

Product description

Microprocessor controlled system for regulation and monitoring of the constant room pressure maintenance. It has to be maintained a constant over- or underpressure in clean rooms or laboratories compared to adjoining rooms (e. g. corridor). This avoids the intrusion respectively loosing of contaminated or uncleaned air with an excessive dust content depending on the application.

The room pressure controller iCM-RP regulates independently the necessary free programmable room under- or overpressure. The setpoint setting occurs via the digital inputs (parameterization via password protected internal menu or laptop with PC2500 software (USB flash drive)).

The adjusted room pressure actual value is shown on the full graphic LC display as a numerical value in Pascal. Exceeding or undercut of the adjusted setpoint setting triggers the visual (red LED) and optional acoustical alarm.

The room pressure controller iCM-RP is a suitable system supplement for the fume hood controller iCM-F-0 (regulation to a constant air inflow) to guarantee the constant room pressure maintenance of the laboratory. Together with the duct pressure controller iCM-DP which regulates a bypass damper or the frequency converter of the fan directly SCHNEIDER provides a completely integrated and independent regulation system.

Functional description

Microprocessor controlled fast regulation system for a constant pressure maintenance of rooms. A fast control algorithm compares the room pressure setpoint with the measured room pressure of the static differential pressure sensor and controls fastly, precisely and steadily independent of pressure fluctuations within the duct net. The parameterized constant room under- or overpressure is therefore constantly maintained.

The room pressure to be regulated is freely adjustable and can be stored fail-safe in an EEPROM. The control velocity is very fast (control time < 3 s) and the actuator running time for 90 ° can be freely adjusted within a range of 3 s to 24 s.

Due to the high control velocity the installation of a door respectively window contact is mandatory, to achieve a steady control behaviour and to avoid unnecessary control cycles during the opening and closing of doors or windows. While using the door or window contact the current control value is „frozen“, this means the room pressure regulation is inactive. The contact can be parameterized as NO (normally open or NC (normally closed).

The SCHNEIDER dampers for the room pressure controller iCM-RP are available in round or rectangular versions.

The room pressure controller iCM-RP regulates independently and has an internal limit value monitoring with a potential-free relay output each for the the upper and lower limit value.



Performance features

- Microprocessor controlled room pressure regulation with a full-graphic LC-display and a numerical room pressure signaling in Pascal
- Compact control system in a wall housing
- Integrated operator panel with status display and alarm acknowledgement
- Integrated optional limit value monitoring of the room under- or overpressure with visual or optional acoustical alarm
- Constant room pressure maintenance freely programmable
- All system data is stored fail-safe in an EEPROM
- Running time of the actuator ≤ 3 s for 90 °, running time delay freely programmable
- Free parameterization of the system data via the internal menu or laptop with software PC2500, e. g. regulation time, over- or underpressure
- Internal static differential pressure sensor with a high long-term stability for the steady measurement of the actual value within a range of ± 50 Pa or optional -80 to +20 Pa (external)
- Fast predictive control algorithm
- Fast, steady and precise control via direct activation of the actuator with feedback potentiometer
- Closed loop
- Monitoring of the customer provided ventilation system
- Suitable as room supply air or exhaust air controller
- Analogue actual value output 0(2) to 10 V DC/10 mA
- Two digital inputs for up to three different room pressure setpoint settings (e. g. airlocks, day/night operation)
- Relay contact 1 x A for limit value monitoring
- Internal power supply 230 V AC

Room pressure controller iCM-RP • Block diagram

Parameterization

The parameterization of the setpoints and the readout of the actual value occur via laptop and software PC2500 (USB flash drive) or the integrated menu.

Constant room regulation

The room pressure controller iCM-RP is delivered in a wall housing, already contains the static differential pressure transmitter (± 50 Pa) and is suitable for the independent room pressure control of supply air as well as for exhaust air.

In block diagram 1 the room pressure controller iCM-RP follows the variable respectively constant room exhaust air and maintains the room pressure within the laboratory rooms in a constant underpressure (e. g. -10 Pa) via the room supply air although the exhaust air volume flow is regulated variably via the temperature sensor T.

The room pressure controller iCM-RP can control rooms in under- or overpressure by a suitably connected static differential pressure transmitter. Laboratories are controlled in underpressure while clean rooms are controlled in over-

pressure to avoid the intrusion of „unclean“ air into the clean room.

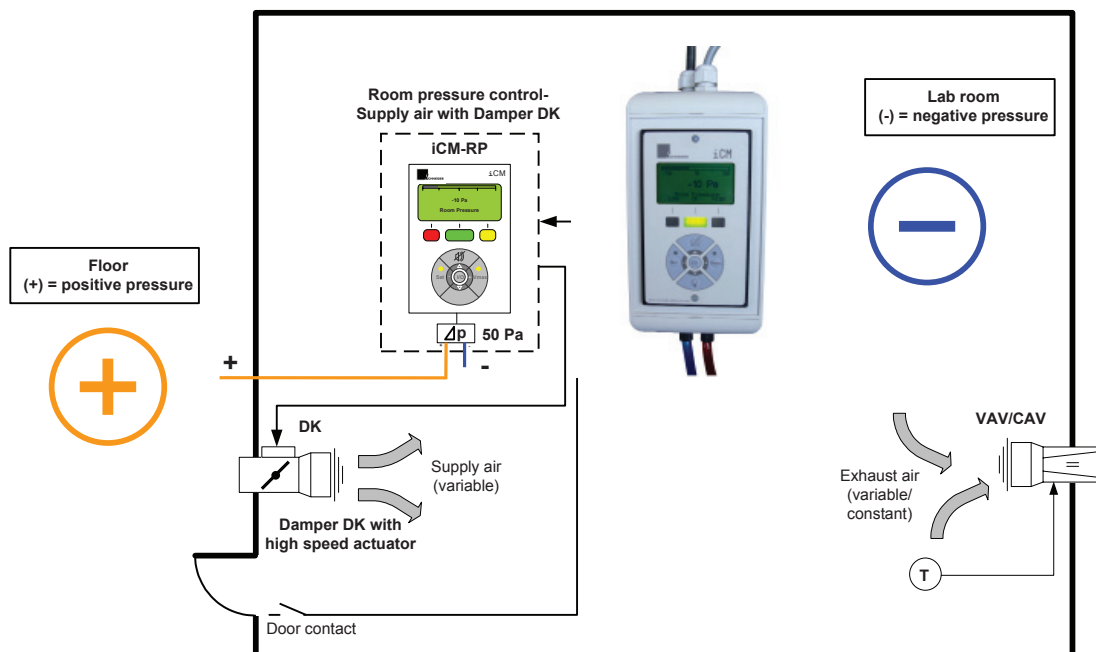
When used in laboratories (underpressure) the static differential pressure transmitter of the iCM-RP measures the pressure difference between the corridor (+) and the clean room (+) and generates the actual value signal for the to be adjusted setpoint.

When used in clean rooms (overpressure) the pressure difference between corridor (-) and the clean room (+) is measured. In this case the (-) connection of the differential pressure transmitter is led through the corridor.

The volume flow for the room exhaust air can also be conveyed in a two-stage operation (day/night operation) or via a constant volume flow controller (CAV).

Due to the fast and precise control algorithm and the fast running actuator with „Fast Direct Drive“ activation it is possible to adjust relatively airtight rooms smoothly as well. For extremely airtight rooms we recommend SCHNEIDER's VCP500 which is especially developed for this application. (see technical data sheet VCP500).

Block diagram 1:
room pressure controller iCM-RP



Constant room pressure

The constant room pressure is regulated depending on the digital input circuit.

The available operating modes are shown in graph 1 and table 1. A 1-point, 2-point or 3-point operation (set value 1 to 3) can be easily realized by direct activation of the digital inputs or via the button Vmax.

Setpoints 1 to 3 for room pressure specification

The room pressure setpoints shown in graph 1 are parameterized for example with the following setpoints:

- setpoint 1 (normal value)** = + 40 Pascal
- setpoint 2 (reduced value)** = + 20 Pascal
- setpoint 3 (emergency)** = + 10 Pascal

The room pressure actual value signal (A-Out1) correlates with the adjusted room pressure.

For the circuit of the digital inputs refer to table 1 and terminal connection plan on page 11.

Positive or negative room pressure setpoint values can be regulated for the airlock pressure controller or clean rooms.

Alarm thresholds

Two independent alarm thresholds can be parameterized with arbitrary alarm values within the sensor range. The alarm threshold values high and low affect the alarm relay. If the alarm relay sinks, the alarm threshold is exceeded or undercut and the alarm status will be signaled.

The alarm threshold values always relate to the to be adjusted prevailing room pressure setpoint.

Example:

- alarm threshold value high** = 5 Pascal
- alarm threshold value low** = 3 Pascal
- setpoint 1 (day)** = + 20 Pascal
- setpoint 2 (night)** = - 15 Pascal

During room pressure maintenance setpoint 1 (+20 Pascal) the alarm threshold value high will be exceeded and signaled at > +25 Pascal and the alarm threshold value low will fall below and signaled at < +17 Pascal (alarm relay drops down).

During room pressure maintenance setpoint 2 (-15 Pascal) the alarm threshold value high will be exceeded and signaled at < -10 Pascal and the alarm threshold value low will fall below and signaled at (alarm relay drops down).

If the input 2 is not wired (dead) setpoint 1 will be automatically adjusted.

The emergency (setpoint 3) can only be activated via button Vmax. The reduced value (setpoint 2) can be activated via the button „set“ or the digital input In2.

Graph 1: constant room pressure regulation (iCM-RP)

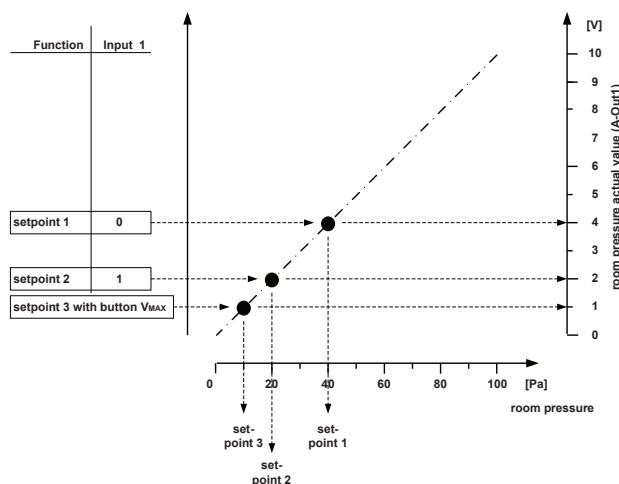


Table 1: iCM-RP-operating modes

function	digital input
	input 2 (day/night)
set value 1 = normal value (day)	0
set value 2 = reduced value (night)	1

The contacts can be parameterized as NO (normally open) or NC (normally closed).

Alarm delay time

The alarm delay time is freely programmable within a range of 0 to 240 s. The alarm mode has to be queued for at least the adjusted time to trigger the alarm. This time period reduces the triggering of false alarms, e. g. in case of instable air supply.

Door-/window contact

To avoid unnecessary regulation cycles by opening or closing of doors respectively windows and due to the high control velocity (< 3 s) a suitable contact has to be connected which „freezes“ the present control value for the operation time which means that for this time period the room pressure control is inactive.

The contact can be parameterized to NO (normally open) or NC (normally closed).

Damper with fast running actuator with feedback potentiometer (standard version)

The room pressure to be adjusted occurs via the damper (supply or exhaust air). The very fast running actuator (3 s for 90 °), specifically developed for SCHNEIDER, is directly mounted to the axis of the damper and possesses a torque of 3 Nm and is suitable for round or rectangular dampers up to a diameter of 280 mm or 250 x 250 mm.

The actuator is directly activated by the control electronics. (fast direct drive). This guarantees a fast and stable control behaviour. This activation mode shows significant advantages compared to the analogue actuator activation (0 to 10 V DC) because the internal control electronics of the analogue (steady) controlled actuator possesses a hysteresis which could cause vibrations in the controller in case of narrow room pressures to be adjusted or airtight rooms.

A feedback potentiometer signals the actual value of the present damper position to the control electronics. A special control algorithm provides the necessary room pressure without vibration fastly and directly.

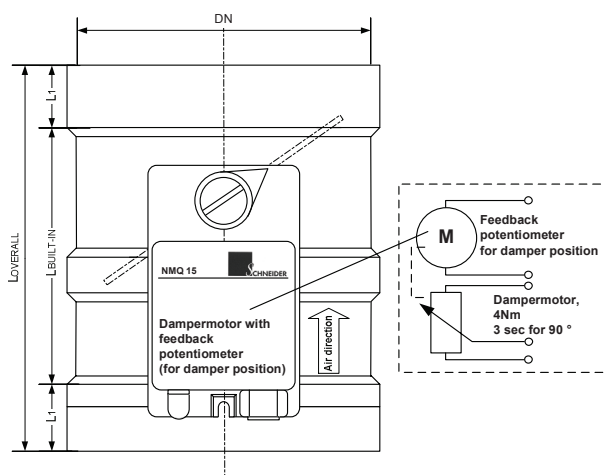
During the activation of the actuator the actual damper adjustment (damper control) is tested at the same time. This control concept with integrated monitoring function of the actuator exceeds the high safety regulations which are mandatory for room pressure controllers.

The end position of the dampers (damper close = 0 % and damper open = 100 %) can be arbitrarily parameterized, that means the actuator stops automatically at the programmed damper position and regulates just within the parameterized spectrum (e. g. between 10 to 80 %). Therefore the minimum and maximum volume flows can be limited without further effort.

IMPORTANT!

Actuator NMQ12 (3 Nm) can be used for round dampers up to a diameter of 280 mm or rectangular dampers up to 250 x 250 mm.

For larger dampers the actuator NMQ24 (8 Nm) with additional external transformer (additional box E4) has to be used.



Damper with fast running actuator with feedback potentiometer

Upward and downward control time freely parameterizable

The upward control time (damper open) and the downward control time (damper closed) is freely parameterizable in 1-second steps from 2 to 24 s. For this reason the control behaviour of the room pressure controller iCM-RP can be adjusted optimally to the room conditions (room size and tightness). Vibration tendencies can be minimized or completely avoided by optimal parameterization.

ATTENTION!

The room pressure controller iCM-RP is not suitable for very airtight rooms. If very airtight rooms should be adjusted exactly and pressure stably we recommend SCHNEIDER's patented room pressure prioritized volume flow controller VCP500 (see technical data sheet VCP500).

Control parameters

All project specific control parameters, e. g. room pressure setpoint, deadzone and close-up range can be retrieved, changed and monitored smoothly on site via the internal service level or a laptop (see overview internal menu list on page 10). A cyclic sequential retrieving and testing of control actual values and setpoints guarantees a very fast, stable and adequate room pressure regulation.

Test- and diagnosis functions

For the commissioning, diagnosis and simple error search it is very important to have an extensive and exact overview of all measured actual values.

SCHNEIDER's special test and diagnosis programm via service module SVM100 or PC software PC2500 provides the service and commissioning staff with the following actual values.

The controller iCM-RP possesses additionally an integrated service level which is accessible with the functional keys via password.

actual value	unit
room pressure	Pa
damper position	%

The following test functions are feasible:

- **Indication of digital inputs**
Indicates the present status of all digital inputs
- **Analogue inputs**
Indicates all analogue inputs with the present signal voltage
- **Analogue outputs**
Indicates all analogue outputs with the present signal voltage
- **Testing of actuator/damper**
Actuator/damper can be opened and closed with this test function

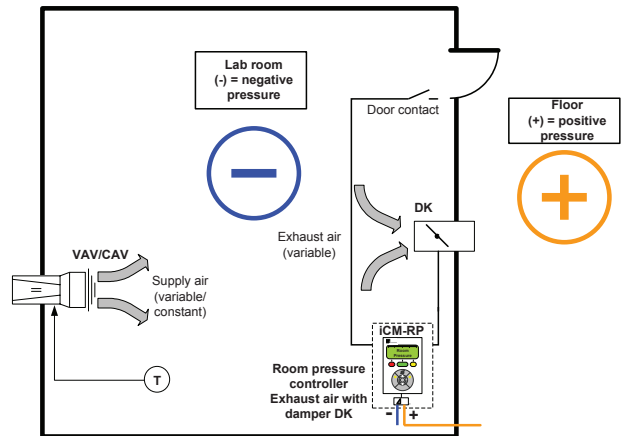
These test and diagnosis functions facilitate and simplify the commissioning and error search significantly.

Room scheme 1 • Room pressure controller iCM-RP with variable or constant room supply air

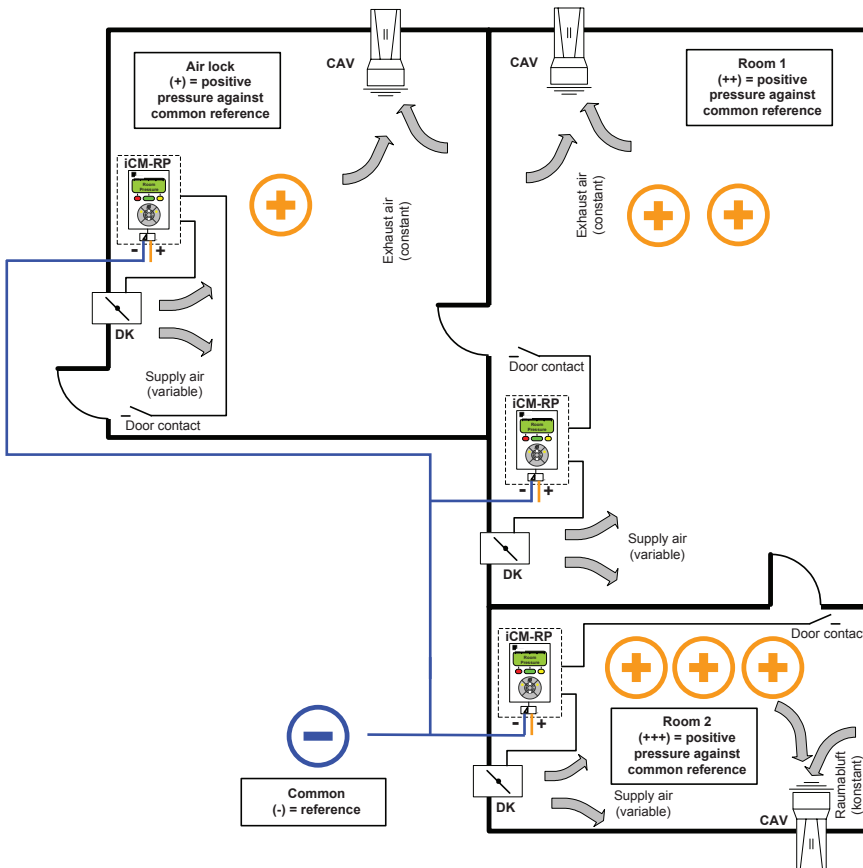
The room scheme 1 correlates with the block diagram 1 (page 2), unless that the room supply air is regulated by a variable (VAV) or constant (CAV) volume flow controller.

The room pressure controller iCM-RP follows the room supply air and maintains the constant room pressure via the room exhaust air. (e. g. -10 Pa).

Clean rooms are mainly controlled in overpressure to avoid the intrusion of „uncleaned“ air into the clean room.



Room scheme 2 • Airlock room pressure controller iCM-RP with variable or constant exhaust air



Room scheme 2 shows an application with constant volume flow controllers (CAV) each for the room exhaust air of the different rooms.

The room pressure controller iCM-RP regulates automatically the parameterizable room overpressure (+) independently for each room.

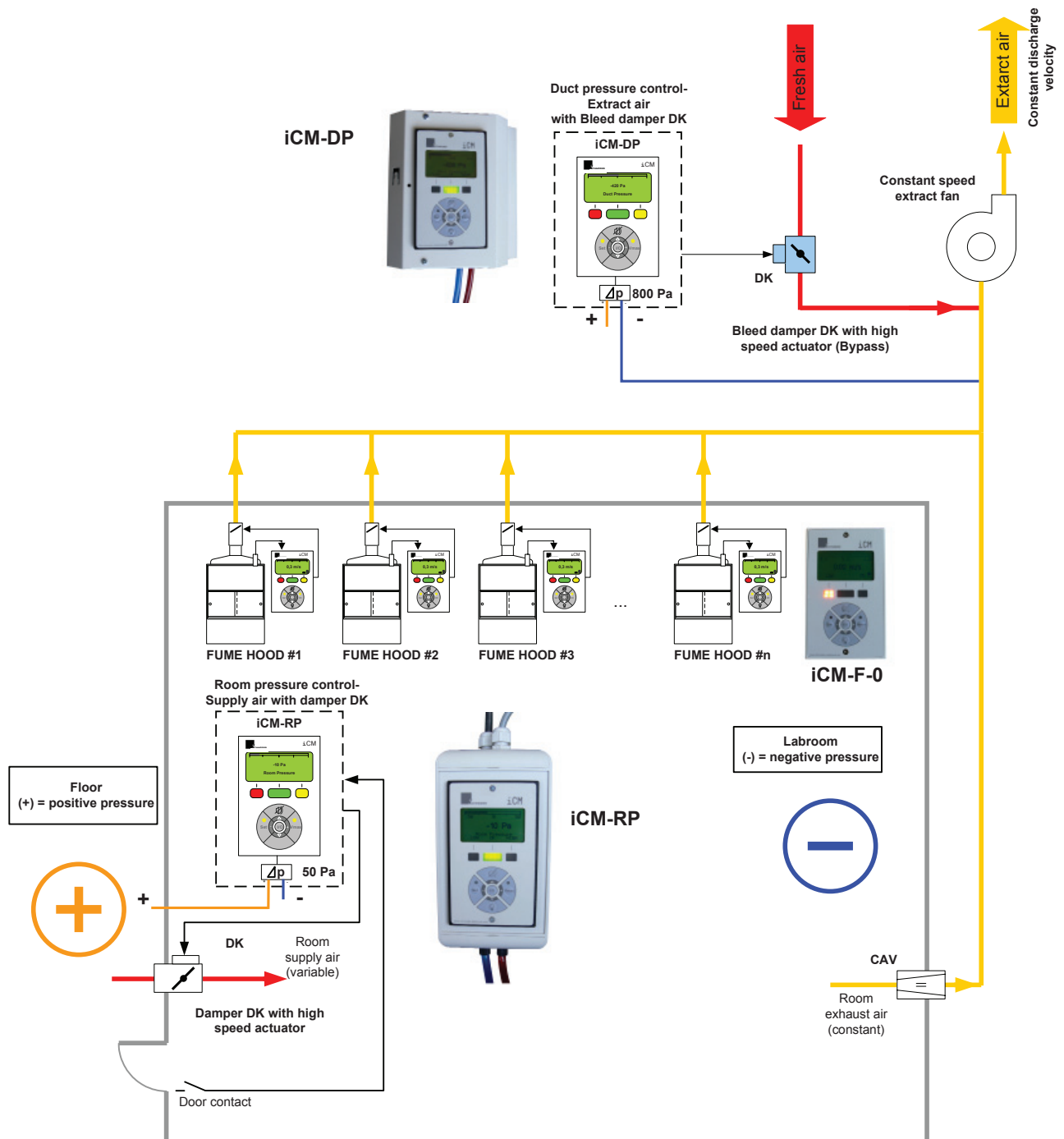
Table 2 shows the parameterized values and the reference measurement of the static differential pressure transmitter. All room pressure controllers iCM-RP are summarized on the (-) = underpressure page and measure against a common reference point. This preferred measuring type guarantees the best stability, at which the reference point should be situated at a constructional favorable position (e. g. calm cellar room without wind load respectively air pressure changes (Attention: elevators)). The wrong measurement of rooms against each other (e. g. room 1 against airlock) leads to reinforced vibration tendencies in the room pressure controlling because room pressure changes e. g. in the airlock affect room 1.

Table 2: example values and reference measurement

room	reference measurement to	parameterized value [Pascal]	pressure difference towards corridor (atmosphere) [Pascal]
airlock	common	+10	+10
room 1	common	+20	+20
Raum 2	gemeinsam	+30	+30

Arbitrary reference measurements and iCM-RP configurations (room supply air or exhaust air) are possible, depending on the applications, at which the control stability (low vibration tendency) should always be taken into consideration.

Block diagram 2: complete independent laboratory control system with laboratory control system iCM-F-0 (face velocity), room pressure controller iCM-RP and duct pressure controller iCM-DP with bleed damper activation



The block diagram 2 shows a complete independent laboratory control system. The fume hoods are adjusted to a constant inflow velocity via the face velocity controller iCM-F-0. Depending on the total exhaust air volume flow, which consists of the extracting fume hoods and the constant controller CAV, the supply air is compensated in such a way to maintain a constant underpressure of - 10 Pa.

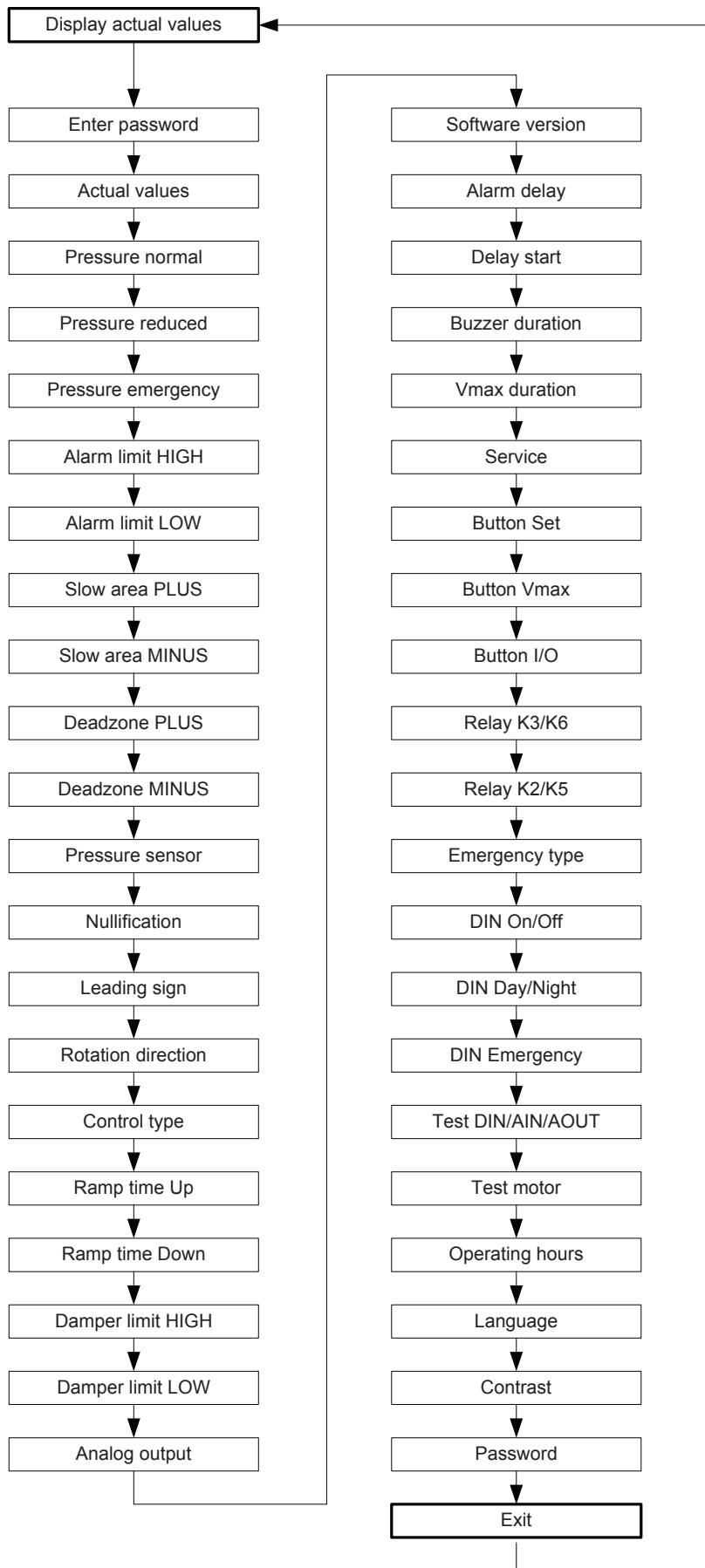
The disadvantage is the direct influence of opened doors respectively windows on the room pressure. To avoid unnecessary regulation of the falling room pressure the connection of a door and/or window contact is recommended. Therefore the room pressure controller will be „frozen“ with the present damper position (inactive) when a door or win-

dow is open to reduce the wearout of the actuator and the gear significantly.

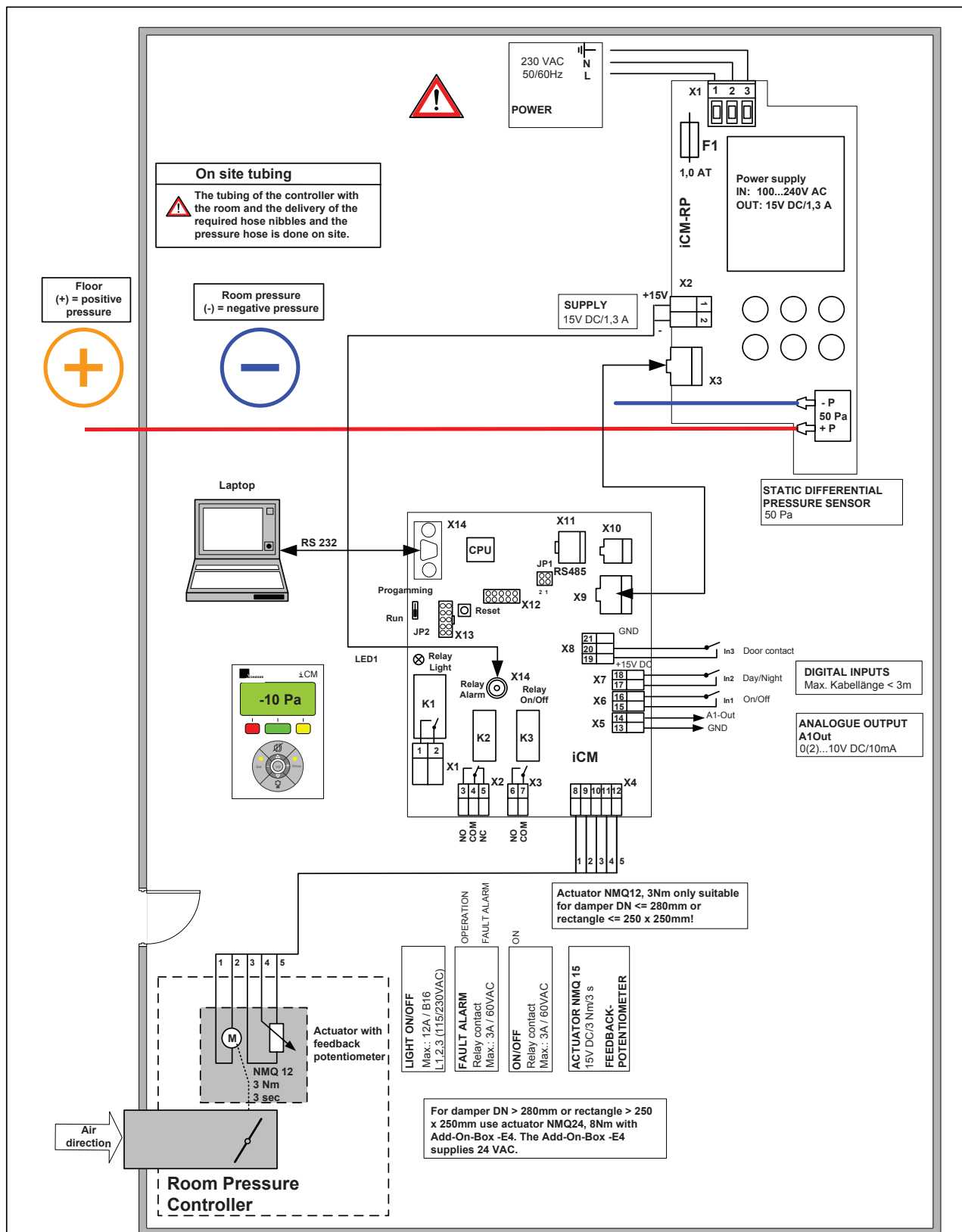
In this example the duct pressure controller iCM-DP works independently as well and is chosen as a bleed damper activation. A duct pressure controller via frequency converter FU for the total supply air and exhaust air is also possible.

Further applications (block diagrams): see technical data sheet iCM-LabSystem.

Survey menu list



Terminal diagram: room pressure controller iCM-RP



Cable specification:	
⚠	Cable type for 230V AC Power: minimum NYM 3 x 1,5 ²
⚠	Cable type for In-/Outputs: IY(S)Y 2x2x0,8 Lg for Voltage supply < 60 V minimum NYM 2 x 1,5 ² for Voltage supply > 60 V up to maximum 250 V

ROOM PRESSURE CONTROL		
Terminal diagram, complete	iCM-RP	
	Rev.: 1.0	Date: 2014/November/03

Dimensions • Volume flow ranges

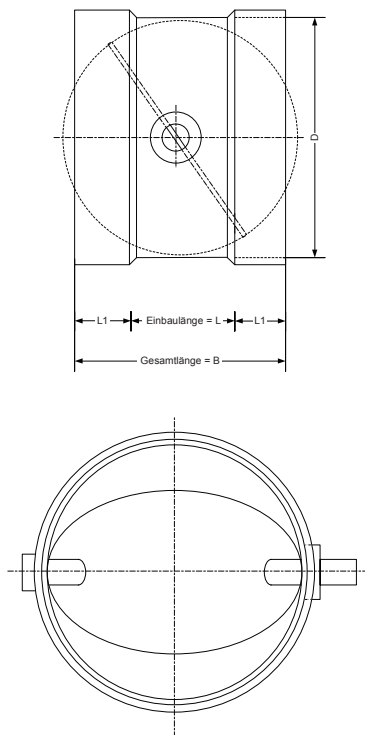
Damper without measuring device PPs, round design, with actuator

- control operating mode: room pressure controller iCM-RP
- high control precision and responsivity
- fast and stable room pressure maintenance (< 2 s)
- option: airtight damper according to DIN

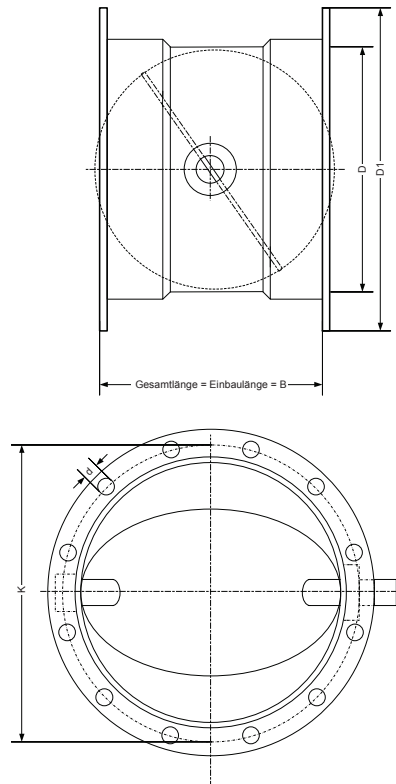
no-nominal width	inner Ø	volume flow V_{MIN} , V_{MAX} , V_{NOM} during flow velocity v		
NW [mm]	D [mm]	$v \approx 0,5$ m/s V_{MIN} [m ³ /h]	$v = 6$ m/s V_{MAX} [m ³ /h]	$v \approx 10$ m/s V_{NOM} [m ³ /h]
160	161	30	434	589
200	201	50	679	1005
250	251	80	1060	1628
315	316	130	1683	2667
400	401	217	2714	4347

The adjoining table shows the volume flows within the appropriate duct flow velocities and nominal widths. In the laboratory (exhaust and supply air) the duct flow velocity $v = 6$ m/s should not be exceeded due to the acoustic noise (flow noise). In case of exceeding this value the sound pressure level of < 52 dB(A) demanded by DIN1946, part 7, can only be achieved with extensive sound absorption. The duct flow velocity can fall below $v = 0,5$ m/s because the room pressure will be adjusted and therefore the required flow velocity (volume flow) is set.

model: DK-XXX-P-MM-1 (socket/socket)



model: DK-XXX-P-FF-1 (flange/flange)



no-nominal width	inner Ø	dimensions socket/socket		
		NW [mm]	D [mm]	W [mm]
160	161	150	40	70
200	201	170	50	70
250	251	175	50	75
315	316	175	50	75
400	401	180	50	80

no-nominal width	inner Ø	dimensions flange/flange				
		NW [mm]	D [mm]	W [mm]	outer Ø D1 [mm]	K [mm]
160	161	210	230	200	7	8
200	201	230	270	240	7	8
250	251	235	320	290	7	12
315	316	240	395	350	9	12
400	401	240	480	445	9	16

■ General	
internal power supply	230/110 V AC/50/60 Hz/ ±15 %
current consumption max.	100 mA
power consumption max.	20 VA
recovery time	600 ms
operating temperature	0 °C bis +55 °C
air humidity	max. 80 % relative, noncondensing

■ Housing (iCM-RP-control unit)	
protection class	IP 40
material	plastic with front foil
color	grey
dimensions (l x w x h)	134 x 80 x 40 mm
weight	approx. 1,0 kg
appliance terminals	screw terminal 0,75 mm ²

■ Wall housing with integrated controller iCM-RP	
protection class	IP 40
material	steel panel
color	white, RAL 9002
dimensions (l x w x h)	150 x 100 x 40 mm
weight	approx. 1,0 kg
appliance terminals	screw terminal 1,5 mm ²

■ Relay outputs	
quantity	1 relay (K1)
contact type	operating contact
switching voltage max.	250 V AC
continuous current max.	8 A
quantity	2 relays (K2, K3)
contact type	two-way/operating contact
switching voltage max.	250 V AC
continuous current max.	3 A

■ Analogue output	
1 output	0(2) to 10 V DC, 10 mA

■ Analogue input	
1 input	0(2) to 10 V DC, 1 mA

■ Digital inputs (galvanically isolated)	
quantity	2 opto-coupler
input voltage max.	24 V DC ±15 %
input current max.	10 mA (per input)

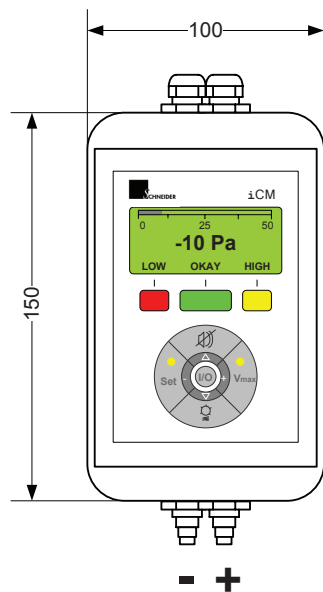
■ Differential pressure transmitter	
measurement principle	static
pressure range	± 50 Pascal
precision	< 0,1 %
response time	< 10 ms
sensor burst pressure	500 mbar

■ Actuator NMQ12, 3 Nm for dampers up to DN280 or rectangular 200x200	
torque	3 Nm
regulating time	3 sec. for 90 °
activation	direct drive with integrated power monitoring
solution	< 0,5°

■ Actuator NMQ24, 8 Nm (only usable with additional box -E4) for dampers from ≥ DN315 or rectangular ≥ 250x250	
torque	8 Nm
regulating time	4 sec. for 90 °
activation	2 to 10 V DC
additional external transformer necessary (e. g. additional box -E4)	230 VAC / 24 VAC / 16 VA
solution	< 0,8°

■ Damper, round or rectangular design	
material	polypropylene (PPs) polypropylene, electroconductive (PPs-el) polyvinyl chloride (PVC) galvanized steel stainless steel

housing iCM-RP: top view



housing iCM-RP: lateral view



Please order for the controller iCM-RP the damper DK with actuator in addition.

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Tender specification iCM-RP

Room pressure controller with integrated microprocessor, static differential pressure transmitter and fully graphic display with numerical signaling of the room pressure actual value. Fast, constant and automatic controlling (< 3 sec) of room under- or overpressure with integrated monitoring function and acoustical alarm as well as provision of two freely programmable relay contacts (e. g. for exceeding the upper and undercut the lower limit value). All setpoints are freely parameterizable via a password secured internal servicing level or laptop with software PC2500 (USB flash

drive). Storage of all system data in the fail-safe EEPROM. Suitable for room pressure regulation via room supply air or exhaust air. Controller built-in a compact and shapely wall housing. Direct digital activation of the fast running actuator (< 3 s for 90 °) for exact and vibration-free room pressure regulation. Damper (round or rectangular) made of different material. All cables are pre-assembled ready to plug-in.

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