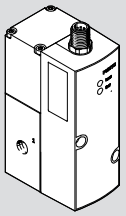
VPPM-...-LK

Proportional-pressure regulator



FESTO

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Operating instructions

8110187
2021-11c
[8110189]

8110187

Translation of the original instructions

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IO-Link® is a registered trademark of its respective trademark holder in certain countries.

1 Applicable Documents

All available documents for the product ➔ www.festo.com/sp.

2 Safety

2.1 Safety instructions

- Only use the product in its original condition without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Take into account the ambient conditions at the location of use.
- Before working on the product, switch off the power supply and secure it against being switched on again.
- Store the product in a cool, dry environment protected from UV and corrosion. Keep storage times short.

2.2 Intended use

The proportional-pressure regulator is intended to regulate a pressure proportional to a specified setpoint value. The product is intended for use in industrial environments.

2.3 Approvals

In combination with the UL inspection mark on the product, the information in this section must also be observed in order to comply with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada.

UL certification information	
Product category code	QUYX, QUYX7
File number	E322346
Considered standards	UL 610101, CAN/CSAC22.2 No. 610101
UL mark	c UL us LISTED

Tab. 1: UL certification information

- The unit shall be supplied by a power source which fulfils the requirements on a limited-energy circuit in accordance to IEC/EN/UL/CSA 61010-1 or on a Limited Power Source (LPS) in accordance to IEC/EN/UL/CSA 60950-1 or IEC/EN/UL/CSA 62368-1 or a Class 2 circuit in accordance to NEC or CEC.

Electrical data and ambient conditions	
Supply voltage	24 V DC
Max. power VPPM-6, VPPM-8	7 W
Max. power VPPM-12	12 W
Rated pressure	up to 1.1 MPa
Max. installation height	2000 m

Tab. 2: Electrical data and ambient conditions

3 Additional information

- Contact the regional Festo contact if you have technical problems ➔ www.festo.com.
- Accessories and spare parts ➔ www.festo.com/catalogue.

4 Product overview

4.1 Function

The proportional-pressure regulator controls the pressure proportionally to a specified setpoint value. A built-in pressure sensor records the pressure at the working port and compares this value with the setpoint value. If there are deviations between the setpoint value and actual values, the proportional-pressure regulator is actuated until the output pressure has reached the setpoint.

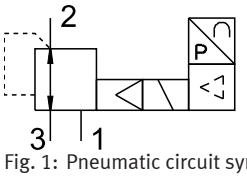


Fig. 1: Pneumatic circuit symbol

4.2 Structure

4.2.1 Product design

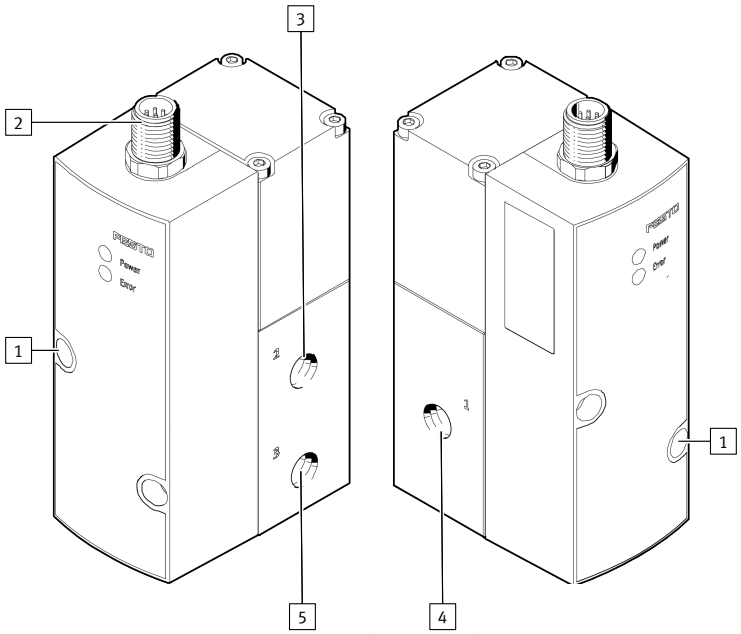
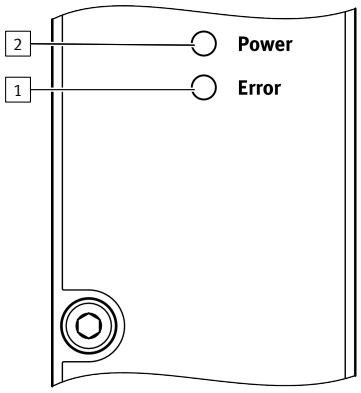


Fig. 2: Connections and mounting holes (in-line valve)

1 Through holes for mounting. With VPPM-12L-...-LK... in the manifold block
2 Electrical connecting plug
3 Working air port (2)
4 Compressed air port (1)
5 Exhaust air port (3)

4.2.2 Display and control elements



1 Red LED [error]
2 Green LED [power]

Fig. 3: Display components

5 Assembly

5.1 Mounting clearances

During assembly make sure that there is sufficient space for the cable connection and the tubing connections. Place the device as close to the consumer as possible. This leads to better control accuracy and shorter response times.

5.2 Wall mounting

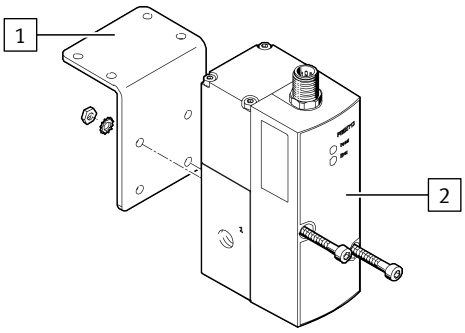
5.2.1 In-line valve

VPPM-6L-... and VPPM-8L-...

- Fasten the VPPM-... [2] with 2 M4 screws. If necessary, use the bracket VAME-P1-A [1].
  - Tightening torque: 1.5 Nm

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Only apply a static load to the VPPM-... when mounting the VPPM-... with the assistance of the bracket.



VPPM-12L-...

- Fasten the VPPM-... with 2 M5 screws.
  - Tightening torque: 2.0 Nm

5.2.2 Sub base valve

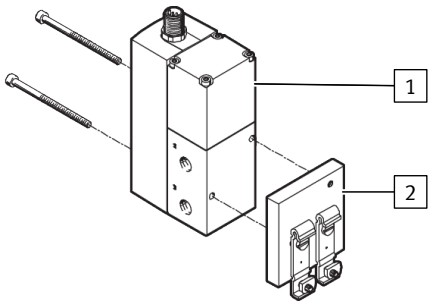
VPPM-6F-... and VPPM-8F-...

- Fasten the VPPM-... to the terminal strip VEABM-P1-SF-G18... with 2 M6 screws.
  - Tightening torque: 1.5 Nm

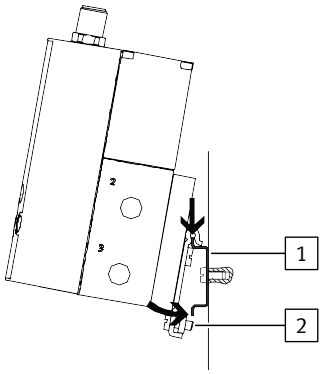
5.3 H.rail mounting (in-line valve)

VPPM-6L-... and VPPM-8L-...

1. Attach the H-rail adapter [2] to the VPPM-... with 2 screws [1].
   - Screws: M4 x 65 for VPPM-6L-..., M4 x 77 for VPPM-8L-...
   - Tightening torque: 1.5 Nm



2. Attach the VPPM -... to the H-rail [1].



3. Fasten the VPPM-... with the retaining screw [2] of the H-rail adapter.
   - Tightening torque: 1.5 Nm

6 Installation

6.1 Pneumatic installation (in-line valve)

1. Connect the compressed air port (1) and the working air port (2) with tubing ➔ Fig. 2.
2. Fit a silencer at the exhaust air port (3) or install an exhaust air duct ➔ Fig. 2.

Operating medium

NOTICE

Too much residual oil content in the compressed air will reduce the service life of the valve.

- When using bio-oils (oils that are based on synthetic ester or native ester, e.g. rapeseed oil methyl ester), the maximum residual oil content of 0.1 mg/m³ must not be exceeded (ISO 8573-1:2010 [–:–:2]).

6.2 Electrical installation

⚠ WARNING

Risk of injury due to electric shock.

- For the electrical power supply, use only PELV circuits in accordance with IEC 60204-1/EN 60204-1 (Protective Extra-Low Voltage, PELV).
- Observe the general requirements of IEC 60204-1/EN 60204-1 for PELV circuits.
- Only use voltage sources that ensure a reliable electric separation from the mains network in accordance with IEC 60204-1/EN 60204-1.

NOTICE

Malfunction due to impaired immunity to interference

Long signal lines reduce the immunity to interference.

- Use the shortest possible signal lines.

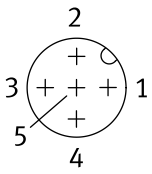
NOTICE

- The connector must not be twisted out of the intended position.
- The tightening torque of the M12 plug socket with cable must not exceed 0.5 Nm.

– The IO-Link master may have either port type A or port type B.

Pin allocation

The individual pins on the electrical connection are assigned as follows:

M12 bushing	Pin	Allocation	Function
	1	24 V DC ($U_{EL/SEN}$)	Operating voltage supply (PS)
	2	n. c.	not connected
	3	0 V DC ($U_{EL/SEN}$)	Operating voltage supply (PS)
	4	C/Q	Data communication
	5	n. c.	not connected
	Lug (on the plug)	FE	Functional earth

Tab. 3: Pin allocation

7 Commissioning

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- Keep high-frequency radiation away from the VPPM-... in order to avoid increased tolerances of the outlet pressure.
- The VPPM-... interprets setpoint signals that are less than 1% Full Scale (FS) as 0 V. In this case the working pressure is set to ambient pressure.
- If the supply voltage or data communication is lost, the output pressure remains unregulated. Leakage results in a change of pressure over the long term.

1. Connect the VPPM-... to an IO-Link master or an I-Port master.

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   - The VPPM-... communicates with the master via the corresponding protocol. The setpoint values and actual values are transmitted cyclically, the diagnostic values acyclically.
   - The valve has a 16-bit input word (setpoint value) and a 16-bit output word (actual value).
   - If the desired data rate is not automatically set at IO-Link, it is possible to force the data rate with a write command to ISDU parameter 0x0048: COM3 = 03, COM2 = 02. The data rate for I-Port is always set to COM3.
   - The power supply of 24 V DC is supplied by the IO-Link master.

2. Select a suitable parameter record ➔ 8 Parameterisation.

The following 3 tables show the recommended parameter sets for the different pneumatic ports:

Parameter sets recommended for VPPM-6...				
Tube length[1)]	Open system	Output volume in ml		
		0 ... 100	100 ... 1000	>1000
0 m	3	3	2	1
1 m	3	3	2	2
3 m	3	3	3	2
≥ 5 m	3	3	3	2

1) with inner tubing diameter 6 mm or 8 mm

Tab. 4: Parameter sets recommended for VPPM-6...

Parameter sets recommended for VPPM-8...				
Tube length[1]	Open system	Output volume in ml		
		0 ... 500	500 ... 2000	>2000
0 m	3	1	2	3
1 m	3	1	2	3
3 m	3	2	3	3
≥ 5 m	3	3	3	3

1) with tubing diameter 8 mm or 10 mm

Tab. 5: Parameter sets recommended for VPPM-8...

Parameter sets recommended for VPPM-12L-...				
Tube length[1]	Open system	Output volume in ml		
		0 ... 2000	2000 ... 10000	>10000
0 m	3	1	2	3
1 m	3	1	2	3
3 m	3	2	3	3
≥ 5 m	3	3	3	3

1) with tubing diameter 12 mm or 16 mm

Tab. 6: Parameter sets recommended for VPPM-12L-...

8 Parameterisation

8.1 Overview of the valve parameters

Number	ISDU index	Subindex	Parameter
0	0x043	1	– Activate monitoring parameterisation errors – Activate limit monitoring for actual value – Activate monitoring supply voltage ➔ Tab. 8 Monitoring
1	0x043	2	– ID ➔ Tab. 9 ID
2	0x043	3	– Unit for pressure specifications (limit value and current pressure value) ➔ Tab. 10 Unit for pressure specifications (limit value and current pressure value)
3	0x043	4	– Control behaviour (preset) – Representation ProcessData Input (Actual value) – Filtering actual value ➔ Tab. 11 Settings: Control behaviour (preset), Representation ProcessData Input (Actual value), Filtering actual value
8 ... 11	0x068	0	– Condition counter limit (switching cycle counter) ➔ Tab. 12 Condition counter limit (switching cycle counter)
12	0x069	0	– Lower pressure limit Low Byte – Lower pressure limit High Byte ➔ Tab. 13 Lower pressure limit/Upper pressure limit
13			
14	0x06A	0	– Upper pressure limit Low Byte – Upper pressure limit High Byte ➔ Tab. 13 Lower pressure limit/Upper pressure limit
15			
16 ... 19	0x06B	0	– Condition counter actual value

Tab. 7: Parameter

8.2 Description of the valve parameters

Monitoring	
Number	0
Description	The monitoring of individual errors for the VPPM-... can be activated or deactivated independently from one other: – Monitoring of parameterisation error: monitors the valve parameterisation. An error message is generated for the following implausible settings: – Upper pressure limit ≤ Lower pressure limit – Upper pressure limit < or > control range (➔ Tab. 15 Ranges of values) – Lower pressure limit < 0 – Limit value monitoring: defines whether the limit values are monitored and whether a diagnostic message is issued if the limit value is undershot or exceeded. – Monitoring of load voltage: defines whether the load voltage U_{out}/U_{Val} is monitored. If the voltage drops too much, a diagnostic message is issued. Active monitoring causes the error to be sent to the IO-Link Master or the I-Port master and displayed by the [Error] LED of the VPPM-....
Bytes	Bit 7: monitoring of parameterisation errors Bit 6: limit monitoring Bit 2: monitoring of the load voltage $U_{out/val}$
Values	**Bit 7 6 5 4 3 2 1 0** Setting **0** x x x x x x x Monitoring of parameterisation errors ir 1 x x x x x x x Monitoring of parameterisation errors x **0** x x x x x x Limit monitoring inactive x 1 x x x x x x Limit monitoring active x x x x x **0** x x Monitoring Uout/Uval inactive x x x x x 1 x x Monitoring Uout/Uval active
Comment	x = value is unimportant for this setting, bold = default

Tab. 8: Monitoring

ID				
Number	1			
Description	Provides valve identification for I-Port.			
Values	In-line valve		Sub base valve	
	0x01:	1/8" 10 bar	0x31:	F6 10 bar
	0x02:	1/8" 6 bar	0x32:	F6 6 bar
	0x03:	1/8" 2 bar	0x33:	F6 2 bar
	0x11:	1/4" 10 bar	0x41:	F8 10 bar
	0x12:	1/4" 6 bar	0x42:	F8 6 bar
	0x13:	1/4" 2 bar	0x43:	F8 2 bar
	0x21:	1/2" 10 bar	—	—
	0x22:	1/2" 6 bar	—	—
	0x23:	1/2" 2 bar	—	—
Comment	Read only			

Tab. 9: ID

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If the unit for the pressure specifications is changed, the parameters for the pressure limit values and the input word (setpoint value) are not automatically converted.

- If the unit is changed, change the parameters for the upper and lower pressure limit values and the input word ➔ Tab. 15 Ranges of values.

Unit for pressure specifications (limit value and current pressure value)				
Number	2			
Description	Defines the unit for pressure indications: limit values, pressure setpoint specification and pressure actual value specification.			
Bytes	Bit 1.0			
Values	Bit 1	0	Setting	Resolution
	0	0	mbar (default)	1 mbar/bit
	0	1	kPa	1 kPa/bit
	1	0	psi	0.1 psi/bit
	1	1	reserved	
Comment	Set the input word before conversion of the unit to zero to avoid accidental pressure fluctuations.			

Tab. 10: Unit for pressure specifications (limit value and current pressure value)

Settings: Control behaviour (preset), Representation ProcessData Input (Actual value), Filtering actual value	
Number	3
Description	Parameterised via this function number are: – Control behaviour (preset): defines the characteristic curve used to control a defined setpoint pressure. – Representation ProcessData Input (Actual value): offers 3 options for what is displayed in the output word (data format ➔ Tab. 14 Process data): – Output of the current pressure value – Output as comparator bit: Bit 0 = 0: pressure value is outside the control range Bit 0 = 1: pressure value is within the control range – Combined output of current pressure value and comparator bit. Bit 0 is also used as a comparator bit. It is no longer used for representing the pressure value. – Filtering actual value: defines he extent of smoothing of the measured values for limit monitoring. This can suppress possible malfunctions.
Bytes	Bit 1, 0: Control behaviour (preset) Bit 3, 2: Representation ProcessData Input (Actual value) Bit 5, 4: Filtering actual value
Values	**Bit 5 4 3 2 1 0** Setting of the control response x x x x **0 0** reserved x x x x 0 1 fast x x x x **1 0** Default: universal x x x x 1 1 Precise Setting of output data type x x **0 0** x x reserved x x **0 1** x x Default: current pressure value in the output word x x 1 0 x x Comparator bit x x 1 1 x x Current pressure value and comparator b Settings of measured value smo **0 0** x x x x Default: no measured value smoothing 0 1 x x x x Smoothing over 2 valu 1 0 x x x x Smoothing over 4 valu 1 1 x x x x Glättung über 8 Werte
Comment	x = value is unimportant for this setting, bold = default

Tab. 11: Settings: Control behaviour (preset), Representation ProcessData Input (Actual value), Filtering actual value

Condition counter limit (switching cycle counter)	
Number	8 ... 11
Description	A limit value for a counter can be set for the internal solenoid coil in the pilot control of the pressure regulator. If the limit value is exceeded, a message is sent to the IO-Link master.

Condition counter limit (switching cycle counter)		
Bytes	Bit 11 or 8: High Byte or Low Byte of the limit value (32-bit values, hexadecimal)	
Values	FFFFFFFF$_h$:	Default: Condition counter limit (switching cycle counter) activated, limit value inactive
	2DC6C0$_h$:	Example: Condition counter limit (switching cycle counter) activated and limit value 3,000,000d set.
	0	Condition counter limit (switching cycle counter) inactive (counter and diagnostic message deactivated, counter reset, counter actual value can read via 0x6B).

Tab. 12: Condition counter limit (switching cycle counter)

Lower pressure limit/Upper pressure limit	
Number	12 ... 13: Lower pressure limit 14 ... 15: Upper pressure limit
Description	These parameters are used to set the lower and upper pressure limit values and diagnostics. Limit value violations or limit value violations are only reported if the output word diagnosis is activated via the 'Activate limit monitoring for actual value' parameter ➔ Tab. 8 Monitoring.
Bytes	Bit 12 or 14: Low Byte Bit 13 or 15: High Byte
Values	Defaults: – Lower pressure limit = 0 (Low Byte: 0, High Byte: 0) – Upper pressure limit: max. pressure value of the valve type ➔ Tab. 15 Ranges of values
Remarks	The upper pressure limit must always be greater than the lower pressure limit. The pressure limit values are checked for validity during parameterisation. If there are invalid parameters and the 'Activate monitoring parameterisation errors' parameter is active, a corresponding error is output ➔ Tab. 10 Unit for pressure specifications (limit value and current pressure value).

Tab. 13: Lower pressure limit/Upper pressure limit

Process data
ProcessData Input (presure actual value)
ProcessData Output (pressure setpoint) LSB (bit 0) can be used as a comparator bit with parameterisation of output data

Tab. 14: Process data

VPPM-...	0L2H-LK...- S1	0L6H-LK...- S1	0L10H-LK...- S1
Value range[1)] Input word (decimal)	0 ... 2000/290/200	0 ... 6000/870/600	0 ... 10000/1450/1000
Value range[1)] Input word (hex)	0$_h$ ... 07D0$_h$/0122$_h$/00c8$_h$	0$_h$ ... 1770$_h$/0366$_h$/0258$_h$	0$_h$ ... 2710$_h$/05AA$_h$/03E8$_h$

1) If mbar/psi/kPa is set as the pressure unit.

Tab. 15: Ranges of values

9 Maintenance

9.1 Disassembly

NOTICE

- When switching off the VPPM.-..., first make sure that the setpoint value is set to 0, then that the supply pressure and finally the supply voltage are switched off.

1. Switch off the following energy sources:
   – Operating voltage
   – Compressed air
2. Disconnect the connections from the device.
3. Remove the device from the mounting surface or H-rail.

9.2 Cleaning

1. Switch off the following energy sources to clean the outside:
   – Operating voltage
   – Compressed air
2. Clean the device on the outside with a soft cloth as required.

10 Malfunctions

Status of the LED displays

Cause	Green LED [power]	Red LED [error]
Communication inactive	on	off
Communication active	flashes at 1 Hz (9:1)	off
Error/diagnostics	off	➔ Tab. 17 Error numbers
Internal error	off	flashes (5 Hz)

Tab. 16: Status of the LED displays

Error numbers

Error number	Description	Status of the red LED [Error]
0x5100	Undervoltage < 18 V	on
0x8CA1	Lower critical limit undershot	off
0x8CA2	Upper critical limit exceeded	off
0x8C42	Switching cycle counter limit value exceeded	off
0x6320	Incorrect parameterisation of the upper or lower limit value	Lights only if parameterised: – lower limit < 0 – upper limit < lower limit

Tab. 17: Error numbers

Fault clearance

Malfunction	Possible cause	Remedy
Device does not respond	No supply voltage, LED [power] off.	Check the connection of the supply voltage 24 V DC.
	No data communication.	– Check control unit. – Check connection.
Flow rate too low	Restriction of the flow cross section by connection technology, LED [Power] on.	Use alternative connections.
Pressure rise too slow	Large cylinder volume and long tube length.	Select another parameter set.
Pressure constant despite modified setpoint specification	Break in the electrical connecting cable.	Replace electrical connecting cable.
	Input pressure P1 too low.	Increase inlet pressure.
	Failure of data communication.	Replace data transmission line.

Tab. 18: Fault clearance

11 Technical data

General technical data		
Design		Proportional-pressure regulator
Mounting position		As desired, preferably horizontal (display elements facing upwards)
Materials		
Housing		Wrought aluminium alloy
Cover		PAXMD6 GF50/gr-P
Seals		Nitrile rubber
Lubrication		silicone-free
Weight		
VPPM-6...	[g]	400
VPPM-8...	[g]	560
VPPM-12...	[g]	2050

Tab. 19: General technical data

Operating and environmental conditions		
Medium		Compressed air in accordance with ISO 8573-1:2010 [7:4:4] inert gases
Information on operating medium		Lubricated operation not possible
Degree of protection		IP 65 when mounted, with tightened mounting screws, in combination with plug socket according to accessories.
Ambient temperature	[°C]	0 ... 60
Temperature of medium	[°C]	10 ... 50
Storage temperature	[°C]	–10 ... +70
Vibration and shock		
Vibration		Tested in accordance with DIN/IEC 68/EN 60068 Part 2-6; wall mounting: 0.35 mm path at 10 ... 60 Hz, 5 g acceleration at 60 ... 150 Hz[1)]
Shock		Tested in accordance with DIN/IEC 68/EN 60068 Part 2-27; wall mounting: ±30 g at 11 ms duration; 5 shocks per direction[1)]

1) Information does not apply when mounting the VPPM-.../VPPX-... on bracket VAME-P1-A/-T.

Tab. 20: Operating and environmental conditions

VPPM-...		0L2H	0L6H	0L10H
Pressure ranges				
Permissible input pressure P1	[MPa]	0 ... 0.4	0 ... 0.8	0 ... 1.1
	[bar]	0 ... 4	0 ... 8	0 ... 11
	[psi]	0 ... 58	0 ... 116	0 ... 159.5
Control range (output pressure P2)[1)]	[MPa]	0.002 ... 0.2	0.006 ... 0.6	0.01 ... 1
	[bar]	0.02 ... 2	0.06 ... 6	0.1 ... 10
	[psi]	2.9 ... 29	8.7 ... 87	1.45 ... 145
Total leakage when new	[l/h]	< 5		
Connection		G 1/8, 1/8 NPT, G 1/4, 1/4 NPT, G 1/2, 1/2 NPT		

VPPM-...		0L2H	0L6H	0L10H
Nominal width				
Pressurisation	[mm]	6 for VPPM-6... 8 for VPPM-8... 12 for VPPM-12...		
Exhaust port	[mm]	4.5 for VPPM-6... 6 for VPPM-8... 12 for VPPM-12...		

1) Input pressure P1 at least 0.1 MPa (1 bar, 14.5 psi) above output pressure P2.

Tab. 21: Characteristic pneumatic values

Characteristic electrical values		
Electrical connection		Pin contact M12x1, 5-pin
Permissible operating voltage	[V DC]	18 ... 30 Permissible residual ripple 1.3 Vpp (IEC 61131-9)
Max. permissible supply line length and signal line length	[m]	20
Max. electrical power consumption		
VPPM-6... and VPPM-8...	[W]	7
VPPM-12L-...	[W]	12

Tab. 22: Characteristic electrical values

IO-Link	
IO-Link type VPPM-...-LK...-S1 – Cable characteristics	Observe IO-Link-specific data
Data rate	Supports all IO-Link data transmission rates
IO-Link specification	Associated IO-Link IODD ➔ www.festo.com/catalogue

Tab. 23: IO-Link

Control characteristics[1)]	
Linearity	1% Full Scale (FS)/2% Full Scale (FS)
Hysteresis	0.5% Full Scale (FS)
Reproducibility	0.5% Full Scale (FS)
Total accuracy	1.25% (S1)/2.25 (2%)
Temperature coefficient	0.04/K

1) Maximum deviation, characteristic values determined at room temperature in accordance with ISO 10094. Linearity refers to the ideal characteristic curve.

Tab. 24: Control characteristics