Arthur Grillo
measuring & controlling systems

Installation and operation manual

DPC200 -
DIFFERENTIAL PRESSURE CONTROLLER

Low pressure with PI-control-mode

Doc.-no.: DPC200_03_UK Issue: 06/2018

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1. General safety instructions

1.1 Signal words for safety instructions

The safety instructions in this operation manual are designed to prevent hazards. They can be found in the operation manual before an operation / task / activity is described, which can entail a possible hazard.

CAUTION	Identification of a hazard with a low risk, which can lead to material damage or minor or moderate bodily injuries.

NOTICE	Signal word for important information regarding the product, which needs to be specifically pointed out.

Hazard word

Type of hazard

Hazard source

Hazard prevention

1.2 Used pictograms and symbols

In this manual the following symbols are used:

 General hazard symbol (danger, warning, caution)	 General information

1.3 General notes

NOTICE

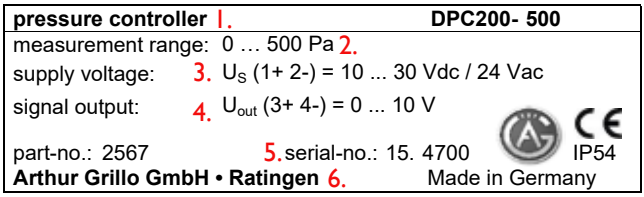
This manual contains information for installation and operation of the pressure controller and is exclusively for the operator and expert staff. The guidelines in this manual will help to avoid danger and downtime.

2. Product description

The differential pressure controller DPC200 measures low pressure of inert gases, particularly of air.

2.1 Type plate

1. Product name
2. Measuring range
3. Supply voltage
4. Signal output
5. Serial no.
6. Manufacturer



2.2 Intended use

This device is primarily intended for use with air conditioning systems, room pressure control or filter control with ebm-papst continuously variable speed fans. It can be operated solely as a sensor (measuring mode) or closed loop controller for pressure / volumetric flow rate control. As analog output the operator can use a signal from 0 ...10V DC. Depending on the settings the signal has different meanings:

1. If the device is used as a pressure sensor, the output signal is proportional to the measured pressure.
2. As a volume flow sensor the device outputs a square root signal.
3. With closed loop pressure or volume flow the output signal stands for the control variable of the PI-control.

2.3 Functional description

A soft silicone diaphragm is used as sensor. Under the influence of the differential pressure the diaphragm displaces a measuring spring until the spring force compensates for the pressure pushing on the diaphragm. A contactless differential transformer and suitable electronics convert this displacement into a continuously variable output voltage signal.
The DPC200 provides two function options:

1. On the one hand it is used as a measuring device. In the measuring mode the differential pressure is shown on the display, and a proportional 0...10V DC output signal is provided.
2. Besides the measuring mode the DPC200 also can be operated in a control mode. Two setpoints can be adjusted in the device and can be selected with the potential free contact input. The PI-Algorithm matches the measured differential pressure with the setpoint and operates the control variable so that a constant pressure results. The control variable is given as a 0...10V DC output signal.

Instead of the quantity ‘differential pressure’ also the quantity ‘volume flow’ can be used for measuring and for control.

3. Installation

The differential pressure controller DPC200 is designed for wall mounting.

- The mounting surface must be solid enough and vibration-free.
- The environment has to fulfill the ambient climatic conditions as given in the technical data.

CAUTION

Material damage

Read the manual carefully before installation and operation

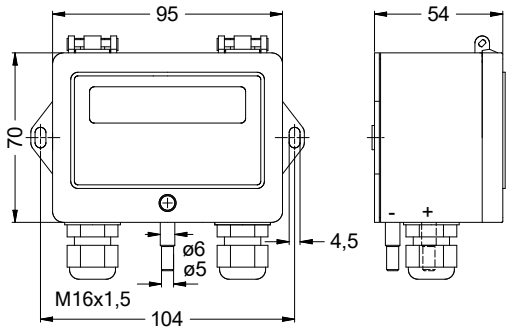
Only experienced stuff may connect the device and bring it into operation.

NOTICE

- The device is position depended.
- The DPC200 must be mounted vertically.

3.1 Dimensions

All dimensions in mm.



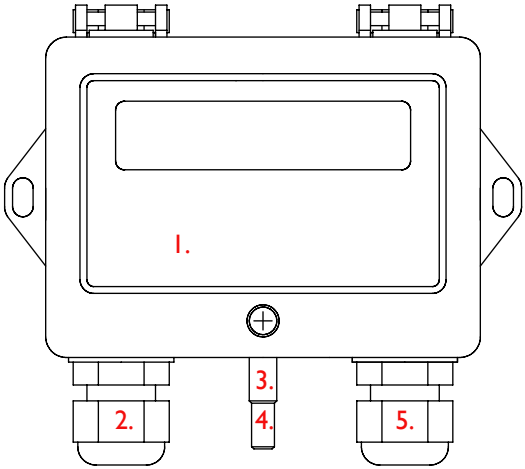
3.2 Wall mounting

1. Hold the DPC200 against the wall. Mark the mounting holes.
2. Drill mounting holes for properly sized screws.
3. Put the screws through the housing mounting holes.
4. Tighten screws.

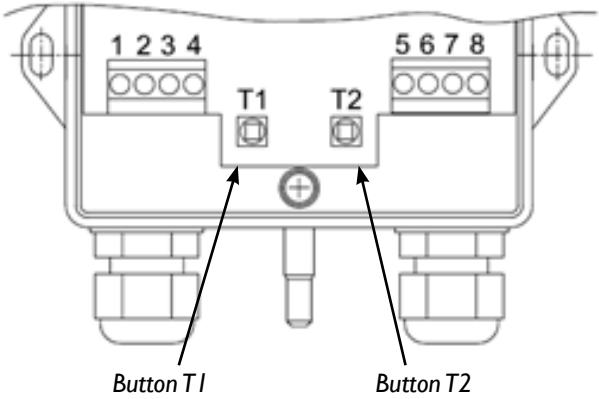
4. Start up

4.1 Overview DPC200

1. Front cover
2. Cable gland
3. Pressure connection 1
4. Pressure connection 2
5. Cable gland



4.2 Schematic view inside

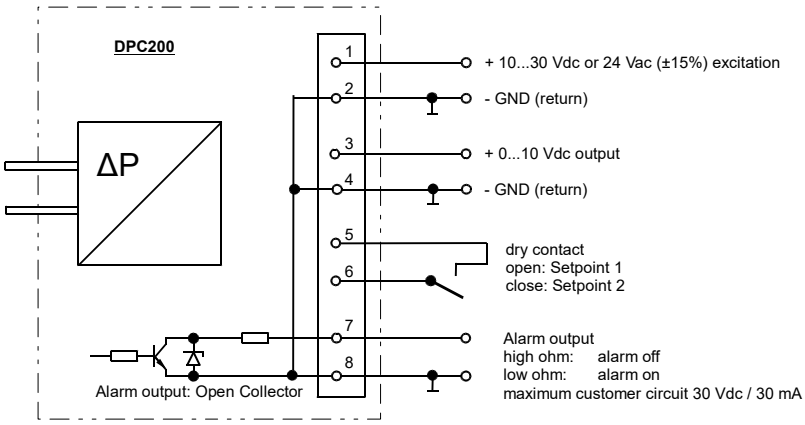


Button T1 and T2 serve for the operation of the menu

4.3 Pressure connections

Connect all pressure connections properly with plastic tubing (inner diameter 5 or 6mm).

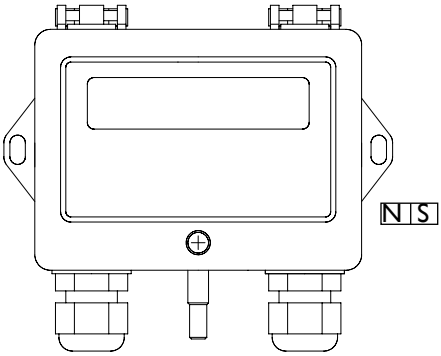
4.4 Electrical connection



1. Unscrew screws of the front cover.
2. Open front cover.
3. Use M16 cable glands for connecting wiring to terminals.

4.5 Zero adjustment

The output signal offset can be zeroed from the outside with a small bar magnet. Do not use buttons T1 or T2.



Adjustment:

- Remove the tubing from the pressure connections.
- Hold the bar magnet (N/S) as shown here to the zero point adjustment for a short period of time to activate an internal reed switch.

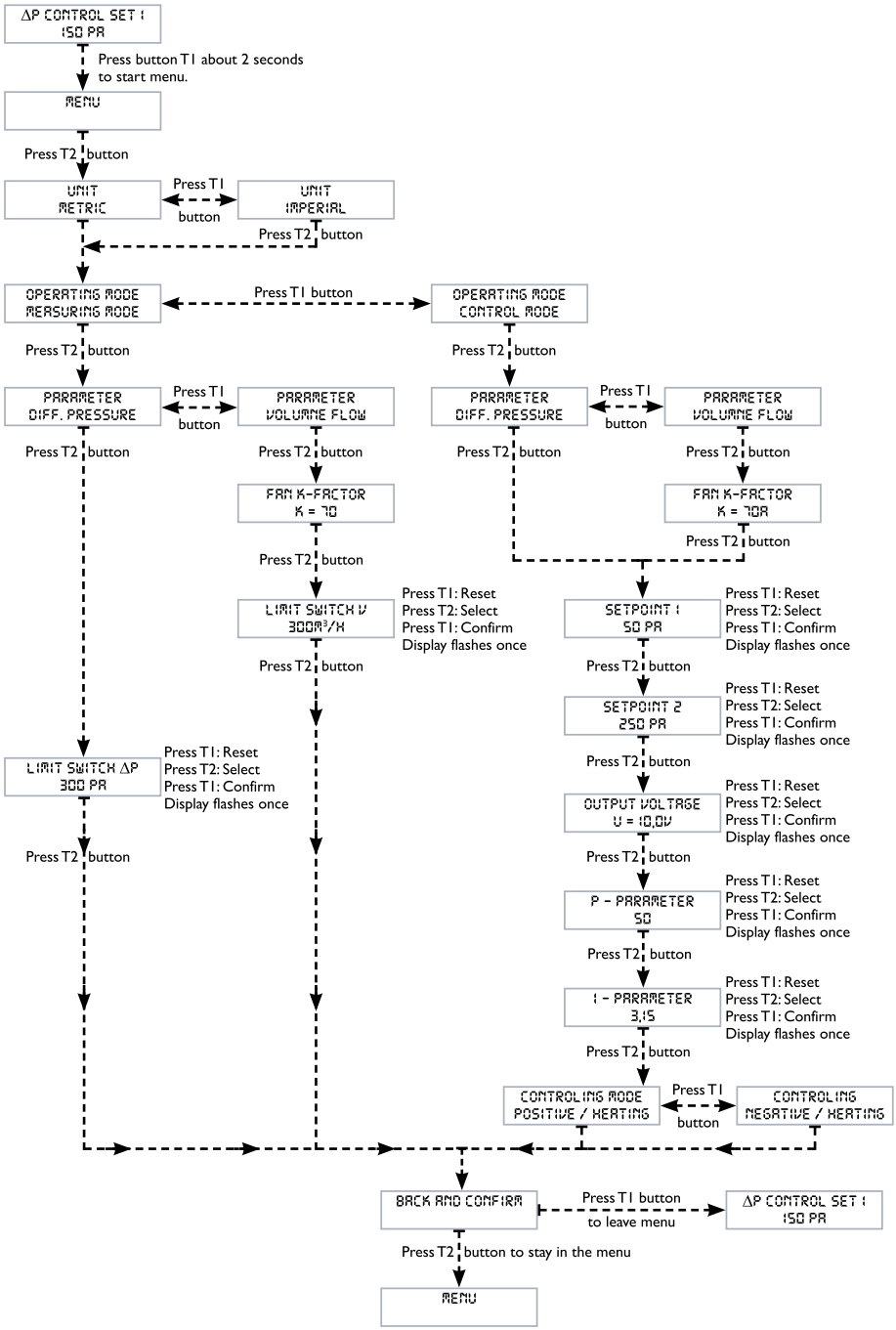
The new zero point will be displayed and stored.

5. Operation

5.1 Start menu

For operating the menu, unscrew the front cover to reach buttons T1 and T2.

5.2 Menu structure



5.3 Measuring mode

Display	Action
ΔP Measurement 200 Pa	**Start menu:** Press button T1 approx. two seconds
menu	Press button T2 to get to the next menu item
unit metric	Press button T1 to switch between: metric <=> imperial Press button T2 to get to the next menu item
operating mode control mode	Press button T1 to switch between: measuring mode <=> control mode Press button T2 to get to the next menu item
parameter diff. pressure	Press button T1 to switch between: diff. pressure <=> volume flow Press button T2 to get to the next menu item

	If selected parameter = diff. pressure
limit switch 150 Pa	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
back and confirm	Press button T1 to leave the menu Press button T2 to stay in the menu

	If selected parameter = volume flow than follows the additional input for the k-factor
fan k-factor k = 70	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
limit switch 300 m³/h	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
back and confirm	Press button T1 to leave the menu Press button T2 to stay in the menu

5.4 Control mode

Display	Action
ΔP Measurement 200 Pa	**Start menu:** Press button T1 approx. two seconds
menu	Press button T2 to get to the next menu item
unit metric	Press button T1 to switch between: metric <=> imperial Press button T2 to get to the next menu item
operating mode control mode	Press button T1 to switch between: measuring mode <=> control mode Press button T2 to get to the next menu item
parameter diff. pressure	Press button T1 to switch between: diff. pressure <=> volume flow Press button T2 to get to the next menu item

	If selected parameter = diff. pressure resp. after the input of the k-factor follows:
setpoint 1 50 Pa	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
setpoint 2 250 Pa	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
output voltage U = 10,0 V DC	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
P - parameter 50	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
I - parameter 3,15	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item
controlling mode positive / heating	Press button T1 to switch between: positive / heating <=> negative / cooling Press button T2 to go to the next menu
back and confirm	Press button T1 to leave the menu Press button T2 to stay in the menu

	If selected parameter = volume flow than follows the additional input for the k-factor
fan k-factor k = 70	Button T1: reset value Button T2: set value Button T1: confirm value, display flashes once Press button T2 to get to the next menu item

5.5 Adjustable parameters

Parameter	Selection or parameter range	Default setting
Unit	Metric or imperial	metric
Operating mode:	Measuring mode or control mode	measuring mode
Parameter	Differential pressure ΔP [Pa] or [InH_2O] Volume flow V [m^3/h or cfm]	differential pressure ΔP [Pa]
K-factor:	Volume flow calculation according to: $V = k \cdot \sqrt{\Delta p}$ with: V = Volume flow in [m^3/h] or [cfm] k = flow factor, adjustment range: 1...10,000 Δp = differential pressure in [Pa] or [InH_2O] Volume flow range up to 999,999 m^3/h **Maximum volume flow (V_{max})** Measuring range: 50 Pa, k=10,000 → V_{max} = 70,710 m^3/h; Measuring range: 500 Pa, k=10,000 → V_{max} = 223,607 m^3/h; Measuring range: 1000 Pa, k=10,000 → V_{max} = 316,228 m^3/h; Measuring range: 2000 Pa, k=10,000 → V_{max} = 447,214 m^3/h; Measuring range: 4000 Pa, k=10,000 → V_{max} = 632,456 m^3/h; Measuring range: 6000 Pa, k=10,000 → V_{max} = 774,597 m^3/h	K = 70
Limit values:	Differential pressure from 0 % up to 100 % of measuring range. Volume flow from 0.5 % up to 100 % of measuring range, k-factor is considered.	OFF
Nominal values (setpoints):	Differential pressure from 0 % up to 100 % of measuring range. Volume flow from 0.5 % up to 100 % of measuring range, k-factor is considered.	placeholder 1: 8888 2: 8888
Output voltage:	0…10 V DC	U_{out} = 10 V DC
P-gain:	0...1000	P = 50
I-gain:	0…100	I = 3.15
Control characteri-stic:	**positive/(heating):** Control deviation = set value – actual value The output increases when: Set value > actual value **negative/(cooling):** Control deviation = actual value – set value The output increases when: Actual value > set value	positive / heating

5.6 Threshold calculation

NOTICE

The device requires a minimum pressure to calculate a volume flow.
Minimum pressure = **0.5 % of the product mesuring range**
PRESSURE < 0.5 % measuring range = Display shows **0 m³/h**
Minimal flow: ***V_min* = $\sqrt{(0.005 \times \text{measuring range})} \times k$**
Maximal flow: ***V_max* = $\sqrt{(\text{measuring range})} \times k$**

Exampel: Threshold calculation
The set limit value must be between minimum and maximum flow.
As reference device we choose DPC200 with a measuring range of 0...1000 Pa.
The limit value calculation formula: $V = \sqrt{\Delta P} \times k$

Given values:

Measuring range = ***0...1000 Pa***; *k-factor (k)* = ***116***; *Limit value (V)* = ***1,200 m³/h***
It follows: $\Delta P = (V / k)^2 = (1{,}200 / 116)^2 = 107\ Pa > 5\ Pa = 0.5\ \%$ *of the measuring range*
Minimal flow: $V\_min = \sqrt{(0.005 \times 1000)} \times 116 =$ **259 m³/h**
Maximal flow: $V\_max = \sqrt{(1000)} \times 116 =$ **3,668 m³/h**

Result: The limit value of **1,200 m³/h** is between V_min and V_max and adjustable by our **DPC200-R (0...1000 Pa)**.

5.7 Function alarm output

The DPC200 has an open collector alarm output; depending on the operating mode the function is different. At the **alarm event** a contact between terminal no. 7 and no. 8 gets low-resistive and can be loaded with a maximum of 30 V DC/ 30 mA. When the alarm is switched off the contact will be high-resistive.

During alarm state in the control mode / measuring mode an exclamation point (!) is displayed (2nd line / 16th character).

Control mode: In order to recognize the limits of control, the alarm output in the control mode refers to the set maximum output voltage ($MaxU_{out}$). $MaxU_{out}$ can be set in the menu item „output voltage“.

In the default setting the value is set to 10 V DC.
Alarm ON: Output voltage for 12 seconds constantly greater than: $0.95 \cdot MaxU_{out}$
Alarm OFF: Output voltage for 12 seconds constantly less than: $0.9 \cdot MaxU_{out}$

Measuring mode: For limit value monitoring a limit value can be entered. This value is set in the menu item „limit switch“. The previously set parameters are taken into account (unit, parameter, k-factor and the measuring range).

As default setting the limits are not active - Display - 2nd line: „OFF“
Alarm ON: Measurement for 12 seconds constantly greater than 1.0 • limit value
Alarm OFF: Measurement for 12 seconds constantly less than 0.95 • limit value

6. Maintenance

The DPC200 contains no wearing or consumable parts. Servicing is not required.
On request, Arthur Grillo GmbH offers an annual calibration with factory certificate.
For information, please contact:

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7. Warranty

Warranty and liability claims for personal and property damage are excluded if they are caused by one or more of the following reasons:

- Improper use of the device.
- Improper installation, commissioning, operation and maintenance of the device.
- Unauthorized modifications to the device beyond the intended use.
- Disasters due to external influences and force majeure.

8. Troubleshooting

Description	Activity
Display does not show anything	Check electrical connection
Measurement stays zero	Function test with a slight pressure increase in measuring mode for differential pressure
Measuring error	Perform zeroing as described in chapter 4.5.
Error remains	Contact manufacturer

9. Disposal

Dispose of parts so as not to endanger the human health or environment. Follow the laws in the country of use for disposing of electronic components and devices during disposal.

10. Specifications

Measuring medium:	Air or inert gases
Measuring principle:	Silicon diaphragm with spring and differential transformer
Lowest span:	0...50 Pa
Highest span:	0...6000 Pa
Overpressure protection:	0.2 bar
Static pressure:	max. 0.2 bar
Pressure connections:	tubing 5 mm ø or 6 mm ø
Enclosure:	UL 94 HB; Case polyamid, cover ABS
Electrical connections:	cable inlet M16x1.5, screw terminal Electronic protection against reversed polarization
Supply voltage:	10...30 Vdc; 24 Vac (±15%)
Current consumption:	approx. 10 mA @ 10 Vdc, approx. 12 mA @ 24 Vdc
Output:	0...10 V (I_{max} = 0.4 mA @ 10 Vdc, I_{max} = 2 mA @ 20 Vdc)
Alarm output:	Open Collector, max. 30 V / 30 mA
Display:	LCD-Display, 2 x16 characters
Mode:	Measuring mode or controlling mode
Controlling algorithm:	PI
Setpoints:	2 setpoints adjustable within software, Setpoints are selectable with floating contact input
Protection class:	IP 54 according EN 60529
Ambient temperature:	-10...50 °C
Storage temperature:	-25...60 °C
Weight:	approx. 250 g
Mounting:	vertical, position dependence by turning of 90°: approx. 25 Pa
Interference / emission:	according EN 61000-6-2, EN 61000-6-3, CE mark

Influences / limits:		
	Zero error:	± 0.75 %
	Sum of linearity and hysteresis (depends on measuring range):	± 0.5 % ... ± 1 %
	Temperature drift, zero point:	± 0.3 % / 10 K
	Temperature drift, span:	± 0.2 % / 10 K

10.1 CE-labelling

As an electric device the DPC200 falls within the scope of the directive 2004/108/EG (EMV-directive). In the scope of the EMV-directive the following norms were applied:

DIN EN 61000-6-2:2006-03 correction 1:2011-06	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
DIN EN 61000-6-3:2011-09	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light industrial environments

You can order the Declaration of Conformity at:

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