located in a magnetic field (B).

An electrically conductive medium (V) flows through the measuring tube. The positive and negative charge carriers are oppositely deflected.

A voltage (U) is generated at right angles to the magnetic field, which is picked up by the two electrodes.

Thereby, the induced voltage is proportional to the average flow velocity of the liquid.

The electronics of the FMG90B converts the induced voltage into a flow-proportional frequency signal.



4 Installation of FMG90B

Before installing, check that

- the wetted materials of the device are suitable for the media being used (→ § 9 "Technical data").
- the equipment is switched off and is in a safe and de-energized state.
- the equipment is depressurized and has cooled down.



SUITABLE TOOLS:

Use only suitable tools of the correct size.

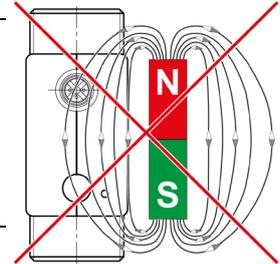
4.1 Installation instructions



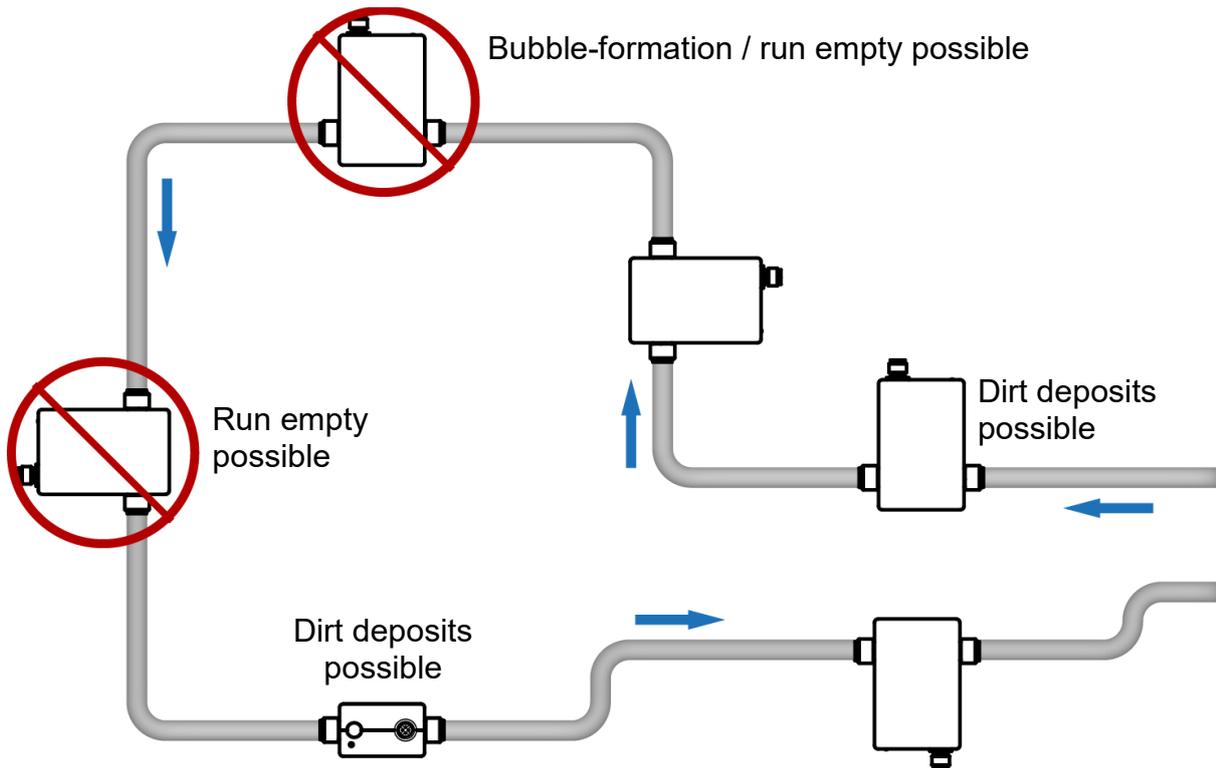
CAUTION! Risk of malfunction due to external magnetic fields!

Magnetic fields close to the device can cause malfunctions and should be avoided.

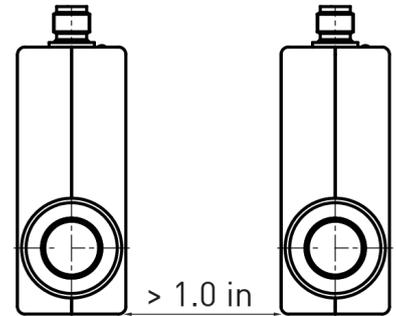
Ensure that no external magnetic fields are present at the installation site of the FMG90B.



- The FMG90B can always be installed anywhere along the pipeline. However, straight sections of piping are preferable.



- Installation can occur in horizontal and vertical pipes. The flow sensor is only suitable for application in completely filled pipe systems.
- As a matter of principle magnetic inductive flow sensors are widely independent from the flow profile. An inlet section is not absolutely necessary. To reach a most highly accuracy of the measurement, you should use straight inlet and outlet sections according to the inner diameter. The inlet section has to be at least 10 x inner diameter; the outlet section 5 x inner diameter in order to achieve the specified accuracy.
- The inlet and outlet sections and the gaskets must have the same or a slightly larger inside diameter than the measuring tube in order to achieve the specified accuracy.
- If two or more FMG90B devices are used side by side, maintain a separation of at least 1.0 in between adjacent devices.
If adjacent devices are too close together, operation of both devices may be impaired due to mutual interference.



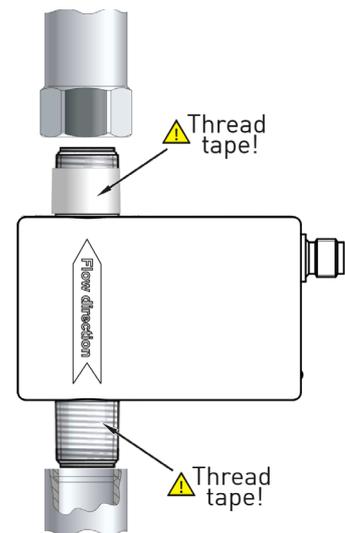
4.2 Assembly

The FMG90B is installed directly into the pipeline. The compact design and light weight of the unit make wall-mounting unnecessary.



IMPORTANT NOTICES:

- Only use suitable gaskets for installation.
 - Observe the flow direction indicated on the type plate.
 - Observe the mounting dimensions (→ § 9.3 "Dimensions").
- ↪ Select an appropriate location for installation (→ § 4.1 "Installation instructions").
To ensure the best possible measuring accuracy, a vertical installation position with increasing flow is preferable (no collecting of dirt deposits).
- ↪ Wrap the FMG90B connections with 1 to 2 wraps of thread tape (e.g. Teflon® tape). Wrap tape in a clockwise direction, viewed from the end, leaving the first two threads uncovered.
- ↪ Make sure the tape does not intrude into the flow path.
- ↪ Attach the FMG90B with arrow pointed in the direction of flow.
- ↪ The fittings should be screwed into FMG90B hand tight.



CAUTION! Material damage!

Maximum torque 3.7 ft lb.

While tightening, counter the FMG90B only by hand!
If you use an open-end or a pipe wrench, the FMG90B can be damaged.



- ↪ To tighten the FMG90B, use an open-end or a pipe wrench for the fittings and only the hand for the FMG90B.

5 Electrical connection

The electrical connection of the FMG90B is made via the 4-pin plug M12x1 at the top of the housing.

The wiring of the FMG90B depends on the ordered version. A distinction is made between frequency output or analog output and frequency output.



CAUTION! Electric current!

The electrical connection should only be carried out by a fully qualified electrician.

↳ De-energize the electrical system before connecting the FMG90B.

Connection cable:

Suitable connection cables with molded coupling socket M12x1 are available in different lengths as OMEGA accessories. The maximum permissible cable length is 10 m.

Connection 4-pin plug M12x1:

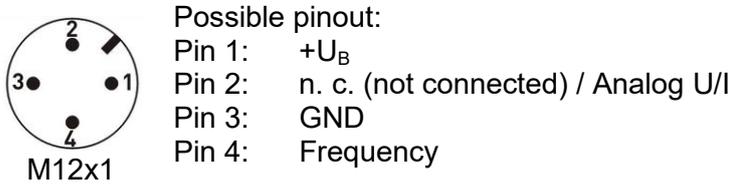
- ↳ Screw the coupling socket of the connection cable to the plug of the FMG90B.
- ↳ Tighten the knurled nut of the coupling socket with a maximum torque of 1 Nm.

5.1 Wirings

Pinout:

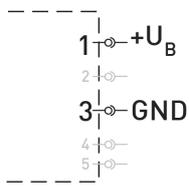
The pinout differs according to the chosen configuration of the device.

Pinout:



⚡ Connect the connection cable according to your version and the pinout on the type plate.

Supply voltage:



FMG90B with frequency output:

Push-Pull:	NPN Open Collector:	PNP Open Collector:
<p>*1: Push-Pull switching outputs of several FMG90B may not be connected in parallel. *2: Recommendation Pull-Up / Pull-Down resistance $R_L \sim 2.5 \text{ k}\Omega$ (12 V) or $\sim 5 \text{ k}\Omega$ (24 V). Ensure that the maximum signal current of 25 mA is not exceeded.</p>		

Use of frequency and analog output

Push-Pull:	NPN Open Collector:	PNP Open Collector:
<p>Recommendation for resistance $R_L \sim 2.5 \text{ k}\Omega$ (12 V) or $\sim 5 \text{ k}\Omega$ (24 V). Ensure that the maximum signal current of 25 mA is not exceeded.</p>		

6 Commissioning and measuring operation

Before switching on the FMG90B for the first time, please follow the instructions in the following section.

6.1 Commissioning

Check that

- the FMG90B has been installed correctly and that all screw connections are sealed.
- the electrical wiring has been connected properly.
- the measuring system is vented by flushing.

6.2 Switching on and off

The FMG90B has no switch and cannot be switched on or off on its own. Switching on and off is carried out by the applied supply voltage.

↪ Switch on the supply voltage.

The green LED lights up. The FMG90B is ready and goes into measuring mode.

6.3 Measuring operation

In the measuring mode, the green LED flashes proportional to the measured flow.



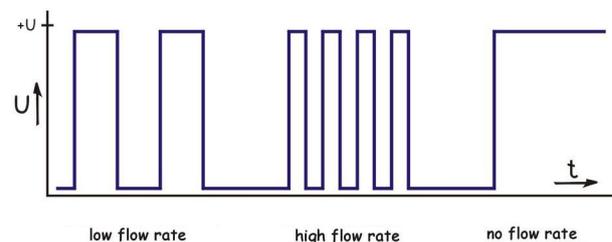
For the human eye, the flashing is no longer visible from a frequency of ~30...40 Hz.

The green LED then seems to light up permanently.

FMG90B with frequency output:

The FMG90B provides according to the version a flow proportional NPN, PNP or Push-Pull square wave signal.

The frequency of the pulse output changes according to the flow (→ Fig.).



FMG90B with analog output:

According to the configuration of the FMG90B, the analog output provides a voltage or current signal.

This signal is proportional to the measured flow. You will find the scaling of the analog output on the type plate.

7 Maintenance and cleaning

Maintenance:

The FMG90B is maintenance-free and cannot be repaired by the user. In case of a defect, the device must be replaced or sent back the manufacturer for repair.



CAUTION! Material damage!

When opening the device, critical parts or components can be damage.

↪ Never open the device and perform any repair yourself.

Cleaning:

Clean the FMG90B with a dry or slightly damp lint-free cloth. Do not use sharp objects or aggressive agents for cleaning.

8 Disassembly and disposal

**CAUTION! Risk of injury!**

Never remove the device from a plant in operation.

↳ Make sure that the plant is shut down professionally.

Before disassembly:

Prior to disassembly, ensure that

- the equipment is switched off and is in a safe and de-energized state.
- the equipment is depressurized and has cooled down.

Disassembly:

- ↳ Remove the electrical connectors.
- ↳ Remove the FMG90B using suitable tools.

Disposal:**NO HOUSEHOLD WASTE!**

The FMG90B consists of various different materials. It must not be disposed of with household waste.

- ↳ Take the FMG90B to your local recycling plant.

9 Technical data

The technical data of customized versions may differ from the data in these instructions. Please observe the information specified on the type plate.

9.1 Characteristics FMG90B

Type	FMG93B	FMG96B	FMG98B	FMG915B	FMG920B	FMG925B
Measurement device characteristics						
Flow range [gpm]	0.026...0.53	0.066...1.3	0.26...5.3	0.66...13.2	1.3...53	3.3...66
Accuracy*	±0.7 % of reading ±0.3 % of range					
Repeatability	±1%					
Output signal starting from [gpm]	0.013	0.026	0.07	0.27	0.53	1.32
Max. flow rate [gpm]	0.66	1.58	6.6	15.8	63.4	79.2
Response time	< 100 ms					
Indication	LED green, flow proportional flashing					
Output signal characteristics						
Frequency output:						
- Pulse rate / K-Factor [pulses/gal]	30000	15000	3000	1500	750	300
- Resolution [ml/pulse]	0.1	0.25	1.0	2.5	5.0	12.5
- Signal shape	Square wave signal • duty cycle 50:50 Push-Pull • NPN open collector • PNP open collector					
- Signal current	≤ 100 mA					
Electrical characteristics						
Supply voltage	12...24 V _{DC} (±10 %) **					
Power consumption	Max 3.6 W					
Electrical protection measures	short-circuit proof • protected against polarity reversal					
Electrical connection	4-pin plug M12x1					
Degree of protection (EN 60529)	IP 65 (only with a connected coupling)					
Process variables						
Medium to measure	Water and other conductive liquids					
- Conductivity	> 20 µS/cm					
- Temperature	14...140 °F (non-freezing)					
Ambient temperature	41...140 °F					
Storage temperature	5...140 °F					
Inner diameter	0.12 in	0.31 x 0.08 in	0.31 in	0.55 in	0.71 in	0.98 in
Max. working pressure (at ... °F)	145 psi (68 °F) • 116 psi (104 °F) • 87 psi (140 °F) higher pressure ratings on request					
Process connection - male thread	¾" NPT	½" NPT		¾" NPT	1" NPT	1¼" NPT

* test conditions: Water 73 °F

** Voltage output 0.5... 10 V only available with 16...24 VDC

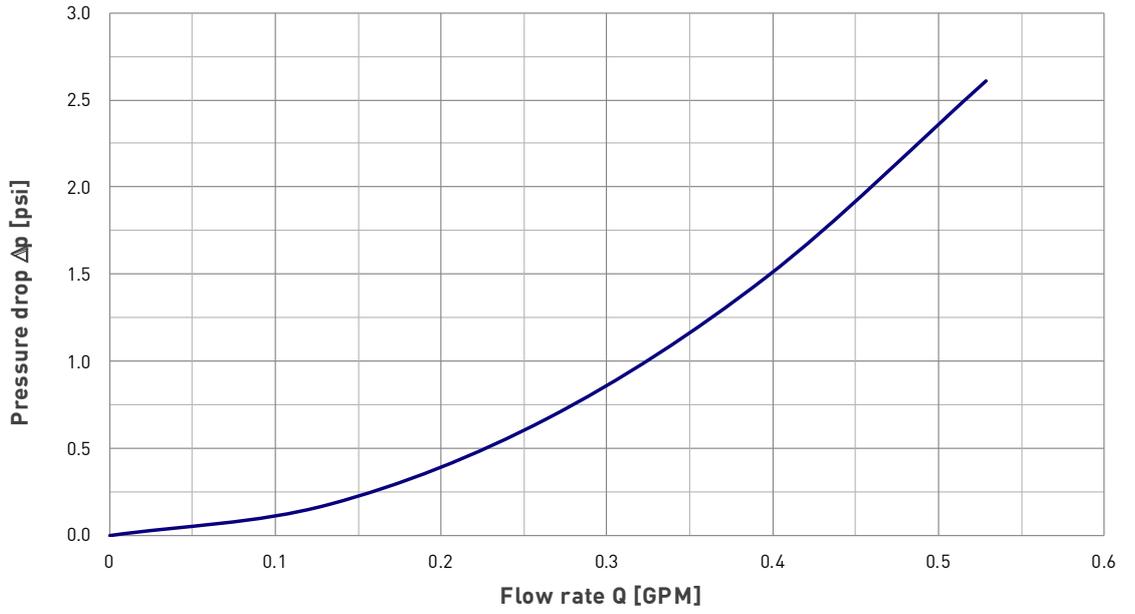
9.2 Materials table

Component	Material	Component-wetted
Housing	ABS	
Measuring tube	POM or PVDF (option)	X
Process connections	POM or PVDF (option)	X
O-ring	EPDM or FKM (option)	X
Electrodes and grounding rings	Stainless steel 1.4404 or Hastelloy C®*	X

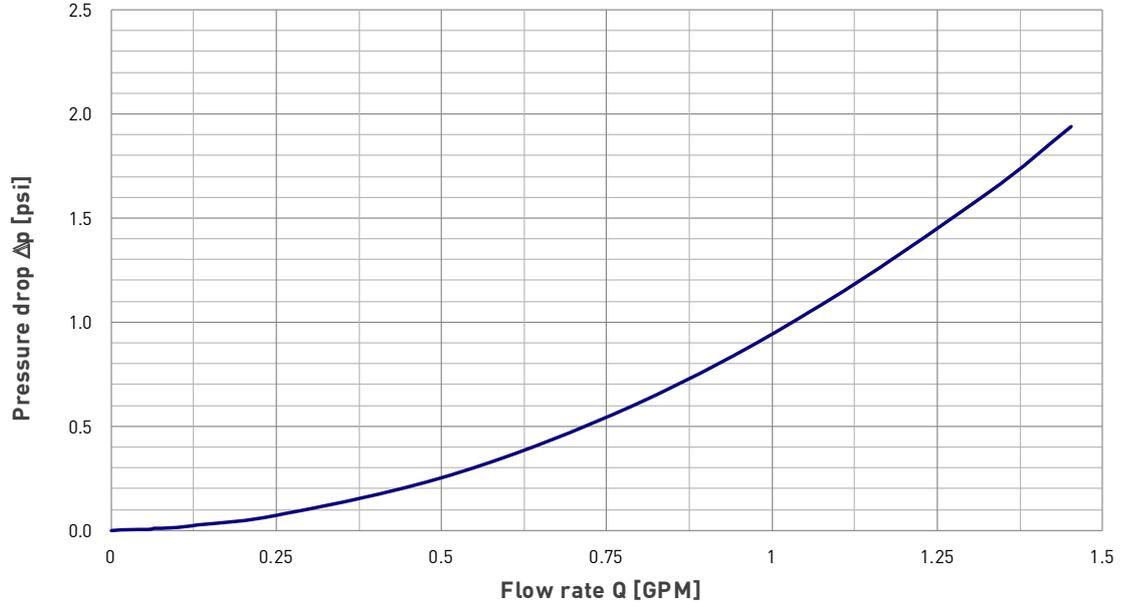
* Available for FMG93B, FMG96B, FMG98B

9.3 Pressure drop

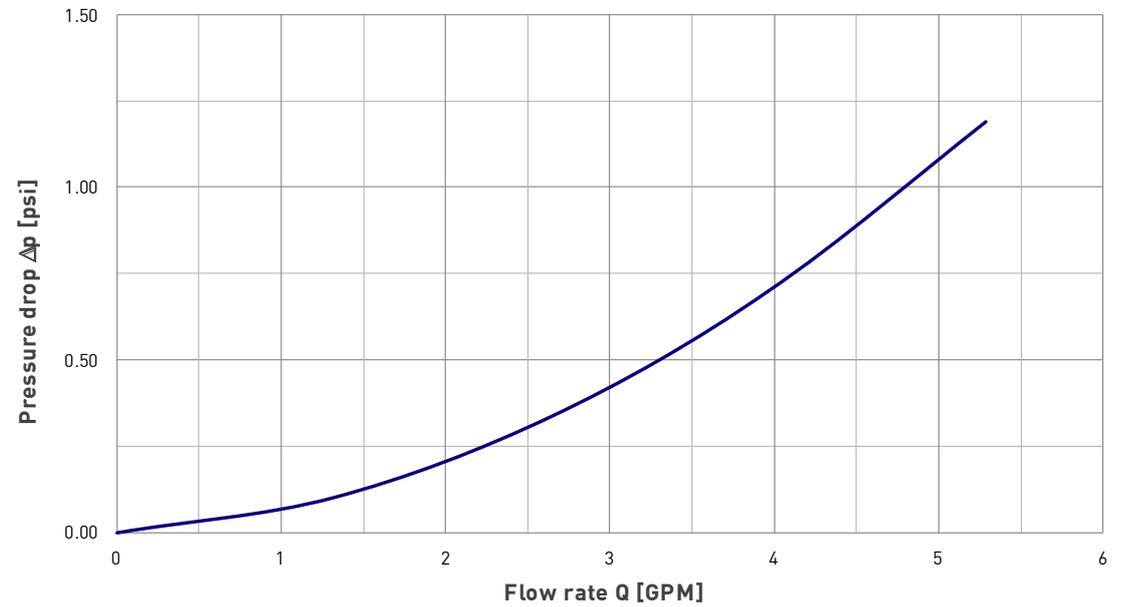
FMG93B



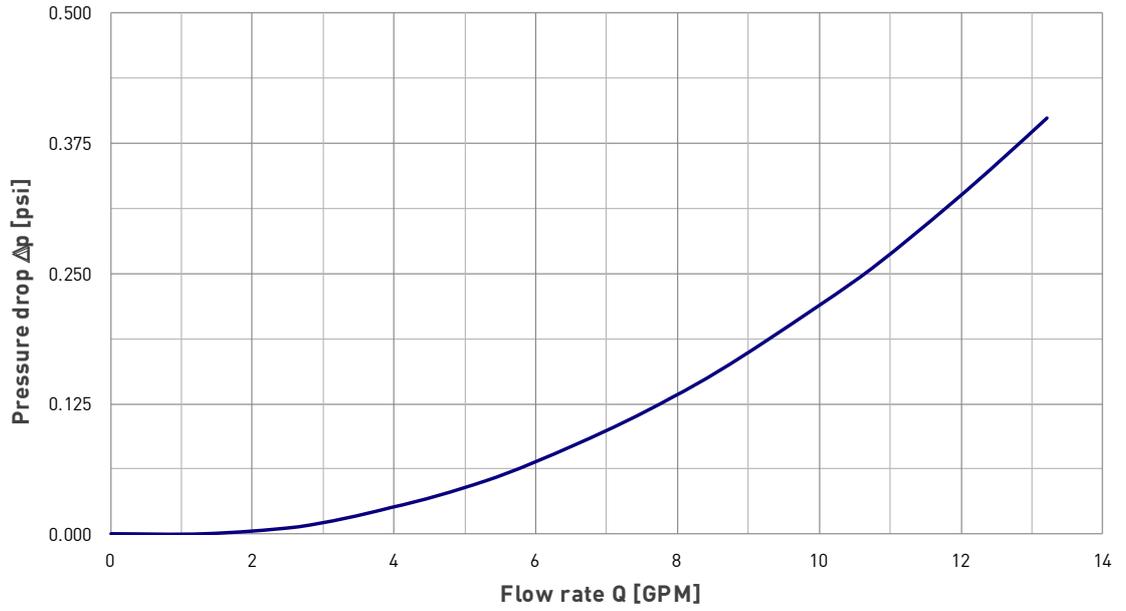
FMG96B



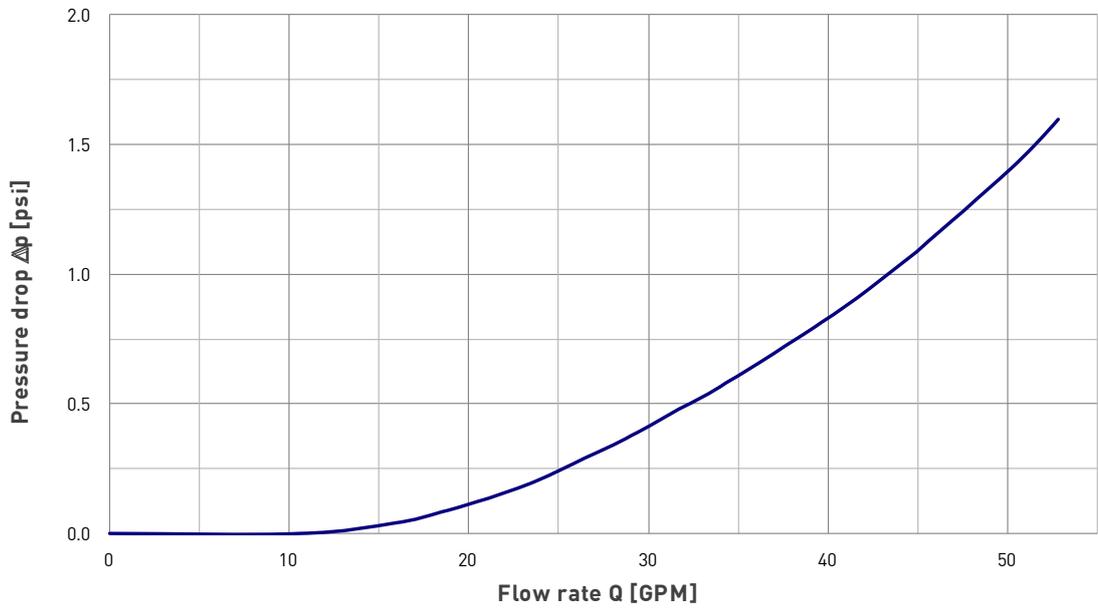
FMG98B



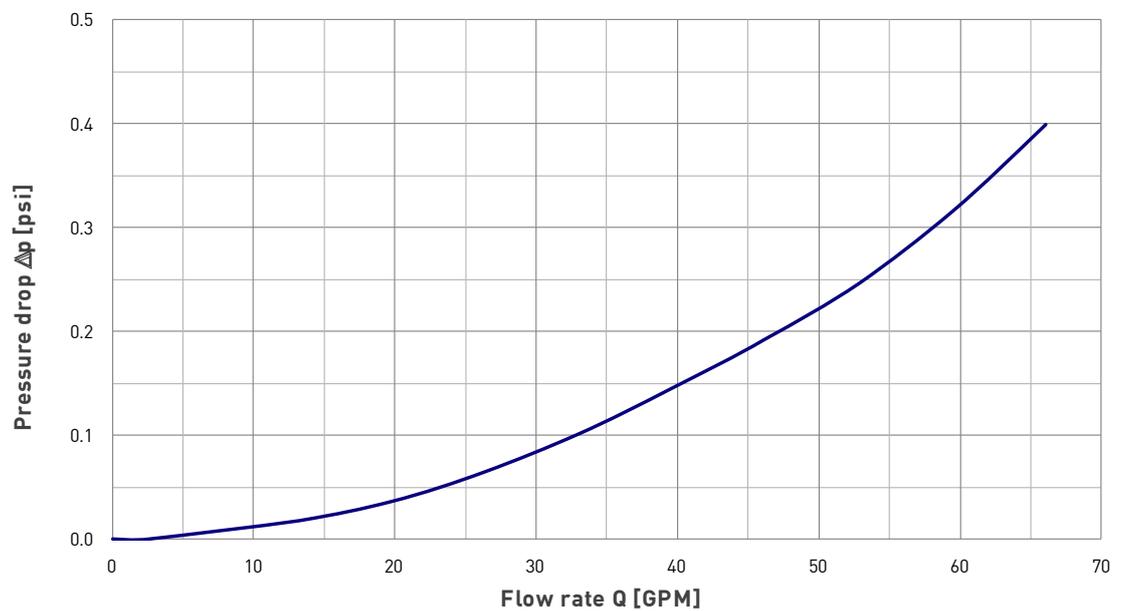
FMG915B



FMG920B

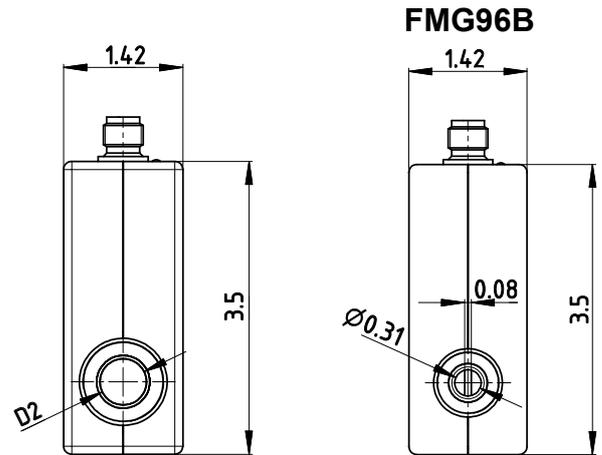
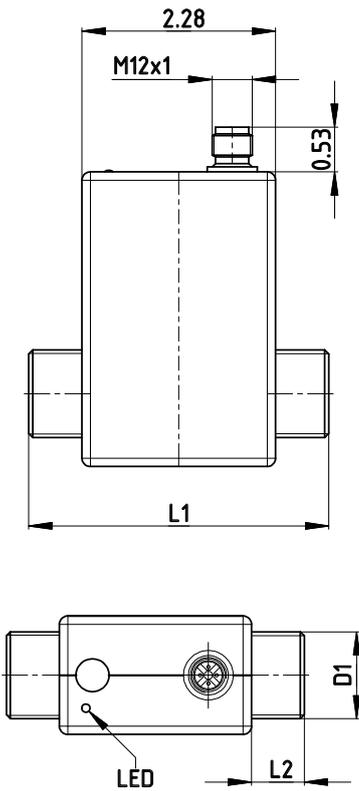


FMG925B



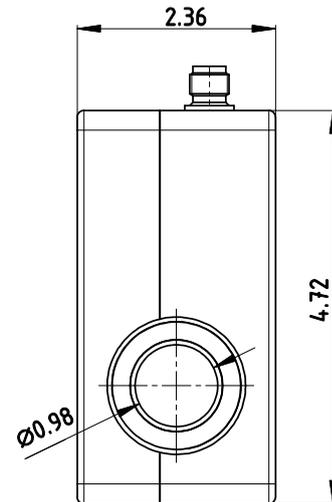
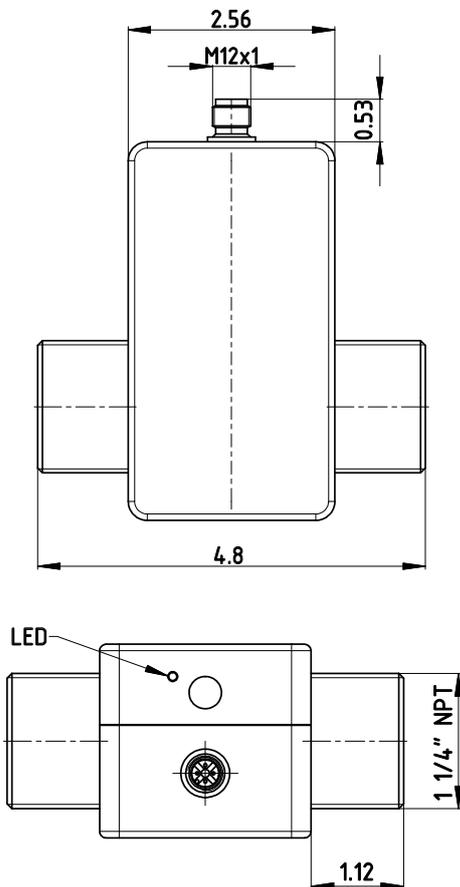
9.4 Dimensions

FMG90B:



Type	L1	L2	D1	D2
FMG93B	3.35	0.51	3/8" NPT	Ø 0.12
FMG96B	3.35	0.51	1/2" NPT	Ø 0.31 x 0.08
FMG98B	3.35	0.51	1/2" NPT	Ø 0.31
FMG915B	3.54	0.63	3/4" NPT	Ø 0.55
FMG920B	3.54	0.63	1" NPT	Ø 0.71

FMG925B:



For your notes

For your notes

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- ☑ Transducers & Strain Gages
- ☑ Load Cells & Pressure Gages
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

FLOW/LEVEL

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☑ Communications-Based Acquisition Systems
- ☑ Data Logging Systems
- ☑ Wireless Sensors, Transmitters, & Receivers
- ☑ Signal Conditioners
- ☑ Data Acquisition Software

HEATERS

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- ☑ Metering & Control Instrumentation
- ☑ Refractometers
- ☑ Pumps & Tubing
- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments

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