



EL-PRESS

Digital Electronic Pressure Meters and Controllers



› Introduction

Bronkhorst High-Tech B.V., the European market leader in thermal Mass Flow Meters/Controllers and Electronic Pressure Controllers, has many years experience in designing and manufacturing precise and reliable measurement and control devices. With a wide range of instruments, Bronkhorst® offers innovative solutions for many different applications in many different markets.

The instruments are made to customers' specification, in various styles, suitable for use in laboratory, industrial and hazardous areas, in such diverse applications as semiconductor and analytical installations, to name but two.

› EL-PRESS series Pressure Meters and Controllers

The EL-PRESS series electronic Pressure Meters and Controllers have a well-proven compact thru-flow design and are available in pressure ranges from 2...100 mbar up to 8...400 bar, both in absolute and relative (gauge) pressure. A differential pressure transducer can also be supplied in the ranges of 2...100 mbar up to 0,3...15 bar. The pressure controller performs with high accuracy and repeatability and should be specified for forward or backward pressure control.

› State of the art digital design

Today's EL-PRESS series are equipped with a diaphragm type piezoresistive pressure sensor and a digital pc-board as standard and offer high accuracy, stability and reliability. The main digital pc-board contains all of the general functions needed for measurement and control. In addition to the standard RS232 output, the instruments also offer analog I/O. As an option, an integrated inter-face board provides DeviceNet™, CANopen®, PROFIBUS DP, Modbus RTU/ASCII, FLOW-BUS, EtherCAT®, PROFINET, Modbus/TCP, EtherNet/IP or POWERLINK protocols.

› Pressure Controllers for every application

The control valve can be furnished as integral part of an EL-PRESS Pressure Controller (EPC), or as a separate component. It is a proportional, electromagnetic control valve with extremely fast and smooth control characteristics. With reference to the specific field of application there are different series of control valves. There is a standard direct acting valve for common applications, a pilot operated valve for high flow rates, the so-called Vary-P valve that can cope with up to 400 bar ΔP and a bellows valve for applications with very low differential pressure.

› EL-PRESS features

- ◆ High accuracy and repeatability
- ◆ High pressure capability up to 400 bar
- ◆ Stable control even at varying process volumes
- ◆ Optional metal sealed and downported constructions
- ◆ Analog I/O signals: 0...5(10) V/0(4)...20 mA
- ◆ Digital communication:
 - ◆ RS232, CANopen®, DeviceNet™
 - ◆ EtherCAT®, PROFIBUS DP, FLOW-BUS, Modbus-RTU/ASCII
 - ◆ Modbus TCP, EtherNet/IP, POWERLINK, PROFINET

› Fields of application

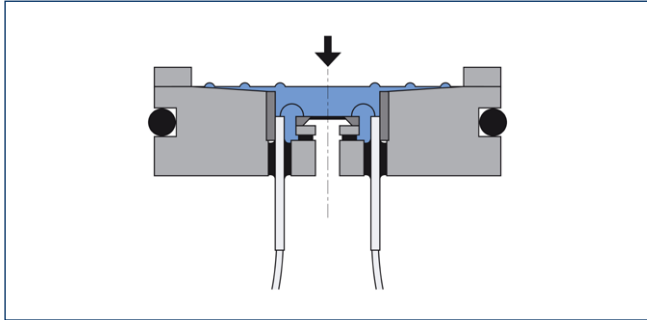
- ◆ Semiconductor processing
- ◆ Gas and liquid chromatography
- ◆ Vapour pressure control in MOCVD processes
- ◆ Protective gas pressure control in extrusion moulding processes
- ◆ Autoclave / reactor pressure control



P-502C Pressure Meter with F-004AC bellows valve for low ΔP applications

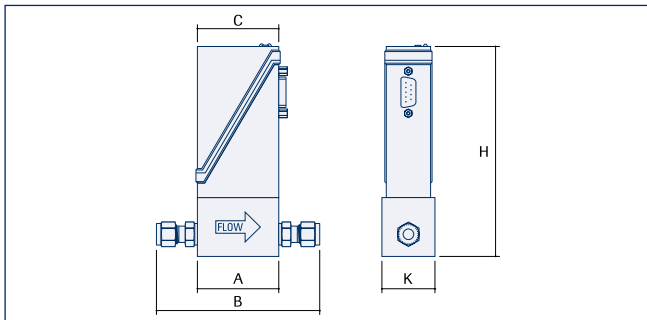
Measuring principle

The Bronkhorst® EL-PRESS pressure sensor is a piezoresistive bridge on the surface of a silicon chip. This chip is drilled out on its reverse side, giving the inside of the chip the form of a pressure diaphragm, whose thickness determines the pressure range. When a pressure acts on this chip, the diaphragm flexes, and the resistor values of the bridge alter in proportion to the pressure. The measuring cell is separated from the external pressure by a thin, sensitive stainless steel diaphragm, and the sealed off cavity between diaphragm and cell is filled with oil.



Cross section drawing of a pressure sensor

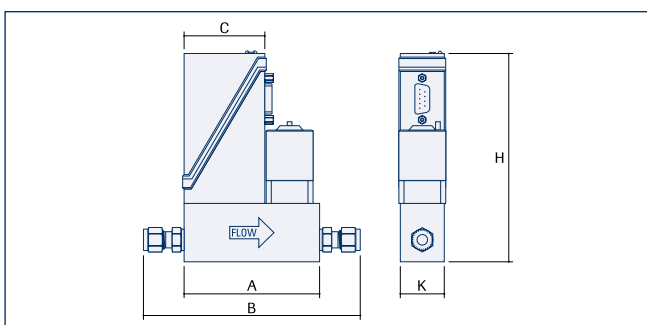
Dimensional drawings



Pressure Meter

Model	A	B	C	H	K	Weight (kg)
P-502C/P-512C/P-522C/P-532C	47	97	47	123	30	0,4
P-502CM ¹⁾	87	124	47	128	29	0,6
P-506C	55	105	47	116	30	0,4

Dimensions in mm.



Forward Pressure Controller

Model	A	B	C	H	K	Weight (kg)
P-602CV/P-612CV	77	127	47	123	25	0,7
P-602CM ¹⁾	87	124	47	128	29	0,7

Dimensions in mm.

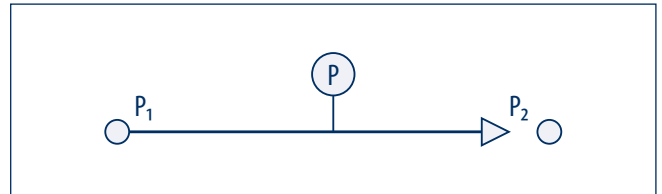
Back Pressure Controller

Model	A	B	C	H	K	Weight (kg)
P-702CV/P-712CV	77	127	47	123	25	0,7
P-702CM ¹⁾	87	124	47	128	29	0,7

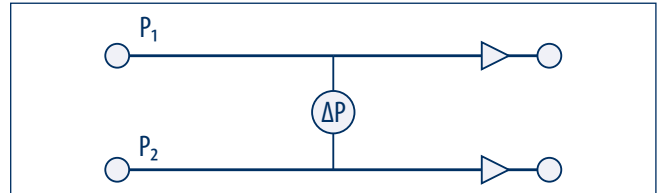
Dimensions in mm.

¹⁾ with 1/4" face seal male connections

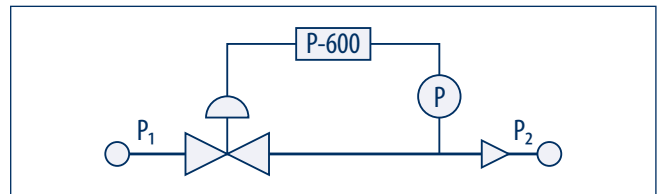
Configurations



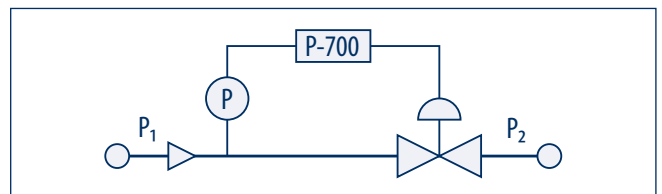
Pressure measurement



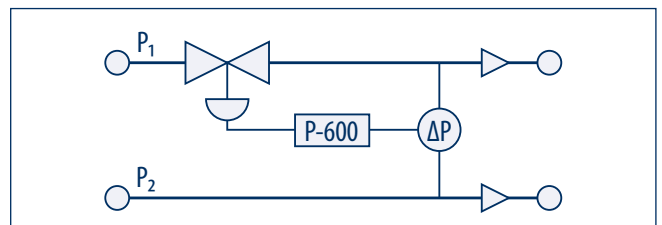
ΔP-measurement



Forward pressure control



Back pressure control



ΔP-control

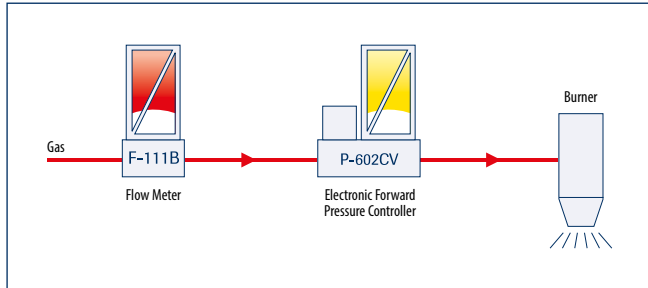


P-506C Differential Pressure Transducer

› Examples of some applications

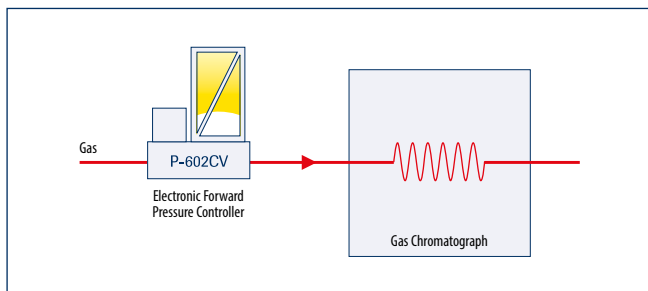
It is of course impossible to picture the possible number of applications. Here is a limited quantity of basic examples, which are often seen with some variations. However, identical or similar configurations are used in totally different applications. Therefore please consider the ones pictured here as examples for solving common applications.

› Pressure control combined with flow measurement



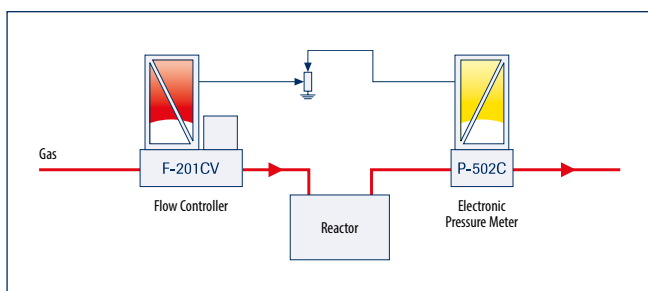
This arrangement of an EL-FLOW Mass Flow Meter with, in series, an EL-PRESS Forward Pressure Controller is used in burner test applications, or tests to check the inlet pressure dependence of the capacity of mechanical pressure regulators, or the tolerance on the bore of orifices, etc.

› Forward Pressure Control in G.C (gas chromatography)



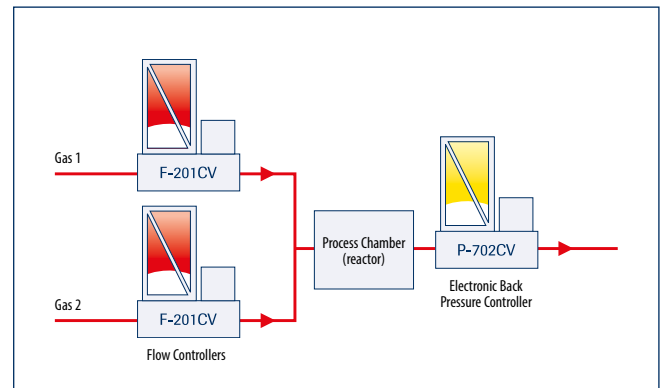
In Gas-Chromatography there is an increasing need to automate all required parameters. The EL-PRESS Forward Pressure Controller enables the user to select a desired pressure profile for the analyses, whereby the pressure is kept constant to a very precise value, even at very low flow rates.

› Pressure control with adjustable flow



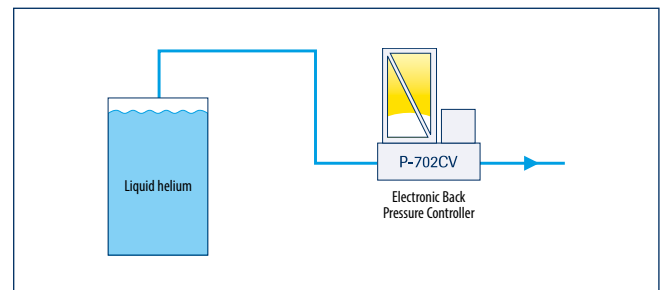
The control valve of the EL-FLOW F-201CV Mass Flow Controller (MFC) forms a closed loop pressure control system with the EL-PRESS P-502C Pressure Transducer: the Mass Flow Meter of the MFC measures the required flow rate to maintain the set pressure level. The setpoint voltage divider enables the user to adjust the maximum flow to build up desired pressure levels. Restriction of the maximum flow may for safety reasons be important in certain processes.

› Back pressure control independent of gas mix and total flow



A gas mixture is formed by EL-FLOW Mass Flow Controllers. In a process chamber the effect of the catalyst on certain reactions is tested. The pressure in the process chamber is controlled to the desired level by means of an EL-PRESS Back Pressure Controller, independent of the total flow and/or the composition of the mixture.

› Compensation of atmospheric pressure changes



Superconducting coils, which are used to generate magnetic fields, are cooled by liquid helium. Depending on the temperature exchange gaseous helium should be vented. With a manually controlled outlet the variation of the atmospheric pressure disturbs the magnetic field. By using an EL-PRESS P-702CV Back Pressure Controller the pressure for the superconducting coils is kept constant, thus eliminating the negative effects of atmospheric pressure variations.

Technical specifications

Measurement / control system	
Accuracy (incl. linearity and hysteresis)	±0,5% of full scale (FS)
Pressure rangeability	measurement: 1:50 (2...100%) control (with flow range 1:50) P-602CV / P-602CM / P-612CV 1:20 P-702CV / P-702CM / P-712CV 1:5
Repeatability	≤ 0,1% RD
Response time sensor	2 msec
Control stability	≤ ±0,05% FS (typical for 1 l _v /min N ₂ at specified process volume)
Operating temperature	-10...+70°C
Temperature sensitivity	0,1% FS/°C
Leak integrity	tested < 2 x 10 ⁻⁹ mbar l/s He
Attitude sensitivity (at 90° change)	< 0,3 mbar (abs./rel. sensors) < 6 mbar (dif. sensors)
Warm-up time	negligible

Mechanical parts	
Material (wetted parts)	stainless steel 316L or comparable
Process connections	compression type or face seal couplings
Seals	standard: Viton® options: EPDM, FFKM (Kalrez®)
Ingress protection (housing)	IP40

Electrical properties			
Power supply	+15...24 Vdc		
Max. power consumption	Supply	at voltage I/O	at current I/O
Meter	15 V 24 V	95 mA 65 mA	125 mA 85 mA
Controller	15 V 24 V	290 mA 200 mA	320 mA 215 mA
Extra for fieldbus (if applicable)	15 V < 75 mA 24 V < 50 mA		
Analog output/command	0...5 (10) Vdc or 0 (4)...20 mA (sourcing output)		
Digital communication	standard: RS232 options: DeviceNet™, CANopen®, PROFIBUS®DP, Modbus RTU/ASCII, FLOW-BUS, EtherCAT®, PROFINET, Modbus/TCP, EtherNet/IP, POWERLINK		

Electrical connection	
Analog/RS232	9-pin D-connector (male);
Profibus DP	bus: 9-pin D-connector (female); power: 9-pin D-connector (male)
DeviceNet™, CANopen®	5-pin M12-connector (male)
EtherCAT®, PROFINET, Modbus-TCP, EtherNet/IP, POWERLINK	2 x RJ45 modular jack (in/out)
FLOW-BUS, Modbus-RTU/ASCII	RJ45 modular jack

Technical specifications subject to change without notice.

Calibration
References verified by an ISO 17025 calibration laboratory, directly traceable to Dutch and international standards.

Models and pressure ranges

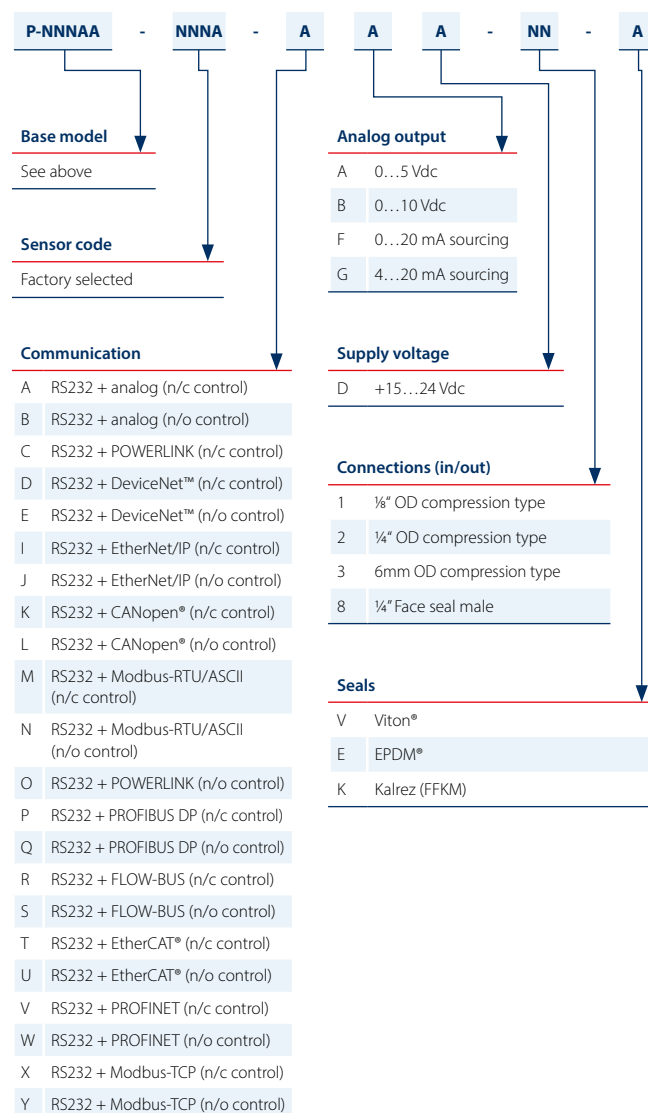
Electronic Pressure Transducers (EPT)			
Models, elast. sealed		Pressure ranges	
P-502C	(absolute/relative)	min. 2...100 mbar	max. 1,28...64 bar
P-512C	(absolute/relative)	min. 1,28...64 bar	max. 2...100 bar
P-522C	(absolute/relative)	min. 2...100 bar	max. 4...200 bar
P-532C	(absolute/relative)	min. 4...200 bar	max. 8...400 bar
P-506C	(differential)	min. 2...100 mbar	max. 0,3...15 bar
Model, metal sealed		Pressure ranges	
P-502CM	(absolute/relative)	min. 7...350 mbar	max. 1,28...64 bar

Electronic Pressure Controllers (EPC)			
Models, elast. sealed		Pressure ranges (abs/rel)	
P-602CV ¹⁾	(forward pressure control)	min. 5...100 mbar	max. 3,2...64 bar
P-612CV ¹⁾	(forward pressure control)	min. 3,2...64 bar	max. 5...100 bar
P-702CV ¹⁾	(back pressure control)	min. 20...100 mbar	max. 12,8...64 bar
P-712CV ¹⁾	(back pressure control)	min. 12,8...64 bar	max. 20...100 bar
Models, metal sealed		Pressure ranges (abs/rel)	
P-602CM ¹⁾	(forward pressure control)	min. 17,5...350 mbar	max. 3,2...64 bar
P-702CM ¹⁾	(back pressure control)	min. 70...350 mbar	max. 12,8...64 bar

1) $K_v\text{-max} = 6,6 \times 10^{-2}$

For ranges of 200 or 400 bar rated pressure controllers and for low-ΔP control applications with K_v -values up to 1,0 please contact factory.

Model number identification



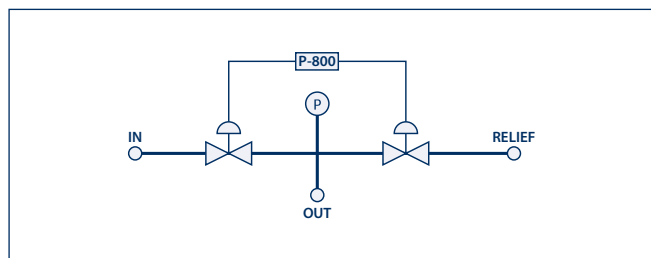
Process Pressure Controllers – P-8x2CV Series

› Principle of operation

The Process Pressure Controller consists of a piezo-resistive pressure sensor and two direct acting, solenoid control valves. The instrument has a gas inlet for pressurisation, a pressure relief outlet and a system outlet. While pressurizing the system - this will normally be a static volume - the pressure sensor and the inlet valve operate as a forward pressure controller and the relief valve remains shut. When the system requires depressurisation, the inlet valve is shut and the pressure sensor in combination with the relief valve will act as back pressure controller.

This dual valve construction is a compact, economical alternative to configurations where forward pressure controllers are combined with separate bleed ports and relief valves. It is considered a great advantage that the relief valve does not continuously vent to the atmosphere. Furthermore the system can be set for either fast or smooth controlled (de)pressurization.

› Configuration

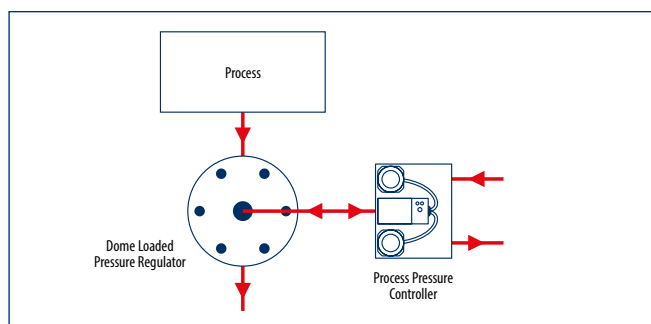


Process Pressure Control

› Features P-8x2CV Series

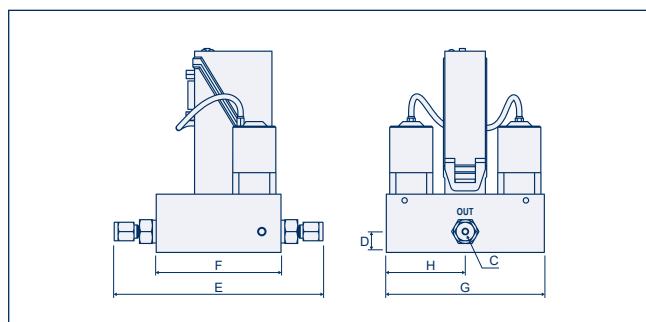
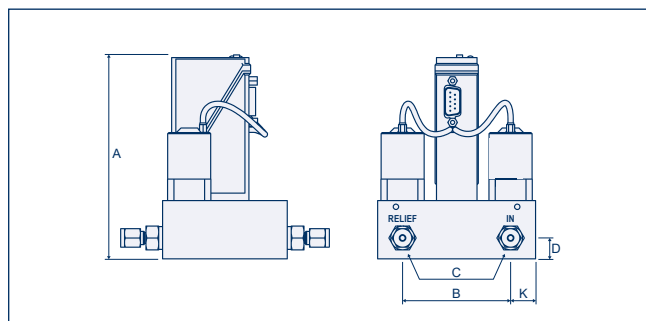
- ◆ Pressure up to 200 bar
- ◆ Dual valve pressure control (inlet/relief)
- ◆ For absolute or gauge pressure
- ◆ High accuracy and repeatability
- ◆ Low gas consumption (no gas bleed)
- ◆ On-board PID controller for pressure control
- ◆ Analog, RS232 and fieldbus communication

› Application: Automated dome loaded back pressure regulator



Dome loaded pressure regulators are often used to process aggressive reactants and by-products at high temperatures. For these severe applications, dome valves can be manufactured from chemically inert materials such as SS316, Hastelloy, Zirconium and Monel. For the automation of dome loaded back pressure regulators, P-8x2CV instruments can be applied to control the position of the membrane to open or close the orifices of the dome loaded regulator, thereby releasing gas or liquids from the process as to keep the process pressure at a constant level.

› Dimensional drawings



Model	A	B	C	D	E	F	G	H	K	Weight (kg)
P-802CV / P-812CV / P-822CV (1/4")	121	65	G 1/8"	12.5	130	75	95	47.5	15	2,3

Dimensions in mm.



EL-PRESS P-812CV Process Pressure Controller

Technical specifications

Measurement / control system

Accuracy (incl. linearity and hysteresis)	± 0,5% of Full Scale (FS)
Pressure control rangeability	1:20 with flow range 1:50
Repeatability	≤ 0,25% RD
Response time sensor	2 msec
Max. Kv-value	1,56 x 10 ⁻³
Max. pressure difference (ΔP)	P-802CV: 64 bar (d) P-812CV: 100 bar (d) P-822CV: 200 bar (d)
Max. flow	approx. 20 l/min N ₂
Control stability	≤ ± 0,1% FS (typical for 100 ml/min N ₂ at specified process volume)
Temperature range	-10...+70°C
Temperature sensitivity	< ± 0,1% FS/°C
Leak integrity (outboard)	tested < 2 x 10 ⁻⁹ mbar l/s He
Attitude sensitivity (at 90° change)	< 0,3 mbar
Warm-up time	negligible

Mechanical parts

Material (wetted parts)	stainless steel 316L or comparable
Process connections	compression type or face seal couplings
Seals 64/100 bar version	static and plungers: Viton® / EPDM / Kalrez®
Seals 200 bar version	static: Viton®, plungers: FKM
Ingress protection (housing)	IP40

Electrical properties

Power supply	+15...24 Vdc ±10%		
Power consumption (based on N/C valve)	Supply	at voltage I/O	at current I/O
	15 V	290 mA	320 mA
	24 V	200 mA	215 mA
Extra for fieldbus (if applicable)	15 V < 75 mA 24 V < 50 mA		
Analog output/command	0...5 (10) Vdc or 0 (4)...20 mA (sourcing output)		
Digital communication	standard: RS232 options: CANopen®, DeviceNet™, PROFIBUS DP, Modbus RTU / ASCII, FLOW-BUS		

Electrical connection

Analog, RS232	9-pin D-connector (male)
PROFIBUS DP	bus: 9-pin D-connector (female); power: 9-pin D-connector (male)
DeviceNet™, CANopen®	5-pin M12-connector (male)
FLOW-BUS, Modbus RTU / ASCII	RJ45 modular jack

Technical specifications subject to change without notice.

Calibration

References verified by an ISO 17025 calibration laboratory, directly traceable to Dutch and international standards.

Models and pressure ranges

Process Pressure Controller (PPC)

Models	Pressure ranges (abs/rel)	
P-802CV	Min. 17,5...350 mbar	Max. 3,2...64 bar
P-812CV	Min. 3,2...64 bar	Max. 5...100 bar
P-822CV	Min. 5...100 bar	Max. 10...200 bar

Model number identification

