halstrup walcher

Pressure measurement technology

Differential pressure (stationary/mobile)
Calibration devices and services
Absolute pressure

A FAMILY-OWNED AND HIGHLY INNOVATIVE SUPPLIER OF CUSTOMISED SOLUTIONS

The Halstrup-Walcher Group consists of the following companies: halstrup-walcher GmbH, Walcher Meßtechnik GmbH and Luftmeister GmbH. We plan for the long-term and see ourselves as a partner. We have close and long-standing relationships not only with our customers but also with our approx. 120 employees, our local community in Kirchzarten and our suppliers.

halstrup-walcher GmbH successfully manufactures and markets products in three business areas: positioning systems for automated format changeover in mechanical engineering applications, pressure measuring technology for cleanroom, air-conditioning and OEM applications as well as drive solutions for spur gears and actuators.

The company develops and manufactures both standard and customer-specific solutions. Its depth of expertise in the twin areas of development and manufacturing as well as its level of in-house production is remarkable. halstrup-walcher's strong quality assurance programme and lean processes have made it a highly professional partner offering impressive performance in terms of quality, costs and punctuality.

THE HALSTRUP-WALCHER GROUP: SPECIALISTS IN THREE SECTORS

PRESSURE MEASUREMENT TECHNOLOGY

Do you need to control the pressure in your cleanroom to keep contaminated air from entering? Do you need a display panel that shows you relevant physical/chemical parameters at a glance? Do you need to monitor an HVAC air filter or fan? Or maintain overpressure or vacuum in one of your machines?

With a portfolio that includes suitable pressure transmitters, calibration devices and digital manometers for stationary or mobile use, halstrup-walcher offers standard instrumentation and customized products for sophisticated pressure measurement tasks.
Always ultra precise.

POSITIONING SYSTEMS

As a manufacturer of machine tools, your customers expect you to supply highly flexible solutions with minimal retooling times. Format changes should be performed automatically, with highest precision and as quickly as possible. The positioning systems required to do this must be compatible with all standard bus systems. And, naturally, you want to be able to offer your customer optimum availability of the machine – supported by condition monitoring for your positioning systems.

Positioning systems from halstrup-walcher include gear, EC motor, absolute encoder, the motor control system and on-board communication to PLC, along with a wide variety of designs and performance characteristics.
Always spot on.

TAILOR-MADE DRIVE SOLUTIONS

You need to make parts move, linear or rotary. Optimised for the existing construction space and with a sharp eye on the costs. With a constantly high level of precision. You need this solution quickly and tailored to your specific requirements. With or without housing. As a motor/gearbox combination. Regulated or with a control system or as a purely mechanical solution. With analog or digital communication.

halstrup-walcher offers solutions covering every aspect of spur gearboxes and actuators. We develop mechanical designs, electronics and all the relevant stages of the manufacturing process in-house – tailor-made.

LEAN MANAGEMENT AT HALSTRUP-WALCHER

Focus on the customer and optimised internal processes

A number of years ago, business theorists spoke of a *"magic triangle"* of quality (Q), costs (C) and punctuality (P). These three factors were considered magical because any measures for improvement could benefit no more than two of them at any time – and these gains could only be obtained at the expense of the third. With the help of lean management, halstrup-walcher has succeeded in breaking the spell of this *"magic triangle"*. We have done so by eliminating errors and failures from all the relevant processes and systematically tackling waste in every area. This liberates the whole team to concentrate fully on the real needs of our customers.

"Shop floor management" has also brought previously unimaginable successes. Employees in every department attend a meeting every working day, where they are able to raise awareness of and discuss current problems. Measures for eliminating these problems immediately and permanently are discussed and agreed at follow-up meetings in the company. These take into account all the relevant information. Everyone contributes, no problem is brushed under the carpet and solutions to the problems are implemented without delay. It is a culture that has won the hearts and minds of both our staff and our customers. halstrup-walcher has now begun *"exporting"* its insights into lean management and offers these as a service to medium-sized enterprises.

	METHODS	CUSTOMER'S BENEFIT
LEAN MANAGEMENT	Freedom from disruption and waste	Desired batch sizes **AND** reasonable prices
	Shop floor management	Short delivery times **AND** outstanding deadline compliance
	Pull-based production	High flexibility (modifications, improvements) **AND** outstanding product quality

CONTENTS

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PRESSURE SENSORS AND OEM SOLUTIONS

HALSTRUP-WALCHER PRESSURE SENSOR TECHNOLOGY

Pressure measurement devices made by halstrup-walcher GmbH are designed for use with non-aggressive, gaseous media. The pressure transmitters operate using the principle of inductive measurement. At the heart of the technology lies a membrane made from beryllium bronze. Inductive displacement transducers measure the deflection of this membrane without any contact.

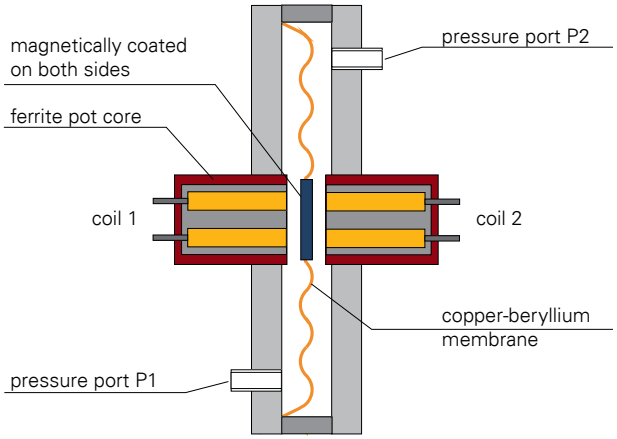
The membrane is situated between two measurement chambers and can therefore provide readings of both positive and negative differential pressures. The measuring cell has no frictional parts or parts subject to mechanical wear. Beryllium bronze is a highly elastic material that is stabile for long periods of time, behaves well under a variety of temperature conditions and is extremely resistant to hysteresis. As a result, this technology is ideal for use in high quality pressure gauges that are capable of taking measurements at pressures as low as a few Pa.

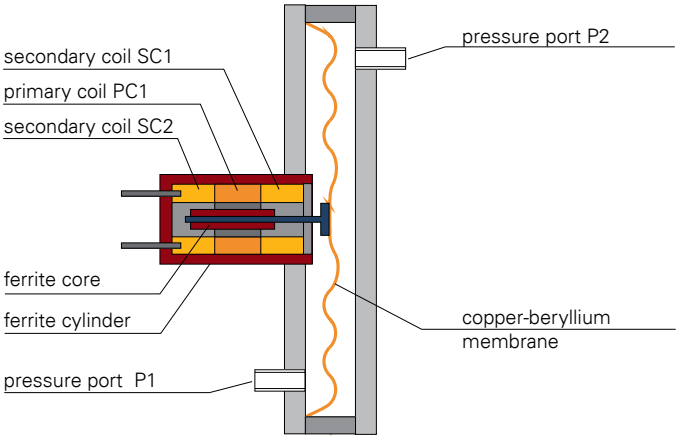
OUR MEASUREMENT SYSTEMS

The patented **dual coil sensor** developed and manufactured by halstrup-walcher sends a differential signal that is linearised by an electronic analysis unit. This system is perfectly suited for use in manufacturing high-quality differential pressure transmitters and digital pressure gauges.

Due to the excellent linearity afforded by its design, the **differential coil sensor** (LVDT) is primarily used for pressure calibration devices.

For basic applications, a piezo-resistive precision measuring cell is also used.



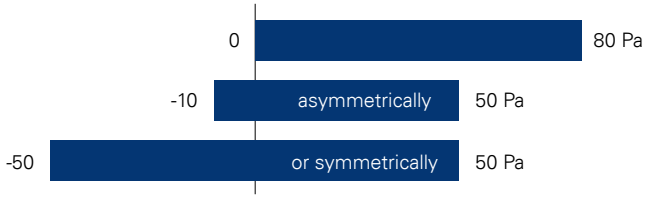


ADVANTAGES OF HALSTRUP-WALCHER PRESSURE MEASUREMENT SYSTEMS

- Ideal even for small measurement ranges
- Exceptional long-term stability guarantees reliable operation over many years
- Absolute zero-point stability (see p. 7)
- High overload resistance (see p. 7)
- Perfect for positive and negative differential pressures
- For symmetrical or asymmetrical measurement ranges
- Separation of the two connection sides (no overflow)

TAILOR-MADE MEASUREMENT RANGES

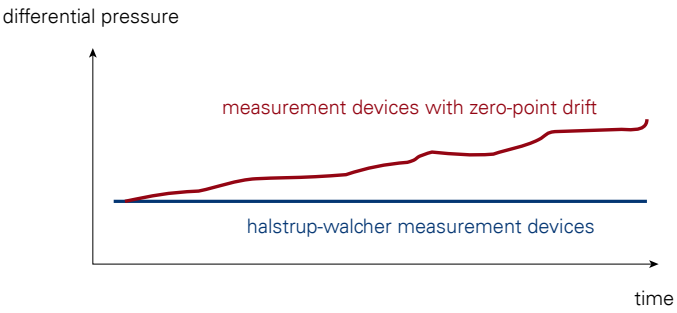
Many halstrup-walcher measurement devices can be scaled in accordance with customer-specific requirements. This enables them to be integrated into the process with the maximum efficiency.



3 examples of a scale in the 100 Pa measurement range

WITHOUT ZERO-POINT DRIFT

The stability of the measurement signal is critical in any application but even more so when measuring small differential pressures. Any drift renders the measurements unreliable. If an instrument is being used to monitor and *maintain overpressure in a cleanroom*, for example, inaccurate measurements could result in microbe or dust levels rising above the permitted limits. Excessive operating costs can result if a measurement value recorded is too low.



halstrup-walcher sensor technology offers a long-term solution to this problem with integrated solenoid valves for regular zero-point correction in addition to exceptionally stable sensors. During this patented procedure, the previous signal is held to prevent interruption of the measurement value. This ensures stable and reliable measurements – even after many years of service!

Advantages of zero-point correction

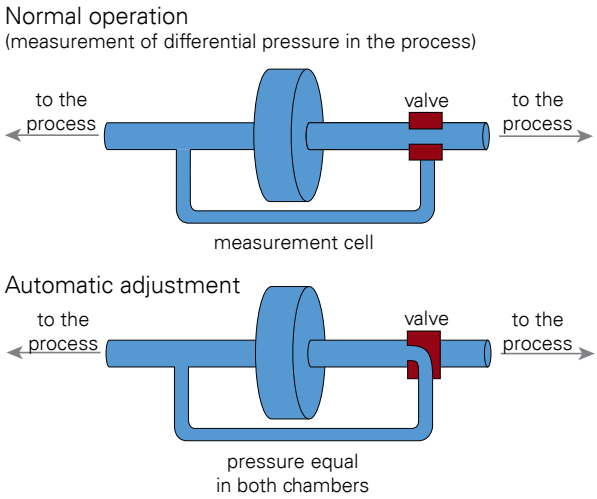
- Excellent reliability of the differential pressure value
- No costly and time-consuming adjustments required
- Process safety guaranteed at all times

AUTOMATIC ZERO-POINT ADJUSTMENT

Solenoid valves regularly open the two chambers of the measurement cell to the interior of the device. The microprocessor now sets the current differential pressure value to zero.

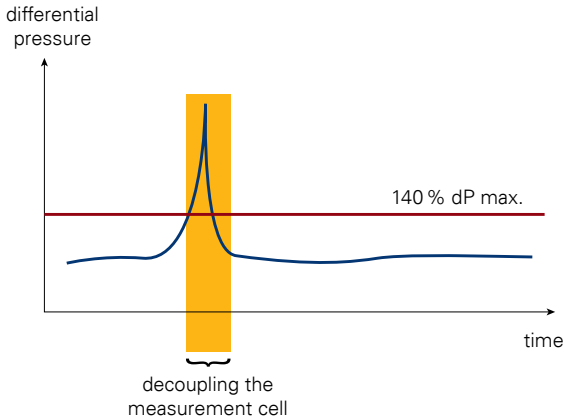
This patented zero-point adjustment procedure is initiated automatically after measurement begins. The process is subsequently repeated at regular intervals – hourly in most devices – and takes only about four seconds, during which time the previous signal is held.

For special applications it is also possible to deactivate the zero-point correction or select and request it via a digital interface.



HIGH OVERLOAD RESISTANCE

Pressure measurement technology should, of course, be highly sensitive. Yet it must also be protected to prevent damage. Here, too, halstrup-walcher sensors provide the optimum solution: If the measurement cell detects a pressure value that is too high (pressure peak or overload), the solenoid valves close within milliseconds. This prevents the measurement membrane from becoming deformed. Shortly afterwards, a new measurement is taken to determine whether normal measurement operations can resume. If the situation has normalised, a zero-point adjustment is performed automatically. The result is a durable technology that not only offers excellent reliability but also outstanding protection for your investment.



CONVERSION TABLE

	Pa	hPa / mbar	kPa	bar	psi	mmH_2O	inH_2O	mmHg	inHg
Pa	1	0.010	0.001	0.00001	0.0001	0.102	0.004	0.008	0.0003
hPa / mbar	100	1	0.1	0.001	0.015	10.197	0.401	0.750	0.030
kPa	1 000	10	1	0.010	0.145	101.968	4.014	7.502	0.295
bar	100 000	1 000	100	1	14.514	10 196.798	401.445	750.188	29.499
psi	6 891.799	68.966	6.894	0.069	1	703.235	27.701	51.813	2.036
mmH_2O	9.804	0.098	0.010	0.000098	0.001	1	0.039	0.073	0.003
inH_2O	249.004	2.490	0.249	0.00249	0.036	25.381	1	1.865	0.073
mmHg	133.316	1.333	0.133	0.00133	0.019	13.624	0.536	1	0.039
inHg	3 386.387	33.898	3.386	0.03386	0.491	345.901	13.624	25.381	1

Please read the lines from left to right. Example: 1 bar = 100 kPa

MEASUREMENT UNCERTAINTY IN PRACTICE

The degree of **measurement uncertainty** is a statistical value, which takes into account the *"error contributions"* of the measurement device itself as well as other influencing factors. These also include errors in the reference (applied for adjustment in the manufacturing process). It describes the range in which the actual value is scattered around the measured value with a probability of 95 %.

Example: The P 26 differential pressure transmitter offers a degree of measurement uncertainty of "± 0.2 % of max. value, but not less than 0.3 Pa". "of max. value" means "of the upper range value". For a scaled measurement range of 0 .. 80 Pa, e.g. the max. value of 80 Pa must be considered. *"Not less than 0.3 Pa"* is a consequence of the degree of measurement uncertainty in the reference. In this example, the degree of measurement uncertainty is calculated as follows:

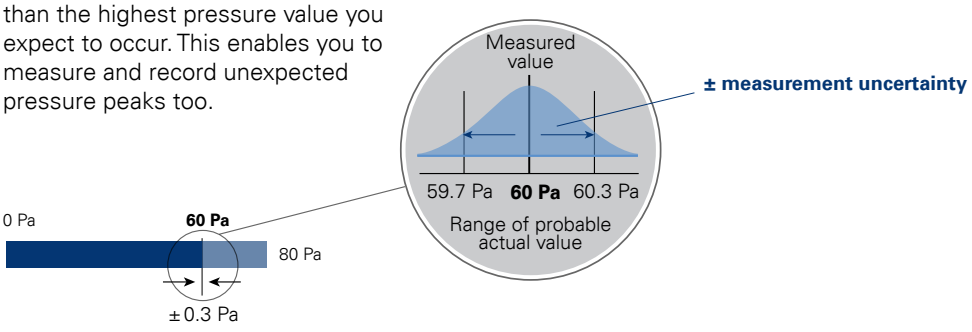
a) ± 0.2 % of max. value = ± 0.2 % x 80 Pa = ± 0.16 Pa

b) But not less than 0.3 Pa

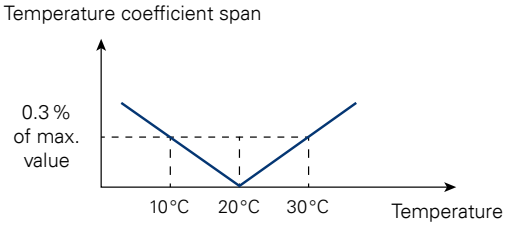
→ In this case, the total degree of measurement uncertainty is 0.3 Pa

→ If you measure a value of 60 Pa, you can therefore assume with a 95 % probability that the actual value lies somewhere between 59.7 Pa and 60.3 Pa, see graph below.

Practical tip: The upper range value of the sensor you use should be approx. 10 .. 30 % higher than the highest pressure value you expect to occur. This enables you to measure and record unexpected pressure peaks too.



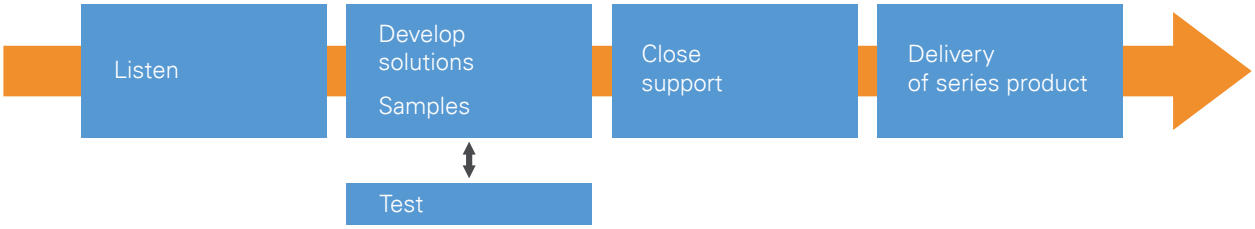
In addition, the term **temperature coefficient span** is used to describe the deviations that can occur if the pressure transmitter performs its measurements not at 20 °C but, e.g. at 35 °C (i.e. 15 K higher). According to the data sheet, a value of e.g. ± 0.03 % of max. value / K should be used for the P 26. In the example given above (at an ambient temperature of 35 °C) there is an additional *"temperature error in the measurement range"* of ± 0.03 % of max. value / K x 60 Pa x 15 K = ± 0.27 Pa.



Practical tip: If possible, install the pressure transmitter in a protected position with room temperature. The connecting tubing from the measurement point to the pressure transmitter can be several metres in length as long as it is not exposed to sources of heat.

CUSTOMER-SPECIFIC DEVELOPMENT

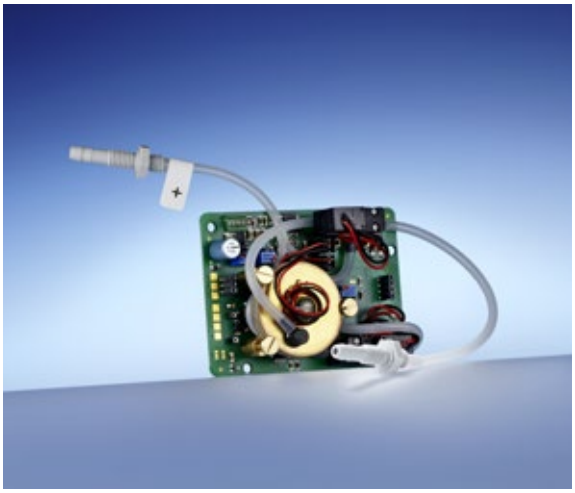
halstrup-walcher supplies a wide range of attractive series products, which are presented in this catalogue. In addition, halstrup-walcher is a specialist in the development of customer-specific solutions, which meet the highest quality standards and can be supplied over a period of years.

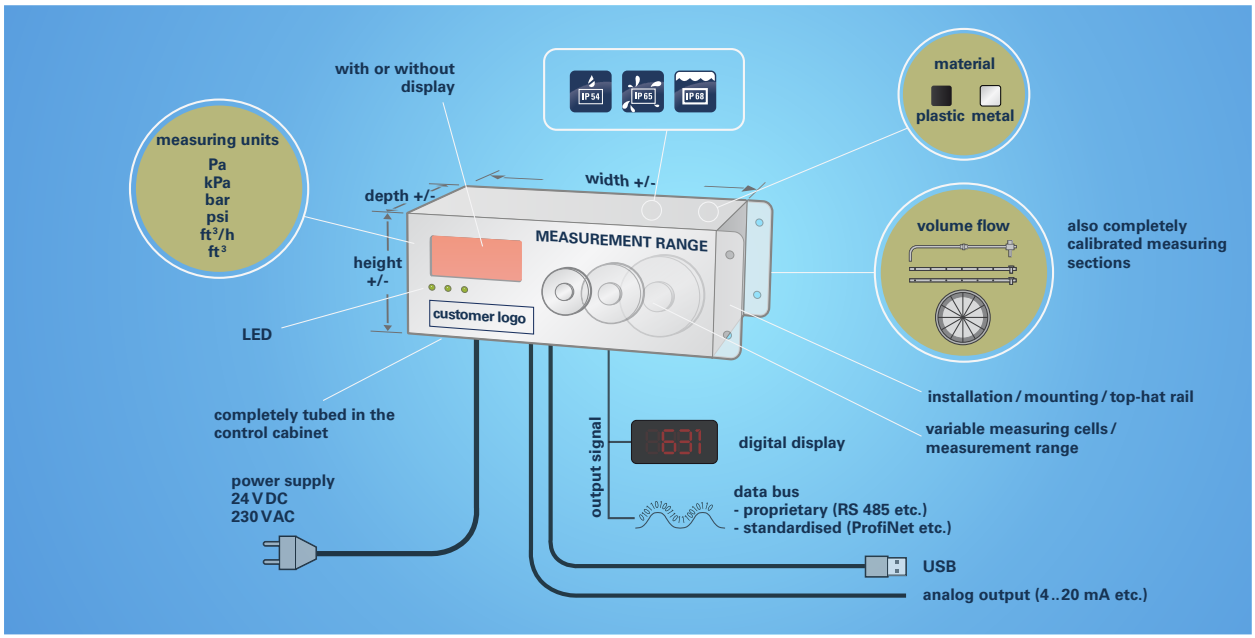


We can adjust all the relevant parameters of our products and developments to your specifications:

- housing size and form
- measurement units (differential pressure, absolute pressure, volume flow, temperature)
- accuracy specifications
- output signals (analog, digital, bus)
- supply voltage
- type of display, LEDs and other signals
- mechanical modules for integration into your process (mountings, primary elements, etc.)

Special feature: We have optimised our processes to enable us to offer you deliveries of small quantities each year at attractive prices. Naturally, we guarantee traceable quality and punctual delivery for all our products.





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DISPLAY PANELS

for process monitoring

PANLES FOR DISPLAYING, ALERTING, NETWORKING

Many companies (e.g. from the Life-Sciences area) have to monitor their critical production processes with a monitoring system. This is about recording systems that have a high degree of data safety to record, transfer and save quality-relevant measuring data.

Professional providers of monitoring systems, as well as validation service providers offer systems that are aligned with GAMP 5 for this task. GAMP means Good Automated Manufacturing Practice; GAMP 5 is a quasi-standard that describes the requirements to setup and validation of computer-aided systems in a regulated pharmaceutics environment as a *"guideline"*.

One important task of monitoring is making measured data visible in the locations where local decisions depend on them. The halstrup-walcher display panels are the best solution for this.

	PUC 44	**PUC 24**	**PUC 28 (K)**
Details on	**p. 12+13**	**p. 18**	**p. 19**
			
Special features	Multi-channel process display with touch screen - Values, curves, bar graph, vector can be displayed - 4 alarms per channel - Modbus/BACnet connection	Cleanroom panel with integrated differential pressure sensor for climate data display, temperature/ humidity measuring transmitter can be connected	Process panel with integrated differential pressure sensor for climate data display, temperature/ humidity measuring transmitter can be connected
Application	Process monitoring for cleanrooms and control cabinets (machines, plants)	Process monitoring for cleanrooms (Pa, °C, % rF)	Process monitoring panel (optional: with calibration connection) (Pa, °C, % rF)
Measurement Range	Up to 4 external analogue values of any phys./chem. values	± 100 or ± 250 Pa, freely scalable within this range, % rF/°C: Depending on the connected measuring transmitter	
Degree of measurement uncertainty	Depending on the connected measuring transmitters	0.5 % of max. value (standard) (differential pressure on board)	
Display	Touch-display (TFT), coloured, 3,5", 320 x 240 pixels	LED-display, 3 lines	
Alerting	Visually/acoustically, cf. p. 12	Relay outputs, acoustic alarm	
Networking	Modbus RTU, BACnet MS/TP	RS 232, PROFIBUS DP (both optional)	

ACCESSORIES

Accessories for PUC 24 and PUC 28 (K) on p. 15.

Parameterisation PUC 44 [1)]
On-site parameterisation (PUC 44) according to customer specifications

Order-No.
in the order key
cf. p. 13

Installation PUC 44 [2)]
Flush-mounted box for masonry wall installations [3)]

9601.0188

[1)] The parameterisation of the PUC 44 takes place via the intuitive touch menu and can be performed by the commissioner without further training.

[2)] All devices of the PUC series have been specifically designed for installation on cleanroom walls and therefore have the matching minimum installation depth, as well as the hygienic design in the versions PUC 44-2/-3 and PUC 24. A recessed socket is not required in these cases (cleanroom wall installations). It is used for types PUC 44-1 and -2 of the exposed installation.

[3)] Recessed area (160 mm x 160 mm, depth = 75 mm) for plastering the flush-mounted box into the wall.

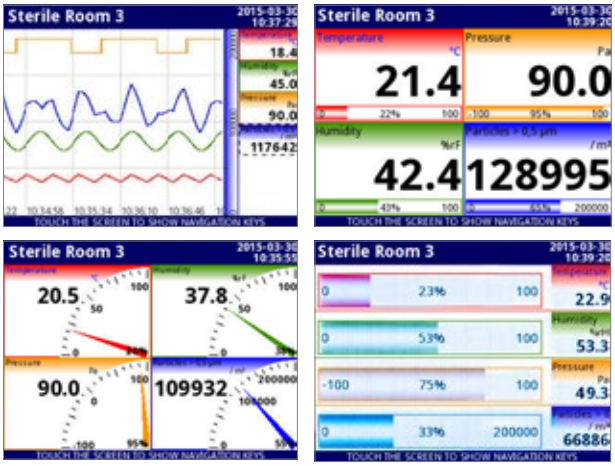
PROCESS MONITORING FOR CLEANROOMS AND CONTROL CABINETS WITH THE PUC 44

For best integration into the cleanroom wall, the cleanroom panel PUC 44 is delivered with two different stainless steel fronts. Both are installed in the cleanroom wall thanks to their low construction depth. In addition to a standard model, a very high-quality, very well cleanable model with magnetic holder is available as an alternative. For installation sites outside of the cleanroom environment and in control cabinet fronts, a simple aluminium front version can be used as well.

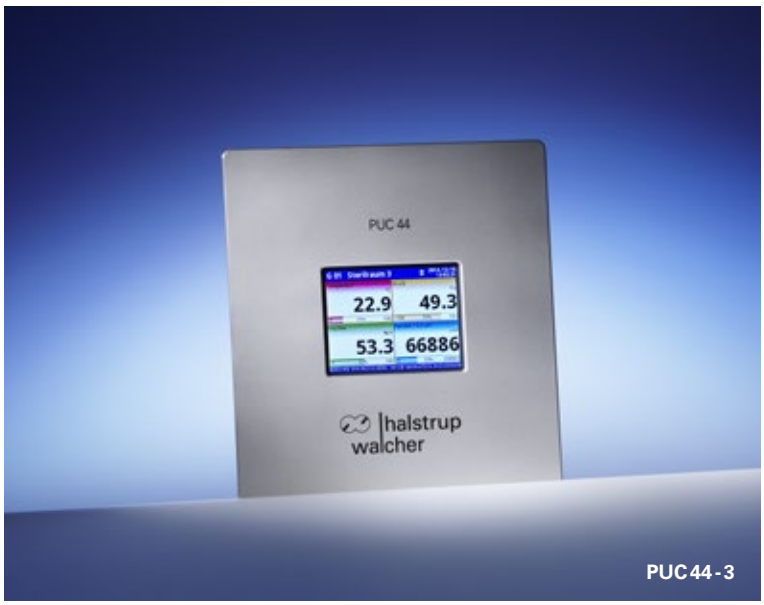
Features

- Multi-channel process display with touch screen
  a) For *high-end cleanroom* applications (PUC 44-3)
  b) For *standard cleanroom* applications (PUC 44-2)
  c) For *control cabinet* installation (PUC 44-1)
- Display of up to **four values** (any phys./chem. values) in one display, free designation of the channels
- The configuration takes place in multiple languages, menu-controlled and via touch operation (without parameterisation software). It can be performed in the factory or by the commissioner.
- Values, curves (time axis adjustable, max. 7 days), vector and bar
- 4 individual alarms LowLow/Low/High/HighHigh for any input can be defined. Signalling takes place as a text and optionally with colour change. The individual alarms are retained while the triggering criterion for the alarm is pending.
- If the signal of a sensor is in the forbidden range (below the alarm "LoLo" or above the alarm "HiHi"), a background colour that can be freely parameterised (e.g. red) will be displayed.
- For a warning, due to the sensor signal threatening to run out of the permitted range (i.e. signals below "Lo" or above "Hi"), another background colour that can be chosen freely will be displayed (e.g. yellow).

- If the sensor value is OK, the background colour is not noticeable. A small bar graph in addition to the alphanumeric value shows how many percent of the defined measured range are currently utilised.
- A collective alarm (of previously defined individual alarms) triggers the acoustic signal. The acoustic alarm is switched off by touching the screen.
- The user only has the right to change the released views and to switch off the collective alarm. The user needs no password for this.
- A one-level password system with at least 6 digits according to GAMP 5 permits access to the configuration by the commissioner or the process officer.
- Recording of data is not intended (no logging function). This facilitates validation.
- The respective current values of the inputs and the condition of the alarms are available via Modbus RTU or BACnet MS/TP at all times.

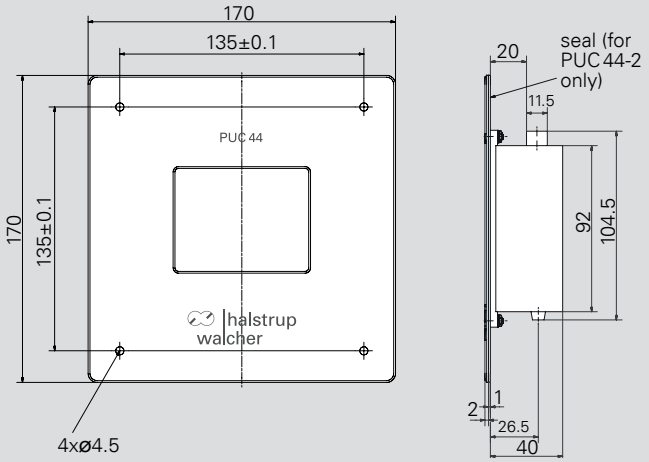


PUC 44

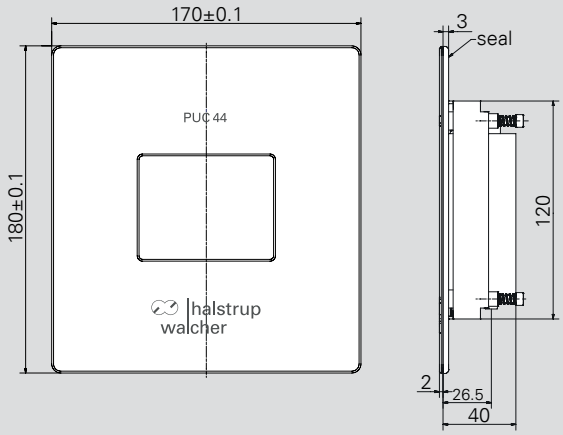


PUC 44-3

PUC 44-1/-2



PUC 44-3



Inputs (adjustable)	up to four analogue inputs (4..20 mA, galvanically separated, Ra = 400..1750 Ω), without transmitter feed
Scaling (adjustable)	deactivated, linear or polygonal (max. 20 points)
Filter	deactivated or with dampening/ filter coefficient
Touch-display	TFT, coloured, 3.5", 320x240 px
Available views (adjustable)	values, bar graph, curve chart, vector diagram
View change	manually or automatically
Time axis curve chart	19s/48s/95s/3min/6min/ 12min/30min/1h/2h/4h/ 8h/16h/24h/3d/7d
Alarm configuration (adjustable)	LoLo..Lo..Hi..HiHi for all channels thresholds: constant, lower threshold, upper threshold, hysteresis timing: delay ON/OFF, retention time ON/OFF acoustic collective alarm freely parameterisable
Alarm display (adjustable)	deactivated, permanent, flashing (period, retention time, alarm source, texts/colours adjustable)
Languages (menu)	English, French, German, Italian, Spanish
Date and time	time zone and summer time can be set
Brightness	20..40..60..80..100 %
Screen saver	deactivated or after 1..5..10..30 min
Access protection	password 6-digit (GAMP 5)
Current consumption	500 mA
Bus communication	Modbus RTU (RS485-based) BACnet MS/TP
Baud rate	1200 bit/s to 115200 bit/s
Connections	1x USB-host on the rear for transfer of configuration files, screw terminals for 4 analogue inputs, bus and supply
Power supply	24 V DC ±5 %
Housing	wall recessing
Protection class PUC 44-1	IP20
Protection class PUC 44-2/-3	IP65 (front side), IP20 (housing and terminals)

Housing type	**A**
Aluminium anodised	1
Stainless steel standard	2
Stainless steel with magnetic holder	3

Bus type / data interface	**B**
Modbus RTU	MB
BACnet MS/TP	BN

Parameterisation	**C**
Provided by customer	0
Factory-provided [1]	1

[1] according to specified parameter list

Order code	**A**	**B**	**C**
PUC 44	–	–	–

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DIFFERENTIAL PRESSURE TRANSMITTERS

MEASUREMENT OF DIFFERENTIAL PRESSURE

Measurement of differential pressure is useful in a broad range of applications. It is used in ventilation and air-conditioning technology but also in many areas of air handling process technology. The next pages show a number of these. You can find more information about pressure sensor technology on p. 6.

halstrup-walcher offers a wide range of products for stationary measurement of differential pressure.

	PUC24	PUC28(K)	P26	P34	P29	PU / PI / PIZ	PS27	REG21
Details on	p. 18	p. 19	p. 20	p. 21	p. 22	p. 23	p. 24	p. 25
								
Application	Process monitoring for clean-rooms (Pa, °C, % rH), with stain-less steel front	Process monitoring panel (optional: with calibration port) (Pa, °C, % rH), aluminium, anodised	High precision, scalable differential pressure transmitter	Measuring transmit-ter with very small dimensions – ideal for the control cabinet	Like P26, for natural gas	For standard applications. PIZ: PI in two wire technology	A basic sensor for simple appli-cations	Measure-ment and regulation of pressure
Housing installation	Installed in wall (panel)		Mounted on a wall/top-hat rail					Rack
Max. measurement range	± 250 Pa		± 100 kPa					
Min. measurement range	± 100 Pa		± 10 Pa		± 250 Pa	± 50 Pa		
Degree of measure-ment un-certainty	0.5 % [1] (standard)		0.2 % of the scaled range (40 .. 100 % of max. value) [2] (optional) 0.5 % of the scaled range (40 .. 100 % of max. value) [2] (standard)		0.2 % [1] (optional) 0.5 % [1] (standard)	0.2 % [1] [3] 0.5 % [1] [2] 1 % [1]	2 % (≥ 100 Pa) or 3 % (for 50 Pa) of the set value	0.5 % [1] [2] 1 % [1]
Square-root (vol-ume flow)	-	-	✓	✓ [4]	✓	-	-	-
Display	✓	✓	optional	-	optional	optional	optional	✓

[1] max. value of upper range value [2] but not less than 0.3 Pa [3] for measurement ranges ≥ 250 Pa only
[4] optionally with stat. pressure sensor and temperature analogue input for compensation

ACCESSORIES

Certificates (see p. 41)	**Order no.**
DAkkS calibration certificate (German)	9601.0003
DAkkS calibration certificate (English)	9601.0004
ISO factory calibration certificate	9601.0002

Connecting components	
Silicone tubing ID 5 mm, OD 9 mm, red (please state length required)	9601.0160
Silicone tubing ID 5 mm, OD 9 mm, blue (please state length required)	9601.0161
Norprene tubing (please state length required)	9061.0132
Y-piece for tubing	9601.0171

Pressure ports

We can supply a wide range of customer-specific pressure ports, e.g. various cutting ring couplings or hose connectors.

MEASUREMENT OF DIFFERENTIAL PRESSURE AND REGULATION OF PRESSURE

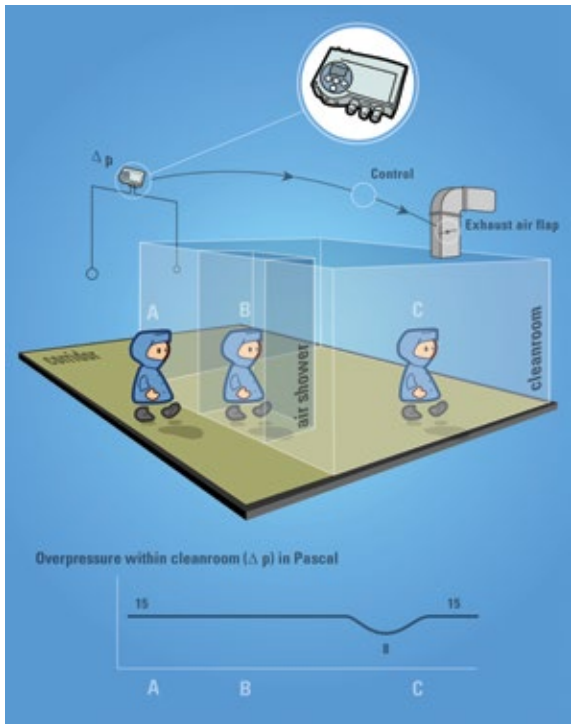
... IN CLEANROOMS

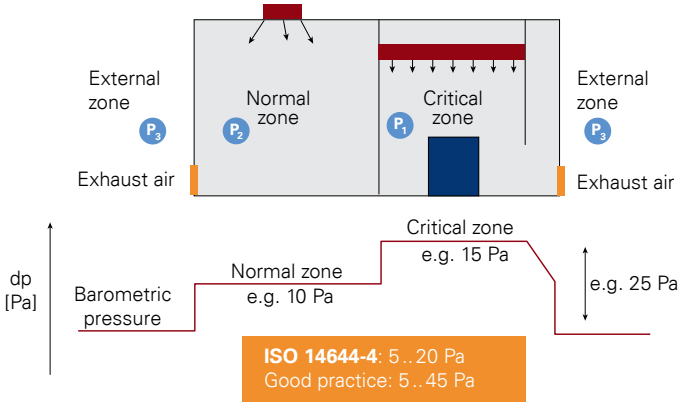
In cleanrooms, it is vital to prevent contaminated air flowing in from corridors or areas with lower cleanroom classifications. This can be achieved by **maintaining a continuous overpressure** inside the cleanroom. The heart of this system is a high-precision differential pressure transmitter operating in the low Pascal range

- → for installation in a wall (panel), (e.g. PUC, see p. 18 and p. 19)
- → for installation in a control cabinet (top hat rail) (e.g. P34, see. p. 21)
- → for mounting on a wall (e.g. P26, see. p. 20)

The standard ISO 14644 requires continuous monitoring and regulation of pressure for all cleanrooms. In addition, spot checks must be performed at regular intervals.

- → use of the KAL portable, high precision calibration and measurement device (see p. 38 and 39)



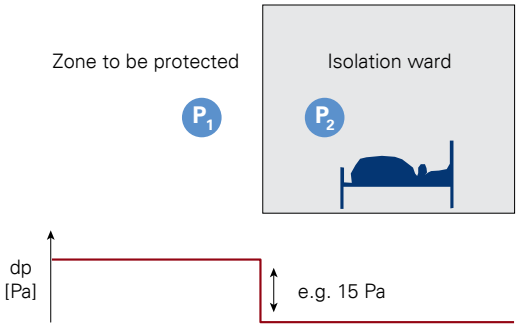


$P_1 > P_2 > P_3$

... IN HOSPITALS

Excluding air that contains bacteria can be a matter of life and death, especially in hospitals, e.g. operating theatres. Here, too, this is achieved by ensuring a constant **overpressure** in the room that prevents contaminated air entering it from surrounding areas.

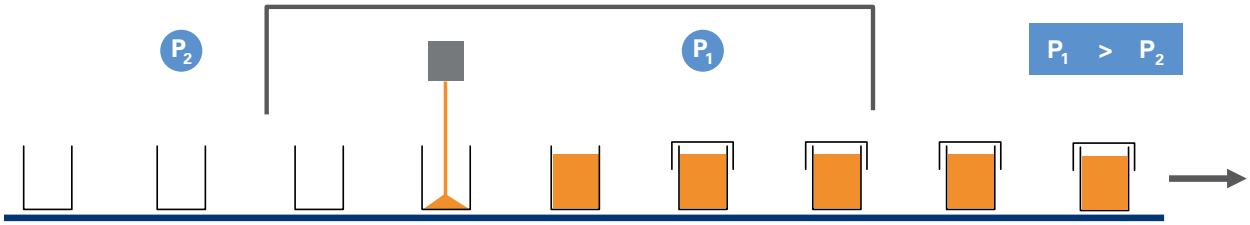
The opposite applies to isolation wards, which are used to prevent the spread of epidemics. In this case, the room must be kept at a constant **underpressure** relative to its surroundings in order to prevent bacteria/viruses escaping.



$P_1 > P_2$

MEASUREMENT OF DIFFERENTIAL PRESSURE AND REGULATION OF PRESSURE

... IN FILLING MACHINES AND HYGIENIC PLANTS



Hygiene and bacteria-free environments are key requirements in both the pharmaceutical and food processing industries. This is achieved through selecting the appropriate materials and time-consuming cleaning processes. But what happens if the goods being protected come into contact with the surrounding air? If this air has not been correctly processed, it will transport microbes and other contaminants (oil aerosols, particles etc.) directly to the endangered product.

For larger hygienic production plants, the construction of whole cleanrooms is a viable option. However, this approach may be inefficient if only a small, enclosable hygienic area is required. The solution to this problem was the development of *"mini-environments"* – isolated, hygienic areas. These ensure that no microbes or contaminants are able to penetrate the protected area.

Measurement and regulation of differential pressure are the keys to maintaining a constant and safe **overpressure** within the mini-environment. Long-term stability is critical in order to prevent unplanned decreases in pressure over time. halstrup-walcher is a specialist in this type of application and offers

- → for mounting on walls or top-hat rails: P 26 (see p. 20)
- → for mounting in walls (panel version): PUC 24 or PUC 28 K (see p. 18/19)

The **pressure** in the filling room must be **higher** than that of the surrounding areas or particles/oil etc. may enter the zone in which the product is being handled.

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PUC 24

Measurement ranges	± 100 Pa or ± 250 Pa freely scalable within this range
Margin of error	0.5 % of max. value
Temperature coefficient span	0.03 % of max. value/K (10 .. 50 °C)
Temperature coefficient zero point	± 0 % (cyclical zero-point correction)
Overload capacity	200 x
Medium	air, all non-aggressive gases
Max. system pressure	10 kPa
Sensor response time	25 ms
Time constants	25 ms .. 40 s (adjustable)
Input signal humidity/temperature module (galvanically separated)	0 .. 10 V, R_i = 470 kΩ 0/4 .. 20 mA, R_i = 50 Ω adjustable
Operating temperature	10 .. 50 °C
Storage temperature	-10 .. 70 °C
Power consumption	approx. 7 VA
Weight	approx. 1 kg
Pressure ports	for tubing NW 3 .. 6 mm
Protection class	IP 65 (recessed in the wall)
Certificates	CE

Supply voltage
24 V DC, ± 10 % smoothed

Output
0 .. 10 V (R_i > 2 kΩ) 0/4 .. 20 mA (R_i < 500 Ω) adjustable
2 contact points, 6 A, 230 V AC, may be configured as desired within this pressure range

Measurement range	**A**
± 100 Pa	0
± 250 Pa	1

Data interface	**B**
none	0
PROFIBUS DP (optional)	DP
RS 232 (optional)	2

Bus connection	**C**
none	0
9-pin Sub-D flush type connector [1]	D
sub-D plug with 150 mm cable	DK
round pin connector M 12 with 150 mm cable	RK

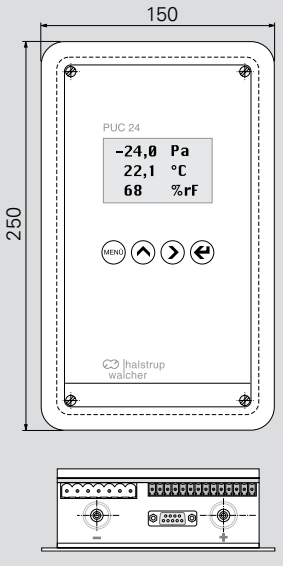
[1] not suitable for wall thicknesses greater than 5 mm

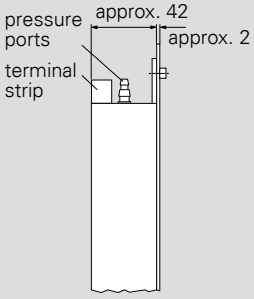
Order code	**A**	**B**	**C**
PUC 24	–	–	–

Can be pre-set on request:
Time constant, relay parameter, analogue output, deactivation of the cyclic zeroing (only for PROFIBUS DP)

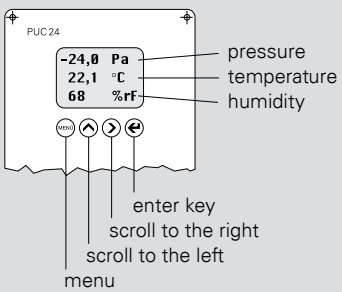
Features

- Cleanroom panel (stainless steel) for displaying air-conditioning data
- Integrated, high precision measurement of differential pressure
- % rH/° C transmitters switchable (independent of manufacturer)
- Optimum cleanroom design (TU Munich/Weihenstephan)
- Solvent resistant stainless steel surface
- 3 analog outputs, optional digital interface
- Acoustic alarm when the threshold value is exceeded, acknowledgement via key
- Optical alarm signal if critical values are exceeded; the display values are shown cyclically inversed/normal
- Bilingual menu (English/German) (others on request)
- Two contact points (6 A/230 V AC)
- Two adjustable limit switches permit the connection of signalling devices and save additional wiring





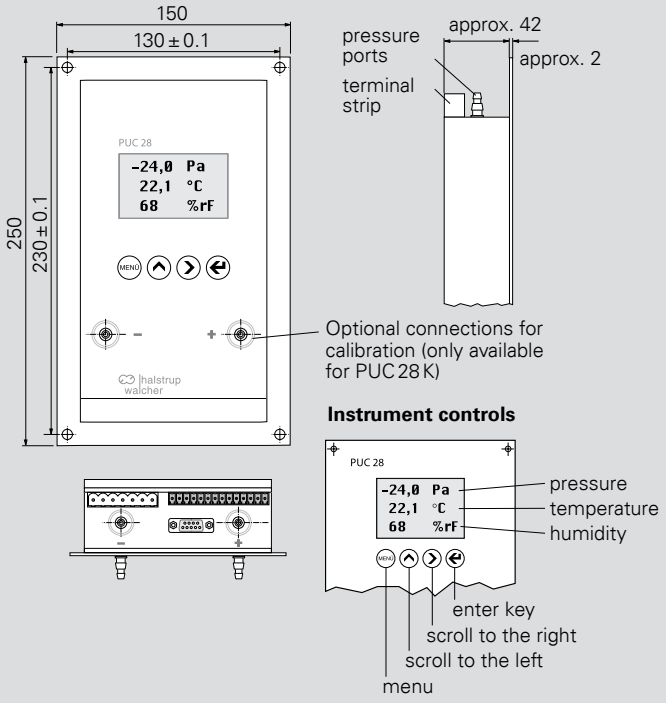
Instrument controls



PUC 28 / PUC 28 K

Features

- Process panel (Aluminium, anodised) for displaying air-conditioning data
- Integrated, high precision measurement of differential pressure
- % rH / °C transmitters switchable (independent of manufacturer)
- Anodised, aluminium housing with easy-to-clean front surface
- With external calibration ports *(design "K")*, for on-site calibration without disassembly
- 3 analog outputs, optional digital interface
- Acoustic alarm when the threshold value is exceeded, acknowledgement via key
- Optical alarm signal if critical values are exceeded; the display values are shown cyclically inversed / normal
- Bilingual menu (English / German) (others on request)
- Two contact points (6 A / 230 V AC)
- Two adjustable limit switches permit the connection of signalling devices and save additional wiring



Measurement ranges	± 100 Pa or ± 250 Pa freely scalable within this range
Margin of error	0.5 % of max. value
Temperature coefficient span	0.03 % of max. value / K (10 .. 50 °C)
Temperature coefficient zero point	± 0 % (cyclical zero-point correction)
Overload capacity	200 x
Medium	air, all non-aggressive gases
Max. system pressure	10 kPa
Sensor response time	25 ms
Time constants	25 ms .. 40 s (adjustable)
Input signal humidity / temperature module (galvanically separated)	0 .. 10 V, R_i = 470 kΩ 0 / 4 .. 20 mA, R_i = 50 Ω adjustable
Operating temperature	10 .. 50 °C
Storage temperature	-10 .. 70 °C
Power consumption	approx. 7 VA
Weight	approx. 1 kg
Pressure ports	for tubing NW 3 .. 6 mm
Protection class	IP 65 (recessed in the wall)
Certificates	CE

Supply voltage
24 V DC, ± 10 % smoothed

Output
0 .. 10 V (R_i > 2 kΩ) 0 / 4 .. 20 mA (R_i < 500 Ω) adjustable
2 contact points, 6 A, 230 V AC, may be configured as desired within this pressure range

Model	Measurement range	A
PUC 28	± 100 Pa	0
PUC 28	± 250 Pa	1
PUC 28 K [1]	± 100 Pa	K2
PUC 28 K [1]	± 250 Pa	K3

[1] "K": with externally accessible pressure calibration ports (no disassembly) (see photo)

Data interface	B
none	0
PROFIBUS DP (optional)	DP
RS 232 (optional)	2

Bus connection	C
none	0
9-pin Sub-D flush type connector [2]	D
sub-D plug with 150 mm cable	DK
round pin connector M 12 with 150 mm cable	RK

[2] not suitable for wall thicknesses greater than 5 mm

Order code	A	B	C
PUC 28	–	–	–

Can be pre-set on request:
Time constant, relay parameter, analogue output, deactivation of the cyclic zeroing (only for PROFIBUS DP)

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P 26

Measurement ranges (also ± measurement ranges) others available upon request	10/50/100/250/500 Pa 1/2.5/5/10/20/50/100 kPa freely scalable from 10 .. 100 % within a measurement range
Margin of error (0.3 Pa margin of error for reference)	± 0.2 % or ± 0.5 % of the scaled range (40 .. 100 % of max. value) (min. 0.3 Pa)
Temperature coefficient span	0.03 % of max. value/K (10 .. 50 °C)
Temperature coefficient zero point	± 0 % (cyclical zero-point correction)
Max. system pressure/ Overload capacity	600 kPa for measurement ranges ≥ 2.5 kPa 200 x for measurement ranges < 2.5 kPa
Medium	air, all non-aggressive gases
Sensor response time	25 ms
Time constants	25 ms .. 40 s (adjustable)
Operating temperature	10 .. 50 °C
Storage temperature	-10 .. 70 °C
Power consumption	approx. 6 VA
Weight	approx. 750 g
Cable glands	3 x M 16
Pressure ports	for tubing NW 6 mm, others available on request
Protection class	IP 65, with USB: IP 40
Certificates	CE, CSA

Output (linear/ root-extracted) [1]	A
0 .. 10 V ($R_L \geq 2$ kΩ)	1
0 .. 20 mA ($R_L \leq 500$ Ω)	0
4 .. 20 mA ($R_L \leq 500$ Ω)	4
± 5 V ($R_L \geq 2$ kΩ)	5

[1] output signals can be configured freely

Power supply	B
24 V AC/DC ± 10 %	24ACDC
24 V AC + 6 % (with galvanic separation)	24AC
230/115 V AC -15 %	230/115

Measurement range	C
Measurement range e.g. 0 .. 10 Pa, -10 .. 50 mbar, ± 100 mmHg (etc.)	

Margin of error	D
± 0.2 % [2]	2
± 0.5 % [2]	S

[2] of the scaled range (40 .. 100 % of max. value) (min. 0.3 Pa)

Display + keyboard	E
none	0
multi-coloured LCD and keyboard	LC

Contact points	F
none	0
air meter	1
2 relays (changeover contacts) max. 230 V AC, 6 A	2

Data interface	G
none	0
USB (data cable supplied)	U0
External zero-point calibration	0X
External zero-point calibration and USB (data cable supplied)	UX

Order code	A	B	C	D	E	F	G
P 26	–	–	–	–	–	–	–

Can be pre-set on request:
Time constant, relay parameter, analogue output root-extracted / linear, deactivation of the cyclic zeroing

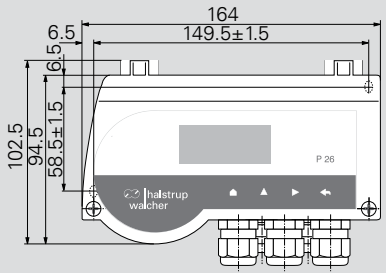
Features

- High precision differential pressure transmitter for top-hat rail or wall mounting (air-conditioning, cleanroom, process)
- Wide range of units available for pressure and volume flow, also ± measurement ranges
- Scalable measurement ranges and units
- Zero-point correction prevents zero-point drift
- Built-in valve provides a high level of overpressure protection
- Multilingual menu (English/French/German/Italian)

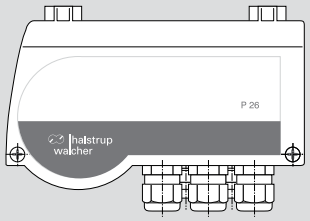
Optional

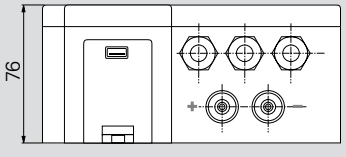
- Contact points with adjustable switching outputs
- Set the zero-point via the interface
- USB interface (free parameterisation software at www.halstrup-walcher.com)
- Air meter function

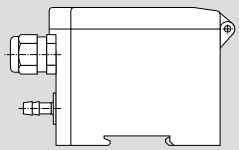
P 26 with display



P 26 without display







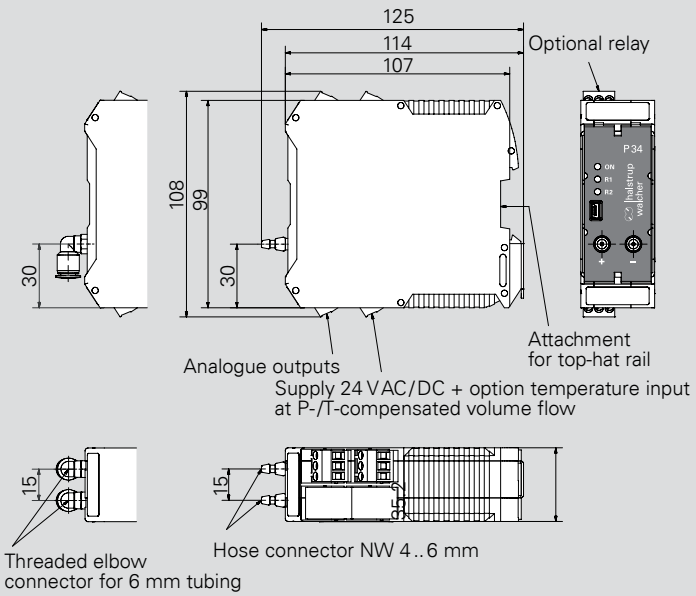
P 34

Features

- Differential pressure transmitter with very small dimensions – ideal for control cabinet installation
- Optionally with temperature analogue input and internal stat. pressure sensor for P-/T-compensated volume flow
- Optionally with relay
- Zero-point correction prevents zero-point drift
- Built-in valve provides a high level of overpressure protection
- Volume flow can be configured via k-factor, dP_{max}/V_{max} or 20 individual values
- With USB interface via PC-software: scaling, characteristic line form and many other parameters can be set
- Delivery possible already completely integrated into the control cabinet (on request)

Easy Mounting

The differential pressure transmitter P34 is particularly developed for space-saving mounting in control cabinets.



Measured data differential pressure

Measurement ranges (also ± measurement ranges) others available upon request	10/50/100/250/500 Pa 1/2.5/5/10/20/50/100 kPa freely scalable from 10..100 % within a measurement range
Margin of error (0.3 Pa margin of error for reference)	± 0.2 % or ± 0.5 % of the scaled range (40..100 % of max. value) (min. 0.3 Pa)
Temperature coefficient span	0.03 % v. E./K (10..50 °C)
Temperature coefficient zero point	± 0 % (cyclical zero-point correction)
Max. system pressure/ Overload capacity	400 kPa measurement ranges ≥ 2.5 kPa 200 x measurement ranges < 2.5 kPa
Medium	air, all non-aggressive gases
Sensor response time	25 ms
Time constants	25 ms..60 s (adjustable)
Operating temperature	10..50 °C
Storage temperature	-10..70 °C
Power consumption	approx. 6 VA
Weight	approx. 450 g
Connections	Screw terminals (connection capacity 0.25.. 2.5 mm²)
USB interface	USB 2.0 Full-Speed Slave (Mini USB)
Pressure ports	for tubing NW 4..6 mm
Protection class	IP20
Certificates	CE

Measured data for P-/T-compensated volume flow (optional)

Measured range absolute pressure	200 kPa
Accuracy absolute pressure	± 2.0 % of max. value
Temperature input	4..20 mA, R_i = 130 Ω Temperature range freely scalable

Power supply
24 VAC/DC ± 10 %

Output (linear / root extracted) [1]	**A**
0..10 V (R_L ≥ 2 kΩ)	1
0..20 mA (R_L ≤ 500 Ω)	0
4..20 mA (R_L ≤ 500 Ω)	4

[1] output signals can be configured freely

Margin of error	**C**
± 0.2 % [2]	2
± 0.5 % [2]	5

[2] of the scaled range (40..100 % of max. value) (min. 0.3 Pa)

Application	**E**
standard	A
P-/T-compensated volume flow	B

Measurement range	**B**
Measurement range e.g. 0..10 Pa, -10..50 mbar, ± 100 mmHg (etc.)	

Contact points	**D**
none	0
2 relays (changeover contacts) max. 230 VAC, 6 A	2

Tubing connectors	**F**
standard grommet for NW 4..6 mm tubing	0
threaded elbow connector for 6 mm tubing	W

Order code	**A**		**B**		**C**		**D**		**E**		**F**
P34	–		–		–		–		–		–

Can be pre-set on request:
Time constant, relay parameter, analogue output root-extracted / linear, deactivation of the cyclic zeroing

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Measurement ranges others available upon request	250/500 Pa 1/2.5/5/10/20/50/100 kPa freely scalable from 10 .. 100 % within a measurement range
Margin of error	± 0.2 % of max. value or ± 0.5 % of max. value
Temperature coefficient span	0.03 % of max. value/K (10 .. 50 °C)
Temperature coefficient zero point	± 0 % (cyclical zero-point correction)
Overload capacity	100 kPa for measurement ranges ≥ 2.5 kPa 200 x for measurement ranges < 2.5 kPa
Medium	natural gas
Max. system pressure	100 kPa for all measurement ranges
Sensor response time	25 ms
Time constants	25 ms .. 60 s (adjustable)
Operating temperature	10 .. 50 °C
Storage temperature	-10 .. 70 °C
Power consumption	approx. 6 VA
Weight	approx. 750 g
Cable glands	2 x M 16
Pressure ports	2 x laboratory nozzle DIN 12898
Protection class	IP 65
Certificates	CE, EN1127-1:2007

Output (linear/ root-extracted) [1]	A
0 .. 10 V (R_L ≥ 2 kΩ)	1
0 .. 20 mA (R_L ≤ 500 Ω)	0
4 .. 20 mA (R_L ≤ 500 Ω)	4
± 5 V (R_L ≥ 2 kΩ)	5

[1] output signals can be configured freely

Power supply	B
24 V DC ± 10 %	24 DC

Measurement range	C
Measurement range e.g. 0 .. 250 Pa, -10 .. 50 mbar, 0 .. 100 mmHg (etc.)	

Margin of error	D
± 0.2 % of max. value	2
± 0.5 % of max. value	S

Display + keyboard	E
none	0
multi-coloured LCD and keyboard	LC

Tubing connections	F
standard for tubing NW 5 .. 8 mm	0
cutting ring coupling 8 mm	S

Order code	A	B	C	D	E	F
P 29	–	–	–	–	–	–

Can be pre-set on request:
Time constant, relay parameter, analogue output root-extracted / linear, deactivation of the cyclic zeroing

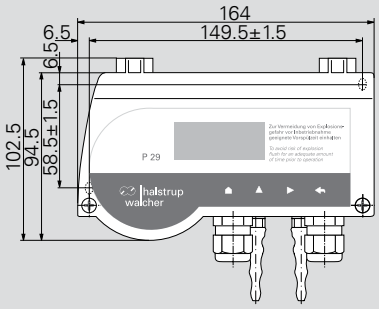
TÜV-tested

As long as a specified flushing process is observed, special electronic encapsulation safely separates any ignition sources from natural gas.

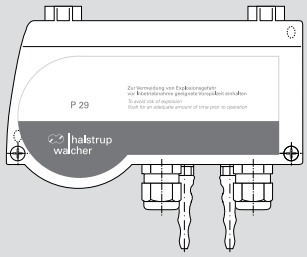
Features

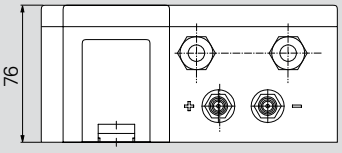
- TÜV-tested differential pressure transmitter for natural gas
- Design changes and technical modifications keep ignition source and gas mixture safely separated (not suitable for Ex-applications)
- Also ± measurement ranges
- Scalable measurement range and display
- For pressure and volume flow measurement
- Zero-point correction prevents zero-point drift
- Built-in valve provides a high level of overload protection
- Also suitable for top-hat rail mounting
- Multilingual menu (English/French/German/Italian)

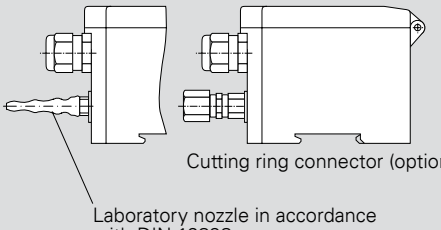
P29 with display



P29 without display





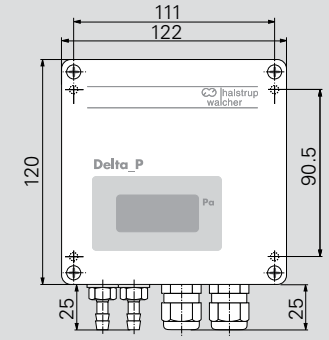


PU/PI/PIZ

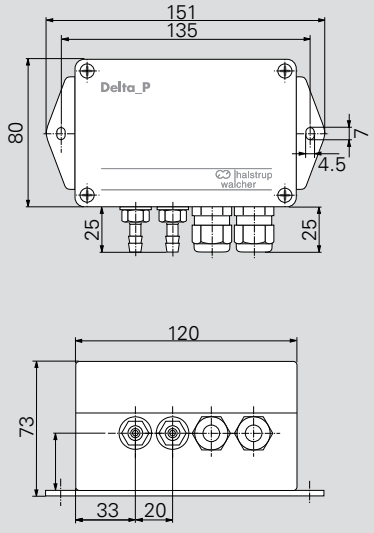
Features

- Differential pressure transmitter with linear curve for air-conditioning applications
- Also available as a two-wire system *("PIZ" model)*
- Also for ± measurement ranges and asymmetric measurement ranges
- With optional LCD

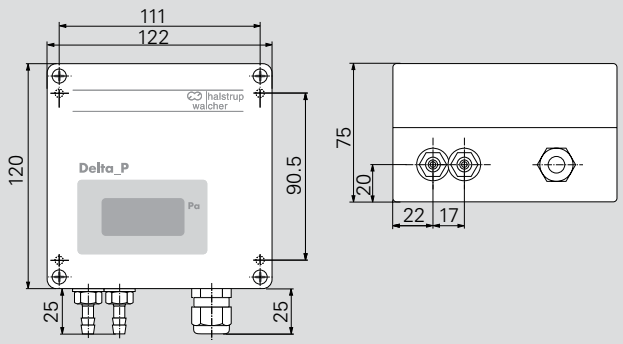
PU / PI with display



PU / PI without display



PIZ with display



Measurement ranges (also ± measurement ranges) others available upon request	50/100/250/500 Pa 1/2.5/5/10/20/50/100 kPa
Margin of error (0.3 Pa margin of error for the reference)	0.2 % of max. value only for measurement ranges ≥ 250 Pa 0.5 % of max. value, min. 0.3 Pa 1 % of max. value
Temperature coefficient span	0.04 % of max. value/K (10..60 °C)
Temperature coefficient zero point	0.04 % of max. value/K (10..60 °C)
Zero point stability	0.5 % of max. value/year
Overload capacity	10 x for measurement ranges ≤ 20 kPa 2 x for measurement ranges > 20 kPa
Medium	air, all non-aggressive gases
Max. system pressure	10 kPa for measurement ranges ≤ 10 kPa max. nominal pressure of the sensor for measurement ranges above 10 kPa
Sensor response time	20 ms
Operating temperature	10..60 °C
Storage temperature	-10..70 °C
Power consumption	PU/PI: approx. 3 VA PIZ: max. 0.6 VA
Weight	approx. 0.8 kg
Cable glands others available upon request	PU/PI: 2 x PG 7 PIZ: 1 x PG 7
Pressure ports	for tubing NW 6 mm
Protection class	IP 65
Certificates	CE, CSA (only for PU/PI)

Model	Output	A
PU	0..10 V (R_L ≥ 2 kΩ)	U
PI	0..20 mA (R_L ≤ 500 Ω)	I0
PI	4..20 mA (R_L ≤ 500 Ω)	I4
PIZ	4..20 mA two-wire (R_L ≤ 50 [UB (V) -10 (V)] Ω)	IZ

Measurement range	B
Measurement range e.g. 0 ..100 Pa, 0..60 mbar, ±110 mmHg (etc.)	

Margin of error	C
0.2 % of max. value only for measurement ranges ≥ 250 Pa	02
0.5 % of max. value min. 0.3 Pa	05
1 % of max. value	1

Supply voltage	D
24 VDC, +20 %/-15 % [1]	24D
24 VAC, +6 %/-15 % (50/60 Hz) [1]	24A
115 VAC, +6 %/-15 % (50/60 Hz) [1]	115
230 VAC, +6 %/-15 % (50/60 Hz) [1]	230
10..32 VDC (two-wire system)	PIZ

[1] not for PIZ

Time constant	E
none	0
1 s	1
2 s	2
5 s	5

LCD	F
none	0
3 ½ digit (see foto)	3
4 ½ digit (only for PU/PI)	4

Order code	A	B	C	D	E	F
P	–	–	–	–	–	–

Relay parameter can be pre-set on request

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PS 27

Measurement ranges (also ± measurement ranges) others available upon request	50/100/200/500 Pa 1/2.5/5/10/20/50/100 kPa
Margin of error	2 % of the set value for ≥ 100 Pa or 3 % of the set value for 50 Pa
Temperature coefficient span	0.1 % of max. value/K
Temperature coefficient zero point	0.1 % of max. value/K
Overload capacity	12 x for measurement ranges ≤ 20 kPa 4 x for measurement ranges ≥ 20 kPa
Medium	air, all non-aggressive gases
Max. system pressure	10 kPa for measurement ranges ≤ 10 kPa max. nominal pressure of sensor for measurement ranges above 10 kPa
Sensor response time	20 ms
Time constants	20 ms..4 s adjustable (factory-provided)
Operating temperature	-20..60 °C with Display 0..50 °C
Storage temperature	-20..70 °C
Power consumption	approx. 1 VA
Weight	approx. 0.25 kg
Cable glands	2 x M 12
Pressure ports	for tubing NW 4..6 mm
Protection class	IP 65
Certificates	CE

Output [1]	A
0..10 V (R_L ≥ 50 kΩ)	1
2..10 V (R_L ≥ 50 kΩ)	2
0..20 mA (R_L ≤ 500 Ω)	0
4..20 mA (R_L ≤ 500 Ω)	4
0..5 V (R_L ≥ 50 kΩ)	5

[1] the output signal can be configured using jumpers

Power supply	B
24 V AC/DC ± 10 % (without galvanic separation)	AC/DC
15 .. 32 V DC (two-wire) (only for A = 4)	ZWL

Measurement range	C
Standard (e.g. 0..100 Pa) [2]	
toggles between: 100 Pa/250 Pa/500 Pa/1 000 Pa	1
toggles between: 250 Pa/500 Pa/1 000 Pa/2.5 kPa	2
toggles between: 1 kPa/2.5 kPa/5 kPa/10 kPa	3
toggles between: 10 kPa/25 kPa/50 kPa/100 kPa	4

[2] others available upon request, also ± measurement ranges

Contact point	D
none	0
1 relay (changeover contacts) max. 230 V AC, 6 A (min. required switching capacity 300 mW) (not for two-wire)	1

LCD	E
none	0
4-digit	1

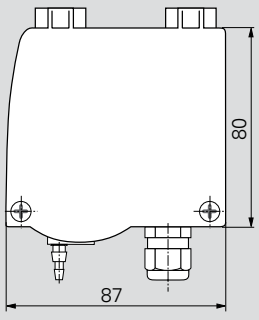
Order code	A	B	C	D	E
PS 27	–	–	–	–	–

Can be pre-set on request:
Time constant and relay parameter

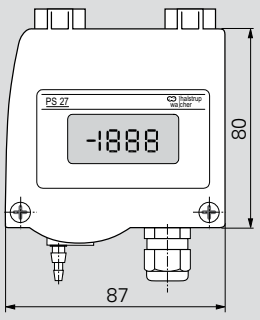
Features

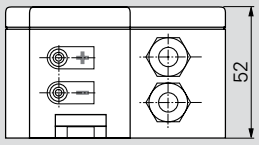
- Compact differential pressure transmitter for basic applications
- Also available with two-wire technology (optional)
- With optional display
- Either with one fixed measurement range or toggling between 4 different measurement ranges
- 4 measurement ranges can be selected via jumpers (optional)
- With ± measurement ranges and asymmetric measurement ranges
- With optional relay (6 A)
- Suitable for top-hat rail mounting and wall surface installation

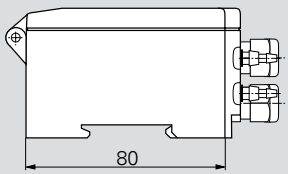
PS 27 without display



PS 27 with display



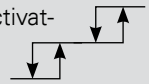




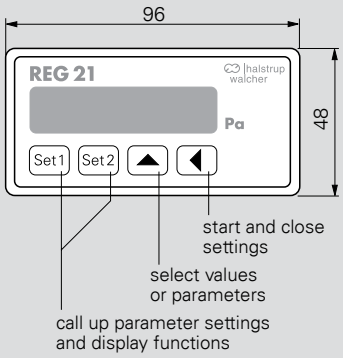
REG 21

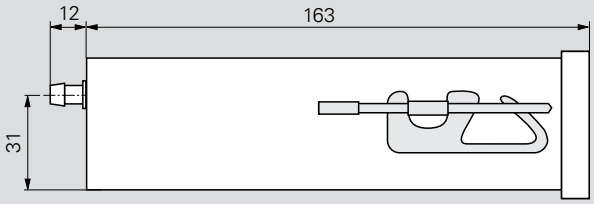
Features

- Pressure measurement and regulation in a device
- Accurate measurement of differential pressure with automatic zero-point correction and high overload protection
- Switching outputs can be used as 2-point regulator (pressure switch), for activating/deactivating a final control element (e.g. pump), with relay hysteresis
- Switching outputs can be used as a 3-point regulator (e.g. ON 1 - OFF - ON 2) for activating/deactivating two final control elements, (e.g. air intake/outflow fans), with relay hysteresis
- Asymmetry also possible, e.g. -10 .. 40 mbar
- Housing: control panel housing (installed)



Panel housing / control panel installation





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Measurement ranges others available upon request	50/100/250/500 Pa 1/2.5/5/10/20/50/100 kPa
Margin of error (0.3 Pa margin of error for the reference)	0.5 % of max. value (min. 0.3 Pa) 1 % of max. value
Temperature coefficient span	0.04 % of max. value/K (10 .. 60 °C)
Temperature coefficient zero point	±0 % (cyclical zero-point correction)
Overload capacity	200 x for measurement ranges < 2.5 kPa 600 kPa for measurement ranges ≥ 2.5 kPa
Medium	air, all non-aggressive gases
Max. system pressure	10 kPa for measurement ranges ≤ 10 kPa max. nominal pressure of sensor for measurement ranges above 10 kPa
Sensor response time	20 ms
Display	4 ½ digit
Time constants	adjustable up to 10 s
Operating temperature	10 .. 60 °C
Storage temperature	-10 .. 70 °C
Power consumption	approx. 5 VA
Weight	approx. 0.8 kg
Pressure ports	for tubing NW 6 mm
Protection class	IP 50 (installed)
Certificates	CE

Output	**A**
0 .. 10 V ($R_L \geq 2$ kΩ)	1
±5 V ($R_L \geq 2$ kΩ)	5
0 .. 20 mA ($R_L \leq 500$ Ω)	0
4 .. 20 mA ($R_L \leq 500$ Ω)	4

Measurement range	**B**
Measurement range (e.g. 0 .. 100 Pa, -10 .. 40 mbar, 0 .. 200 mmHg etc.)	

Margin of error	**C**
0.5 % of max. value (min. 0.3 Pa)	05
1 % of max. value (standard)	1

Power supply	**D**
24 VDC, +20 %/-15 %	24D
24 VAC, +6 %/-15 % (50/60 Hz) (with galvanic separation)	24A
115 VAC, +6 %/-15 % (50/60 Hz)	115
230 VAC, +6 %/-15 % (50/60 Hz)	230

Contact points	**E**
2 relays with floating changeover contacts 230 VAC (50/ 60 Hz), 6 A	R
2 transistors with open collector $U_{CE} \leq 50$ V; $I_C \leq 200$ mA, floating	T

Order code	**A**		**B**		**C**		**D**		**E**
REG 21	–		–		–		–		–

Can be pre-set on request:
Time constant, relay parameter, deactivation of the cyclic zeroing

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In air ducts and processes

MEASUREMENT OF VOLUME FLOWS

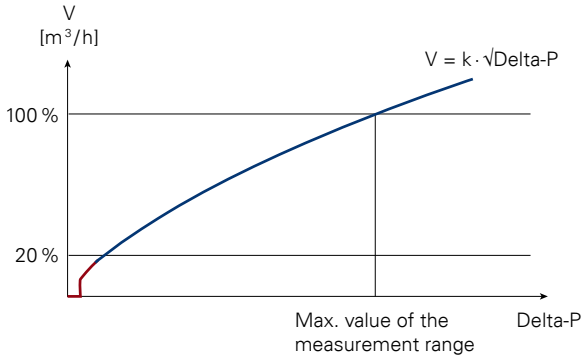
VOLUME FLOW MEASUREMENT

In building and process technology, it is necessary to measure the quantities of air flowing into rooms or processes or being circulated in the plant. The quantity of air transported in a given period of time is known as the volume flow (most common unit: m^3 or ft^3 per hour). Accuracy down to the last decimal point is not usually critical in these applications. The key features are reliability, robust build quality and good value for money.

The most commonly used method of measuring volume flows is based on the principle of differential pressure. This has a number of specific advantages:

- low investment costs, especially for ducts with medium or large cross-sections
- minimal calibration costs
- process technology: can also be used in plants where temperatures differ significantly from room conditions

Please note that the differential pressure method of measuring volume flow cannot accurately record very small volume flows. These low measurement values are therefore suppressed *(creep suppression)*, e.g. the lowest 3 % of the differential pressure measurement range. However, in typical air conditioning and ventilation systems, as well as in most process technology plants, the volume flows lie between 20 and 100 % of the maximum measurement range so this does not result in any significant limitations.



SUITABLE DEVICES

halstrup-walcher offers a choice of high quality differential pressure transmitters with square-root output. All these devices are designed for indoor room conditions as well as for overpressures of up to 6 bar optional. Please contact Luftmeister GmbH, a company in the Halstrup-Walcher Group (www.luftmeister.com), for selecting a primary element and for on-site calibration.

	P26	**P34**	**P29**
Details on	**p. 20**	**p. 21**	**p. 22**
			
Special feature	Scalable, large selection of units	Similar to P26, specifically designed for the control cabinet	Similar to P26, can be used in applications with natural gas
Volume flow	✓	✓	✓
Volume (consumption)	✓ (optional)	-	-
Differential pressure	✓	✓	✓
Accuracy	✓ ✓	✓ ✓	✓ ✓
Pressure / temperature compensation	-	✓ (optional: Absolute pressure sensor on board, temperature analogue input)	-
20-point curve	-	✓ (can be stored)	-

CONVERSION TABLE

	m^3/h	**m^3/min**	**ft^3/h**	**ft^3/min**
m^3/h	1	0.0167	35.3147	0.5886
m^3/min	60	1	2118.8800	35.3147
ft^3/h	0.0283	0.0005	1	0.0167
ft^3/min	1.6990	0.0283	60	1

Please read the lines from left to right.
Example: 1 m^3/h corresponds to 35.3147 ft^3/h.

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Portable

DIGITAL PRESSURE GAUGES

OVERVIEW

	EMA 200	EMA 84
Details on	**p. 30**	**p. 31**
		
Features	Portable digital pressure gauge with min./max. value memory and free selection of units, also suitable for flow measurements	Rugged, portable digital pressure gauge
Measurement ranges	±200 Pa (±2 mbar) ±2 kPa (±20 mbar) ±20 kPa (±200 mbar) ±200 kPa (±2000 mbar)	0..100 Pa (0..1 mbar) 0..1 kPa (0..10 mbar) 0..10 kPa (0..100 mbar) 0..100 kPa (0..1000 mbar)
Margin of error	0.5 % of max. value	0.2 % of max. value, min. 0.3 Pa for measurement ranges 1..50 kPa or 0.5 % of max. value for measurement ranges 1..100 kPa or 1 % of max. value

The EMA 200 is available with 4 measurement ranges. The units (Pa, kPa) are shown in the display or printed on the keyboard film (mbar, mmH_2O, inH_2O).

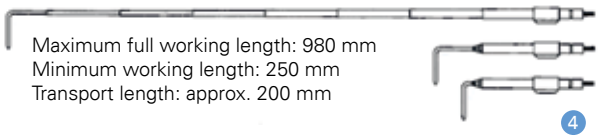
The EMA 84 is also available with 4 measurement ranges. The following units may be selected: Pa/mbar and mbar/kPa. The measurement range selected (incl. the units) is printed on the device.

ACCESSORIES

	Order no.
Shoulder bag EMA 200	9074.0001 1
Carrying bag EMA 84	9063.0001 2
Shoulder bag EMA 84 (with LCD viewing window)	9064.0001 3
DAkkS calibration certificate, German (p. 41)	9601.0003
DAkkS calibration certificate, English (p. 41)	9601.0004
ISO factory calibration certificate	9601.0002
Connecting components (tubing etc.)	see p. 15
Telescoping pitot tube (EMA 200) for flow measurements	9061.0193 4


1


2


Maximum full working length: 980 mm
Minimum working length: 250 mm
Transport length: approx. 200 mm
4

APPLICATION

After start-up of an air-conditioning system and cleanroom, or during maintenance or validation work, it is necessary to monitor a large number of pressure values. It is therefore essential to measure and record the following values accurately:

- ventilator pressure
- pressure drop at power units and filters
- overpressure in the cleanroom
- flow in the air duct and rooms

The EMA range of handheld pressure gauges are simple to operate, have a rugged design and are optimised for long-term use in building services engineering and industrial applications.

3

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EMA 200

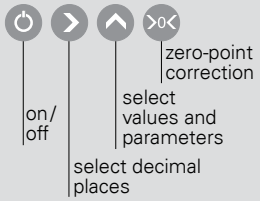
Margin of error	0.5 % of max. value
Overload capacity	10 x for measurement ranges ≤ 10 kPa 2 x for measurement ranges > 10 kPa 1.2 x in the 200 kPa measurement range
Calculation of air speed	$v = 1.291 * \sqrt{\Delta p}$ with v in m/s and Δp = differential pressure at the pitot tube in Pa (pitot factor and density adjustable) with telescoping pitot tube, see p. 29
Zero-point correction	performed electronically by pressing zero-point key
Medium	air, all non-aggressive gases
Analog output	0..2 V ($R_L \geq 2$ kΩ) 0..1..2 V ($R_L \geq 2$ kΩ) for negative and positive measurement ranges
Display	3 ½ digit LCD, character height = 10 mm
Time constants	1..10 s
Operating temperature	0..50 °C
Storage temperature	-10..70 °C
Power supply	9 V battery (service life approx. 100 h) (display reads *"low bat"* when power falls below a certain minimum level) Switches off automatically after approx. 20 min.
Weight	approx. 0.4 kg
Pressure ports	for tubing NW 4..6 mm
Certificates	CE

Measurement range			**A**
± 200 Pa	(± 2 mbar)	1.5..18 m/s	0
± 2 kPa	(± 20 mbar)	5..58 m/s	1
± 20 kPa	(± 200 mbar)	15..180 m/s	10
± 200 kPa	(± 2000 mbar)		100

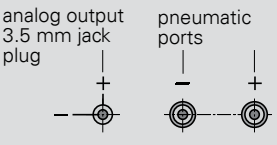
Order code	**A**
EMA 200 –	

Features

- High-end pressure gauge for differential pressure and flow measurements
- Adjustable pitot factor and density
- Zero-point correction at the push of a button
- Min./max. value memory
- Temperature measurement



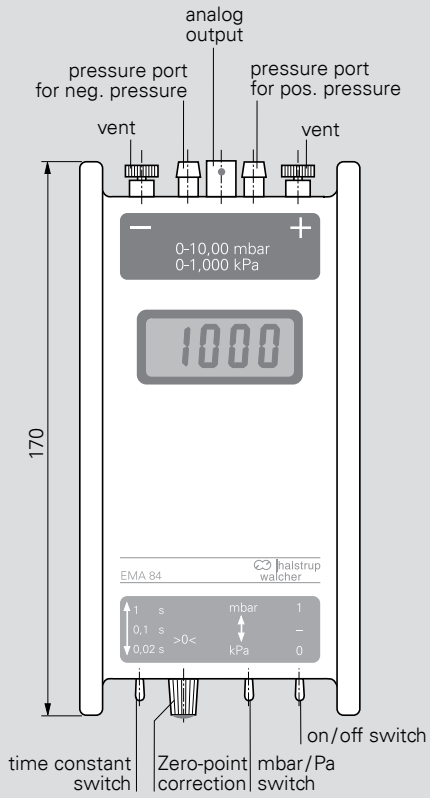
Connection diagram

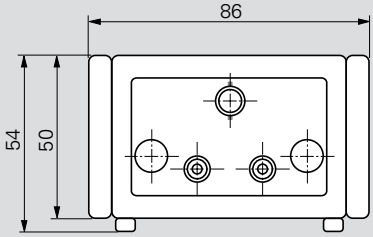


EMA 84

Features

- Very robust digital pressure gauge
- Ideal for service technicians, easy-to-read display
- High level of accuracy
- Manual zero-point correction
- With optional analog output for writer or power/voltage logger





Margin of error	0.2 % of max. value (min. 0.3 Pa) for measurement ranges 1 .. 50 kPa or 0.5 % of max. value for measurement ranges 1 .. 100 kPa or 1 % of max. value
Overload capacity	10 x for measurement ranges ≤ 10 kPa 2 x for measurement ranges > 10 kPa
Zero-point correction	via potentiometer on front face
Medium	air, all non-aggressive gases
Analog output	0 ..1 V (R_L ≥ 2 kΩ) BNC connector
Display	3 ½ digit LCD, character height = 13 mm
Time constants	toggles between 0.02 s; 0.2 s; 1 s
Operating temperature	10 .. 60 °C
Storage temperature	-10 .. 70 °C
Operating position	preferably horizontal
Power supply	9 V battery
Weight	approx. 0.8 kg
Pressure ports	for tubing NW 6 mm
Certificates	CE

Measurement range		**A**
0 .. 100 Pa	(0 .. 1 mbar)	0
0 .. 1 kPa	(0 .. 10 mbar)	1
0 .. 10 kPa	(0 .. 100 mbar)	10
0 .. 100 kPa	(0 .. 1 000 mbar)	100

Margin of error	**B**
0.2 % of max. value (min. 0.3 Pa) for measurement ranges 1 .. 50 kPa	2
0.5 % of max. value for measurement ranges 1 .. 100 kPa	5
1 % of max. value	1

Analog output	**C**
none	0
0 ..1 V (optional)	1

Order code	**A**	**B**	**C**
EMA 84	–	–	–

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ABSOLUTE PRESSURE TRANSMITTERS

ABSOLUTE PRESSURE TRANSMITTERS

Absolute pressure measurements are essential for determining atmospheric pressure. Here, the current pressure is compared with a vacuum. While atmospheric pressure measurements are only able to record (weather-dependent) ambient pressure, i.e. approx. 1 013.25 hPa ± 50 hPa, *"traditional"* measurements of absolute pressure are also able to compare other pressure values, e.g. 0.75 hPa, to the vacuum depending on the selected pressure range.

	AD 1000	**BA 1000**
Details on	**p. 34**	**p. 34**
		
Features	Absolute pressure transmitter	Atmospheric pressure transmitter
Measurement range	0 .. 50 kPa 0 .. 100 kPa 80 .. 120 kPa 90 .. 110 kPa 100 .. 0 kPa	80 .. 120 kPa 85 .. 115 kPa 90 .. 110 kPa 95 .. 115 kPa
Margin of error	± 1 % of measurement range Reference ± 0.5 hPa with respect to sea level	
Display	3 ½ digit, see foto (optional) 4 ½ digit (optional)	

ACCESSORIES

	Order no.
DAkkS calibration certificate, German	9601.0003 (see p. 41)
DAkkS calibration certificate, English	9601.0004 (see p. 41)
ISO factory calibration certificate	9601.0002
Connecting components (tubing etc.)	see p. 15

APPLICATION

Weather forecasting is one area where it is vital to be able to measure atmospheric pressure accurately. Air-conditioning systems, too, often measure the current level of atmospheric pressure in order to avoid excessive differences in pressure, e.g. in entrance areas/air curtains.

Precise measurements of absolute pressure are also vital in many scientific and production processes where it is essential to have a (weather-dependent) process pressure value, e.g. frequently required for pressure compensation of volume flow measurements.

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AD / BA 1000

Margin of error	± 1 % of measurement range Reference ± 0.5 hPa with respect to sea level
Temperature coefficient span	0.04 % / K (10 .. 60 °C)
Calibration temperature	22 °C
Operating temperature	10 .. 60 °C
Storage temperature	-10 .. 70 °C
Signal stability	0.3 hPa / year
Reduction	0 .. 850 m above sea level (please indicate when placing your order)
Power consumption	approx. 3 VA
Cable glands	2 x PG 7 (housing without display) 2 x PG11 (housing with display)
Protection class	IP 54
Weight	approx. 0.6 kg
Pressure ports [1]	for tubing NW 6 mm
Certificates	CE

[1] AD 1000: 1 pressure port, BA 1000: no pressure port

Product	Measurement range	A
AD 1000	0 .. 50 kPa	50A
	0 .. 100 kPa	100A
	80 .. 120 kPa	80A
	90 .. 110 kPa	90A
	100 .. 0 kPa	0A
BA 1000	80 .. 120 kPa	80B
	85 .. 115 kPa	85B
	90 .. 110 kPa	90B
	95 .. 115 kPa	95B

Output	B
0 .. 10 V ($R_L \geq 2$ kΩ)	1
0 .. 20 mA ($R_L \leq 500$ Ω)	0
4 .. 20 mA ($R_L \leq 500$ Ω)	4

Power supply	C
24 V DC, + 20 % / - 15 %	24D
24 V AC, + 6 % / - 15 % (50 / 60 Hz)	24A
115 V AC, + 6 % / - 15 % (50 / 60 Hz)	115
230 V AC, + 6 % / - 15 % (50 / 60 Hz)	230

LCD	D
none	0
3 ½ digit, see foto	3
4 ½ digit	4

Reduction [2]	E
none	0
please indicate in meters (e.g. 2 m) [2]	

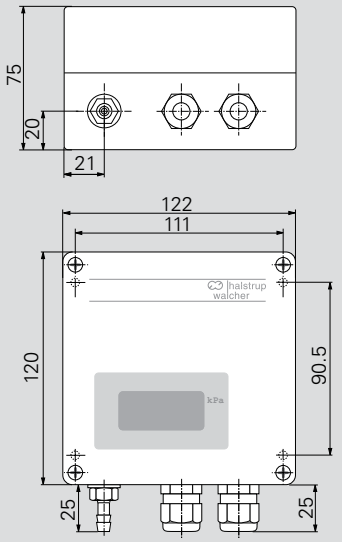
[2] only for BA 1000

Order code	A		B		C		D		E
AD-BA 1000		–		–		–		–	

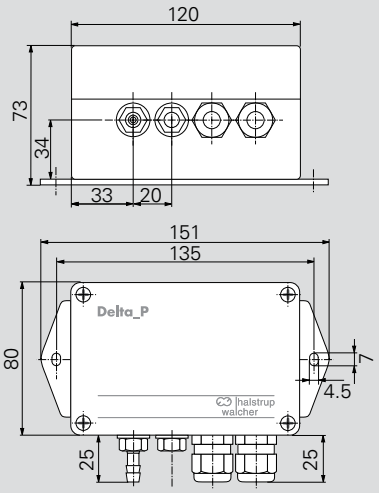
Features

- Precise absolute pressure transmitter
- AD: for absolute pressure
- BA: for atmospheric pressure
- High level of accuracy and long-term stability
- Little zero-point drift or hysteresis; largely independent of temperature
- The size of the optional display can be adjusted (reduced) in the factory to correspond to the height of the installation site, see DIN ISO 2533 (only BA 1000)

AD / BA 1000 with display



AD / BA 1000 without display



AD 1000: 1 pressure port
BA 1000: no pressure port

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Pressure calibration

MOBILE CALIBRATION DEVICES

HIGH PRECISION ON-SITE MEASUREMENT AND CALIBRATION

The KAL range from halstrup-walcher comprises three pressure calibration devices that offer outstanding value for money and can be used either for stationary (e.g. in a customer's own laboratory) or mobile applications.
They combine the following features:

- integrated pressure generation (for setting the calibration point)
- high precision pressure measurement (for recording the calibration value)

In the KAL 84, the pressure is generated using a manual pump and integrated pressure bellows. In the KAL 100/200, the calibration point (target pressure) is entered via a keyboard/display and automatically generated using a high precision pump. With these devices, the user can select not only the display language but also the unit of pressure. In addition, the KAL 200 has a USB interface so that pressure sequences can be programmed using supplied PC software. This makes it possible to produce time-optimised calibration sequences.

	KAL 200	**KAL 100**	**KAL 84**
Details on	**p. 38**	**p. 38**	**p. 39**
			
Pressure generation	automatic		manual
Applications	mobile or stationary (laboratory)		
Measurement ranges	0..100 Pa/0..200 Pa/0..500 Pa/0..1 kPa/0..2 kPa/ 0..5 kPa/0..10 kPa/0..20 kPa/0..50 kPa/0..100 kPa/ ±100 Pa/±200 Pa/±500 Pa/±1 kPa/±2 kPa/±5 kPa/ ±10 kPa/±20 kPa/±50 kPa/-80..100 kPa		0..100 Pa (0..1 mbar) 0..1 kPa (0..10 mbar) 0..10 kPa (0..100 mbar) 0..100 kPa (0..1 000 mbar) 0..300 mmHg (0..400 mbar)
Margin of error	0.1 % of max. value ±1 digit Measurement ranges>0..200 Pa/±200 Pa 0.2 % of max. value ±1 digit Measurement ranges 0..200 Pa/±200 Pa 0.3 % of max. value ±1 digit Measurement ranges 0..100 Pa/±100 Pa	0.2 % of max. value ±1 digit Measurement ranges>0..200 Pa/±200 Pa 0.5 % of max. value ±1 digit Measurement ranges ≤ 0..200 Pa/±200 Pa	0.2 % of max. value ±1 digit Measurement ranges 0..50 kPa 0.5 % of max. value ±1 digit
Interface	USB (standard)	USB (optional)	-
Analog measurement input for test object	✓	optional	-
Battery life (rechargeable)	8 h	8 h	2 h
Factory calibration certificate	✓	Accessory	Accessory

ACCESSORIES

	Order no.
Carrying bag KAL 84	9062.0001 1
Hand pump KAL 84	9601.0036 2
Transport case KAL 100/200	9220.0002 3
Carrying bag KAL 100/200	supplied as standard
DAkkS calibration certificate, German	9601.0003 (see p. 41)
DAkkS calibration certificate, English	9601.0004 (see p. 41)
ISO factory calibration certificate	9601.0002 (included for KAL 200)

Hand pump KAL 84
Order no. 9601.0036

Carrying bag KAL 84
Order no. 9062.0001

Transport case KAL 100/200
Order no. 9220.0002


Carrying bag KAL 100/200
supplied as standard

APPLICATIONS FOR THE "KAL" CALIBRATION DEVICE

The high performance rechargeable battery makes the KAL range ideal for on-site applications. *"Mobile calibration"* removes the need to send pressure measurement devices to an external calibration laboratory and thus saves a great deal of time and expense. Customers can now perform ISO calibrations *themselves* by using a DAkkS-calibrated KAL device.

The KAL range provides the optimum solution for the following typical applications:

- mobile or stationary calibration of pressure values in cleanrooms (pharma, semiconductors etc.)
- mobile or stationary calibration of blood pressure monitoring equipment in hospitals etc.
- mobile or stationary calibration of differential pressures in air-conditioning systems

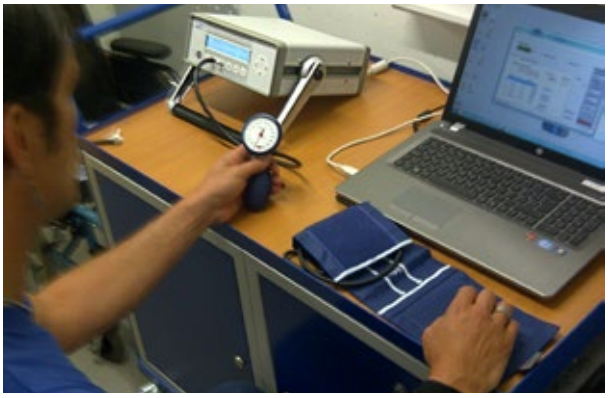
EFFICIENCY AND REGULATORY COMPLIANCE – CALIBRATING BLOOD PRESSURE MONITORS ON-SITE

Every hospital and nursing home now uses blood pressure monitors. It is vital that these instruments operate precisely and reliably. Moreover, the equipment must retain its accuracy over months and years of use. False readings from blood pressure monitors are a matter of life and death. The greatest risk, however, is posed by drug dosage errors, which risk straining the patient's circulatory system. Instruments are calibrated each year to prevent incidents such as these from occurring, a process that involves comparing measured values to highly precise control values.

If measurements are relevant to human health, regular instrument calibration is required by law. The *"Ordinance on Medical Devices"* stipulates that regular testing be performed and documented. The responsibility for risk assessment lies with the operator.

One legally secure method accepted by auditors is to document the calibration in the facilities management software. But how can a calibration of this type be performed efficiently?
On-site calibration by a qualified technical service is more efficient than removing a number of the blood pressure monitors from the wards every few weeks and sending them to an external laboratory for calibration.

The battery powered KAL 200 pressure calibration device from halstrup-walcher is the ideal solution. Pressure sequences can be pre-programmed using the supplied software. The KAL 200 pressure generator then generates each pressure *(the target value)* with extreme precision and reads the *actual value* on the test object (blood pressure monitor).
The actual value is then entered on-site in standardised test records that are administrated by the facilities management software. The data are now available at any time – ensuring efficiency and regulatory compliance.



In practice: Blood pressure monitors in the nursing home Solina in Spiez (Switzerland) are calibrated by the technician responsible.

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KAL 100/200

Margin of error KAL 100	0.2 % of max. value ± 1 digit Measurement ranges > 0..200 Pa / ± 200 Pa 0.5 % of max. value ± 1 digit Measurement ranges ≤ 0..200 Pa / ± 200 Pa
Margin of error KAL 200	0.1 % of max. value ± 1 digit Measurement ranges > 0..200 Pa / ± 200 Pa 0.2 % of max. value ± 1 digit Measurement ranges 0..200 Pa / ± 200 Pa 0.3 % of max. value ± 1 digit Measurement ranges 0.. 100 Pa / ± 100 Pa
Hysteresis	0.1 % of max. value
Overload capacity	600 kPa for measurement ranges > 3 kPa 200 x for measurement ranges ≤ 3 kPa
Temperature coefficient zero point	± 0 % (cyclical zero-point correction)
Temperature coefficient span	KAL 100: 0.04 % of max. value / K (10..40 °C) KAL 200: 0.03 % of max. value / K (10..40 °C)
Calibration temperature	22 °C
Medium	air, all non-aggressive gases
Measurement input/ power supply (test object)	0..10 V, 0/4..20 mA Accuracy: 0.2 % of max. value 24 V DC / 100 mA
Display	Alphanumeric display with 2 x 20 characters, backlighting
Operating temperature	10..40 °C
Storage temperature	-10..70 °C
Weight	approx. 4.5 kg
Pressure ports	Ø 6 mm, for tubing NW 5 mm
Certificates	CE

Model	A
KAL 100	100
KAL 200	200

Power supply	C
115 V AC, 6 % / -15 % (50/60 Hz)	1
230 V AC, 6 % / -15 % (50/60 Hz)	2
115 V AC, 6 % / -15 % (50/60 Hz) and rechargeable lithium ion battery	1A
230 V AC, 6 % / -15 % (50/60 Hz) and rechargeable lithium ion battery	2A

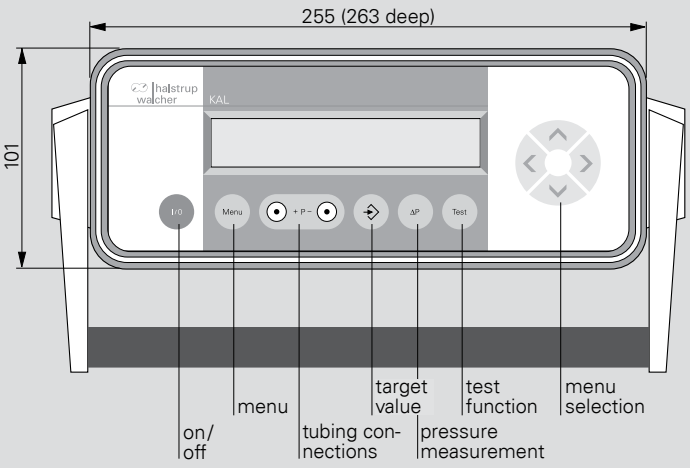
Data interface	D
none	0
USB + measurement input for test object (standard for KAL 200)	1

Measurement ranges	B
0..100 Pa	0
0..200 Pa	02
0..500 Pa	05
0..1 kPa	1
0..2 kPa	2
0..5 kPa	5
0..10 kPa	10
0..20 kPa	20
0..50 kPa	50
0..100 kPa	100
± 100 Pa	0A
± 200 Pa	02A
± 500 Pa	05A
± 1 kPa	1A
± 2 kPa	2A
± 5 kPa	5A
± 10 kPa	10A
± 20 kPa	20A
± 50 kPa	50A
-80..100 kPa	100A

Order code	A	B	C	D
KAL	–	–	–	–

Features

- High precision measurement and calibration device in one
- Runs on mains supply or battery, highly flexible (optional)
- Battery life approx. 8 hours, ideal for mobile applications
- Automatic zero-point correction provides high zero-point stability
- Internal pump quickly and accurately generates negative or positive differential pressures of up to 100 kPa
- Optional USB interface available (Standard for KAL 200)
- Factory calibration certificate supplied as standard (KAL 200)
- Unit conversion (e.g. mmHg, mmH_2O, psi, etc.)
- Multilingual menu (English / French / German / Italian / Spanish)
- With power supply and measurement input for the external test object (transmitter being calibrated)

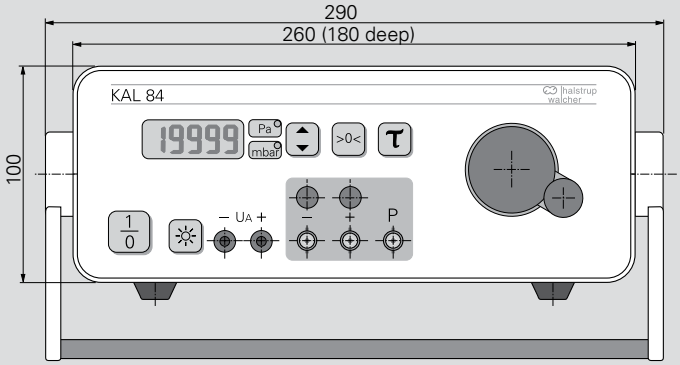


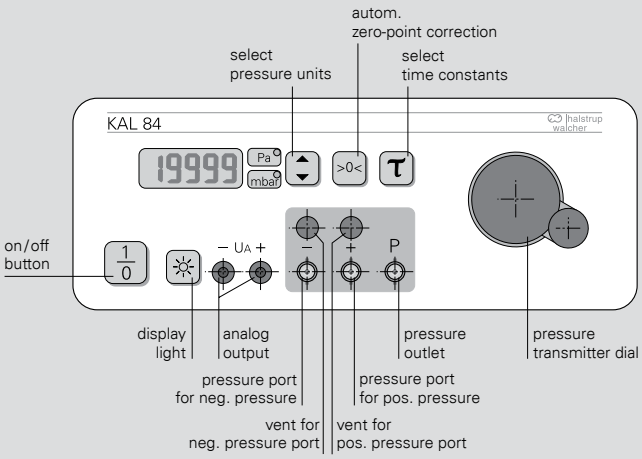
User software

KAL 84

Features

- Highly accurate, reproducible results
- Internal pressure generation using pressure transmitter dial
- Very rugged and light:
  excellent for service applications
- Unit conversion, e.g. mmHg/kPa, mbar/kPa
- Rechargeable battery allows for portable operation





Margin of error [1]	0.2 % of max. value ± 1 digit for measurement ranges 1 .. 50 kPa 0.5 % of max. value ± 1 digit
Hysteresis	0.1 % of max. value
Temperature coefficient zero point	not applicable; Push button for resetting zero-point
Temperature coefficient span	0.04 % of max. value/K (10 .. 40 °C)
Calibration temperature	22 °C
Medium	air, all non-aggressive gases
Displacement volume	approx. 100 cm^3 (1, 10, 100 kPa) approx. 200 cm^3 (100 Pa)
Analog output	0 .. 1 V ($R_L \geq 2$ kΩ) 2 connectors Ø 4 mm
Display	4 ½ digit LCD character height = 10 mm
Time constants	toggles between 0.1 s; 1 s
Operating temperature	10 .. 40 °C
Storage temperature	-10 .. 70 °C
Power supply	NiCd rechargeable 9 V battery with AC adaptor
Weight	approx. 3 kg
Pressure ports	for tubing NW 6 mm
Certificates	CE

[1] all measurement ranges have a 99 % overrange.

Measurement ranges [2]	A
0 .. 100 Pa (0 .. 1 mbar)	0
0 .. 1 kPa (0 .. 10 mbar)	1
0 .. 10 kPa (0 .. 100 mbar)	10
0 .. 100 kPa (0 .. 1 000 mbar)	100
0 .. 300 mmHg (0 .. 400 mbar)	300

[2] others available upon request

Margin of error	B
0.5 % of max. value ± 1 digit	1
0.2 % of max. value ± 1 digit for measurement range 1 .. 50 kPa (optional)	2

Power supply	C
230 V AC adaptor	230
115 V AC adaptor	115

Order code	A	B	C
KAL 84	–	–	–

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Calibration of
pressure and volume flow

CALIBRATION SERVICES

CALIBRATION SERVICES

DAKKS AND ISO CALIBRATIONS IN THE LABORATORY

Germany's national metrology institute (Deutsche Akkreditierungsstelle GmbH) has certified Walcher Meßtechnik GmbH – a member of the Halstrup-Walcher Group – to perform pressure calibrations in accordance with DIN EN ISO/IEC 17025. Services also include recalibration of products *(factory calibration certificates)* as directed by the ISO 9001 quality management system for measuring equipment. The DAkkS calibration allows the customer to perform ISO compliant pressure calibrations independently.
Calibration and, on request, adjustment of measurement or calibration devices is offered for instruments from all manufacturers.

Walcher Meßtechnik

DAkkS Deutsche Akkreditierungsstelle D-K-15083-01-00

PRESSURE CALIBRATION IN THE LABORATORY

Overview of services provided by our certified calibration laboratory for *pressure measurements* in accordance with DIN EN 17025:

- Differential pressure transmitters, calibration devices, absolute pressure transmitters and portable pressure gauges
- absolute pressures of 0.25 bar to 20 bar in gases (laboratory medium: air)
- negative and positive overpressures of -10 mbar to 20 bar in gases
- ISO, DAkkS certificates and adjustments

VOLUME AND MASS-FLOW CALIBRATION IN THE LABORATORY

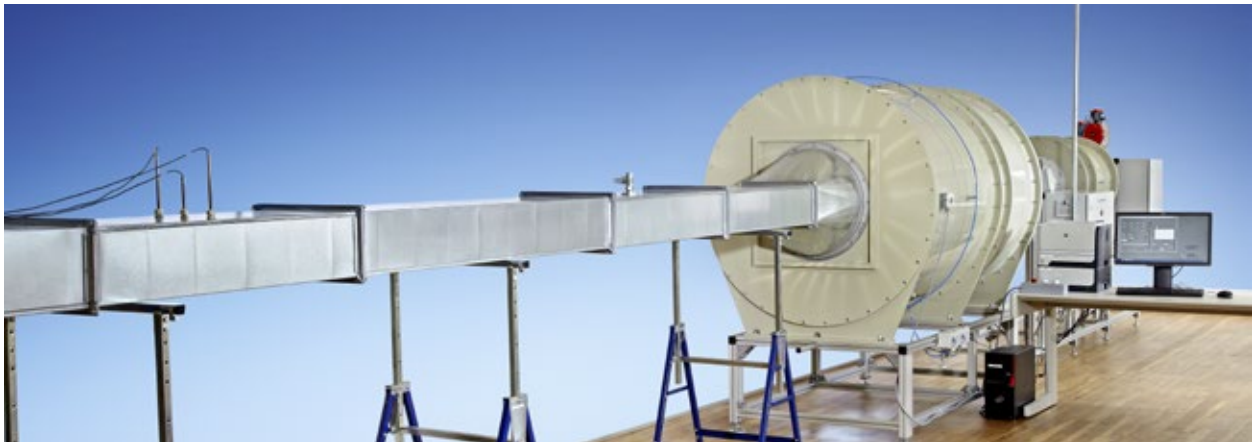
Performance overview of our calibration lab for the measured value *"volume and mass flow"*:

- Volume flow of at least 25 m^3/h up to max. 4500 m^3/h for channel diameters of 50 to 700 mm
- Mass flow of 30 to 5400 kg/h for channel diameters of 50 to 700 mm

For calibration of

- Volume flow meters (installed in the pipe section)
- Balometers, primary elements (k-factor), fans
- Complete volume flow measuring sections (channel or pipe section with primary element and differential pressure transmitter, e.g. P34 can be calibrated at up to 20 points), see also p. 21.

Test stand inlet nozzles for volume and mass flow



Test stand for volume and mass flow

MAINTENANCE OF OVERPRESSURE IN CLEANROOMS OR MINI-ENVIRONMENTS

A PRACTICAL OVERVIEW OF AN APPARENTLY FAMILIAR FIELD

Cleanroom operating requirements are becoming ever more stringent. The maintenance of overpressure is a good example of this process at work. The objective is to prevent any inflow of contaminated air by maintaining stable pressure cascades. Facilities with a number of cleanrooms (or plants with a number of mini-environments) create areas with different pressure levels in order to provide the greatest possible protection for the most sensitive zones.

In the past, auditors could often be satisfied by showing them the pressure measurement on a large, round pressure gauge display. Much more accurate methods are required today. And this is perfectly justifiable. Uncontrolled contamination can endanger the quality of the end product and, in extreme cases, create a health risk.

The obligation to ensure continuous monitoring of overpressure described in standard DIN EN ISO 14644 cannot be met simply by installing a display. Where are the regulating countermeasures if the overpressure falls below the critical threshold value? It is also unrealistic to expect that operating personnel will be close at hand to rectify the situation at precisely the moment that this happens. Consequently, it is now standard practice to measure differential pressure continuously (i.e. using a pressure transmitter) and transmit this signal to a control module.

Solutions based on either *"static"* differential pressure transmitters or a *"dynamic"* approach are available on the market for this purpose. The latter is based on the overflow principle – a small quantity of air flows from one room into the next; the velocity of flow is recorded and used to calculate the differential pressure.
This *dynamic* method has two important disadvantages:

1. The dynamic measurement principle requires an outflow of air from the higher pressure to the lower pressure room. Thus an exchange of air takes place between the rooms. However, it is a frequent requirement that each cleanroom must have a separate, high quality supply of filtered air in order to prevent cross-contamination. This is not a problem for pressure transmitters that use static sensors.
2. Where regulation of more than two cleanrooms is required, it is important to ensure that the pressure intervals are maintained at stable levels. The dynamic principle can only be used to calculate the differential pressure of one room in relation to its neighbouring room. There is no common pressure reference value (*"pneumatic zero potential"*). Static differential pressure transmitters offer an elegant solution to this problem, e.g. by pneumatically connecting the negative pressure ports of all neighbouring pressure transmitters.

Fig. 1: Without overpressure, the cleanroom is at risk of contamination

However, there are differences even between *static* differential pressure transmitters and the details separate the men from the boys. Measuring tiny pressures in the range below 30 or even 10 Pascal reliably and over many years is anything but *technological "child's play".* By way of comparison: normal air pressure of approx. 1 bar is equal to around 100 000 Pascal, so 10 Pascal are a vanishingly small fraction of the pressure of our environment! Most *static* differential pressure transmitters have two key weaknesses in this measurement range:

1. Most pressure transmitters with static measurement cells do not offer a stable measurement range over the long term. Over time, the measurement value will "wander" away from 10 Pascal, for example, and eventually result in an error of several Pascal.
2. At the same time, they do not guarantee zero point stability. This means that over time the zero signal (i.e. a differential pressure of zero Pascal) will be subject to a drift, which can often be as high as 1 to 2 Pascal per year.

Background: many suppliers use sensors, which do not meet the high standards required for measuring the smallest pressure ranges.

The measurement technology specialist halstrup-walcher has over forty years of experience in this area and exploits this know-how in refined and reliable solutions to both these problems. For example, improvements made to the membrane design over many decades have pro-

duced world class measurement range stability. At the same time, solenoid valves ensure that the zero point is always maintained with perfect accuracy. This is done by a *regular, automatic zeroing process* performed with the help of solenoid valves. Every measurement is therefore absolutely reliable even after years of operation.

Until a few years ago there was a trend in cleanroom measurement technology: so-called *panels* with integrated sensors. These panels are set into the cleanroom wall and display a variety of climate data such as temperature and humidity as well as overpressure. The pressure and usually the other values are measured directly at the panel. These instruments are not as frequently used today because the most advantageous position for the sensors may not be the ideal installation point for the panel. For example, the preferred location for measuring humidity and temperature is in the exhaust air duct because the value obtained here reflects the climate of the room as a whole. Furthermore, it is more convenient to install differential pressure sensors in a neighbouring control cabinet than directly behind a wall mounted panel.

Installing differential pressure transmitters in a control cabinet offers two advantages:

1. The *"pneumatic zero potential"* described above (for maintaining clear pressure intervals in several zones) is extremely easy to implement. All the pressure transmitters for neighbouring rooms are installed next to each other in the control cabinet and a short hose connection between the neighbouring pressure transmitters is all that is required to provide the same pressure reference value.
2. Calibration (which is obligatory every year in many cleanrooms) takes place outside the cleanroom. In addition, all the pressure transmitters are conveniently arranged next to each other for the calibration process. This saves a considerable amount of time.

When selecting the appropriate differential pressure transmitter for a control cabinet, professional cleanroom equipment suppliers ensure that the unit has a compact design, ideally a narrow *"disk module",* that permits a large number of units to be installed alongside each other. Not only the size but also the accuracy of the pressure transmitter must meet the required standards (min. 0.5 % of the max. value, or even 0.2 % of the max. value for exceptionally critical applications). Wiring and the ease of replacing modules during servicing are also important criteria to consider when selecting a suitable pressure transmitter.

Fig. 2: Installation of a P34 differential pressure transmitter in the control cabinet of the cleanroom monitoring system

The new P34 differential pressure transmitter from halstrup-walcher for control cabinet installation is the optimum solution to all three of these requirements:

- It guarantees first class data accuracy (high stability membrane, automatic zeroing) even for the smallest measurement ranges of just a few Pascal.
- The extremely compact design requires only minimal space in the control cabinet.
- Cables are connected to coded, non-confusable terminal bars so that initial installation and replacement of modules can be performed quick and correctly.

One further feature demonstrates that the P34 was designed by practical engineers for practical use: the measurement value can be read out via two galvanically separated analogue outputs. This enables the building control system and the monitoring system to receive the measurement signal independently of each other.

As already mentioned at the beginning of this article, cleanroom operating requirements are becoming ever more stringent. When selecting components, this is one good reason to rely on manufacturers who offer suitable cleanroom concepts that meet these requirements.

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Pressure measurement technology catalogue – Date: 06/2016 – Subject to technical changes without notice