

# Instruction Manual

## KAL 100/200 Calibration Device with Rechargeable Battery



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## Table of Contents

1	Purpose of instruction manual	3
2	Conformity	3
3	Safety precautions	4
3.1	Appropriate use	4
3.2	Shipping, assembly, electrical connections and start-up	4
3.3	Troubleshooting, maintenance, repairs, disposal	4
3.4	Symbols	4
4	Instrument description	6
4.1	Functions	6
4.2	User interfaces	7
4.2.1	Power input, primary on/off switch, micro fuse	8
4.2.2	I/O switch	9
4.2.3	Menu key	9
4.2.4	Target value key	10
4.2.5	"Test" key	11
4.2.6	Pressure key	11
4.2.7	Pressure input port	12
4.2.8	Purge feature	12
4.3	Menu items	12
4.3.1	Incrementation	12
4.3.2	P-input	12
4.3.3	Units of pressure	13
4.3.4	Unit 2 (optional)	13
4.3.5	Zeroing	13
4.3.6	Language	13
4.3.7	Rechargeable battery	14
4.3.8	Default settings	14
5	Battery operation	15
5.1	Charging the rechargeable battery	15
5.2	What to do in the case of total discharge	16
6	Zeroing	17
6.1	Manual zeroing	17
7	Overpressure protection	17
8	USB port	18
8.1	Commands for the serial interface	19
8.1.1	Operating modes	19
8.1.2	Setting parameters	20
8.1.3	Miscellaneous	20
8.1.4	Query values	21
8.2	Interface configuration	23
9	PC software	24
9.1	Software downloads	24
10	Troubleshooting	25
11	Technical data	25

## 1 Purpose of instruction manual

Please read this instruction manual thoroughly before operating the instrument in order to avoid injury or equipment damage caused by improper use of this instrument or failure to follow these instructions.

This instruction manual describes the features of the **KAL 200 calibration device** and provides guidelines for its use.

Any individual charged with handling this instrument must be trained in proper instrument operation and informed of all potential hazards. The instruction manual, and in particular the safety precautions contained therein, must be followed carefully. **Please contact the manufacturer immediately if you do not understand any part of this instruction manual or if you require additional information.**

Handle this manual with care and ensure that it

- is readily available throughout the lifecycle of the instrument,
- is provided to any individuals who assume responsibility for operating the instrument at a later date, and
- includes any supplementary materials provided by the manufacturer.

halstrup-walcher GmbH reserves the right to continue developing this instrument model without documenting such development in each individual case. We will be happy to determine whether this manual is up-to-date.

## 2 Conformity

This device is state of the art. It complies with the legal requirements of EC directives. This is shown by the CE mark.

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The manufacturer owns the copyright to this instruction manual. It contains technical data, instructions and drawings detailing the device's features and how to use it. It must not be copied either wholly or in part or made available to third parties.

### 3 Safety precautions

#### 3.1 Appropriate use

The KAL 200 calibration device is used for testing and calibrating pressure sensors.

Always observe the operating requirements – particularly the permissible supply voltage – indicated on the rating plate and in the “Technical data” section of this manual.

The instrument may only be handled as indicated in this manual. Modifications to the instrument are prohibited. The manufacturer is not liable for damages caused by improper use or failure to follow these instructions. Violations of this type render all warranty claims null and void.

#### 3.2 Shipping, assembly, electrical connections and start-up

Please do not close the pressure inlets during shipping! Changes in barometric pressure may damage devices with low measuring ranges.

Assembly and the electrical connections should only be handled by professionals. Only technical personnel who are appropriately trained and authorized by the operator of the facility may assemble the instrument and set up its electrical connections.

Pressurized air or breath is not to be used for performance tests, as this could damage instruments with low measurement ranges.

Measurement errors may occur if the instrument is not kept protected from sunlight.

See the individual sections of this manual for specific safety precautions.

#### 3.3 Troubleshooting, maintenance, repairs, disposal

The individual responsible for the electrical connections must be notified if the instrument is damaged or if errors occur that cannot be corrected as indicated in Section 10.

This individual must take the instrument out of service until the error has been corrected and ensure that it cannot be used unintentionally.

##### **Always unplug the power cord before opening the instrument!**

This instrument requires no maintenance.

Only the manufacturer may perform repairs that require the housing to be opened.

The electronic components of the instrument contain materials that can be reused. The instrument must therefore be sent to a recycling plant when you no longer wish to use it. The environment codes of your particular country must be complied with.

#### 3.4 Symbols

The symbols shown here are used throughout the following text to highlight the hazards associated with using the **KAL 200** and to point out important information for operating the instrument.



**WARNING!**

This warns you of a potential hazard that could lead to bodily injury up to and including death if the corresponding instructions are not followed.



**WARNING:**

This warns you of a potential hazard that could lead to significant property damage if corresponding instructions are not followed.



**INFORMATION:**

This indicates that the corresponding information is important for operating the instrument properly.

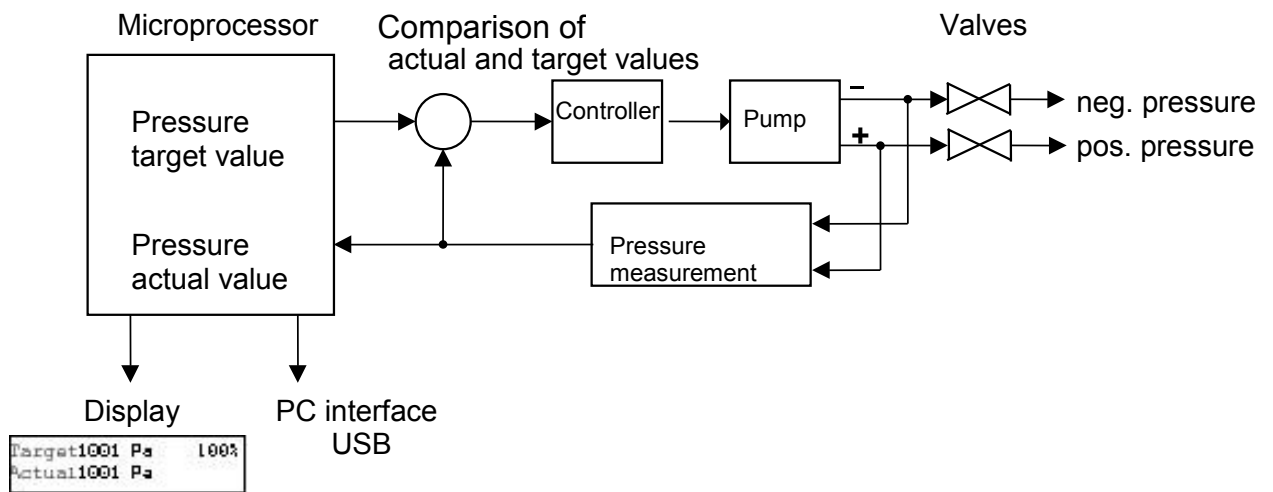
## 4 Instrument description

### 4.1 Functions

The KAL 200 microprocess-controlled pressure calibration device can be used for the following:

- Simply generating positive and negative reference pressures
- Measuring positive and negative pressures
- Measuring differential pressure
- Identifying leaks in a test object
- Determining dynamic response behaviour of a test object

Fig. 1 Basic circuit diagram



## 4.2 User interfaces

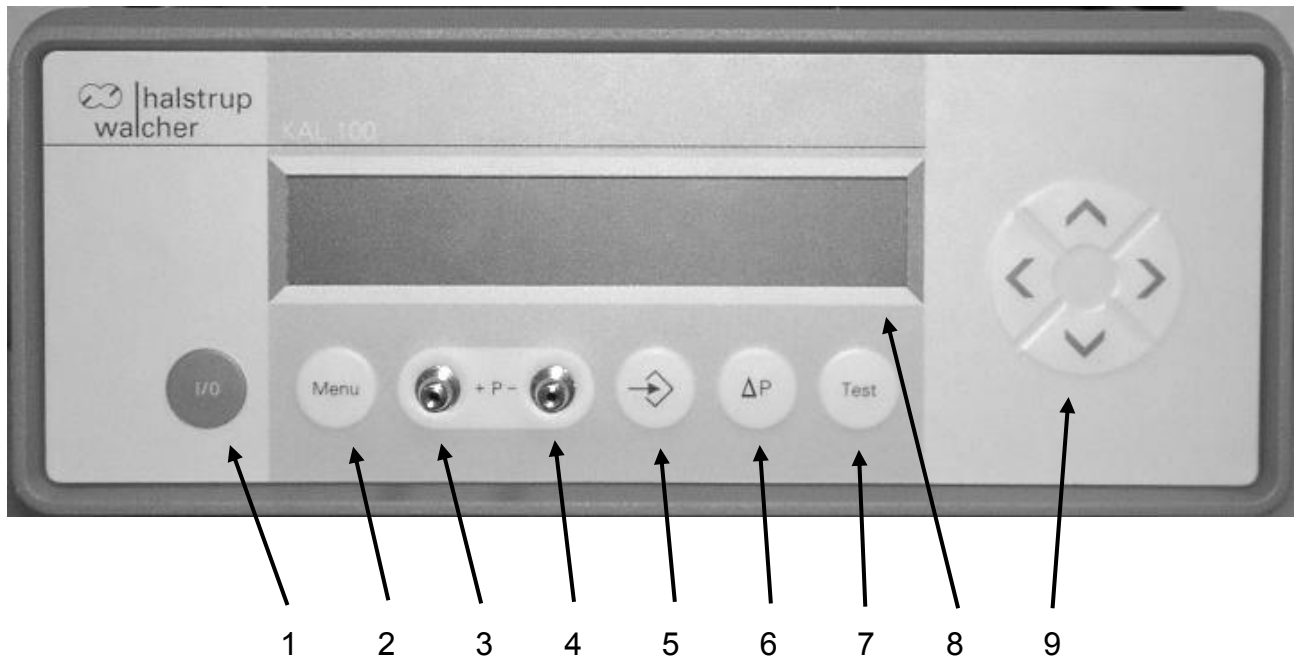


Fig. 2 Front

- 1 Secondary on/off switch
- 2 Menu
- 3 Positive pressure input/output
- 4 Negative pressure input/output
- 5 Target value
- 6 Pressure measurement
- 7 Test
- 8 Alphanumeric display
- 9 Navigation keys

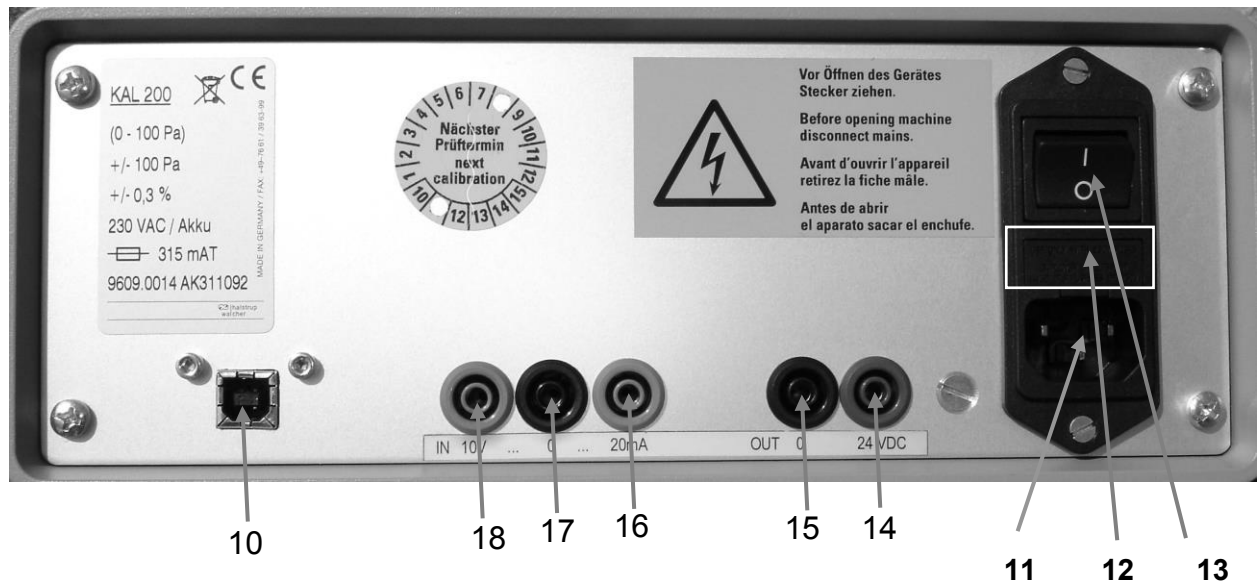
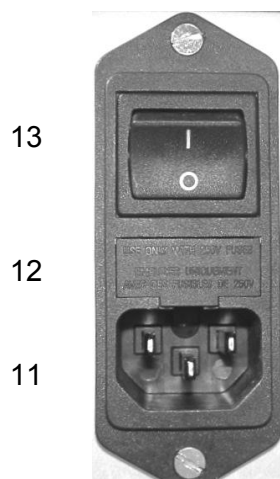


Fig. 3 Rear

- 10 USB port
- 11 Inlet connector for non-heating apparatus
- 12 Micro fuse, 315 mA, 5 x 20 mm
- 13 Primary on/off switch
- 14 Power supply +24V/125mA, galvanic separation
- 15 Ground for 24V/125mA
- 16 Input port for current measurement 0...20 mA, input resistance 240 Ohm
- 17 Ground connector for voltage and current input port
- 18 Voltage input 0...10V,  $R_i = \text{approx. } 40\text{k}\Omega$

4.2.1 Power input, primary on/off switch, micro fuse



The KAL 200 calibration device is designed at the factory to accommodate a supply voltage of 230 VAC/50-60 Hz (115 VAC/50-60 Hz is optional). Voltage fluctuations of +6% to -15% are permissible.

The supply voltage connector (11) is located on the rear of the instrument (inlet connector for non-heating apparatus + ground wire).

The instrument's micro fuse (12) is located above this connector. Value: 315 mA; dimensions: 5 x 20 mm. Located above the micro fuse is the double-pole, primary on/off switch (13), which separates the KAL 200 from the supply voltage.



**WARNING! Risk of Electrical shock! Failure to unplug the power supply cord before replacing the fuse may result in fatal injuries!**



#### 4.2.2 I/O switch



Secondary on/off switch; in standby mode the power input is approx. 5 W.

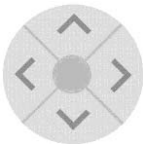
Pressing the primary on/off switch, a double-pole switch located on the rear of the instrument, separates the instrument from the power supply.

#### 4.2.3 Menu key



Pressing the menu key allows the operator to adjust the following 8 settings:

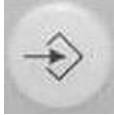
- Target value increments: 5, 10, 20, 25, 50, 100%
- Pressure input: +P, -P, Diff (both)
- Units of pressure: kPa, hPa, Pa, mbar, Torr, mmHg, mmH<sub>2</sub>O, inH<sub>2</sub>O
- (Optional) Unit in the 2nd line (unit of pressure, V, mA)
- Zeroing: on, off
- Language: German, English, French, Italian, Spanish
- Battery data: Voltage, present current, present current source, battery charge status
- Default settings



Navigation keys

Item 1 is displayed when the menu function is first activated; users may select other items by pressing the right/left navigation keys. The arrows on the display indicate which navigation keys are active. Pressing any of the operating mode keys (target value, pressure, test) exits the menu. Exiting the menu saves user preferences, which will be automatically set the next time the instrument is switched on.

#### 4.2.4 Target value key



The target value function and integrated hose pump allow the user to enter a predefined pressure. The target value is set using the navigation keys. The purge valve is activated or deactivated by repeated pressing of the target value key.

Press the right/left navigation keys to position the blinking cursor over the digit to be changed. Select the desired value by pressing the up/down keys. To change the sign of the target value, position the cursor over the +/- sign and press the up/down keys to change. Move the cursor to the right positions over the percentage symbol, to change the percentage by the increments previously specified in the menu.

The target pressure to be set is the product of the target value and the percentage value.

Example: Increment set from the menu: 25 %; target value 1000 Pa

0 % => 0 Pa; 25 % => 250 Pa; 50 % => 500 Pa; 75 % => 750 Pa; 100 % => 1000 Pa

<b>S</b>	<b>+100.00 Pa</b>	<b>100 %</b>
<b>A</b>	<b>+ 99.98 Pa</b>	<b>+OK</b>

The actual pressure is shown in the lower portion of the display. It takes about 1s to adjust settings when small volumes are connected. An additional pump is advisable if connecting larger volumes, as it would otherwise take too long to adjust the settings. The maximum target value may not exceed 120% of the measurement range.

	<b>----standby---</b>	
<b>I</b>	<b>0.61 Pa</b>	<b>+P</b>

If no tubing is connected to the pressure input valve and the target value has been set to 0 or 0%, the KAL 200 will constantly seek to correct for pressure differences (such as those caused by temperature drift). To minimize this, the control unit (motor) shuts down after roughly 5 min. The display reads "inactive".

Press any key (other than the I/O switch) to return the instrument to the "active" state.

#### 4.2.5 "Test" key



The test feature blocks both pressure ports. This allows the operator to measure a drop in pressure on the test object itself (leakage test).

Elapsed time and departure from the starting pressure (in %) are shown in the top line of the display. Pressing the test key starts the measurement again. The target value feature allows the user to restore the previous target pressure.

Test	2s	-0.02 %
A + 99.98 Pa		+OK



**Only one pressure port may be connected if using the KAL 200 to generate positive or negative overpressure. The hose pump draws in air through the other pressure port.**

#### 4.2.6 Pressure key



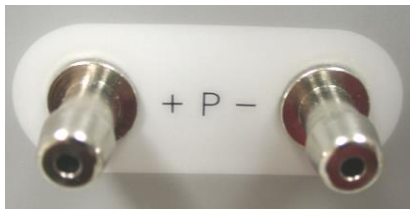
This allows the user to measure both positive and negative pressures up to a nominal pressure of +20%. In other words, a KAL 200 with a measurement range of 1000 Pa can measure up to  $\pm 1200$  Pa. The pressure measurement capsule is protected if this value is exceeded. Differential pressures can be measured by using both pressure ports. Navigation keys do not have any function in this case.

The purge valve is activated or deactivated by repeated pressing of the target value key.



**The P-input must be set properly in order to ensure that pressure measurements are as accurate as possible. The KAL 200 should also be operated at room temperature (22°C).**

#### 4.2.7 Pressure input port



For technical reasons, the sensitivity of the pressure sensor varies according to the pressure chamber used. Selecting the pressure input allows the user to compensate for these differences. The selected setting is displayed along with the "+P", "-P" or "dP" symbols.

#### 4.2.8 Purge feature

If the instrument is in target value or pressure mode, the purge feature can be activated or deactivated by pressing the appropriate key again. This connects the two ports of the instrument with each other internally in order to release any overpressure. This feature is also useful if sensitive sensors are to be connected. The use of short lengths of tubing can result in high pressures, which may damage or even destroy the sensor. No pressure can build if the purge feature is activated as the air can escape through the free port. When the purge feature is activated, the two pressure ports of the KAL200/100 are displayed in the lower line on the right.

### 4.3 Menu items

#### 4.3.1 Incrementation

This feature allows the user to modify the percentage of the target value in the following increments: 5 %, 10 %, 20 %, 25 %, 50 % and 100 %.

#### 4.3.2 P-input

This allows the user to select the pressure input as: +P, -P or DIFF.

#### 4.3.3 Units of pressure

This feature allows the operator to select the units used for displaying pressures. Certain measurement ranges cannot be displayed meaningfully in some units, in which case the units in question are not available. The following units may be selected:

- hPa
- mbar
- Torr
- mmHg
- mmH<sub>2</sub>O
- inH<sub>2</sub>O
- kPa
- Pa

#### 4.3.4 Unit 2 (optional)

As an option, the KAL200 can now be fitted with an input port for voltage measurements and an input port for current measurements. If this option is active, it can be used to display the measurement, which is presented in the second line. For example, if the user selects V as the unit, the voltage measured at the voltage input port will be displayed in the second line. This also applies for the pressure and target value features. The KAL200 is therefore capable of measuring the voltage and output current of a sensor. These values can also be readout using the interface and, if necessary, processed directly in a form. The corresponding ports are located on the rear of the instrument.

#### 4.3.5 Zeroing

By default the instrument resets the zero point approximately 6 minutes after it is initially switched on and then automatically every 30 minutes or after a major temperature change. Zeroing always results in changes in volume and thus to pressure. This can disrupt certain measurement sequences. Zeroing is automatically suppressed when the instrument is in test mode. The instrument can also be zeroed by pressing and holding (approx. 0.5 s) any of the operating mode keys (target value, pressure, test).

#### 4.3.6 Language

This feature allows the operator to select the language used. The languages available are German, English, French, Italian and Spanish.

#### **4.3.7 Rechargeable battery**

With this menu item, the user can display the voltage, present current, battery charge status and present current source for the instrument. Use the UP and DOWN keys to select the parameters to be displayed.

#### **4.3.8 Default settings**

Press the UP or DOWN navigation keys to restore the default settings. Default settings are as follows:

- Incrementation = 25%
- P-input = +P
- Units = hPa
- Zeroing = ON

## 5 Battery operation

The device contains a rechargeable lithium ion battery, which allows the device to operate even when not connected to a mains electricity supply. The operating time provided by the battery depends on the mode of operation. When measuring pressure, a fully charged battery is capable of powering the device for between 20 and 30 hours. The operating time is less in target value mode as additional electricity is required to drive the device. However, even in this mode, an operating time of 8...10 hours should pose no problem.



**If you do not intend to use the device for a longer period of time, you should fully charge the rechargeable battery beforehand in order to avoid total discharge.**

### 5.1 Charging the rechargeable battery

In order to maximise the operating life of the rechargeable battery, it is important to ensure that it always has a sufficient residual charge. As the device continues to consume power when switched off, albeit at a very low level, this is particularly important if it is to be left switched off for a longer period of time. Consequently, there is a risk of the battery discharging completely over an extended period.

While operating in normal mode, the battery is charged using a low current in order to prevent additional heat being generated by the device itself. The charging time here is approx. 12 hours. When the device is switched off (key on the front panel), it checks the status of the battery and activates the charging mode if it is less than 80% charged. The display shows the following message:

```
Accu: Charging
Charging: xx.x%
```

The device switches itself off when the battery is fully charged. If you wish to use the device before charging has been completed, you can start the normal operating mode again at any time by pressing the on/off switch on the front panel. Switching off the mains power supply interrupts the charging process.

**The charge level is displayed in 25%-steps. The 0% and the 25% Steps might be seen only after a long period of not using the KAL. In the normal use the KAL would switch itself off at a charge level of about 40%, which is approx. at 13,5V. This early cutoff is done to avoid a deep discharge during a longer period of storage.**

After switching on the KAL, the charge level must be evaluated and sent to the Display unit. Due to this the displayed charge level may be delayed or might show wrong values( 0.0%) for some seconds.

The device cannot charge if it is not connected to the mains power supply or if the master switch on the back of the device is not switched on. In this case, the following message will be displayed for a few seconds as soon as the residual charge of the battery falls below 40%:

**Charge < 40%**  
**connect mains**

If the main power supply is not connected or switched off the device will switch off itself after a few seconds. If this happens, the device should be connected to the mains power supply to charge the rechargeable battery. This is particularly important if the device will not be used for a longer period of time.

If, after switching on the power supply, the device reports with the normal operating mode (display: KAL200 Rev. X.X), it can be put into the rapid charge mode described above by pressing the on/off switch on the front panel.

Due to the 25% steps of the charge level, the level might show 100.0% for some time. At a real charge level of aprox. 90% the display will switch the 90% Display, but the battery will continue to charge. When the battery is fully charged (device has switched itself off), you can separate the device from the mains power supply again. The charged battery has enough power to work for 1 to 2 days with the KAL or some month of not using the KAL200.

## 5.2 What to do in the case of total discharge

The integrated rechargeable battery has its own protective switch. This completely switches off the output voltage of the battery if it falls below a specified value. If this happens, the display of the KAL200/100 may not show the battery symbol. Whenever it is switched on, the KAL100/200 will attempt to reactivate the rechargeable battery. It is therefore advisable in these circumstances to switch the device on and off until the rechargeable battery symbol is visible once again.

**However, the most effective method is to avoid leaving the device with an empty battery for an extended period and always to charge the battery before any longer periods during which it will not be in use.**



## 6 Zeroing

External influences such as temperature, position or ambient pressure can shift the instrument's zero point, i.e. the value displayed when the pressure ports are open. Zeroing is the process by which the instrument automatically registers this shift and figures it into the currently displayed pressure value. The instrument always zeroes itself after it is switched on. If automatic zeroing has been activated, it will zero itself again after 6 min. and then every 30 min.

Zeroing switches the internal valves, which necessarily involves a loss in pressure. If this interferes with instrument operation, the automatic zeroing feature can be switched off. Automatic zeroing is always suppressed when the instrument is in test mode.

Display when zeroing:

**Zeroadjust**

### 6.1 Manual zeroing

Pressing and holding the 'pressure', 'target value' or 'test' keys will cause the instrument to zero itself regardless of the menu setting.

## 7 Overpressure protection

The KAL 200 has an internal overpressure safeguard that protects the precision pressure measurement capsule from damage. Nevertheless, great caution should be taken when connecting the instrument to an unknown pressure source.

## 8 USB port

The KAL 200 has a USB port, which is detected by a PC as a serial interface. This port allows the instrument to exchange information and commands with a PC. This feature allows the operator to save settings and to transfer results to a PC.

The interface (USB serial port (COMx)) has the following settings:

- 9600 baud
- 8 data bits
- no parity
- one stop bit

The following table provides an overview of commands and the corresponding data.

## 8.1 Commands for the serial interface

### 8.1.1 Operating modes

Command	Meaning	Echo
MT	Mode – test	MT
MZ	Mode – zeroing	MZ
MS	Mode – target value	MS
MP	Mode – pressure measurement	MP
MK1	Keyboard on	MK1
MK0	Keyboard off	MK0
MB	Block ports. Instrument is inactive. Cancel using commands MS or MP	MB
ME	Cancel purge in pressure or target value mode using MM	
MM	Measure in pressure or target value mode	
MI0	Positive P-input	MI0
MI1	Negative P-input	MI1
MI2	Differential pressure measurement	MI2

### 8.1.2 Setting parameters

Command	Meaning	Format		Description	
>PSxxx.xxxxx	Target value in hPa	Floating			
>PDx	Incrementation	1 digit, 8 bit	0..5	0: 5% 2: 20% 4: 50%	1: 10% 3: 25% 5: 100%
>PEx	Units	1 digit, 8 bit	0..9	0: kPa 2: hPa 4: psi 6: mmHg 8: inHg	1: Pa 3: mbar 5: Torr 7: mmH2O 9: inH2O
>PLx	Language	1 digit, 8 bit	0..4	0: German 2: French 4: Spanish	1: English 3: Italian
>PPxxx	Percentage value	1 digit, 8 bit	0 ... 100		

### 8.1.3 Miscellaneous

Command	Meaning	Echo
STOS	Save setting parameters	OK
RCLS	Load setting parameters	OK
RCLP	Load device parameters	OK
RV	Retrieve device revision	Kal200 Rev. X.X

### 8.1.4 Query values

Command	Meaning	Format	Output string	Range of values
?PS	Target value in hPa	Floating	PS vxxx.xxxxx	
?PB	Measurement range in hPa	Floating	PB vxxx.xxxxx	
?PD	Incrementation	1 digit	PD x	0..5 (see also 8.1.2)
?PE	Units	1 digit	PE x	0..9 (see also 8.1.2)
?PL	Language	1 digit	PL x	0..4 (see also 8.1.2)
?PP	Percentage value	3 digits	PP xxx	0..100
?MI	Input mode	1 digit	MI x	0..2 (see also 8.1)
?ST	Status	8 digits, binary	ST bbbbbbbb	<ul style="list-style-type: none"> <li>• bit 7 MSB, pressure OK</li> <li>• bit 6, unused</li> <li>• bit 5, keys active</li> <li>• bit 4 pressure meas.</li> <li>• bit 3, test mode</li> <li>• bit 2, target value mode</li> <li>• bit 1, zeroing active</li> <li>• bit 0, teach mode</li> </ul>
?BR	Readout measurement range	Floating, in hPa	BR vxxx.xxxxx	
?AL	Battery charge status	Floating in %	AQ xxx.x	
?AU	Battery voltage	Floating in %	AU xxx.x	
?AI	Battery current	Floating in mA	AI xxx	
?AQ	Active current source	String	"Mains" or "Battery"	
?IP	Readout actual pressure	Floating, in hPa	IP vxxx.xxxxx	
?IV	Readout voltage	Floating in V	IV vxxx.xxxxx	
?IA	Readout current	Floating in mA	IA vxxx.xxxxx	
?ID	Readout pressure diff. (test)	Floating, in hPa	ID vxxx.xxxxx	
?IZ	Readout duration (test)	5 places, in s	IZ xxxxx	

v = prefix    x = number, 0..9        b = binary digit; 0 or 1

#### 8.1.4.1 Converting hPa/mbar to desired units

Multiplier	Units
100	Pa
0.0145038	psi
0.7500616827	Torr
0.7500616827	mmHg
10.1971623	mmH <sub>2</sub> O
0.0295299875	inHg
0.40146307597	InH <sub>2</sub> O

## 8.2 Interface configuration

Using Windows XP set up the following series interface configuration (COM port). The process is similar for other Windows systems.

To find the interface configuration: go to Start/Settings/Control Panel: click on System and select the Hardware tab. Click on Device Manager and select Ports. Double-click on the used COM port and then select the Port Settings tab.

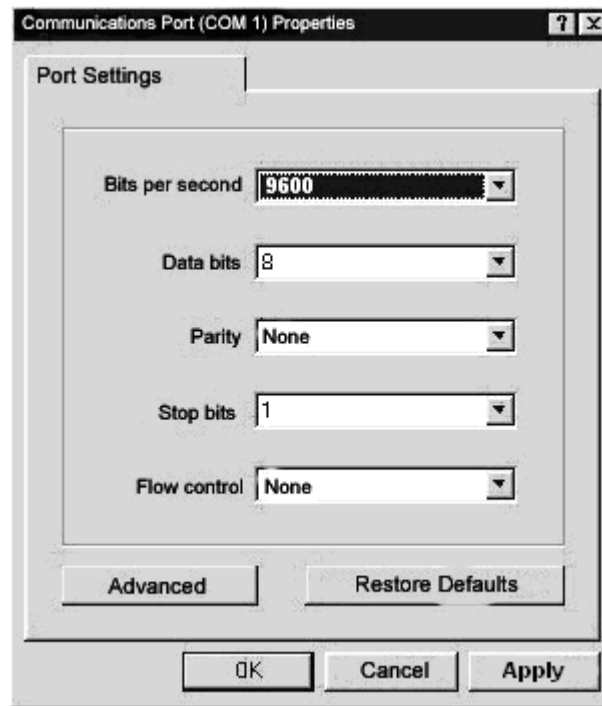


Fig. 4 Properties

## 9 PC software

### 9.1 Software downloads

You can download this PC software from the following link:

[https://www.halstrup-walcher.de/de/downloads/software/index.php?choice\[\]=476401476401](https://www.halstrup-walcher.de/de/downloads/software/index.php?choice[]=476401476401)

To find a short description go to the menu item “?” and select “help”.




## 10 Troubleshooting

Problem	Cause	Corrective Action
Instrument is not functioning, display is dark	No power	→ Check to see if the electrical cord is plugged in properly at the inlet for non-heating apparatus → Switch on instrument at the primary switch (on rear panel) → Check fuse; replace if necessary <b>Caution: Unplug power cord!</b>
Instrument does not reach set pressure; pump runs continuously	Leak in the system, diameter of tubing too large	→ Secure tubing properly; eliminate any leaks → Maximum tubing diameter 5 mm

## 11 Technical data

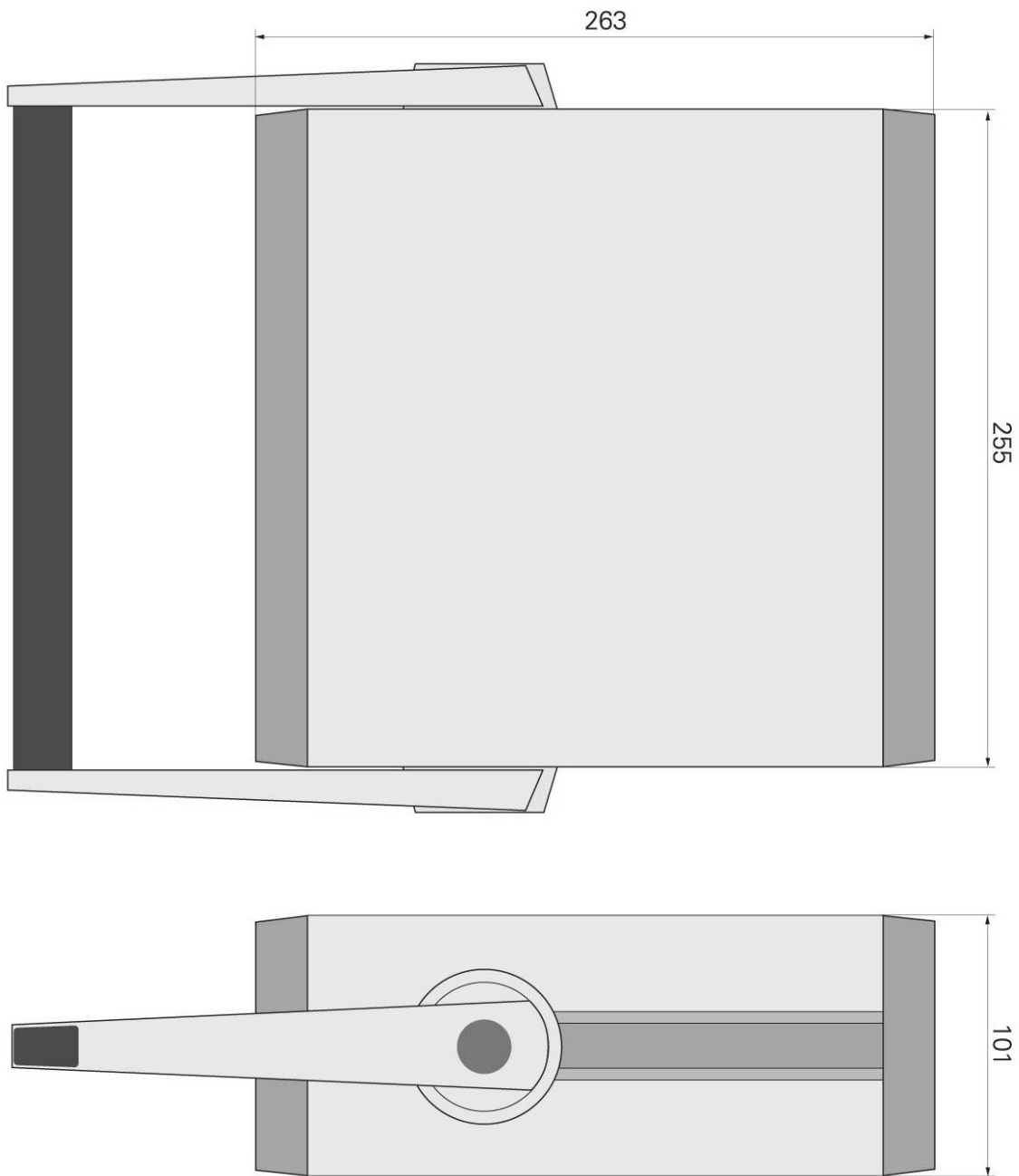
Measurement data	
Measurement ranges	0-100 Pa, 0-1 kPa, 0-10 kPa, 0-100 kPa
Overpressure range	20 %
Overload capacity	600 kPa for 10 kPa and 100 kPa measurement ranges 200x for 100 Pa and 1 kPa measurement ranges
Linearity based on a pressure/measurement range of 0...100% at +17...+27°C	±0.1 % ±1 digit ±0.3 % (at 100 Pa) ±0.1 % (at 1...100 kPa)
Hysteresis	0.1 %
Resolution	0.01 % of the final value
Temperature-dependent drift in zero point	none (cyclic zeroing)
Temperature-dependent drift in measurement range	0.03 % / K
Voltage input	0..10V, Ri approx. 40 kOhm, accuracy: +/-0.2% of the final value
Current input	0..20mA, output load 240 Ohm, accuracy: +/-0.2% of the final value

<b>Ambient conditions</b>	
<b>Medium</b>	Air, all non-aggressive gases
<b>Operating temperature</b>	+10°C to +40°C
<b>Storage temperature</b>	-10°C to +70°C
<b>Relative humidity</b>	0...80 %
<b>EMC standards</b>	EN 55011; EN 61000-4-3, EN 61000-4-6
<b>Conformity</b>	 Declaration of conformity available upon request
<b>Electrical data</b>	
<b>Power consumption</b>	16 VA
<b>Supply voltage options</b>	230 VAC/115 VAC +6 %/ -15 % (50-60 Hz)
<b>Setting time</b>	The setting time depends on the connected volume and ranges from 10s – 30s
<b>Digital output</b>	USB port
<b>Display</b>	Alphanumeric LCD
<b>Rechargeable battery</b>	
<b>Operating endurance – pressure</b>	> 20 h
<b>Operating endurance – target value</b>	> 8 h
<b>Charging time – KAL200 in active mode</b>	approx. 12 h
<b>Charging time – KAL200 switched off</b>	approx. 6 h
<b>Physical data</b>	
<b>Pressure ports</b>	Ø 6 mm for NW5 tubing (5mm internal diameter)
<b>Dimensions (w x h x d)</b>	288 x 102 x 247 mm
<b>Weight</b>	4.3 kg
<b>Operating position</b>	horizontal
<b>Charging time – KAL200 in active mode</b>	approx. 12 h

## Appendix A

<b>Parts in contact with measurement medium</b>	
Beryllium bronze CuBe2	Araldite CY236 / HY988
Mu metal (nickel alloy)	Loctite 242e
Brass CuZn39Pb3	Carbonyl iron
Aluminium AlCuMgPb / AlMg3	KEL (FPM: (fluorinated rubber)
Silicon (tubing), optional: Viton	Vepuran Vu 4457/51
Crastin (PTBP)	UHU-Plus endfest 300 binder

Dimension drawing



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