

# SwemaMan 7

## Operating instructions

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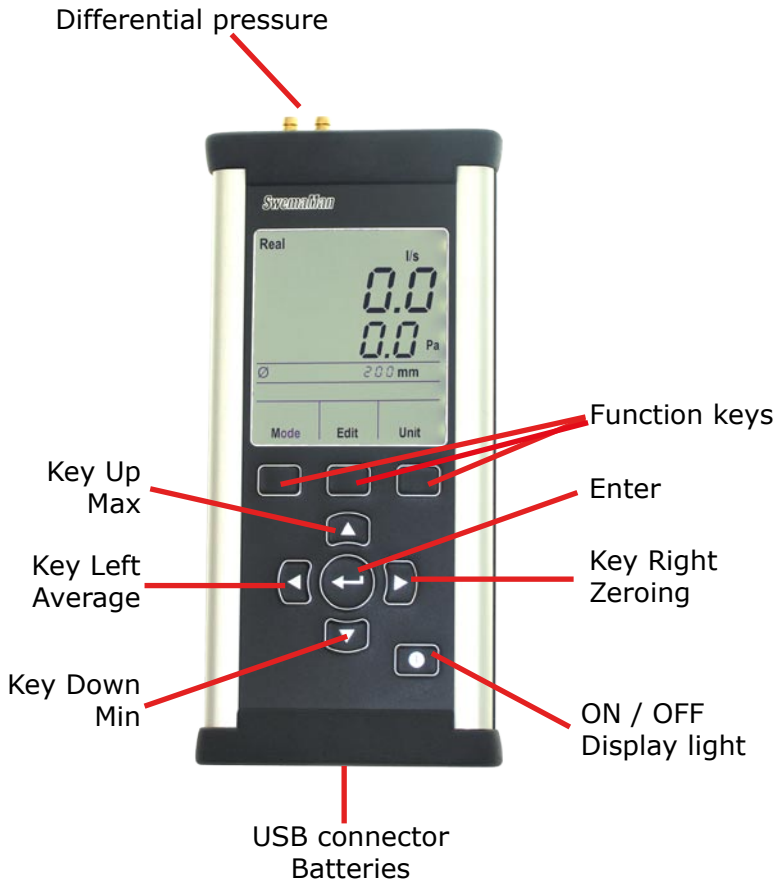
**WARNING! Before start measuring please read chapter "6. Settings (Set)". At delivery k2-factor is turned on.**

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# 1. Introduction

SwemaMan 7 is a micro manometer for differential pressure, air flow and air velocity. Differential pressure is measured in Pa, airflow in l/s, m<sup>3</sup>/h or CFM and air velocity in m/s or fpm. It's possible to set barometric pressure and temperature to compensate for correct air density. Measure airflow either with k-factor or with area in duct. The area is entered into the instrument directly, as diameter or as height x width. SwemaMan 7 can calculate minimum, maximum and average value. Saved measurements are easily transferred to a PC.

SwemaMan 7 has display light, usb connector and are delivered with two easily replaceable AA batteries.



## 2. Technical data

Differential pressure: -1000...9999Pa

Measurement uncertainty

at 23°C ±5°C: ±1% read value

min ±0,5Pa (after zeroing)

Uncertainty according to GUM (JCGM 100:2008) using a coverage factor of 2, which for a normal distribution corresponds to a probability of 95%. It is important to correct the measurement values with the corrections stated in the calibration certificate to obtain the above uncertainties.

Non condensing, non moist air, <80%RH, non aggressive gases.

Air velocity: 2...129m/s, 390...9999fpm

Memory: 50 measurement protocols

Operating condition: 0...50°C

Resolution: 0,1Pa at -999.9...999.9Pa, 1Pa at 1000...9999Pa

Battery: 2pcs AA batteries, one time or rechargeable

Battery operating time: <150h (24h with display light turned on)

Digital output: USB to PC for print out of stored data and online measurement

Size: 180x82x36mm

Weight: 389g

IP-code: IP50 (protects against dust)

## 2. Start of instrument

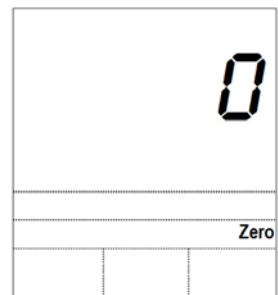
When starting the instrument (**ON/OFF-button**), the display shows the battery voltage, firmware version and calibration date. After a couple of seconds it's in measuring mode. SwemaMan 7 will start in the same measuring mode it was set to when turned off.

**Display light:** The display light can be turned On and Off by pressing the **ON/OFF-button** (when instrument is turned on).

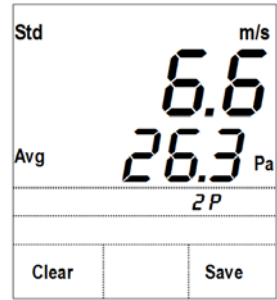
**Turn Off:** To turn off the instrument press and hold down the **ON/OFF-button** for about 2 seconds until the text "OFF" is shown on the display.

**Zeroing:** To reset the pressure sensor to zero press **Key Right**. When the pressure sensor is zeroing the text "Zero" and the digit "0" will be shown on the display (see picture to the right).

Note! Disconnect pressure from the pressure connectors before zeroing.



**Measurement:** When in measuring mode press **Enter** to store a value in the volatile memory. The number of measuring points stored in the volatile memory is shown on the display directly under the measured values, "2P" (see picture to the right) means the two measuring points has been stored. When **Enter** is pressed an average of the measuring points is shown for a short while before the measured values is shown in real time again.



**Average, Max & Min:** To check the average, max or min value of the stored measurement points press **Key Left** (Average), **Key Up** (Max) or **Key Down** (Min), as long as the button is hold down the corresponding value will be shown on the display.

**Save a measurement:** After a measuring point has been stored it's possible to save the measurement into SwemaMan 7:s Notebook by pressing **Save**. The display will show which note number the measurement is saved as (example n3 = note 3). To instead erase the measurement from the volatile memory press **Clear**.

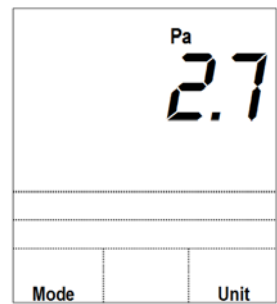
## 4. Unit

Press **Unit** to alternate between the different units. The units SwemaMan 7 can display are:

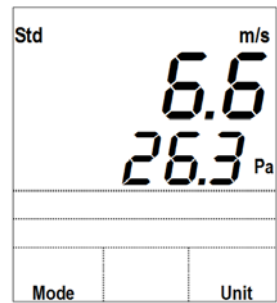
- Pa
- m/s & Pa (fpm & Pa if US-unit is selected)
- l/s & Pa (cfm & Pa if US-unit is selected)
- m<sup>3</sup>/h & Pa (cfm & Pa if US-unit is selected)
- hPa & °C (inHg & °F if US-unit is selected)

**Differential Pressure (Pa):** Press **Unit** until SwemaMan 7 shows the unit Pa. A measurement with average, max and min and also saving of the measurement is possible. If pressure is bigger than 10.000 Pa or lower than -1000 Pa (out of range) the digit will flash.

**Air Velocity (m/s & Pa):** It's possible to measure air velocity with SwemaMan 7 by connecting a pito static tube. Press **UNIT** until SwemaMan 7 shows the units m/s and Pa. A measurement with average, max and min and also saving of the measurement is possible. Air velocity lower than 0.7 m/s will be shown as zero.



Differential pressure measurement



Air velocity measurement

Air velocity is calculated according to the formula:

$$v = \sqrt{\frac{2 \cdot \Delta P}{\rho}}$$

$\Delta P$  = dynamic pressure (= total pressure - static pressure (Pa))

$\rho$  = density of air =  $1.2038 \cdot \frac{B \cdot 293.15}{1013 \cdot (273.15 + t)}$  (kg/m<sup>3</sup>)

B = barometric pressure (can be set to a value manually. If set to standard 1013 hPa is used)

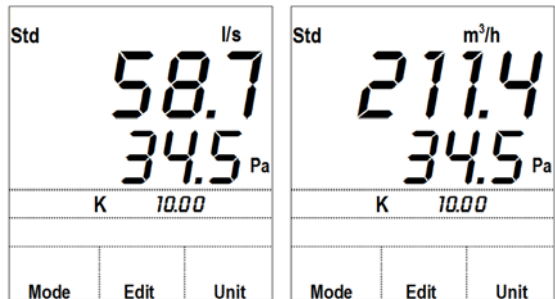
t = air temperature (can be set to a value manually. If set to standard 20°C is used)

**Air Flow (l/s & Pa or m<sup>3</sup>/h & Pa):** It's possible with SwemaMan 7 to do a couple of different air flow measurements. The air flow measurements possible are:

- Measurement in circular duct (set Diameter)
- Measurement in rectangular duct (set Height x Width)
- Measurement in duct (set Area)
- Flow factor measurement
- K-factor measurement

If SwemaMan 7 is set to air velocity measurement press **Unit** and air flow measurement in l/s will be displayed, press **Unit** once more for air flow in m<sup>3</sup>/h.

The kind of air flow measurement that will be displayed is what SwemaMan 7 was set to measure last time (k-factor measurement is set as standard). See chapter "5. Mode" for more information about the different air flow measurements and how to change settings.

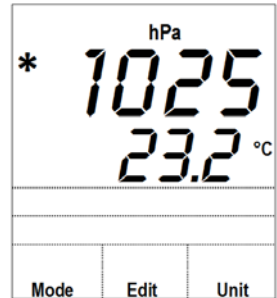
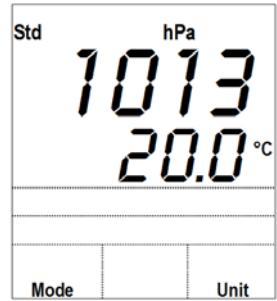


Air flow measurement with k-factor in l/s and m<sup>3</sup>/h

**Barometric pressure & Temperature (hPa & °C):** Press Unit until hPa & °C is displayed. The barometric pressure and temperature shown on the display will be the values SwemaMan 7 uses to compensate for the density of air (air density compensation is used at air velocity and air flow measurements).

As standard SwemaMan 7 will be set to use a barometric pressure and temperature set to 1013hPa and 20°C.

When a measurement is using air density compensating SwemaMan 7 show this with the text "Std" or with a "\*" in the top left corner of the display.



**Std** = Standard density (1013 hPa & 20°C)

**\*** = Both barometric pressure and temperature set manually

See chapter "6. Settings (Set)" for more information how to change between Std and \*.

## 5. Mode

When SwemaMan 7 is in measuring mode (all measuring modes) it's possible to press **Mode**. In Mode it's possible with the **Arrow Keys** to change type of air flow measurements, go to settings for SwemaMan 7 or to Notebook (saved measurements), confirm with **Enter** or abort with **Esc**.

∅ = Measurement in circular duct (set Diameter)

↕↔ = Measurement in rectangular duct (set Height x Width)

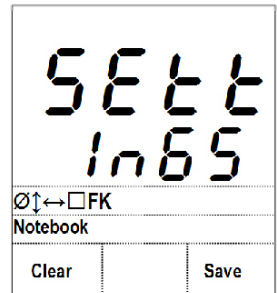
□ = Measurement in duct (set Area)

F = Flow factor measurement

K = K-factor measurement

Set = Settings

Notebook = Saved measurements



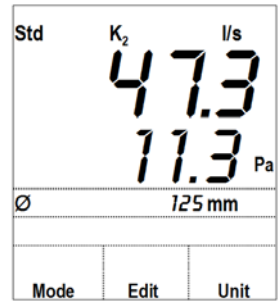
### Ø Air flow measurement in circular duct:

Go to Ø and press **Enter** for measuring air flow in circular duct by setting a diameter.

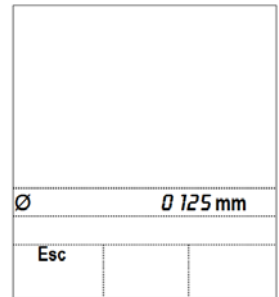
The diameter SwemaMan 7 is set to measure with is displayed direct under measured pressure. SwemaMan 7 has 13 preset diameters between 80 - 1250mm (standard diameters for circular ducts) that can be changed by **Up & Down Keys**. Please note! It's not possible to change diameter until a started measurement has been saved or erased from the volatile memory.

To set a diameter manually press **Edit**, use the **Arrow keys** to change the diameter and press **Esc** or **Enter** to return to measuring mode. Use **Unit** to change between l/s and m<sup>3</sup>/h.

SwemaMan 7 is as standard set to compensate for the  $k_2$ -factor (reduces the area of a duct). When the  $k_2$ -factor is turned on the symbol  $k_2$  will be shown above the measured air flow, see chapter "6. Settings (Set)" for more information about the  $k_2$ -factor and how to turn it On/Off.



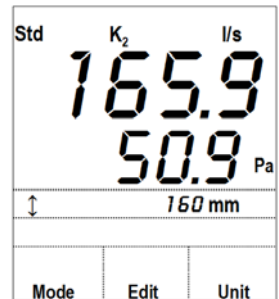
Air flow measuring mode with set diameter.



Editing of duct diameter.

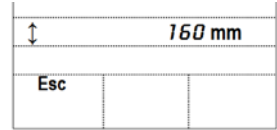
### ↕↔ Air flow measurement in rectangular duct:

Go to ↕↔ and press **Enter** for measuring air flow in rectangular duct by setting Height x Width. The Height x Width SwemaMan 7 is set to measure with is displayed direct under measured pressure (the display toggles between showing set height and width).



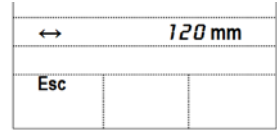
Air flow measuring mode with set Height x Width.

To change height or width press **Edit**. Use **Arrow keys** to set the height and press **Enter** to set the width, when finished press **Enter** again and SwemaMan 7 returns to measuring mode.



Use **Unit** to change between l/s and m<sup>3</sup>/h.

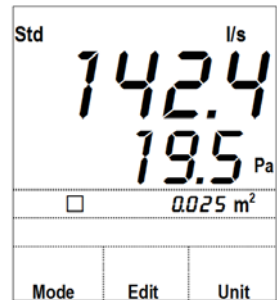
SwemaMan 7 is as standard set to compensate for the k<sub>2</sub>-factor (reduces the area of a duct). When the k<sub>2</sub>-factor is turned on the symbol k<sub>2</sub> will be shown above the measured air flow, see chapter "6. Settings (Set)" for more information about the k<sub>2</sub>-factor and how to turn it On/Off.



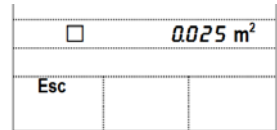
**Air flow measurement with setting of Area directly:** Go to  and press **Enter** for measuring air flow with an area set manually. The area SwemaMan 7 is set to measure with is displayed direct under measured pressure

Use **Unit** to change between l/s and m<sup>3</sup>/h.

To change the area press **Edit**, use the **Arrow buttons** to change it (0.001... 9.999 m<sup>2</sup>) and press **Esc** or **Enter** to return to measuring mode.



Air flow measuring mode with a set area



Editing of area

### F Flow Factor measuring:

Go to F and press **Enter** for Flow factor measuring. In this measuring mode it's possible to set an air flow in l/s, SwemaMan 7 calculates what k-factor that correspond to this air flow depending on the measured differential pressure.

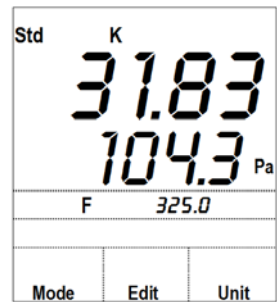
The k-factor is calculated by:

$$k = \frac{F}{\sqrt{(\Delta P)}}$$

$k = k\text{-factor}$

$F = \text{Flow Factor (Air Flow in l/s)}$

$\Delta P = \text{Differential pressure}$



Flow Factor measuring mode.



The Flow factor SwemaMan 7 is set to measure with is displayed direct under measured pressure.

To change the Flow Factor press **Edit**, use the **Arrow buttons** to change it (0.001... 9999 l/s) and press **Esc** or **Enter** to return to measuring mode.

**k-factor measuring:**

Go to K and press **Enter** for k-factor measuring. The air flow is calculated by:

$$q = k \times \sqrt{\Delta P}$$

*q = Air Flow*

*k = k-factor*

*ΔP = Differential pressure*

The k-factor SwemaMan 7 is set to measure with is displayed direct under measured pressure.

Use **Unit** to change between l/s and m<sup>3</sup>/h.

**Please note!** The calculated air flow is based on a k-factor corresponding to l/s.

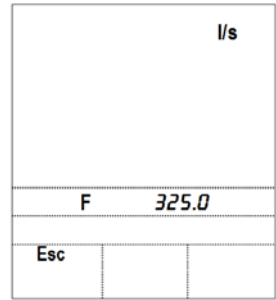
If the flow exceeds 10000 with k-factor and SI units enabled, the screen will alternate between the measured value and a multiplier. Meaning values too large to display will show a corresponding factor of ten, e.g. \*10 when they are cut off.

SwemaMan 7 can store 10 preset k-factors that can be toggled by **Up & Down Keys**.

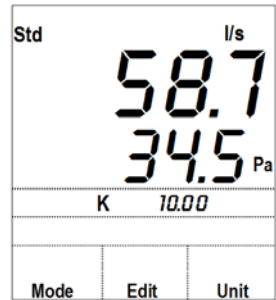
Please note! It's not possible to change diameter until a started measurement has been saved or erased from the volatile memory.

To change a k-factor (choose between K0-K9, the digit is only shown for about a second after

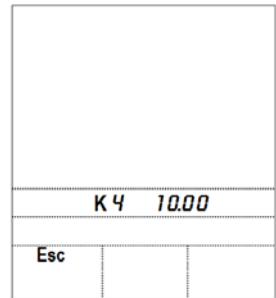
**Up/Down Key** has been pressed) press **Edit**. Use the **Arrow keys** to change the diameter and press **Esc** or **Enter** to return to measuring mode.



Editing of Flow Factor



Air flow measuring mode with k-factor



Editing of k-factor number 4

## 6. Settings (Set)

For settings press **Mode**, go to "Set" and press **Enter**. Use **Key Left/Right** to see the different settings, to change a setting press **Edit** or use **Key Up/Down**. When changes are done press **Esc** or **Enter** and SwemaMan 7 will go back to measuring mode. Following settings are available:

**Unit syst:** Set units to SI- or US-unit system.

SI-unit: Pa, m/s, l/s, m<sup>3</sup>/h, hPa & °C

US-unit: Pa, fpm, cfm, inHg & °F

**Density:** Set how SwemaMan 7 should calculate and compensate air density depending on barometric pressure and air temperature (air density is used at air velocity and air flow measurements). The different settings possible:

Std: Barometric pressure is set to 1013hPa & temperature is set to 20°C

\*: Barometric pressure and temperature can both be set manually (as default they are set to 1013hPa and 20°C).

**Duration:** Set how long the averaging of the displayed values should be. Possible settings are 0.5, 1, 2, & 10 seconds. Higher averaging time will give a slower change of the displayed measured values. As default the averaging time is set to 2 seconds.

**k<sub>2</sub>-factor (K<sub>2</sub>):** Turn the k<sub>2</sub>-factor On or Off. If the k<sub>2</sub>-factor is turned "On" SwemaMan 7 reduces the area of the duct depending on the duct dimensions when calculating the air flow. Calculation of air flow:

k<sub>2</sub>-factor Off:  $q = \text{area} \times \text{air velocity}$

k<sub>2</sub>-factor On:  $q = k_2 \times \text{area} \times \text{air velocity}$

Below is the k<sub>2</sub>-factor values SwemaMan 7 uses:

Circular ducts:

$\emptyset \leq 160 \text{ mm} \gg k_2 = 0.89$

$160 < \emptyset \leq 400 \text{ mm} \gg k_2 = 0.95$

$400 < \emptyset \leq 1250 \text{ mm} \gg k_2 = 0.98$

Rectangular ducts:

Height>Width »  $k_2 = 0.94$

Height<Width »  $k_2 = 0.98$

Height=Width »  $k_2 = 0.96$

Source: "Metoder för mätning av luftflöden in ventilationsinstallationer (T09)" with correction from NBI:s rapport nordtest Prosj. 1463-99 rev. 23-05-01.

**Display light (Bac. light):** On or Off.

The display light can also be turned On and Off by pressing the **ON/OFF-button**.

## 7. Notebook

In Notebook it's possible to see and print stored measurements. For Notebook press **Mode**, go to "Notebook" and press **Enter**.

Use **Left/Right Key** to choose which saved note to display, the note number for the stored measurement (n1, n2, n3 etc.) is displayed direct under the stored measured value.

The saved value displayed in Notebook is the average of the measurement. To see maximum and minimum value of the measurement use the **Up & Down Key**. If **Enter** is pressed SweMaMan 7 will display some more information of the saved measurement. The extra information displayed is the barometric pressure and temperature used. If an air flow measurement has been saved the k-factor or duct dimension used will also be shown here.

Std	m/s	
6.6		
Avg	Pa	
26.3		
n2		
Notebook		
Esc	Print	Erase

Stored measurement in notebook with note number 2 (n2).

With **Erase** it's possible to erase all stored measurements. If pressed the text "Erase?" will be displayed, to erase the stored measurements press **All** to abort press **Esc**.

Instead of erasing all stored measurements it's possible to erase the last saved note. In notebook go to the last saved note, when it's displayed press **Erase**. Now two options will be available, press **Note** to erase the last saved note or press **All** to erase all stored measurements.

n2		
Notebook		Erase?
Esc	Note	All

Erase the last saved note or all the stored measurements?

