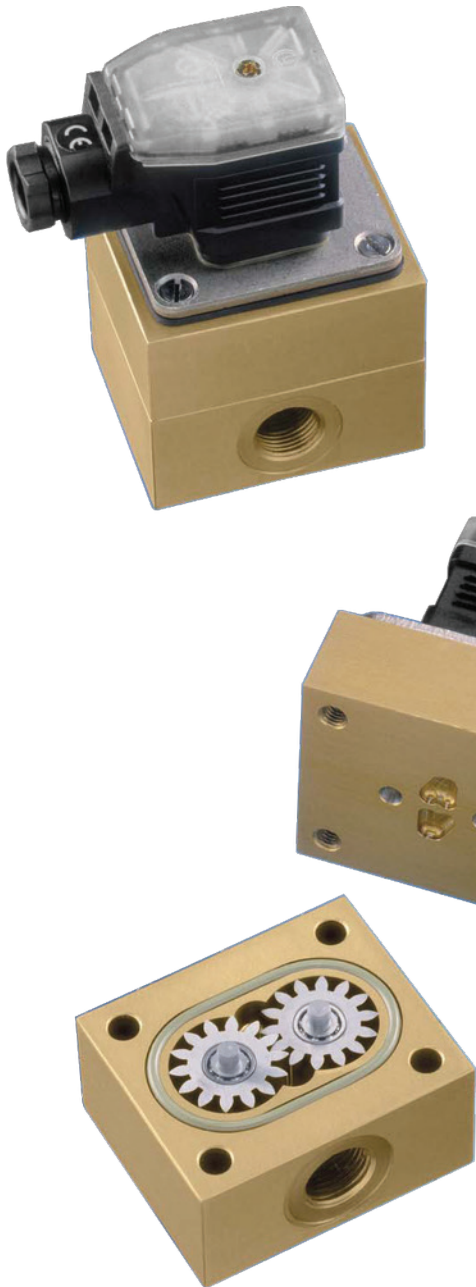


**1 YEAR**  
WARRANTY



# FPD20 Series

## Gear wheel flow sensor

# User's Guide

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It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**WARNING:** These products are not designed for use in, and should not be used for, human applications.

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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:



One Omega Drive, P.O. Box 4047  
Stamford, CT 06907-0047  
Tel: (203) 359-1660  
e-mail: info@omega.com

### Hazard signs and other symbols used:



**DANGER!** Risk of death due to electric current!  
This sign indicates dangers which could lead to serious health defects or to death.



**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!** Risk of injury in the case of excessive pressure!  
This sign indicates dangers which could arise from excessive pressure in a piece of equipment.



**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 FPD20 series from Omega are high-precision instruments for measuring volumetric flow and for dosing applications. They work on the positive displacement principle. Media used are oils and other viscous lubricating fluids.

### Measuring principle:

The flowing medium sets the pair of precision gears proportionally to flow rate into rotation. A non-contact pick-up senses the wheel rotation.

As every tooth produces a pulse, the sensor's resolution is extremely high and even tiny volumes can be measured.

The frequency produced is proportional to flow rate.

The FPD-22 has a double channel-output signal with approx. a 90° phase offset. For standard applications the read out of one channel is sufficient. In case the flow direction should be determined, both channels are read.

### Can be used in:

- Flow rate measurements
- Consumption measurements
- Dosing applications

### Versions and scope of delivery:

- FPD-... Flow sensor + adapters
- FPD-...-BSPP Only flow sensor

## 1.1 Intended use

The FPD20 is only intended to be used for measuring volumetric flow and for dosing applications in machines or systems.



### WARNING! No safety component!

The gear wheel flow sensors of the series FPD20 are not safety components in accordance with Directive 2006-42-EC (Machine Directive).

↳ Never use the FPD20 as a safety component.

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



### CAUTION! Material damage!

The flow sensor is not suitable for measuring water.

Before installing the device, check that the wetted materials of the device are compatible with the media being used (→ "Wetted components").

## 1.2 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 FPD20, 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 FPD20 correspond 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 FPD20 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").
- ⚠ Only use the FPD20 if it is in perfect condition. Damaged or faulty devices must be checked without delay and, if necessary, replaced.
- ⚠ When fitting, connecting and removing the FPD20 use only suitable appropriate tools.
- ⚠ Hold the volume sensor during fitting and in transport only by its housing, never by the plugged connector socket!
- ⚠ 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:

- ⚠ Only the housing of the flow sensor FPD-23 can be dismantled for cleaning, the other flow sensors must under no circumstances be dismantled as this will damage the instrument!
- ⚠ When removing the upper section of the flow sensor, do not use screwdrivers or similar tools as levers. Pliers must not be used to remove the gear wheels from the housing.

- ⚠ No abrasive media permitted.
- ⚠ The pressure loss  $\Delta p$  must not be exceeded, otherwise it could cause damage:
  - $\Delta p = 145$  psi by FPD-21 and FPD-22
  - $\Delta p = 232$  psi by FPD-23 and FPD-24.
- ⚠ Leaks of hazardous materials that are conveyed must be collected and disposed of in such a way that there is no danger to persons or to the environment. Statutory regulations must be observed in these cases.
- ⚠ Important for maintenance, cleaning and disassembly:  
The device and conduits can still contain the conveyed medium or a cleaning agent. All regulations concerning this medium must be complied with. Sufficiently large collecting containers should be available.
- ⚠ During work on and removal of sensors depressurize pipework and disconnect electricity.

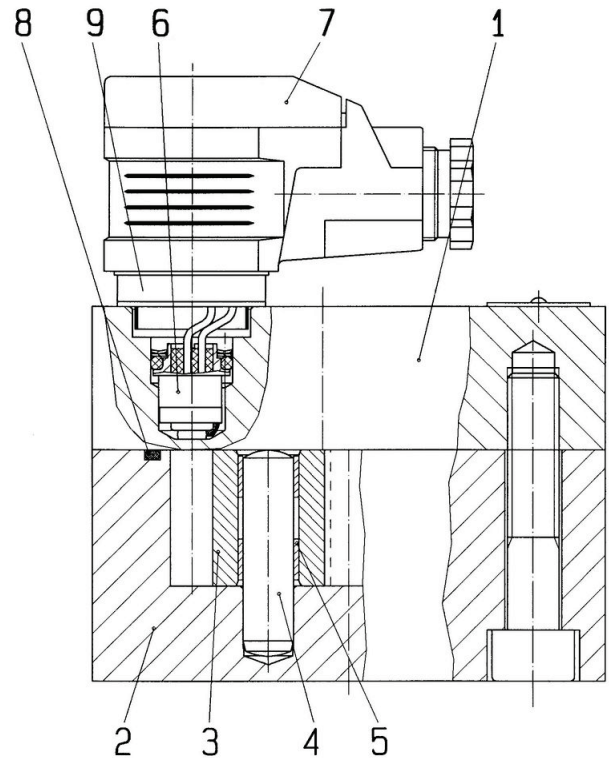
Further warnings that are specifically relevant to individual operating procedures or activities can be found at the beginning of the relevant sections of this operating manual.

### 3 Construction and function

Inside the sensor housing are two gear wheels and their low-friction bearings. During operation these are driven by the moving fluid. This gear wheel movement is sampled non-contacting through a sensor in the top of the housing and converted into electric signals. The signals are conveyed via a preamplifier plugged to the top of the housing to the display unit which is connected to the meter.

#### Construction / Components:

- ① Top of the housing.
- ② Bottom of the housing.
- ③ Gear.
- ④ Bearing shaft.
- ⑤ Bearing.
- ⑥ Sensor.
- ⑦ Connector socket with preamplifier.
- ⑧ O-ring.
- ⑨ Plug.





## 4 Installation and electrical connection

Before delivery the flow sensor was tested in the factory and is ready to use as soon as it has been fitted and the electrical leads connected. Safe access to the integral measuring unit for visual inspection should be provided at all times, even if the unit is in operation.



### CAUTION! Material damage!

Hold the volume sensor during fitting and in transport only by its housing, never by the plugged connector socket!

Before installing, check that

- the wetted materials of the device are suitable for the media being used (→ § 9.1 "Wetted components").
- 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 FPD20

The device can be connected with your system with the aid of pipe connections in the housing (→ § 9: "Technical data").



### CAUTION! Material damage!

Only piping and connectors may be used which are suitable for the expected pressure range. Observe the specifications of the manufacturer concerned!

↳ Ensure that the maximum operating pressure of the flow sensor cannot be exceeded.

### Mounting:

- ↳ Firstly deaerate the system completely.
- ↳ Clean the flow system thoroughly. All component parts must be free of installation residues (metal shavings, weld spatter).
- ↳ Turn the adapter into the flow sensor (not applicable for type FPD-...-BSPP).
- ↳ Connect the pipes to the inlet and outlet of the metering unit. Observing the manufacturer's instructions.  
Here is:
  - the fitting position any
  - the flow direction any
- ↳ When installing, make sure no jointing compounds get into the interior of the pipelines.



IMPORTANT!

The flow sensor must not be distorted during installation.

- ↳ After commissioning, check all connections for leaks.

## 4.2 Electrical connection

The electrical connection of the FPD20 is via cable socket.

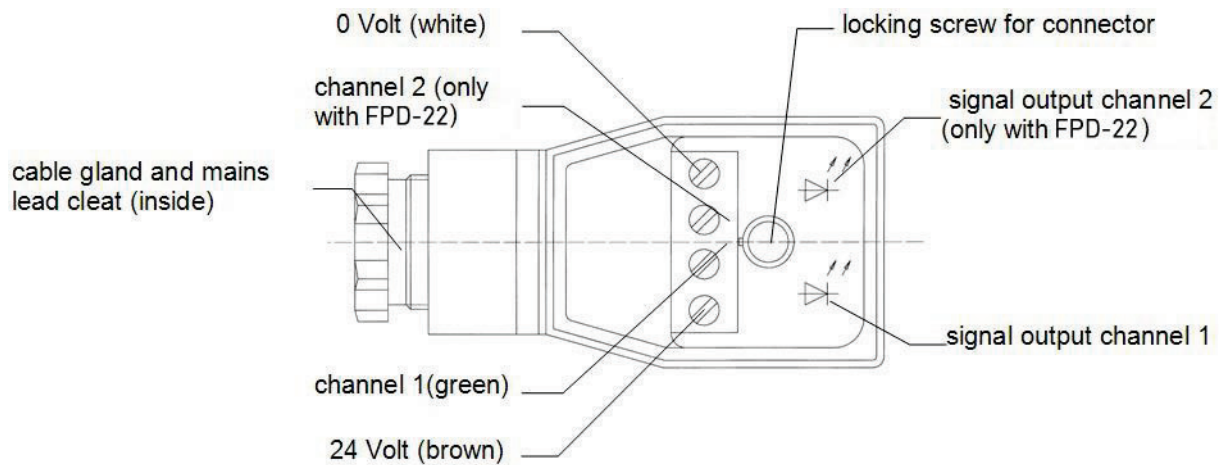
### CAUTION! Electric current!



The electrical connection of the FPD20 should only be carried out by a fully qualified electrician.

↪ De-energize the electrical system before connecting the FPD20.

- ↪ Unscrew the fastening screws and pull the cable socket off of the top of the housing.
- ↪ Pull the locking screw out of the connector. Only after removing the screw, you can open the connector socket's cap and pick them away.
- ↪ Open the connector socket's cap and loosen the cable gland and the mains lead cleat.
- ↪ Arrange the connection cable through the screwed cable gland and fix the electrical connections according to the allocation plan below.



- ↪ Tighten the mains lead cleat and the cable gland.
- ↪ Close the cap and put the locking screw into the connector socket.
- ↪ Put the connector socket on the plug and tighten the locking screw slightly.

## 5 Operation

The flow sensor has been factory-tested before delivery. It is ready to use as soon as it has been mounted and the electrical leads connected.

When it is in use, one LED in the connector lights up as long as there is a continuous flow of fluid through the measuring unit.



**IMPORTANT!** Comply with the permissible limits!

The flow sensor must only be operated within the permitted limits (→ § 9: "Technical data").

## 6 Problems and returns

If the flow sensor is not operating perfectly, first check the electrical components while the unit is operating.

**⚠** This work may only be done by a qualified electrician.

### Problems:

The following table details what problems you can solve yourself and how to solve them.

Problems	Possible cause	Remedy
The LED on the flow sensor is lit but the values displayed are wrong.	Faulty connection between the flow sensor and the analyzing unit.	Check the connection and replace the cable or connector if necessary.
The LED display does not illuminate during operation (there is definitely media flow).	Damaged wiring between sensor and circuit board.	Send the meter to the manufacturer for repair.
	The sensor is defective.	
	The preamplifier is defective.	Check preamplifier and replace if necessary.
	Failure of the supply voltage.	Check supply cable and fuses.
	Measuring unit is blocked.	<b>Switch off the volume sensor immediately!</b> The volume sensor can be dismantled and cleaned (→ "Cleaning").
Leakage, escaping medium	Leaking o-ring in housing.	Check the compatibility of the seal, consult the manufacturer if necessary and install a new o-ring (only with FPD-23) or let install by manufacturer.

### Returns:

When returning OMEGA equipment please note that inspection and/or repair can only take place when accompanied by a Safety Data Sheet for the flow medium, and the equipment has already been flushed and cleaned prior to return. If this condition is not observed, then OMEGA reserves the right to return the instrument carriage unpaid.

These conditions serve to protect the safety of our staff - we are grateful for your understanding.

## 7 Maintenance and cleaning



### **CAUTION! Risk of injury due to electric shock or over-pressurization!**

There is a great risk of injury when working on a live or pressurized device.

↪ Make sure that the plant is shut down professionally.



↪ Make sure the system is depressurized before you start working with or remove the device.



### **CAUTION! Material damage in case of curing fluids or deposits!**

Curing fluids or deposits can damage the device and its components.

↪ Clean the device as soon as possible using a suitable cleaning agent (→ § 7.2.2).



### **CAUTION! Material damage when opening!**

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

↪ Never open or dismantle the device.

Exception: Open only the FPD-23 for cleaning (→ § 7.2.3).

### 7.1 Maintenance

The FPD20 is maintenance-free and cannot be repaired by the user. In case of a defect, the device must be replaced or returned to the manufacturer for repair.

#### **IMPORTANT! Clean in regularly scheduled intervals.**

The FPD20 should be flushed with a suitable cleaning agent in regularly scheduled intervals. The cleaning intervals depend on the properties of the fluid being used.



↪ Comply with the safety data sheet or the specifications of the manufacturer of the fluid being used.

### 7.2 Cleaning



#### **IMPORTANT! Open only the FPD-23 for cleaning!**

Never dismantle the volume sensors FPD-21, FPD-22 and FPD-24 under any circumstances since that will damage the measuring instrument!

#### 7.2.1 General cleaning

Clean the FPD20 with a dry or slightly damp lint-free cloth. Do not use sharp objects or aggressive agents for cleaning.

### 7.2.2 Flushing the volume sensor

- ↪ Remove the flow sensor (→ § 8: "Removing the device").
- ↪ Empty the measurement device.
- ↪ Flush the device with a cleaning agent that is suitable for the components (→ § 9.1) being used (e.g., solvents, acetone...).
- ↪ Reinstall the measuring instrument in your metering section (→ § 4.1).

### 7.2.3 Cleaning the FPD-23

#### **CAUTION! Material damage when opening!**

Opening with unsuitable tools can cause scratches and damages to the interior surfaces of the device. They lead to measurement errors, premature wear and malfunctions.



- ↪ Never lever apart the volume sensor in the separation joint between the housing top and the housing bottom with a screwdriver or similar tool.
- ↪ Never take the gear wheel out of the housing with a pair of piston.

- ↪ Loosen and remove the fastening screws that hold both measuring-element housing-halves together.
- ↪ Carefully separate the housing top from the housing bottom.
- ↪ Carefully remove the interior volume sensor components.
- ↪ Clean the interior of the housing bottom, the gear wheel, the bearing and the O-ring with a cleaning agent that is suitable for the material (e.g. solvents, acetone...).

#### **Important in case of damages!**



If mechanical damage is found within the housing or on the gear wheels, the complete unit must be returned to the manufacturer for repair. (→ § 6: "Returns").

- ↪ All parts must be free of contamination. Ensure that no foreign matter remains inside the flow sensor during installation.
- ↪ Insert both gear wheels and their bearings in the lower housing part.
- ↪ Lay the o-ring in the groove of the housing.
- ↪ Place the upper housing part over the lower housing part.
- ↪ Tighten all the screws holding the housing crosswise with a torque of 50 Nm.
- ↪ Reinstall the measuring instrument in your metering section (→ § 4.1).

## 8 Removing the device 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 removal:

Before removing, make sure

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

### Removing the device:

- ↪ Loosen the securing screw on the connector socket cap.
- ↪ Remove the cable socket cover and pull the cable socket off the housing.
- ↪ Remove the electrical connections.
-  The device and conduits may still contain the conveyed medium or a cleaning agent. All regulations concerning this medium must be complied with. Sufficiently large collecting containers should be available.
- ↪ Disengage the pipeline connections from the housing with appropriate tools and remove the FPD20.
- ↪ When using hardening media, clean the flow sensor with a suitable cleaning agent as promptly as possible (→ § 7.2.2).



**IMPORTANT!** Do not hold onto the cable socket!

When cleaning, transporting and installing the flow sensor, make sure that it is carried by holding the housing only and not by the connector socket.

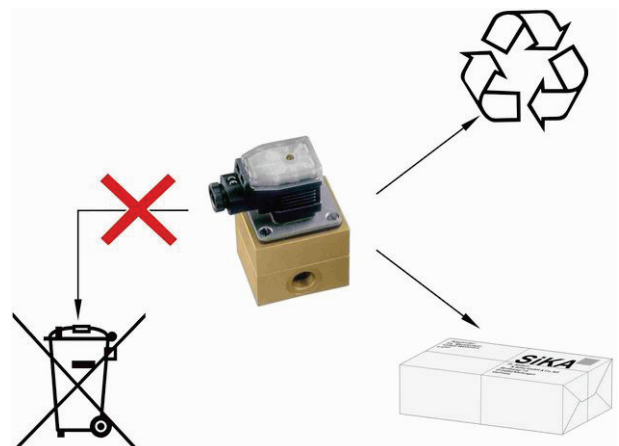
### Disposal:



### NO HOUSEHOLD WASTE!

The FPD20 consists of various different materials. It must not be disposed of with household waste.

- ↪ Take the FPD20 to your local recycling plant
- or
- ↪ send the FPD20 back to your supplier or to OMEGA.





## 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 FPD20

Type	FPD-21	FPD-22	FPD-23	FPD-24
<b>Measurement device characteristics</b>				
Measuring range *	0.02...4 l/min	0.16...16 l/min	1..65 l/min	1...200 l/min
Accuracy (of reading)	±2 %	±1 %	±2,5 %	±1 %
Number of measuring channels	1	2	1	1
Display for pulse signal (in the cable socket)	1 LED	2 LEDs (2 channels)	1 LED	1 LED
<b>Output signal characteristics</b>				
<b>Frequency output:</b>				
- Pulse rate / K-factor	25,000 pulses/l	4,082 pulses/l	500 pulses/l	191.5 pulses/l
- Resolution	0.04 ml/pulse	0.245 ml/pulse	2 ml/pulse	5.222 ml/pulse
- Signal shape	Square wave signal, PNP • duty cycle 1:1 ±15 %			
- Power output	0.3 W • short-circuit proof			
<b>Electrical characteristics</b>				
Supply voltage	12...30 V <sub>DC</sub> • protected against polarity reversal			
Power consumption (short-circuit proof)	0.6 W	0.9 W	0.6 W	0.6 W
Electrical connection	Connector plug EN 175301-803-A, including cable socket			
Degree of protection according to EN 60529	IP 65 (with attached cable socket)			
<b>Process variables</b>				
Medium to measure:	Viscous fluids with lubricity (No water or aqueous solutions • No abrasive substances)			
- Viscosity	20...4,000 mm <sup>2</sup> /s	1...3,000 mm <sup>2</sup> /s	20...4,000 mm <sup>2</sup> /s	20...4,000 mm <sup>2</sup> /s
- Temperature	14...176 °F			
Ambient temperature	14...176 °F			
max. operating pressure	2901 psi	2321 psi	2321 psi	1160 psi
max. pressure peaks	3481 psi	2901 psi	2901 psi	1450 psi
max. pressure drop	146 psi	146 psi	233 psi	233 psi
Process connection	G <sup>1</sup> / <sub>4</sub>	G <sup>3</sup> / <sub>8</sub>	G <sup>3</sup> / <sub>4</sub>	G1
Adapter **	¼-18 NPT	⅜-18 NPT	¾-14 NPT	1-11 ½ NPT
Weight	0.5 kg	0.7 kg	1.9 kg	6 kg
Geometrical gear volume	0.04 cm <sup>3</sup>	0.245 cm <sup>3</sup>	2 cm <sup>3</sup>	5.222 cm <sup>3</sup>

\* Limited measuring range with higher viscosities (→ § 9.2 "Pressure drop").

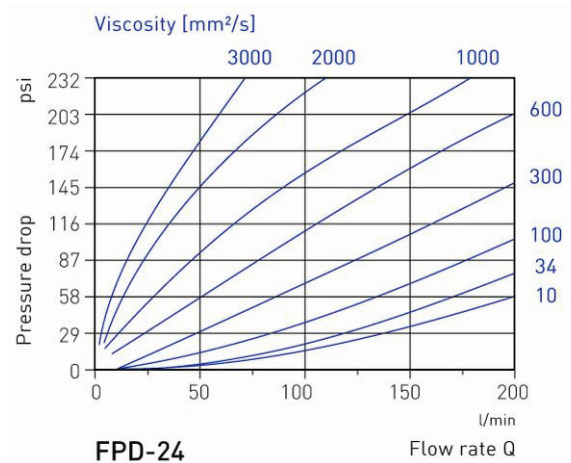
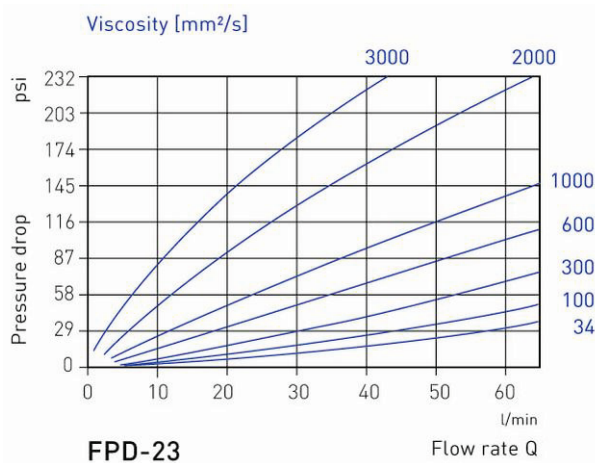
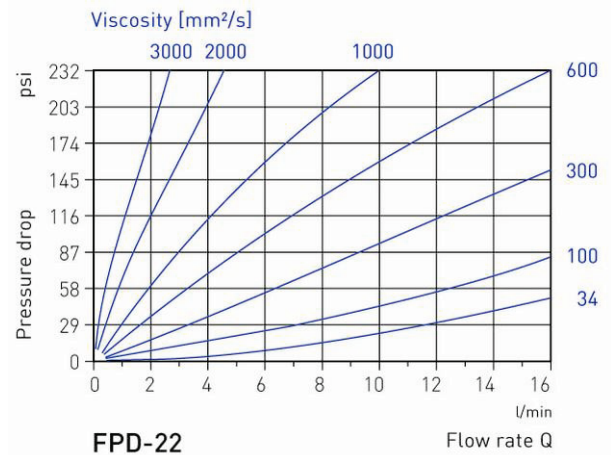
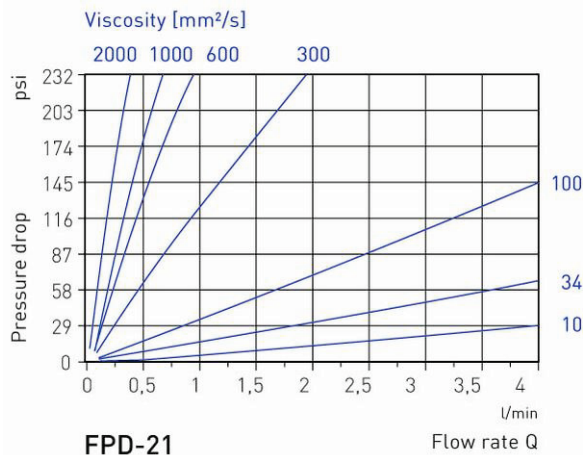
\*\* not Type FPD-...-BSPP.

**Wetted components:**

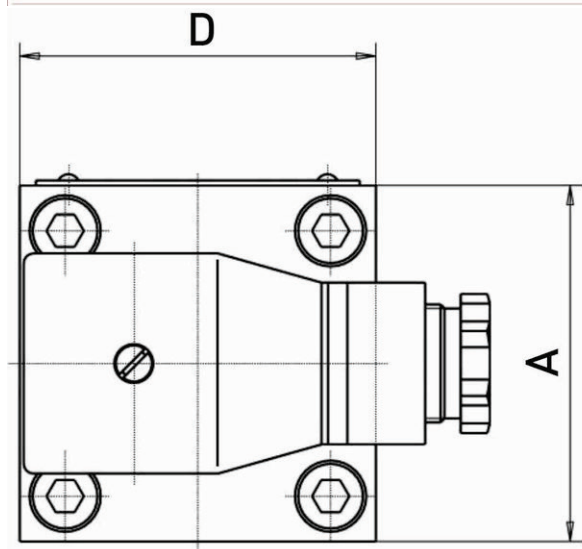
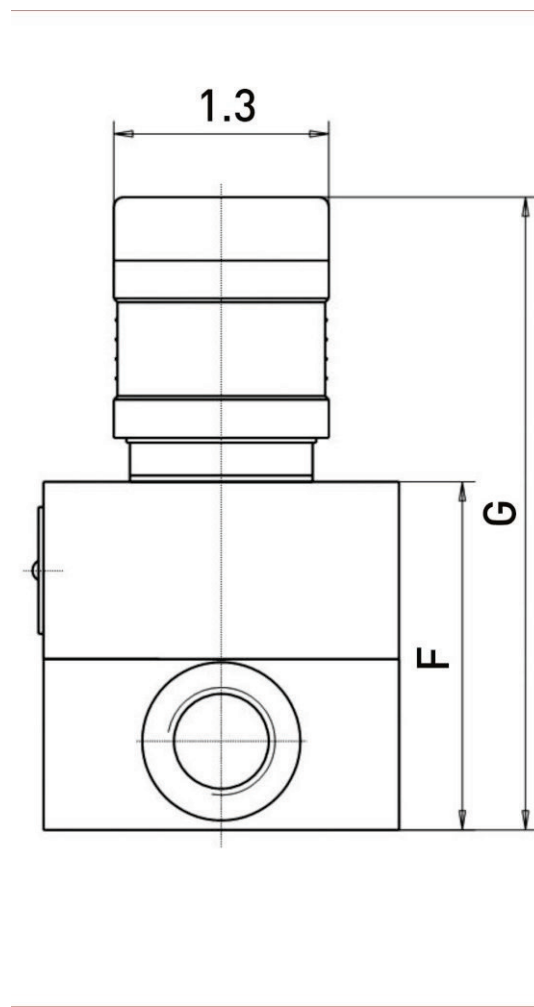
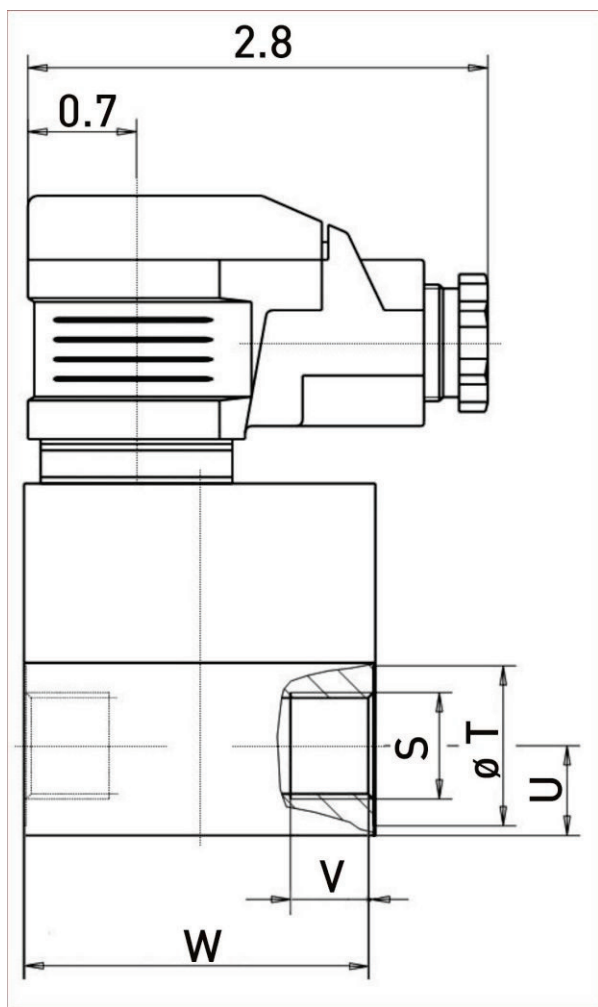
Type	FPD-21	FPD-22	FPD-23	FPD-24
Housing	Aluminum AlMgSi F30 (hard faced)	Aluminum, golden anodized	Aluminum AlMgSi F30 (hard faced)	
Gears	Stainless steel 1.4462	Steel 16 MnCr5, hardened	Stainless steel 1.7139	
Bearing	Ball bearing	Stainless ball bearing	Plain bearing (P10)	Ball bearing
Gaskets	FKM			
Adapter*	Steel, zinc-coated			

\* not Type FPD-...-BSPP.

**9.2 Pressure drop**



**9.3 Dimensions**



Type	FPD-21	FPD-22	FPD-23	FPD-24
A	2.2	2.2	3.9	6.7
D	2.2	2.2	3.5	4.7
F	2	2.2	2.9	4.1
G	3.8	4.2	4.6	5.9
S	G <sup>1</sup> / <sub>4</sub>	G <sup>3</sup> / <sub>8</sub>	G <sup>3</sup> / <sub>4</sub>	G1
T	0.8	1	1.4	1.7
U	0.5	0.6	0.9	1.2
V	0.5	0.5	0.7	0.8
W	2.2	2.2	3.5	4.7
Dimensions in in				

**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 the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED 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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