- **Port size: 1/4” (ISO G or NPT)**
- **Reliable, rugged, open loop control**
- **Proportional I/P and E/P converters**
- **Minimum vibration effects**
- **IP65 environmental protection**
- **Mounting bracket and connector included**

Technical features

Medium:
Oil free, dry air, filtered to 5 µm
Output Pressure:
0,2 ... 1 bar (2,9 ... 14 psi)
0,2 ... 2 bar (2,9 ... 29 psi)
0,2 ... 4 bar (2,9 ... 58 psi)
0,2 ... 8 bar (2,9 ... 116 psi)
See ordering options
Supply pressure:
At least 0,7 bar (10 psi) above max. required output pressure.
up to 2 bar (29 psi) instruments: max 5 bar (72 psi)
up to 8 bar (116 psi) instruments: max 10 bar (145 psi)
Flow capacity:
> 300Nl/min forward & relief flow
Air consumption:
up to 1 bar (1 psi): 2,8 Nl/min
up to 2 bar (29 psi): 4,0 Nl/min
up to 4 bar (58 psi): 7,5 Nl/min
up to 8 bar (116 psi): 9,0 Nl/min

Linearity:
≤ 0,5% of span
Hysteresis:
≤ 0,5% of span
Response Time:
<0,35 seconds for 10 .... 90% or 90 ...10% of output pressure into a 10cc load (1 bar range instruments)
Temperature Sensitivity:
< 0,1% of span/°C between -40 ... +85°C (-40 ... 185°F)
Supply sensitivity:
<0,075% span output change per % supply pressure change
Port sizes:
Main ports:
G 1/4 or 1/4 NPT
Integral gauge ports:
G 1/4 or 1/4 NPT

Ambient/Media temperatur:
-40 ... +85°C (-40 ... 185°F)
Air supply must be dry enough to avoid ice formation at temperatures below +2°C (+35°F)
I.P. Rating:
IP65 in normal operation
Weight:
1,0 kg
Mounting Position:
Surface mounting bracket provided.
Alternative mounting options available.
Vibration Effect:
5% of span: 4mmp-p 5 ... 15Hz and 2g sine 15 ... 150Hz.

Materials:
Body: Passivated zinc die-casting, epoxy painted
Cover: Glass reinforced PA
Diaphragms: NBR

Electrical parameters

Input Signal	mA versions 1 ... 4 bar: 2 wire 4 ... 20 mA; 3 wire 4 ... 20 mA +12 ... 24 V mA versions 6 ... 8 bar: 3 wire 4 ... 20 mA +12 ... 24 V voltage versions 1 ... 4 bar: 2 wire 0 ... 10 V; 3 wire 0 ... 10 V +12 ... 24 V voltage versions 6 ... 8 bar: 3 wire 0 ... 10 V +12 ... 24 V
Failure Mode	Output pressure falls to zero signal state when electrical supply fails
Connections	30 mm square connector provided (DIN 43650, form A) mountable in four orientations
Span/Zero	Adjustable up to 20 % output range - fur her information available

Option selector

VP10★★★★★0★A00

Pressure range	Substitute
0,2 ... 1 bar / 3 ... 15 psi	**01**
0,2 ... 2 bar / 3 ... 30 psi	**02**
0,2 ... 4 bar / 3 ... 60 psi	**04**
0,2 ... 6 bar / 3 ... 90 psi	**06**
0,2 ... 8 bar / 3 ... 120 psi	**08**

Unit of Measure	Substitute
bar	**B**
psi	**P**

Power supply	Substitute
None requied	**0**
12 / 24 V (Required for 6 & 8 bar units)	**1**

Input signal	Substitute
0 ... 10 V / 1 ... 10 V	**1**
4 ... 20 mA	**4**

Port size	Substitute
1/4 NPT	**K**
1/4 BSP	**J**

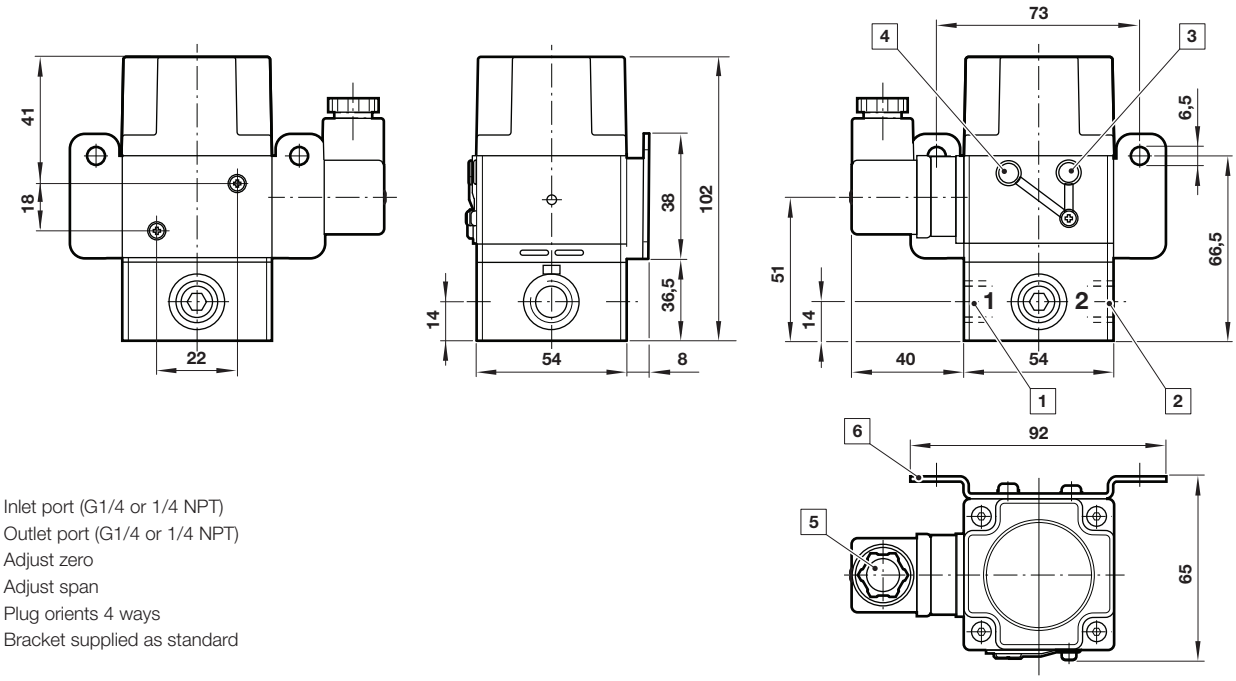
Other options available:

- Alternative input signal ranges
- Alternative pressure ranges
- Flying Leads
- Conduit entry with flying leads
- Junction box (M20 / ½” NPT)
- Intrinsically safe certification
- 50 mm pipe mounting bracket
- Captured exhaust
- Reverse acting
- Split range

IMI Precision Engineering

Dimensions

Dimensions in mm
Projection/First angle



1 Inlet port (G1/4 or 1/4 NPT)
2 Outlet port (G1/4 or 1/4 NPT)
3 Adjust zero
4 Adjust span
5 Plug orients 4 ways
6 Bracket supplied as standard

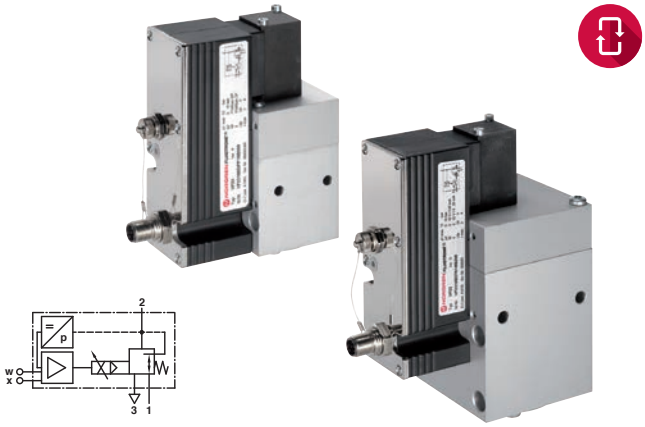
Warning

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under **»Technical features/data«**.
Before using these products with fluids other than those specified, for non-industrial applications, life-support systems or other applications not within published specifications, consult IMI NORGREN.

Through misuse, age, or malfunction, components used in fluid power systems can fail in various modes.

The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.
System designers must provide a warning to end users in the system instructional manual if protection against a failure mode cannot be adequately provided.
System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.

- **Port size: G1/4 ... G3/4**
- **All-digital control electronics**
- **Variable pressure control**
- **Optional: serial interface with VP-Tool Software**
- **Optional actuation via fieldbus (separate datasheet on request)**



Technical features

Medium:
Filtered (50 µm), unlubricated or lubricated condensate-free compressed air or neutral gases Due to the lubricants and their additives, use of lubricated compressed air can affect the dynamics and service life
Operation:
Proportional solenoid
Pressure range:
Operating pressure P1 max:
7 bar (101 psi), 12 bar (174 psi), 17 bar (246 psi)
Operating pressure P2:
0 (0,02) ... 2 bar (0 ... 29 psi)
0 (0,1) ...10 bar (0 ... 145 psi)
0 (0,16) ... 16 bar(0 ... 232 psi)

Flowrate:
See flow characteristics
Flow direction:
1 –> 2, 2 –> 3
Service life:
> 10 Million operations, max. stroke
Linearity:
< ± 1,0 % (p2 max.)
Control accuracy:
< ± 1,0 % (p2 max.)
Response accuracy:
< ± 0,2 % (p2 max.)
Hysteresis:
< ± 0,5 % (p2 max.)

Repeat accuracy:
< ± 0,5 % (p2 max.)
values related to 20°C and 24 V d.c. power supply
Ambient:
Valve series is designed for indoor use at normal industrial ambient
Ambient/Media temperature:
Media
-5 ... +50°C (+23 ... +122°F)
(no condensation permitted)
Ambient
-5 ... +60°C (+23 ... +140°F)
Air supply must be dry enough to avoid ice formation at temperatures below +2°C (+35°F).

Materials:
Valve housing: Aluminium
Electronic housing: PAA
Seals: NBR, HNBR on request
Internal parts : PBT
Springs : Steel

Option selector

VP23★★B★★★1★★★★★

Pressure range	Substitute
0 ... 2 bar	**02**
0 ... 10 bar	**10**
0 ... 16 bar	**16**
Nominal size	**Substitute**
8 mm	**D**
16 mm	**E**
Set point	**Substitute**
4 ... 20 mA	**4**
0 ... 10 V/difference	**7**
Profibus DP	**P**

Option	Substitute
Serial interface	**B200**
Serial interface + LED-display *1)	**B201**
Connector	**Substitute**
M12/8 pin	**M**
Fieldbus spec. (on request)	**N**
Actual value	**Substitute**
0 ... 10 V/4 ... 20 mA	**6**
Profibus DP	**P**

*1) LED-display for bus version not available

Function
The electronic pressure controller is used in conjunction with an electric set-point (control signal) to quickly and precisely set a pressure at the pressure connection (2). Even with consumption of the medium (compressed air or neutral gases) the output pressure is controlled (see flow rate characteristics)

Proportional valves are used in many different applications across all sectors of industry. They are used anywhere where precise and fast direct or indirect control of pressure, force, rotational speed etc. is required.

Application example: Contact pressure control of welding electrodes in automotive manufacture

Assembly
The electronic pressure controller consists of:
- Proportional solenoid
- An integrated pressure sensor
- µP-driven control electronics
- Serial interface
- A pneumatic control plunger
- Optional:
  Fieldbus interface
  Configuration software VP-Tool (please order separately)
  LED display for the size of the output pressure

Operating principle
The valve has a closed loop controller, meaning that the output pressure is constantly being measured by the internal pressure sensor and compared to the specified set-point.

If the output pressure is lower than the set pressure or if a higher pressure is desired, the pneumatic control plunger is actuated by the electric proportional solenoid. A connection is then established between connection 1 (input pressure) and 2 (output pressure) until the pressure is the same as the specified set-point.

If the output pressure is higher than the set pressure or if a lower pressure is desired, the pneumatic control plunger is actuated by the electric proportional solenoid. A connection is then established between connection 1 (input pressure) and 3 (ventilation connection) until the pressure is the same as the specified set-point.

In addition, after the supply voltage is switched off, the output pressure set last is vented down to 0 bar.

Electrical parameters
Endurance limit in relation to oscillations to DIN EN 60068-2-6:
10g at 12-500Hz in switched-off-status

Durability under shock effect to DIN EN 68-2-67: 30 g/10 shocks
Valves should not be used in safety systems that require blocking or exhaust valves
Without power the pneumatic connection 2 -> 3 is open

Supply

Supply voltage	UB	18 ... 32 V d.c.
Residual ripple max.	[%]	10
Current consumption at 16 bar	NG 8,16 max. [A]	approx. 1,8 A at 24 V d.c.
	NG 8,16 static at 25°C (corrected) [A]	approx. 1,4 A at 24 V d.c.
Current consumption at 10 bar	NG 8,16 max. [A]	approx. 1,8 A at 24 V d.c.
	NG 8,16 static at 25°C (corrected) [A]	approx. 1,2 A at 24 V d.c.
Current consumption at 2 bar	NG 8,16 max. [A]	approx. 1,8 A at 24 V d.c.
	NG 8,16 static at 25°C (corrected) [A]	approx. 1,2 A at 24 V d.c.

Inputs (signal)
Set point W (+/-U d) analogue differential

Voltage signal UE (V)	0 ... 10
Input resistance RI (kΩ)	170
Set point W(I) analogue: **Current signal UE (mA)** **Burden (Ω)**	 4 ... 20 500
Max. input voltage (V)	-10 ... 40

Outputs (signal)
Output pressure actual value X(U)

Voltage signal of pneumatic output pressure UA (V)	0 ... 10 V = 0 ... max. p2
Output current max. IA (mA)	1

Output pressure actual value X(I)

Current signal of pneumatic output pressure IA (mA)	0 (4) ... 20 mA = 0 ... max. p2
Load resistance RL (Ω)	500 recommended

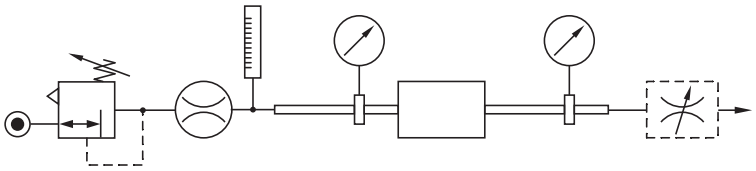
Output »pressure reached« X (comp)

Switching range (% max. p2)	+/-2%
Digital output signal	PLC-Level
Control pressure outside of switching range (X≠W)	Low
Pressure reached (X = W) (V)	High
Outout current max. (mA)	10

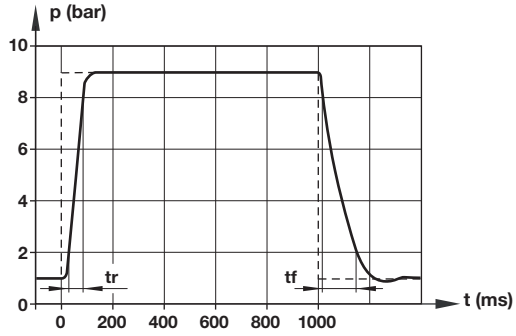
Pneumatic parameters
Recommended application area by nominal value:
NG8: Volume (closed) from 100 ... 1500 cm³
NG16: Volume (closed) from 1000 ... 8000 cm³

Residual ripple max.	[%]	10
Input pressure p1 max.	[bar]	17/12/7
Output pressure p2 max.	[bar]	0-16 / 0-10 / 0-2
Flow quantity NG 8	[l/min]	see diagram
Flow quantity NG16	[l/min]	see diagram
Switching times (10%-90%) nominal size 8 at volume 400 cm3		
Typical values for P1=12 bar		
Pressure build-up (tr) 1 bar ... 9 bar	100 [ms]	
Pressure build-up (tf) 4 bar ... 5 bar	50 [ms]	
Pressure drop (tr) 9 bar ... 1 bar	250 [ms]	
Pressure drop (tf) 5 bar ... 4 bar	50 [ms]	
Switching times (10%-90%), nominal size 16 at volume 1000 cm3		
Typical values for P1=12 bar		
Pressure build-up (tr) 1 bar ... 9 bar	100 [ms]	
Pressure build-up (tf) 4 bar ... 5 bar	50 [ms]	
Pressure drop (tr) 9 bar ... 1 bar	100 [ms]	
Pressure drop (tf) 5 bar ... 4 bar	50 [ms]	

Test assembly flow
CETOP RP 84 P.: flow characteristic of pneumatic devices



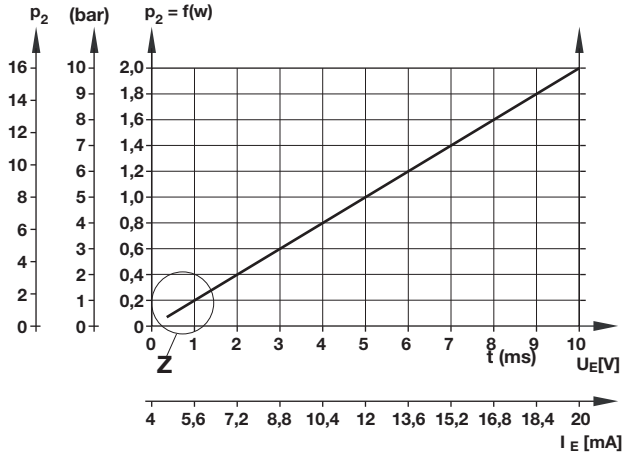
Step-response diagram

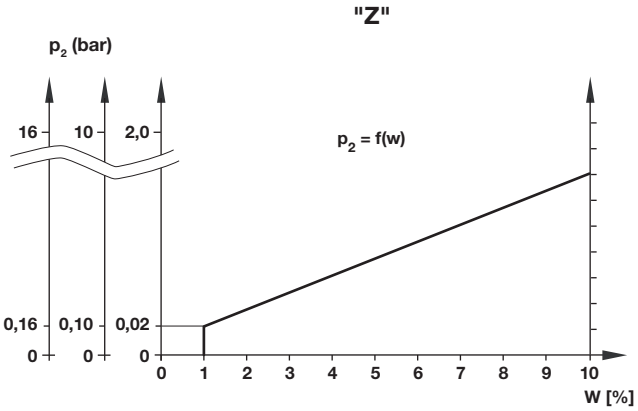


Pneumatic characteristics curves

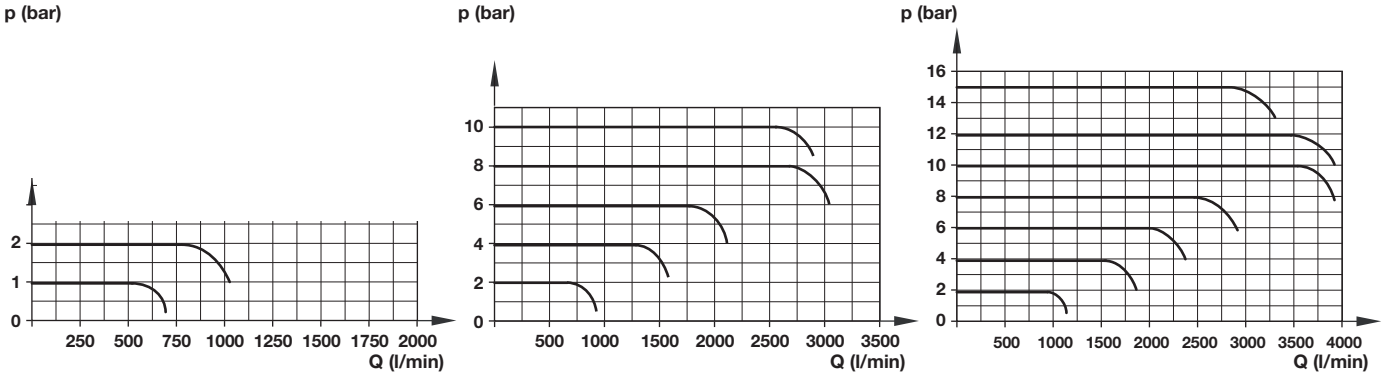
Flow rate characteristic as a function of the set-point (voltage/current) and input pressure 7 bar, 12 bar, 17 bar for nominal value 8 and 16

Static characteristics

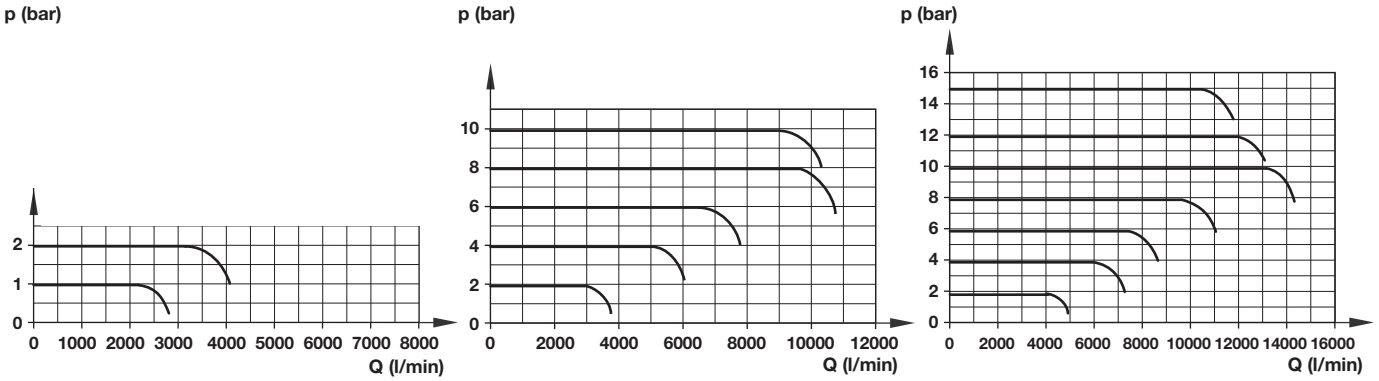




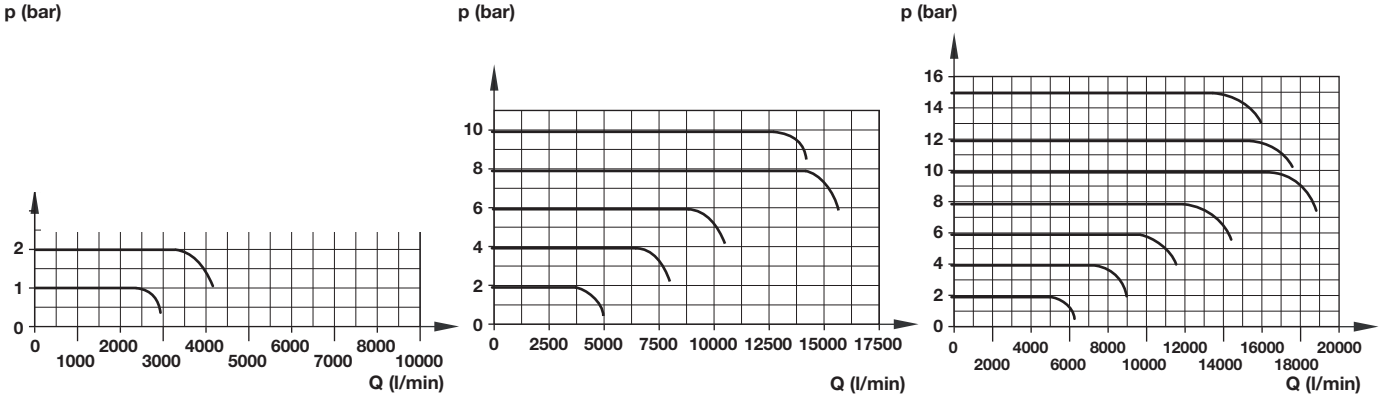
Flow rate characteristics NG 8/P1=7 bar, 12 bar, 17 bar



Flow rate characteristics NG 16/connection plat ae 1/2” (NG12); P1=7 bar, 12 bar, 17 bar



Flow rate characteristics NG 16/connection plate 3/4“ (NG20); P1=7 bar, 12 bar, 17 bar



Functional descriptions, status LED and amplification degree setting

General Status LED indicator)

Status	Status-LED
Device off	off
Device running	single-colour green
Valve fault*	red*
Outout current max. (mA)	10

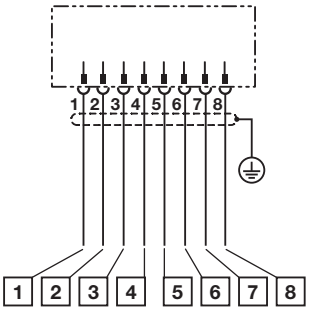
* Potential error sources:
- Current supply or internal references outside the permitted range
- Valve not adjustable (X≠W Time out)
- Program cycle interrupted

Setting controller gain via PC with VP-Tool

The gain of the integrated controller is set in the factory to a value which allows universal use of the valve. If necessary, the controller gain can be varied to suit a specific pneumatic application of the valve. When the screw plug is opened the interface connector can connected and via VP-Tool the controller gain can be adjusted. Adjustment by VP-Tool via serial interface

Connection diagrams

1. Standard connection (M12x1; 8-pin)



1 W (I), white
2 X (komp), brown
3 W (-Ud), green
4 W (+Ud), yellow
5 X (I), grey
6 Ub pink
7 GND blue
8 X (U), red

Assignment

Supply:

Pin		Description	Colour of connection cable
6	Ub	power supply 18 ... 32 V d.c.	Pink
7	GND	power ground/PGND	Blue

Input

Set point:

Pin		Description	Colour of connection cable
3	-W	Analogue GND/set point input voltage 0 ... 10 V	Green
4	+W	Signal/set point input voltage 0 ... 10V	Yellow
1	W(I)	Set point input current 4 ... 20 mA	White

Depending on the order number, both outputs (U/I) but only the ordered input will be active.
Voltage input 0 ... 10 V between pins 4 and 3 Current input between pins 1 and 7

Comparator output/pressure switch*

Pressure reached:

Pin		Description	Colour of connection cable
2	X (comp)	Digital output signal PLC level (I max) =3,3 mA	Brown
		High : pressure reached devation Iw-xI < ± 2%	
		Low: pressure not reached devation Iw-xI > ± 2%	

The output relates to Gnd Pin 7
* selectable via VP-Tool

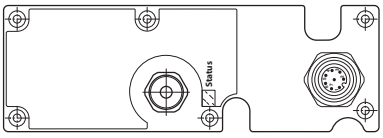
Function

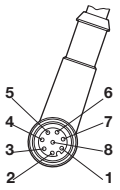
Option LED indicator

Pressure range	Display values
0 ... 2 bar	0,00 ... 2,00
0 ... 10 bar	00,0 ... 10,0
0 ... 16 bar	00,0 ... 16,0

2 coloured LED-display

LED indicator green	pressure devation from setpoint < +/- 2%
LED indicator red	pressure devation from setpoint > +/- 2%





Output

Pin		Description	Colour of connection cable
5	X(I)	Actual value current 4 ... 20 mA	Grey
8	X(U)	Actual value voltage 0 ... 10V	Red

Voltage output refers to Gnd Pin 7.
Due to the voltage drop on the ground wire you should consider an accuracy loss of the voltage output.
Both outputs are active as standard.

3. Serial interface connection

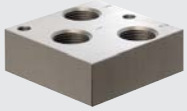
Connection of serial interface
Remove fitting, plug in the interface cable, establish communication with VP-Tool.

Connecting plugs

Description	Specification	Model
Connecting plug	M12x1; 8-pin; 5 m, 8 x 0,25 mm², straight	0250811
Connecting plug	M12x1; 8-pin; 5 m, 8 x 0,25 mm², 90°	0250813
Connecting plug	M12x1; 8-pin; convertible, 90°	0252383
Connector (Bus only)	M12x1, 5-pin, 5 m, 90°, A-Coded, open (power)	0252088
Connector (Bus only)	M12x1, 5-pin, 5 m, 90°, B-Coded, open (Bus in)	0251310
Connector (Bus only)	M12x1, 5-pin, 5 m, 90°, B-Coded, open (Bus out)	0251312
Connector with cable (Bus only)	Plug M12x1, 5-pin, 5m, 90°, B-Coded, (Bus in/out)	0252091

Note: Cable material PUR shielded

Connection plates



Description	Ports	Model
Connection plate NG 8	G1/4	0542636
Connection plate NG 8	G3/8	0543705
Connection plate NG16	G1/2	0542814
Connection plate NG16	G3/4	0542840

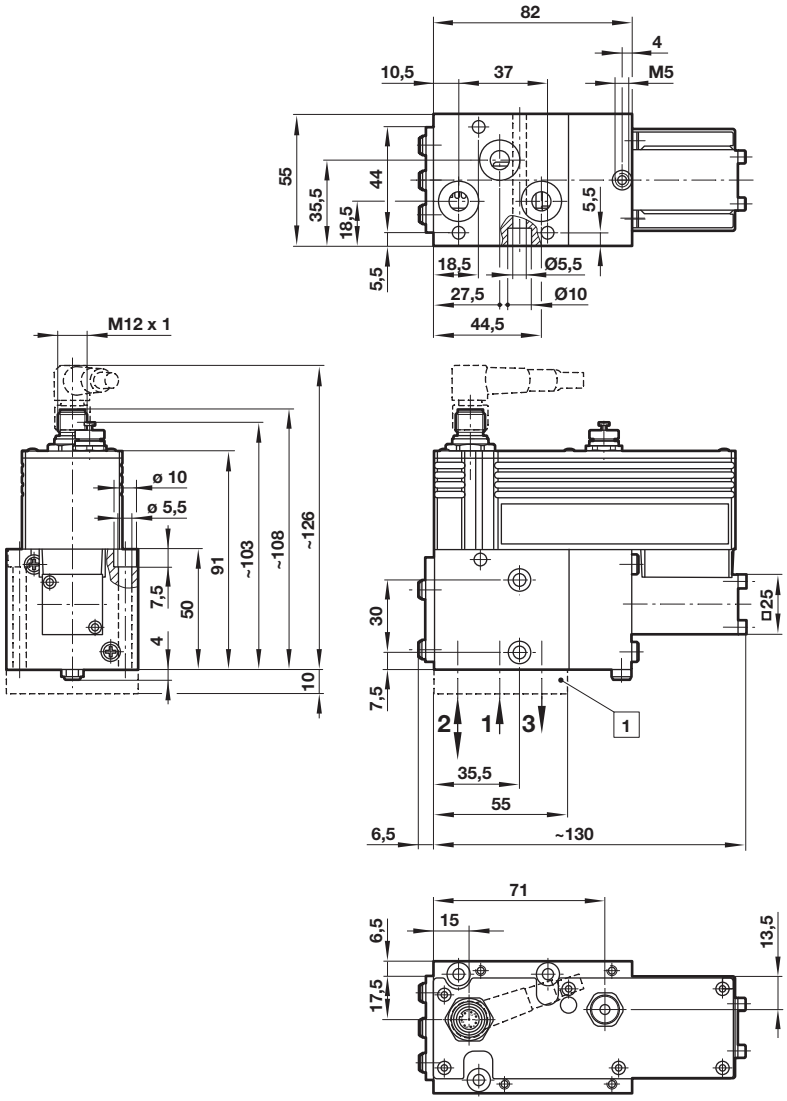
Serial interface accessories

Description	Adaptor cable  Model
Adaptor cable with software CD VP tool	5988319

Basic dimensions

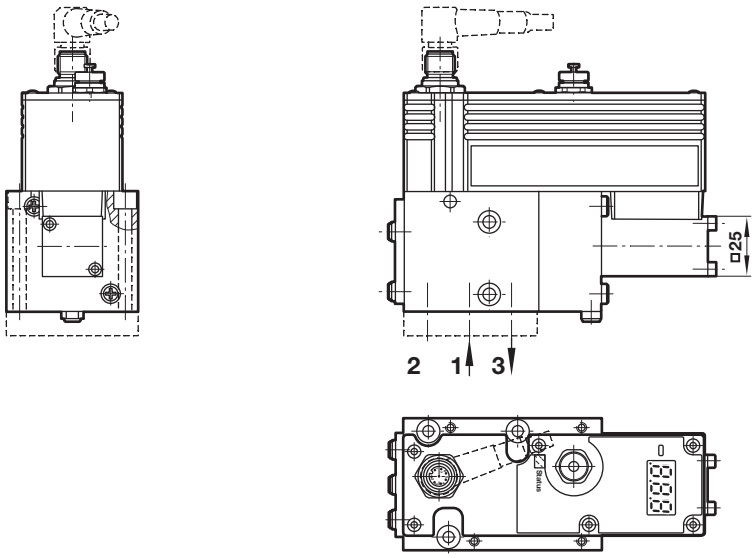
Standard ND8

Dimensions in mm
Projection/First angle



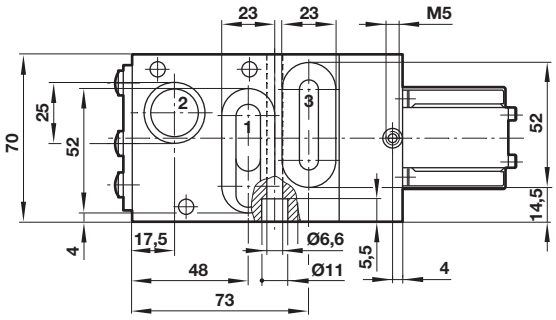
2 Connection plate

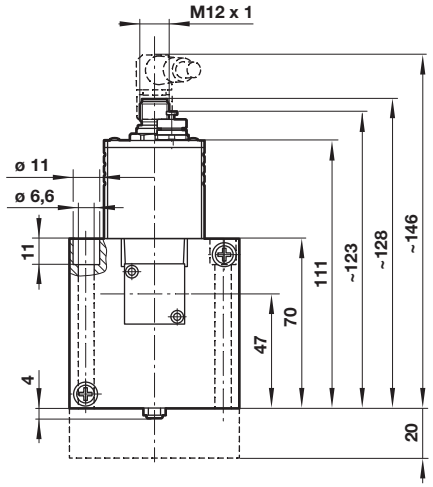
ND8 with serial interface, LED indicator

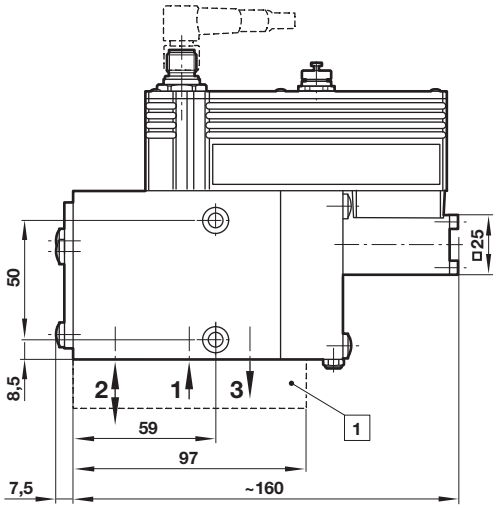


Dimensions ND16

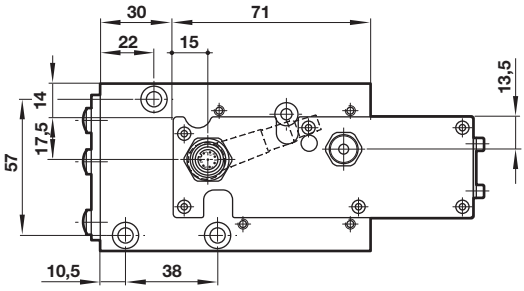
Dimensions in mm
Projection/First angle



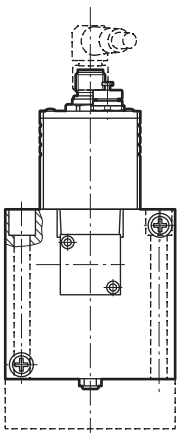


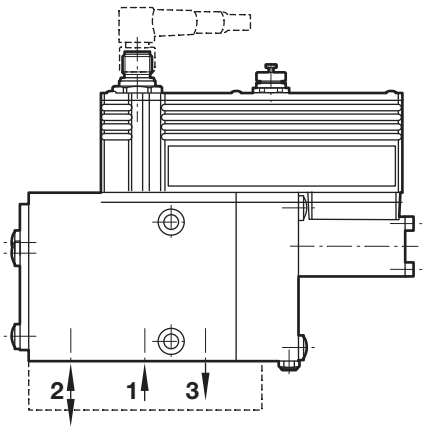


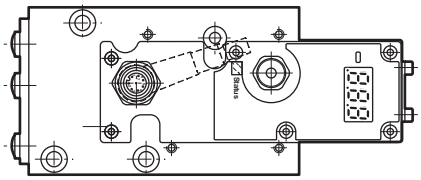
2 Connection plate



Dimensions optional serial interface, LED indicator ND16

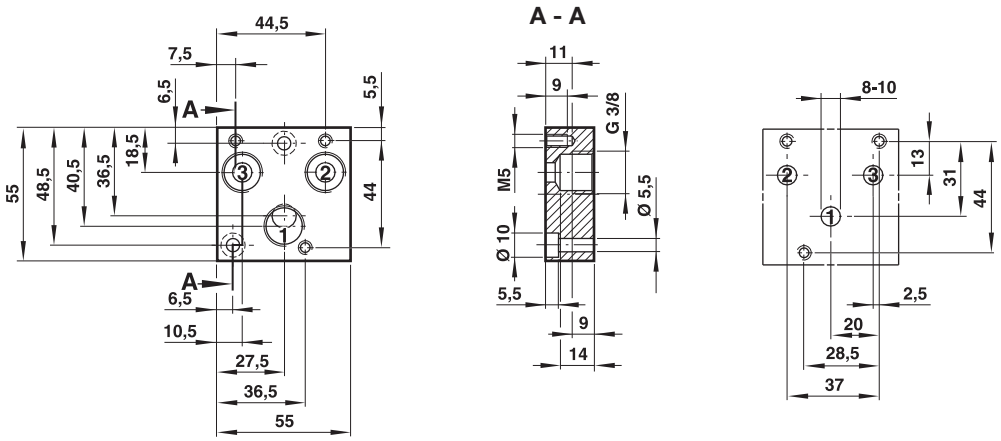




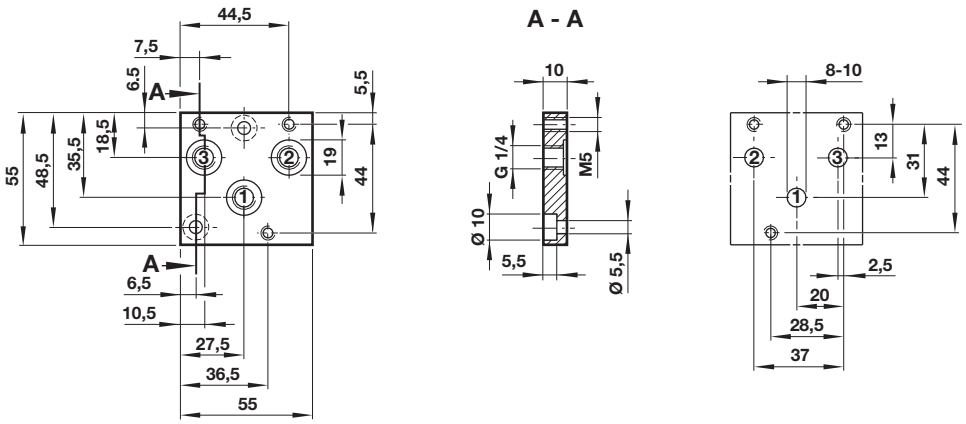


Connection plate
0543705, G3/8 ports preferable for VP23xxBDxx1xxxxx valve

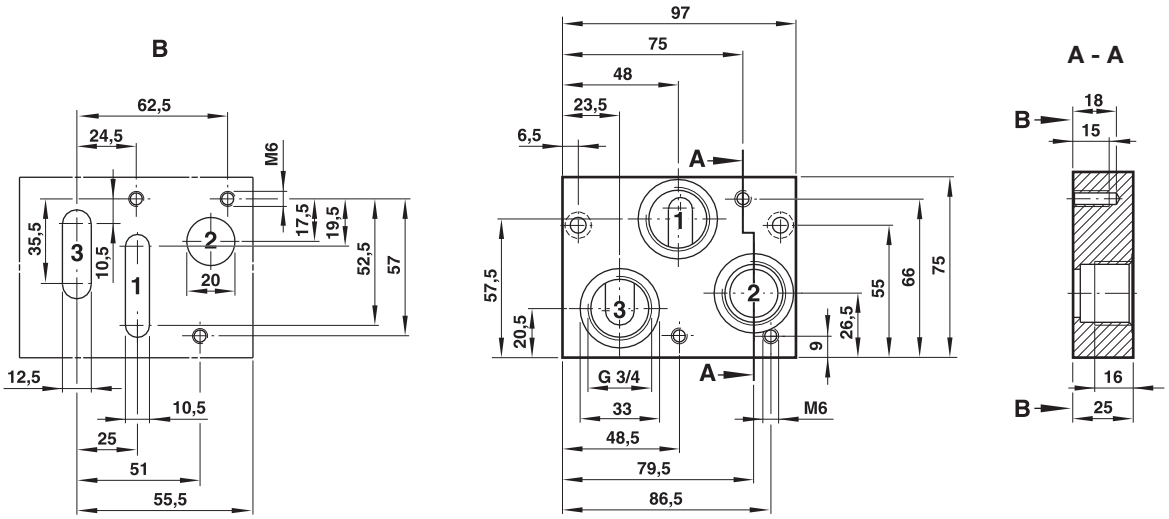
Dimensions in mm
Projection/First angle



0542636, G1/4 ports optional for VP23xxBDxx1xxxxx valve

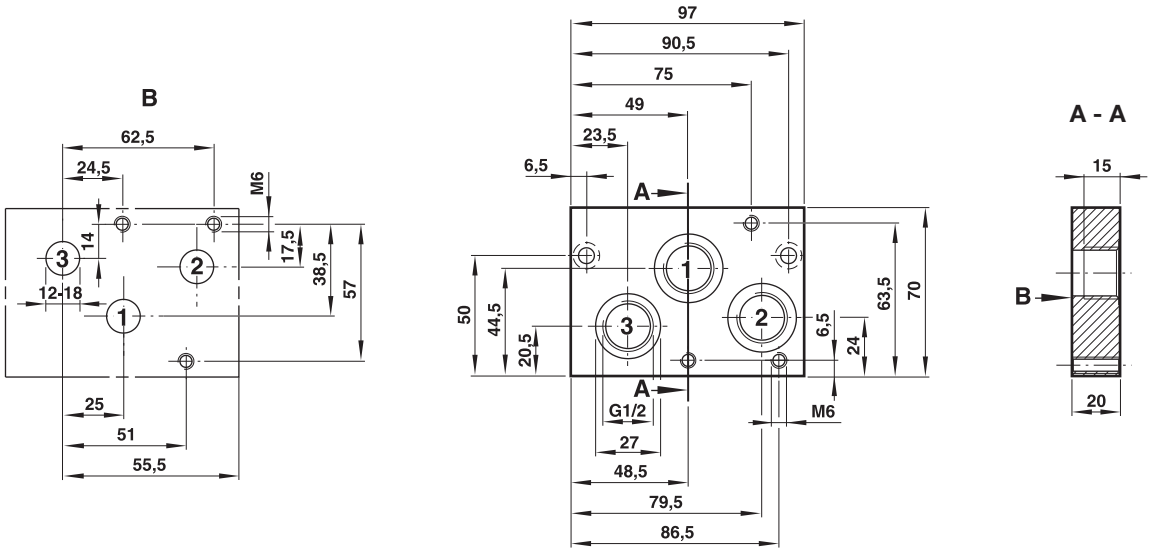


0542840, G3/4 ports preferable for VP23xxBExx1xxxxx valve



Connection plate
0542814, G1/2 ports optional for VP23xxBExx1xxxxx valve

Dimensions in mm
Projection/First angle



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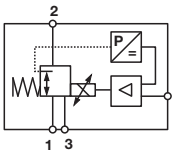
- **Port size: 1/4” (ISO G or NPT) or manifold**
- **Closed-loop air piloted proportional pressure control valve**
- **High flow**
- **Excellent performance characteristics**
- **Fast response time**
- **Adjustable gain and pressure range**
- **Low power consumption**
- **Feedback signal**
- **Manifold mountable**



Technical features

Medium:
Compressed dry air,
oil free filtered to 5 µm.
Operation:
Air piloted spool valve with integrated electronic pressure control
Output (nominal) pressure:
Standard units:
0 ... 2 bar, (0 … 30 psi);
0 ... 4 bar, (0 … 60 psi);
0 ... 6 bar, (0 … 90 psi);
0 ... 8 bar, (0 … 120 psi);
0 ... 10 bar, (0 … 150 psi)
Vacuum units:
-1 ... 1 bar (-15 ... 15 psi)
Supply pressure:
Minimum 2 bar (29 psi) above maximum output required.
Standard units: 12 bar max. (174 psi)
Vacuum units: 6 bar max. (90 psi)

Air Supply sensitivity:
Better than 0,75% span output change per bar supply pressure change
Flow:
Standard units up to 1400 N l/min (see characteristic curves)
Vacuum units up to 300 N l/min
Air consumption:
< 5 N l/min
Ambient/Media temperature:
0 ... +50°C (+32 ... 122°F)
Air supply must be dry enough to avoid ice formation at temperatures below +2°C (+35°F)
Temperature Sensitivity:
Typically better than
0,03% span/°C

Degree of protection:
IP65 in normal operation [exhaust and baffle protected from water ingress at temperatures <+5°C (+41°F)]
Linearity:
< 1%
Hysteresis and deadband:
< 1%
Response Time:
< 80 ms (from 10 ... 90% of output pressure into a 0,1 litre load).
Vibration & shock immunity:
< 3% span
0,75 m/s^2, 5 ... 150Hz,
1 m/s^2, 5 ... 150Hz
Weight:
0,55 kg

Materials:
Body: Aluminium
Lid: Zinc die cast,
Front cover: Grivory
End cap: PA

Maintenance:
No maintenace required
Calibration:
Gain, Span, Zero

Electrical details

Electromagnetic compatibility	Conforms to EC requirements EN 50081-2 (1994) and EN 50082-2 (1995)
Electrical input signal	4 ... 20 mA or 0 ... 10 V factory set
Electrical power input	24 V d.c. ±25%, (power consumption < 1 W)
Output pressure feedback signal	0 ... 10 V full range, <±1% Accuracy
Connections	M12x1, 5-pin

Standard proportional valves
Option selector

VP50★★★★★11H00

Output pressure	Substitute
0 ... 2 bar/30 psi	**02**
0 ... 4 bar/60 psi	**04**
0 ... 6 bar/90 psi	**06**
0 ... 8 bar/120 psi	**08**
0 ... 10 bar/150 psi	**10**
Unit for pressure	**Substitute**
bar	**B**
psi	**P**

Input signal	Substitute
0 ... 10 V	**1**
4 ... 20 mA	**4**
Port size	**Substitute**
G 1/4	**J**
NPT 1/4	**K**
Manifold	**X**

For options not shown and any specific requirements please contact the Norgren technical department via; www.norgren.com/ws

Vacuum proportional valves - 1 ... 1 bar (-15 ... 15 psi)

Option selector

VP50★★★★★11HV1

Absolute pressure range	Substitute
0 ... 2 bar/30 psi	**02**
Unit for pressure	**Substitute**
bar	**B**
psi	**P**

Input signal	Substitute
0 ... 10 V	**1**
4 ... 20 mA	**4**
Port size	**Substitute**
G 1/4	**J**
NPT 1/4	**K**
Manifold	**X**

Connecting plugs

Elbow connector M12 x 1

Page 4

0250081

Manifold mount assembly to ISO 2 sub base

Single manifold

Page 4

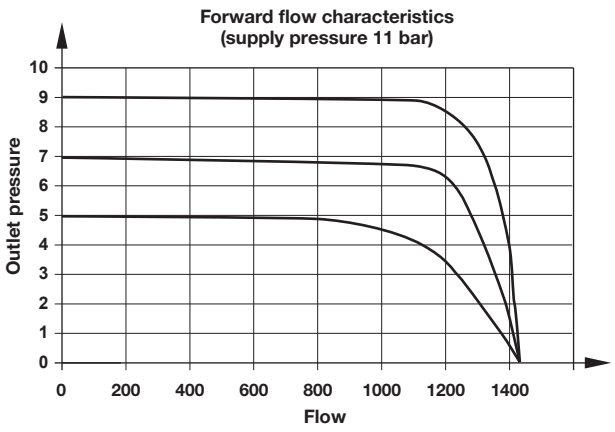
ZZ5M00

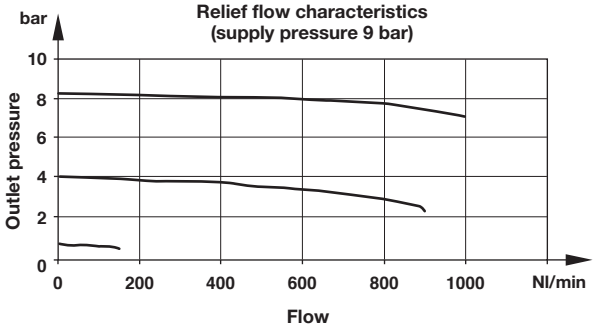
O-rings, flat seal and screws are included

Electrical connector pin looking into the end of the instrument

Pin-No.	Function
1	+24 V d.c. supply
2	0 ... 10 V feedback
3	Control signal (+VE)
4	Common (supply signal and feedback return)
5	Chassis

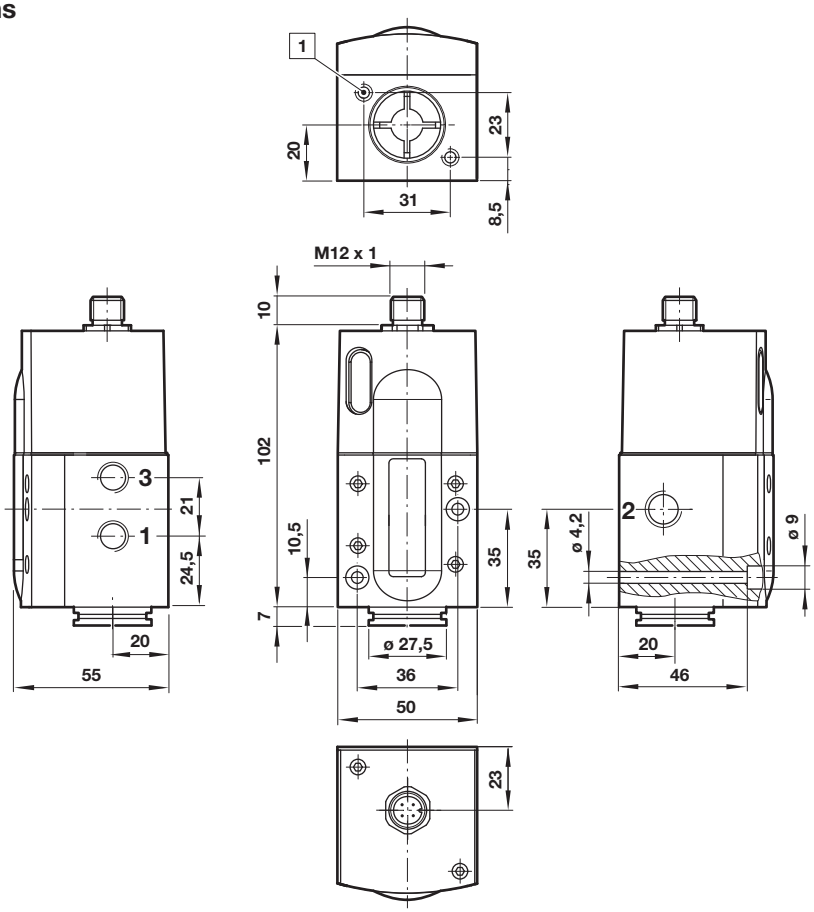
Characteristic curves (standard units)





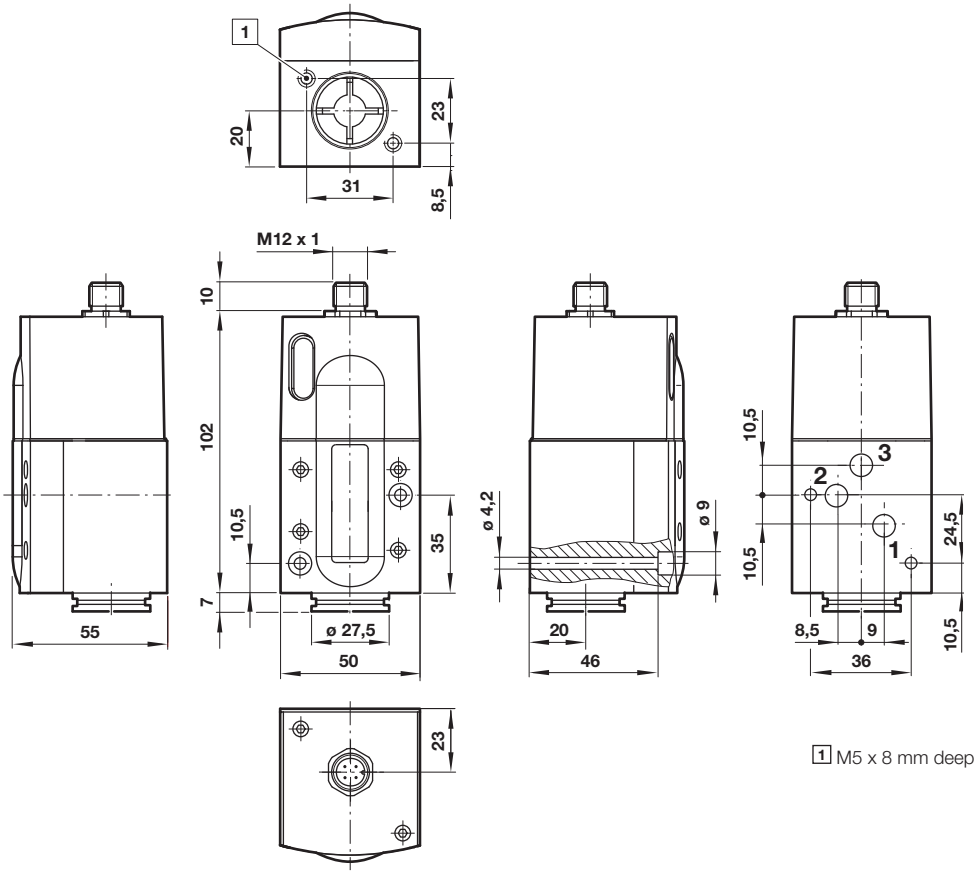
Basic dimensions

Dimensions in mm
Projection/First angle



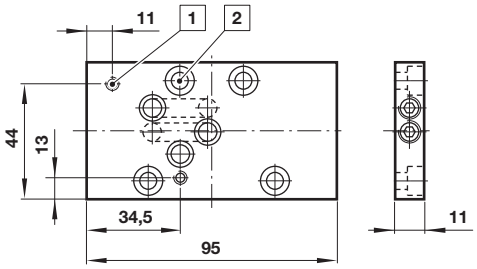
1 M5 x 8 mm deep

VP50 with manifold surface



1 M5 x 8 mm deep

Manifold mount assembly to ISO 2 sub base included all seals and screws

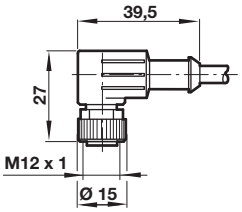


1 Two screws M4 x 50 mm deep to mount the VP50 onto the manifold
2 Four screws M6x16 mm deep to mount the manifold onto the iso subbase

Connector

Model: 0250081

Dimensions in mm
Projection/First angle



Connector, 90°
M12 x 1, 5 pin, female,
5 m cable length, A coded

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- **Nominal size: 8 mm**
- **High flow rate - low pressure loss**
- **Calibrated, linear flow characteristic with zero crossover**
- **Choice of setpoint input: 4 to 20 mA, ±5 V, 0 to 10 V, fixed value, function generator**
- **Fast dynamic response**

Technical features

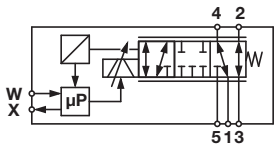
Medium:
Air acc. to ISO8573-1
Grouping: 2-3-1, filtered (recommended < 3 µm), dried, oil-free
The dynamic performance and service life of the valve may be significantly reduced if using unfiltered air containing water and oil!
Operating pressure on all ports:
-1 ... 16 bar (-14 ... 232 psi)
Pneumatical flow coeff.:
C = 290 Nl/(min bar)
Critical pressure ratio:
b = 0,1 ... 0,4

Calibrated flow rate (Qmax.):
1200 Nl/min at P1 = 6 bar (87 psi), P2, P4 = 5 bar (72 psi)
Leakage:
Typical value: 8 Nl/min at (P1 = 10 bar (145 psi), P2/P4 = 0 bar)
Port size:
G1/4, 1/4 NPT or flange mounted according ISO 1
Spool deadtime:
3 ms max
Risetime 10 ... 90%:
5 ms
Threshold frequency -3dB:
105 Hz

Service life:
> 250 million full stroke operations with recommended air quality
Ambient/Media temperature:
Ambient: 0 ... +60°C (+32 ... +140°F)
Media: +5 ... +60°C (+41 ... +140°F)
Storage temperature:
-20 ... +80°C (-4 ... +176°F)
Condensation not permitted!
Air supply must be dry enough to avoid ice formation at temperatures below +5°C (+41°F).

Materials:
Electronic enclosure: PAA
Valve housing and internal parts: anodised aluminium
Other static seals: NBR
Actuator magnet: Fe, surface refined

Technical data, standard model

Symbol	Orifice (mm)	Flow (l/min)	Set point	Actual value	Weight (kg)	Model
	8	1200	4 ... 20 mA	0 ... 10 V, 4 ... 20 mA	1,25	VP6010LJ461MB200
	8	1200	-5 ... +5 V	0 ... 10 V, 4 ... 20 mA	1,25	VP6010LJ661MB200
	8	1200	0 ... 10 V	0 ... 10 V, 4 ... 20 mA	1,25	VP6010LJ761MB200

Option selector

VP6010L★★★1★B200

Pneumatic port	Substitute
G1/4	**J**
1/4 NPT	**K**
ISO 1	**T**
Set point	**Substitute**
4 ... 20 mA	**4**
-5 V ... +5 V differential	**6**
0 ... 10 V differential	**7**

Electrical connection	Substitute
M12/8 polig	**M**
Output	**Substitute**
0 ... 10 V/4 ... 20 mA	**6**

Construction data:

Vibration resistance:
DIN EN 60068-2-6, 10 g at 12-500 Hz switched off. When working more than > 1 g function interference.

Shock resistance:
DIN EN 60068-2-67, 30g /18 schocks.

Weight:
1,25 kg

Electrical parameters

Supply voltage (Ub):
21 ... 32 V d.c.

Residual ripple:
10%

Switch-on point:
21 V

Switch-off point:
18 V

Voltage across diff. inputs:
-10 ... +40 V

Other voltages:
0 ... Ub V

Current input:
4 ... 20 mA

Working resistance:
500 Ω

Differential voltage input:
± 5 V
0 ... 10 V

Internal impedance:
117 kΩ

Current output:
4 ... 20 mA

Voltage output:
0 ... 10 V

Current consumption at 24 V
setpoint, static:
0,1 A

Setpoint ±100%, 50 Hz sinus:
0,3 A

abs. max. for 10s:
2,0 A

Accessories

	Connection cable	
		
Description	**Model**	**Model**
M12x1, 8-pol., 5 m, standard	0250811	0250813

Material: PUR

Serial interface accessories

Description	Adaptor cable
	
	Model
Adaptor cable with software CD VP tool	5988319

Description

Design:

The flow-optimised, metal-sealed 5/3 way spool attains the setpoint position at maximum possible speed under µP control circuit using a moving coil and position sensor.
In the production process, the setpoint value is mapped onto setpoint travel for each VP60, to deliver a linear relationship between setpoint value and flow rate under constant pressure conditions. This cancels out any device-specific manufacturing tolerances.
The valve cannot correct for the physical effect of changing pressure conditions on the flow rate.
However, these changes do not affect the proportionality and zero crossover of the characteristic curve, which has precision adjustment.
In the event of power loss or faults, a spring forces the spool into the preferred position.
The low-loss, digital electronics are integrated in the valve.

Function:

The VP60 is a bi-directional linearised control valve.
The flow rate is (between calibrated negative an positive maximum) continuosly variable adjustable by set value.
All ports are closed in the centre position.
Above-centre setpoint values open the paths 1 to 2 and 4 to 5.
Below-centre setpoint values open the paths 1 to 4 and 2 to 3.
The latter paths are fully opened by spring control in the event of power loss or faults.

The VP60 can be used, e.g. for continuous, reversible speed control of double-acting cylinders or reversible pneumatic motors.

5/3 operation:

Filtered compressed air (see technical data)
is supplied to port 1. The actuator (e.g. cylinder) is connected to ports 2 and 4. Ports 3 and 5 are used as the exhaust. Mufflers with low flow resistances should be connected here.

The power-off response of the actuator (e.g. cylinder moving in or out) depends on its connection to ports 2 and 4 of the VP60 as shown in its connection diagram.

If no movement is required for the power-off response the system developer concerned must provide additional non-return valves.

3/2 operation:

For loads that need only one supply connection
(e.g. spring-return cylinders).
The following sub-functions are possible:

3/2 power-off response exhaust:

Load connected to port 2. Port 4 closed.
Air is taken in for an above-centre setpoint value and expelled for a below-centre setpoint.
In case of an error the cylinder assumes the spring set preferred position.

3/2 power-off response air intake:

Load connected to port 4. Port 2 closed.
Air is expelled for an above-centre setpoint value, and taken in for a below-centre setpoint. (The cylinder assumes the opposite position to the spring-set preferred position for power off).

If no movement is required for the power-off response, the system developer concerned must provide a non-return valve.

The VP60 fault output can be used as the control signal for the output stage of the non-return valves.
The VP60 does not include such an output stage as standard.

2/2 operation:

For loads with continuous air flow requiring just one supply port and no exhaust. (e.g. jets or turbines).
The following sub-functions are possible:

2/2 NC (power-off closed):

Load connected to port 2. Ports 3, 4 and 5 closed

The VP tool software can be used to assign the whole setpoint range with optional action (opening/closing) to 2/2 valve operation.
Otherwise the VP60 remains closed below the centre.
An air intake action can be configured above the centre.
centre = closed, max. setpoint value = max. flow.

2/2 NO (power-off open):

Load connected to port 4. Ports 2, 3 and 5 closed.

The VP tool software can be used to assign the whole setpoint range with optional action (opening/closing) to 2/2 valve operation.
Otherwise the VP60 remains closed above the centre.
An air intake action can be configured below the centre.
min. setpoint value = max. flow, centre = closed.

Functional safety:

VP60 is not a design with fail-safe (type caused) features.
Safety orientated features on valve level cannot be confirmed, neither conforming to EN-ISO13849 (PL) nor to IEC61508 (SIL).
For engine controls (complex mechatronic systems) with VP60 series we strongly recommend a risk analysis, e.g. conforming to EN ISO12100.

Information about the current standard situation are available at the institutes VDMA or BGIA

Installation recommendation:
It is strongly recommended to fit a 3 µm filter before the supply port 1.

To maintain the linearity of the VP60 even at high flow rates, the nominal size of pipes and any extra valves fitted should at least be larger than the VP60 (DN8), i.e. DN10, and be as short as possible.

For dynamic applications, it is advisable to build in buffer capacity, equal to the working volume of the actuator, in the compressed-air supply between the filter and port 1.

Pipes should be cleaned of any residues, e.g. by blowing out, before connecting to the VP60.

If installed on moving surfaces, the valve should be fitted as perpendicular as possible to the main direction of movement.
The VP60 can be fitted in any orientation. The preferred orientation is vertical, however, with the magnet uppermost (the thermal load from the electronics, and the mechanical forces on the spool, are lowest in this orientation).

Voltage supply:
The VP60 is rated for a 24 V d.c. voltage supplied between Ub and GND. Reversing the polarity of the supply will not damage the electronics because they have built-in protection. The valve will not work, however.

The actuator system (= spool position controller) soft starts at a voltage of 21 V and above, preventing severe current spikes.
Although the mean current consumption is limited to 0.6 A (at 24 V) over 10 seconds because of the thermal balance, and is reduced reversibly to 0,2 A if this limit is exceeded, spikes up to 2 A may occur.

The system developer should take this factor into account to avoid overloading the power supply.

Note:
Some power supplies have electronic current limiting, which reduces the output voltage when activated. This may cause the voltage to drop below the 18 V switch-off threshold of the VP60 actuator. The valve then draws drastically less current (40 mA),
so the power supply voltage rises again above the switch-on threshold; this can therefore set up an undesirable oscillation process.

Voltages continuously greater than 36 V destroy the internal overvoltage protection.

Since the VP60 starts working at 21 V, the specified supply voltage range is 21 to 32 V. If the voltage drops below the switch-on threshold, operation of the valve is still guaranteed until the voltage falls below the 18 V switch-off threshold.

This 3 V hysteresis prevents the aforementioned oscillations if the power supply is designed properly. Any ripples in the supply (rated value 10% Ubrated = max. 2,4 V) must be less than this hysteresis for the VP60 to be able to start operating properly.

Setpoint inputs:
The input and input range is factory-set according to the type code specified in the order; these settings are indicated on the type plate.
The active input can be changed via the V24 interface, PC and VP tool software. Values outside the range limits are handled as values equal to the respective limits.

Note:
The resistance of the GND wire of the supply cable lies between the GND star point of the switch cabinet (terminal block with strapping) and the internal GND potential of the VP60; this produces a voltage drop that depends on the current drawn from the power supply.
This means that the GND potential of the VP60 is raised by this voltage above the star point. A voltage referenced to GND in the switch cabinet would appear in the VP60 as a potential reduced by this voltage drop. Since the setpoint encoder usually does not know the actual current drawn from the supply, this results in a random error in the setpoint input.

For this reason there is no GND-referenced voltage input for the setpoint in the VP60. The design of differential current and voltage inputs means that they do not experience such an error.

Current input (Iin):
The setpoint can be input here in the range 4 to 20 mA across a working resistance of 500 Ω to GND. The working resistance is only enabled when the valve is operating and the current input is selected.
If this input is enabled but a current source is not connected, the 4 mA setpoint value is used, i.e. -100% (path 1 to 4 and 2 to 3).

Differential voltage input (+Ud, -Ud):
The difference between the two voltages gives the setpoint value.
+Ud with reference to -Ud can be in the range of 0 to 10 V or -5 to +5 V. The range can be changed using VP tool. Both voltages should lie within the common mode rejection range of -10 to 40 V. Both inputs have an internal impedance of 117 kΩ to an internal source voltage of 3,6 V vs GND. This situation is produced by the design of the internal differential amplifier.
If this input is enabled but a setpoint encoder is not connected, 0 V is used as the setpoint value:
i.e. in the 0 to 10 V range -100% (path 1 to 4 and 2 to 3); in the -5 ... 5 V range 0% (approximately the centre, all ports closed).

If the GNDs of the setpoint encoder and power supply source are connected in the switch cabinet, the valve's response will also depend on which of the inputs +Ud und -Ud is not connected and what setpoint voltage is input. The following actual flow rates result:

The following actual flow rates result:

0 ... 10 V:
+Ud not connected: -27%.
-Ud not connected, +Ud = 0V: -100%, +Ud = 5 V: -53%, +Ud = 10 V: -6%.

-5 ... 5 V:
+Ud not connected: 73%
-Ud not connected, +Ud = -5 V: -100%,
+Ud = 0 V: -53%, +Ud = 5 V: 23%.

Internal fixed value:
If the VP60 will only ever need to regulate the flow to a fixed setpoint value, this value can be set using the VP tool software without additional external circuitry.

Note:
This approach can be used by applications to control the VP60 directly via the V24 interface. Please see separate datasheet.

Frequency generator:
This option can be used for varying the setpoint input over time for demonstrations and endurance testing.

Actual value outputs:
The direct spool position is not output here, but the actual flow rate in 5/3 operation calculated back from the spool position under constant pressure conditions. This allows direct comparison of setpoint and actual values, except in the following situations.
The built-in scaling function allows a huge variation in the relationship between setpoint value and desired flow rate, and hence the user can deliberately change the direct 1:1 representation.
In 2/2 operation enabled using VP tool, the whole setpoint range is assigned to just one flow-rate quadrant. The actual value will then only vary in the selected quadrant (1 to 4 (0 ... 50%) or 1 to 2 (50 ... 100%)) as regards 5/3 operation, even with 1:1 scaling.

Voltage output 0 ... 10 V:
Voltage – actual flow-rate relationship:
0 V = -100%, 5 V= 0% (centre, ports closed), 10 V=100%
The output is referenced to GND and can supply a max. load current of 10mA. (The information given for the setpoint inputs regarding the ground line also applies here)

Current output 4 ... 20 mA:
Current – actual flow-rate relationship:
4 mA = -100%, 12 mA= 0% (centre, ports closed), 20 mA=100%
The source (high side) normally drives a 500 Ω working resistance to GND.

Other working resistances can also be used, provided the minimum 3 V voltage that the source needs to work is taken into account, i.e. the voltage at the current output cannot be greater than Ubmin - 3 V at 20 mA. e.g. Ubmin =18 V. 18 V - 3 V = 15V.
Rmax = 15 V / 20 mA = 750 Ω.

LED indicator:
The LED in the electronic enclosure cover shows green for running OK and red for the following faults: supply voltage too low, excess current in actuator or execution error in microprocessor (µP) program

Power-on test:
The µP in the VP60 starts to work at a supply voltage of about 8 V and above. The Power-on test lasts about 500 ms, in which it checks the code consistency, and that the RAM and CPU are working. The LED shows a green light during this time. If a fault is found, the LED turns red and operation is not started. If the test was OK, the VP60 immediately starts operating and the LED goes out for about 2 s, to indicate the smooth transition into operation (LED green).

Undervoltage:
Supply below 18 V. The actuator is switched off immediately (40 µs), because the moving coil system can no longer generate the forces needed for operation, and the power dissipation in the output stage electronics rises to unauthorised levels.

The undervoltage state ends once the voltage goes above 21 V.
In a soft-start phase lasting approximately 80ms, the actuator current increases to the operating current required at that instant, with regular valve operation then resumed.

In the 18 to 21 V range, the prevailing state is maintained (hysteresis). So, once the voltage has risen above 21 V, the VP60 still remains operating down to 18 V.

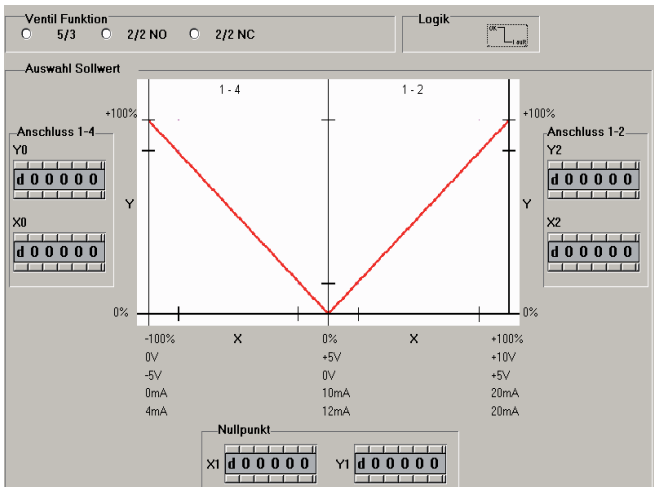
Excess current:
This fault condition exists when the thermal load derived from the 10-second mean absolute value of the actuator current has reached the limit of the actuator. In the event of a fault, the current is reduced but not cut off. The fault remains in force until the mean current value has dropped below the continuous-load limit of the drive system. The fault has then passed and the current is no longer limited.
The excess-current fault can have a number of causes, and indicates that the setpoint position of the spool has not been reached:
Natural wear after well over 250 million full stroke operations has made the spool stiff to move – its service life has expired.
The control edges have become jammed by dirt particle – possibly no filter fitted. As the VP60 does not switch off, but continues to work at lower performance, the particles may get blown out.
The setpoint value changes continuously at too high a frequency and too large a stroke at a high rate of change. Until the situation is rectified, the VP60 follows the setpoint value far more slowly.
Up to 50Hz, it is possible to achieve ±100% spool stroke, at 100 Hz still ±50%. Maximum operating frequencies are achieved by a sinusoidal waveform for the setpoint.

Program execution errors:
During operation, the VP60 tries to keep running by correcting or restarting the system.
The V24, PC and VP tool can be used to display any errors that occur.

Fault output:
The high-side output (24 V) can supply a 15 mA current to GND.
The power-on test is not shown here – the output is not enabled until the valve is operating. The logic signal assignment can be set using VP Tool. The factory setting is enabled (24 V) for operation OK, disabled (0 V, off) for undervoltage or excess-current faults.

Note:
If reversing the logic assignment (enabled, 24 V for fault), it should be remembered that no fault can be signaled if there is no power connected.

Scaling:



Note:
It is only useful to perform scaling in the valve if working with rigid (analogue) setpoint systems. In software-configurable installations (controller cards), it is clearer to set and manage all setpoint-related parameters (limits, gradients, offsets etc.) in the application software. Scaling is performed via the V24 interface, using a PC and VP tool.

The relationship between setpoint and flow-rate is defined by three X/Y coordinate pairs. The X values refer to the setpoint value, the Y values to the flow rate corresponding to X.
With regard to 5/3 operation, X0/Y0 specifies the setpoint value at and above which the max. flow rate in direction 1-4 is to be obtained; X2/Y2 specifies the same in the 1-2 direction.
X1 defines the position of the zero point. The flow rate (Y1) at the zero point cannot be set for 5/3 or 3/2 operation because it equals the low leakage level for this position, which is fixed by design constraints.

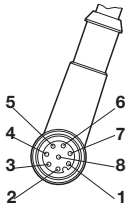
5/3 and 3/2 operation:
Y0 and Y2 can be used to adjust the gradient of the setpoint/flow rate characteristic between 100% and 10% of the maximum flow rate.
X0 and X2 can be used to place limits in the range 100 ... 50% (setpoint) on the flow-rate limits set in Y0/2.

2/2 NC operation:
Since the entire setpoint range (X) is applied to the path 1-2 in this case, X/Y-1/2 can be used to define the transfer function to suit.
Flow rate value Y1 applies below setpoint value X1. Flow rate value Y2 applies above X2. Between these points, the characteristic is linear-proportional.

2/2 NO operation:
The details for NC operation apply here to X/Y-0/1 for the path 1-4.

Electrical inputs and outputs:

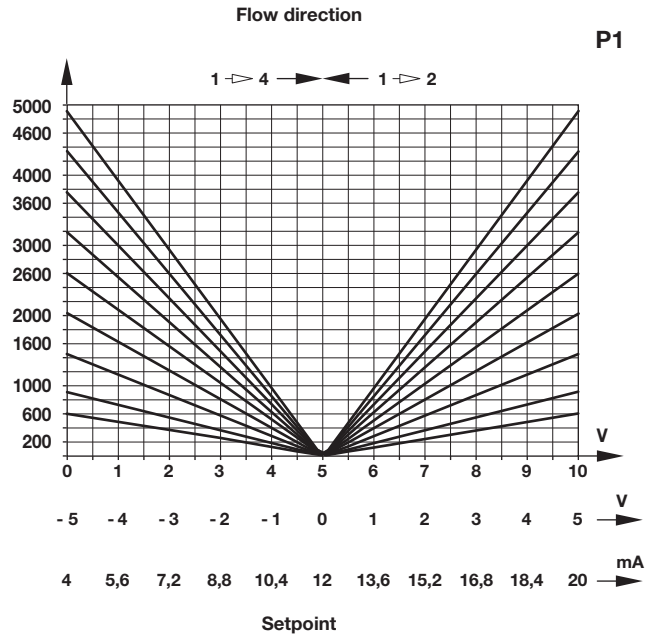
In addition to the power supply, the VP60 has two analogue inputs and two analogue outputs, plus one digital output. These are combined in one 8-pin M12 connector:



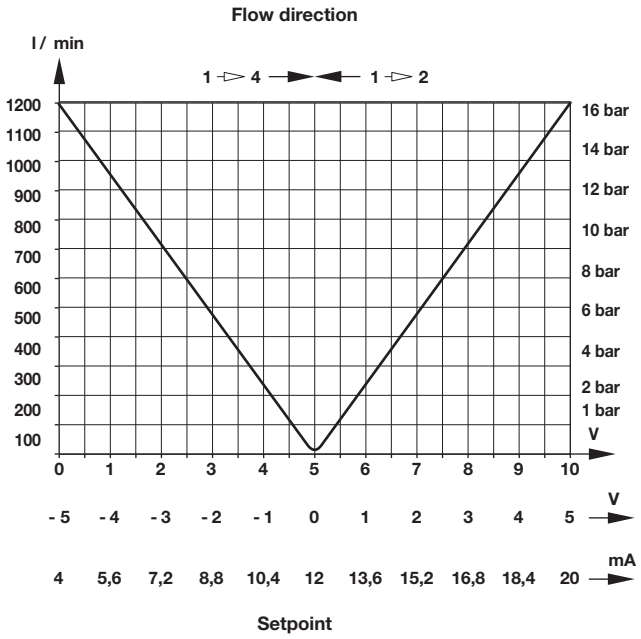
Pin	Colour	Name	Function
1	white	Iin	Setpoint input, current 4 ... 20 mA (500 Ω working resistor to GND)
2	brown	Fault	Fault output (current limited to 15 mA from Ub)
3	green	-Ud	Setpoint input, differential voltage, reference potential
4	yellow	+Ud	Setpoint input, differential voltage, 0 ... 10 V / ± 5 V signal
5	grey	Iout	Current output, actual value, 4 ... 20 mA from Ub
6	pink	Ub	Supply voltage +24 V d.c.
7	blue	GND	Supply ground GND
8	red	Uout	Voltage output, actual value 0 ... 10 V (referenced to GND)

Curves

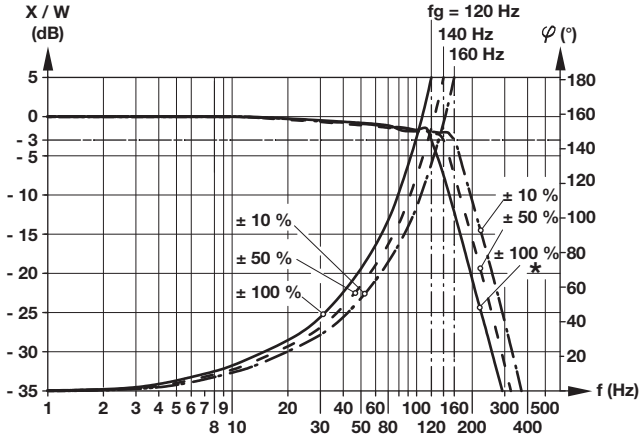
Flow-rate as a function of setpoint value and P1, P2, P4 = 0 bar (free-flowing):



Flow-rate as a function of setpoint value at constant pressure P1=6 bar, P2, P4 = 5 bar:

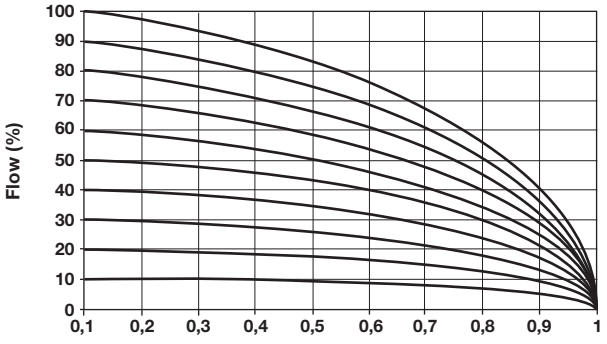


Frequency response and phase of spool position-controller for 10, 50 and 100% setpoints



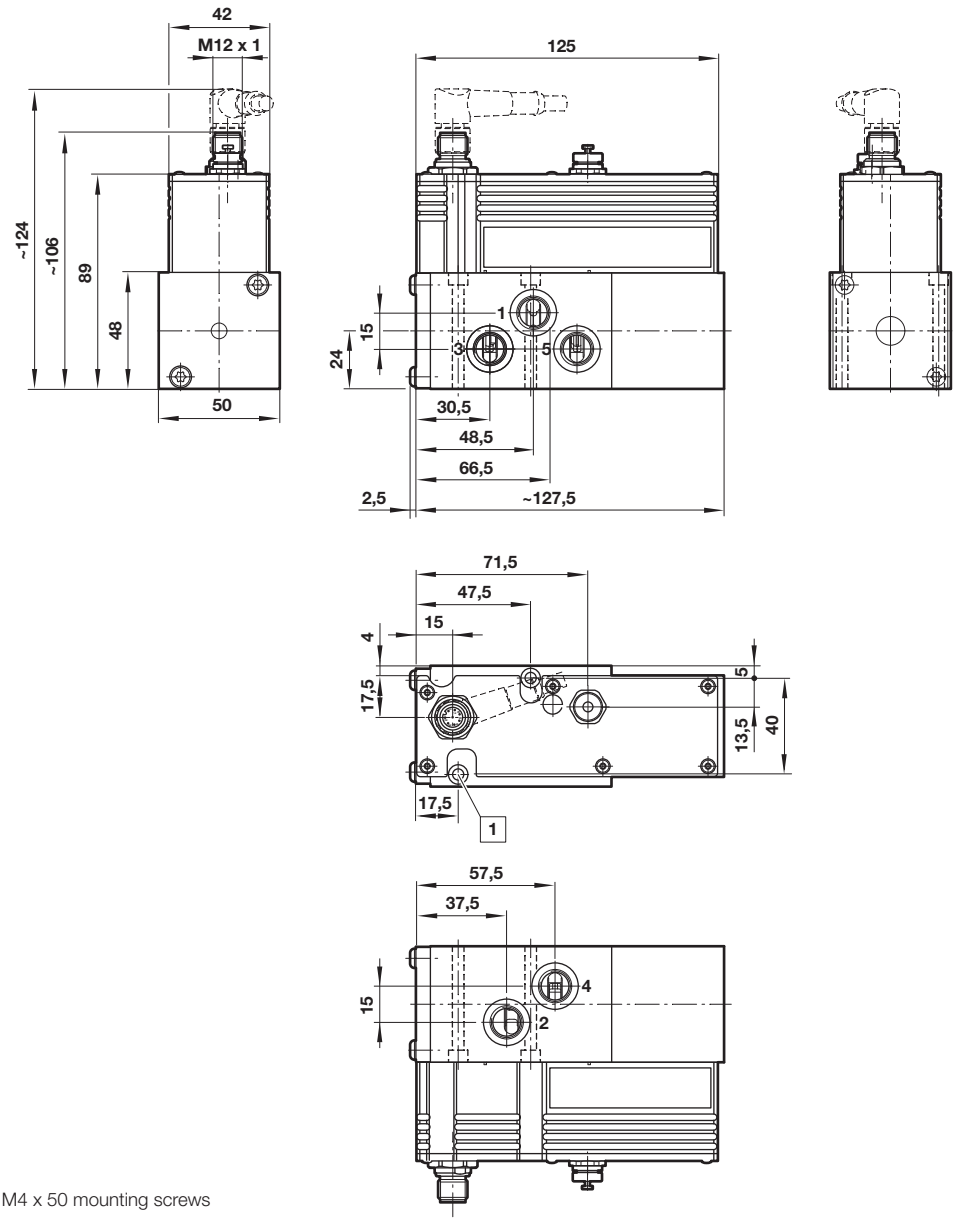
Valve in 5/3 operation. 0% corresponds to centre position

Flow-rate as a function of the pressure ratio P2/P1 for setpoint values 10, 20, ...100%



Basic dimensions
Standard model G1/4 and 1/4 NPT

Dimensions in mm
Projection/First angle



1 Valves are delivered with M4 x 50 mounting screws

Warning

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under **»Technical features/data«**.
Before using these products with fluids other than those specified, for non-industrial applications, life-support systems or other applications not within published specifications, consult IMI Precision Engineering, Norgren GmbH.
Through misuse, age, or malfunction, components used in fluid power systems can fail in various modes.

The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.
System designers must provide a warning to end users in the system instructional manual if protection against a failure mode cannot be adequately provided.
System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.