

SwemaMan 8

Operating instructions



PLEASE NOTE: At delivery k_2 -factor and automatic density compensating for atmospheric pressure and temperature is turned on. Read more in chapter "4. Unit" section "Barometric pressure & Temperature (hPa & °C):" and chapter "6. Settings (Set)".

Contents:

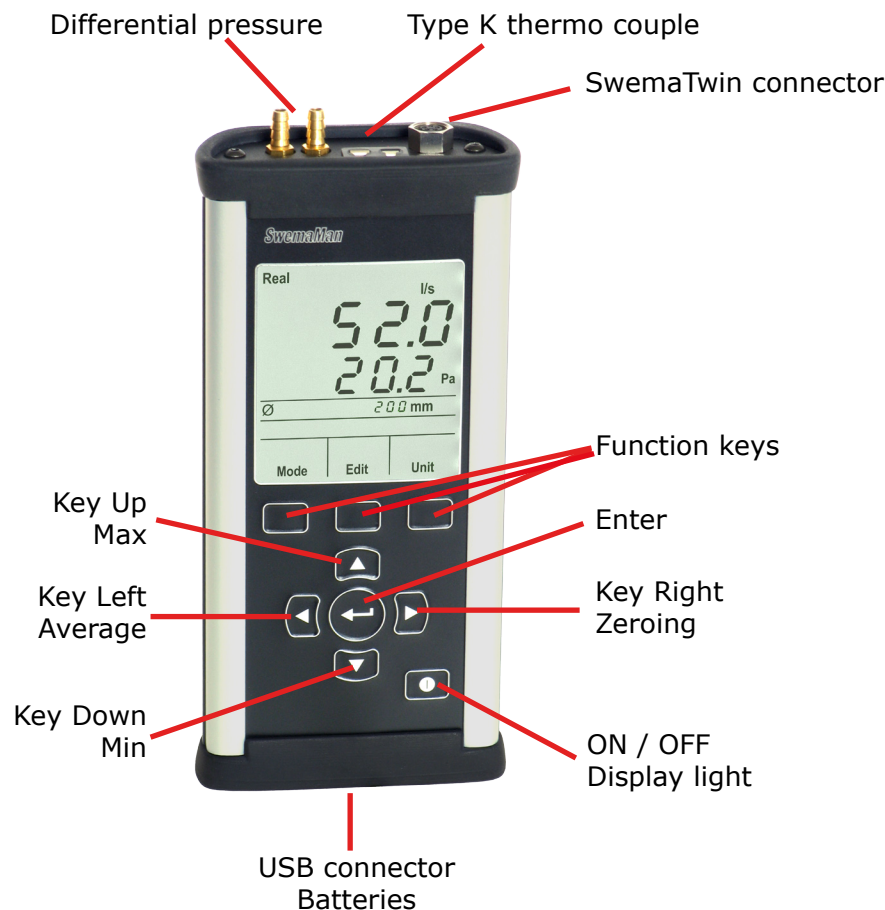
SWEMA AB
 Pepparv. 27
 123 56 FARSTA
 Tel: +46 8 94 00 90
 Fax: +46 8 93 44 93
 E-mail: swema@swema.com
 Web page: www.swema.com

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1. Introduction

SwemaMan 8 is a micro manometer for differential pressure, air flow and air velocity. Differential pressure is measured in Pa, airflow in l/s, m³/h or CFM and air velocity in m/s or fpm. SwemaMan 8 has a built in barometer and a thermo couple type K connector that makes it possible to compensate for correct air density. Measure airflow either with k-factor (according to EN 16211 method ID 3, ST 1, ET 1) or with area in duct (according to EN 16211 method ID 1). The area is entered into the instrument directly, as diameter or as height x width. SwemaMan 8 can calculate minimum, maximum and average value. Saved measurements are easily transferred to a PC.

SwemaMan 8 has display light, a built in valve (short-circuits the pressure) and are delivered with two easily replaceable AA batteries.



1.

2. Technical data

Differential pressure: -100... 1500 Pa

Air velocity: 2... 50 m/s

Barometer: 600... 1200 hPa

Ambient temperature: 0... 50°C

Measurement Uncertainty

at 23°C ±5°C:

±0.3% read value, min ±0,4Pa

±2,5 hPa

±1°C

at 0... 50°C:

±0,33% read value, min ±0,4Pa

±4 hPa

±2°C

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.

Memory: 50 Notes

PC-communication: USB

Battery: 2x 1,5V AA (Standard or rechargeable)

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

Size: 180x82X36mm, Weight: 390g

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 8 will start in the same measuring mode it was set to when turned off.

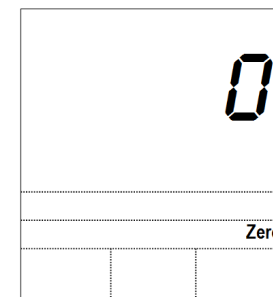
Display light: The display light can be turned On and Off by pressing the **ON/OFF-button** (when instrument is turned on).

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**.

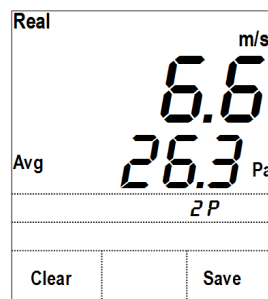
It's possible to set SwemaMan 8 to do an auto zeroing at each measurement, see chapter "6. Settings (Set)" for more information and how to turn this function On/Off.

When the pressure sensor is zeroing the text "Zero" and the digit "0" will be shown on the display (see picture to the right).



2.

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.

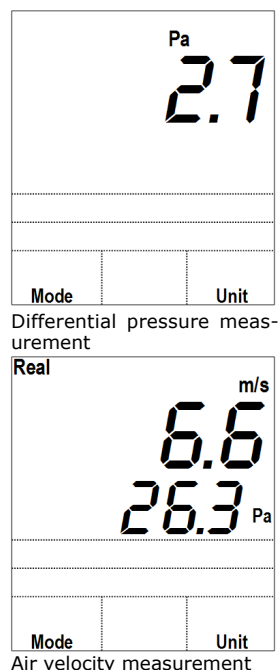
Save a measurement: After a measuring point has been stored it's possible to save the measurement into SwemaMan 8:s Notebook by pressing **Save**. The display will show which note number the measurement is saved as (example n3 = note 3). To instead erase the measurement from the volatile memory press **Clear**.

4. Unit

Press **Unit** to alternate between the different units. The units SwemaMan 8 can display are:

- Pa
- m/s & Pa (fpm & Pa if US-unit is selected)
- l/s & Pa (cfm & Pa if US-unit is selected)
- m³/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 8 shows the unit Pa. A measurement with average, max and min and also saving of the measurement is possible. If pressure is bigger than 1500 Pa or lower than -150 Pa (out of range) the digit will flash.



Air Velocity (m/s & Pa): It's possible to measure air velocity with SwemaMan 8 by connecting a pito static tube. Press **UNIT** until SwemaMan 8 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.

3.

Air velocity is calculated according to the formula:

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

ΔP = dynamic pressure (= total pressure - static pressure (Pa))

ρ = density of air = $1.2038 \cdot \frac{B \cdot 293.15}{1013 \cdot (273.15 + t)}$ (kg/m³)

B = barometric pressure (measured by the built in barometer or is set to a value manually. If set to standard 1013 hPa is used)

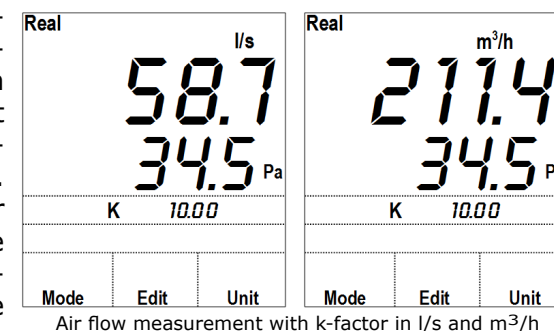
t = air temperature (measured with a connected thermo couple or is set to a value manually. If set to standard 20°C is used)

Air Flow (l/s & Pa or m³/h & Pa): It's possible with SwemaMan 8 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 8 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 m³/h.

The kind of air flow measurement that will be displayed is what SwemaMan 8 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.



4.

Barometric pressure & Temperature (hPa & °C):
Press Unit until hPa & °C is displayed. The displayed values are measured by the in built barometer and thermo couple sensor (if set to "Real", for more info see below).

If no thermo couple is connected it's possible to set a value for the temperature manually (is set to 20.0°C as standard) by pressing **Edit**. Set wanted temperature with the **Arrow Keys** and press **Enter** when finished.

The barometric pressure and temperature shown on the display will be the values SwemaMan 8 uses to compensate for the density of air (air density compensation is used at air velocity and air flow measurements).

When a measurement is using air density compensating SwemaMan 8 show this with the text "Real", "Std" or with a "*" in the top left corner of the display:

- Real** = Real density (measured barometric pressure and measured or manually set temperature)
- 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 Real, Std and *.

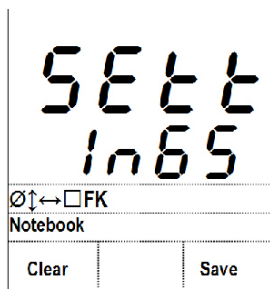
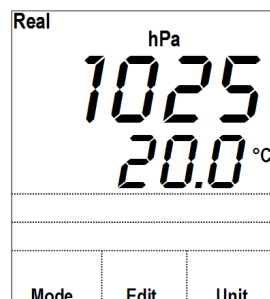
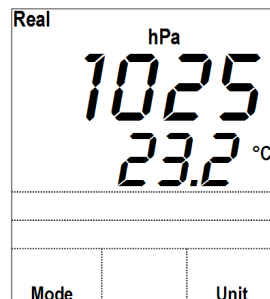
5. Mode

When SwemaMan 8 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 8 or to Notebook (saved measurements), confirm with **Enter** or abort with **Esc**.

Ø = 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

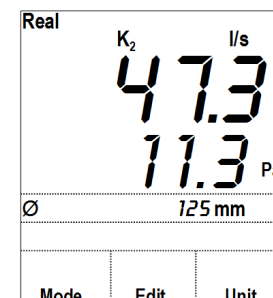
Ø Air flow measurement in circular duct:

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

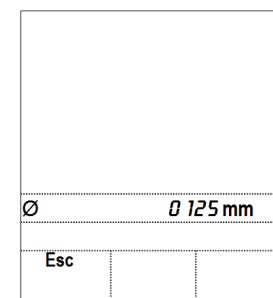
The diameter SwemaMan 8 is set to measure with is displayed direct under measured pressure. SwemaMan 8 has 13 preset diameters between 80 - 1250mm (standard diameters for circular ducts) that can be changed by **Up & Down Keys**. Please note! It's not possible to change diameter until a started measurement 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 m³/h.

SwemaMan 8 is as standard set to compensate for the k₂-factor (reduces the area of a duct). When the k₂-factor is turned on the symbol k₂ will be shown above the measured air flow, see chapter "6. Settings (Set)" for more information about the k₂-factor and how to turn it On/Off.



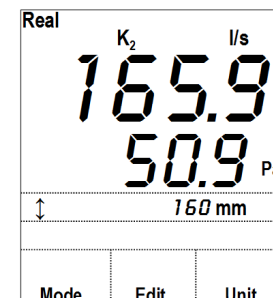
Air flow measuring mode with set diameter.



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 8 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 8 returns to measuring mode.

Use **Unit** to change between l/s and m³/h.

SwemaMan 8 is as standard set to compensate for the k₂-factor (reduces the area of a duct). When the k₂-factor is turned on the symbol k₂ will be shown above the measured air flow, see chapter "6. Settings (Set)" for more information about the k₂-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 8 is set to measure with is displayed direct under measured pressure

Use **Unit** to change between l/s and m³/h.

To change the area press **Edit**, use the **Arrow buttons** to change it (0,001... 9,999 m²) and press **Esc** or **Enter** to return to measuring mode.

↑ 160 mm		
Esc		

Editing of height

↔ 120 mm		
Esc		

Editing of width

Real l/s		
142.4		
19.5 Pa		
☐ 0.025 m ²		
Mode	Edit	Unit

Air flow measuring mode with a set area

☐ 0.025 m ²		
Esc		

Editing of area

Real K		
31.83		
104.3 Pa		
F 325.0		
Mode	Edit	Unit

Flow Factor measuring mode.

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 8 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-factor

F = Flow Factor (Air Flow in l/s)

ΔP = Differential pressure

The Flow factor SwemaMan 8 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.

l/s		
F 325.0		
Esc		

Editing of Flow Factor

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 8 is set to measure with is displayed direct under measured pressure.

Use **Unit** to change between l/s and m³/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 8 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.

Real l/s		
58.7		
34.5 Pa		
K 10.00		
Mode	Edit	Unit

Air flow measuring mode with k-factor

K 4 10.00		
Esc		

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 8 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, m³/h, hPa & °C

US-unit: Pa, fpm, cfm, inHg & °F

Density: Set how SwemaMan 8 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:

Real: For barometric pressure the measurements from the in built barometer is used. For temperature the measured temperature from connected thermo couple is used. When turning on the instrument and if no thermo couple is connected the temperature is set to 20°C, but it can be changed manually.

Std: Barometric pressure is set to 1013 hPa & 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). When the instrument is restarted the density setting will go back real

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.

k₂-factor (k₂): Calculation of air flow in a duct using a pitot static tube according to EN 16211 Measurement of air flow on site. Turn the k₂-factor On or Off. If the k₂-factor is turned "On" SwemaMan 8 reduces the area of the duct depending on the duct dimensions when calculating the air flow.

k₂-factor Off: $q = \text{area} \times \text{air velocity}$

k₂-factor On: $q = k_2 \times \text{area} \times \text{air velocity}$

Below is the k₂-factor values SwemaMan 8 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 $\gg k_2 = 0.94$

Height<Width $\gg k_2 = 0.98$

Height=Width $\gg k_2 = 0.96$

According to EN 16211.

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

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

Automatic zeroing (auto null): On or Off. If set to On SwemaMan 8 will zero check the differential pressure sensor every time a value is stored in the volatile memory.

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 8 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.

Real	m/s
	6.6
Avg	26.3 Pa
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?

8. Data communication

SwemaMan 8 can be connected to **SwemaTerminal3**, a free program for windows available when searching for SwemaTerminal 3 at www.swema.com.

There you can also find an instruction and a driver for PC. With SwemaTerminal 3 it is possible to read measured values, certificates and do logging. The instrument connects to the PC as a virtual com-port. By sending a keyboard sign the instrument can perform certain commands. A sign can be sent through a terminal program for example through the terminal window in **SwemaTerminal 3**:

- [Ctrl] + [A] - zeroing the pressure indication of the instrument.
- [] Space - print current measured values (without unit).
- [,] Comma - print current measured values (with unit).

Certain settings can also be set by computer, in addition to using the keypad in the instrument:

- [ENTER] To open a menu with keyboard shortcuts.
- [T] Averaging time - same as **duration** in section 6.
- [H] Set air temperature - change the temperature manually if no thermocouple sensor is connected.

[O] Decimal delimiter (0=point, 1=comma): Choose the decimal delimiter.

[U] Unit system (SI=0, US=1): Choose 0 or 1 to select unit system. Same as in the instrument, see section 6.

[S] Auto shutoff within a selected amount of passive minutes. Auto shutoff: 0 = never, 0.1 to 1500 minutes can be selected.

[P] Print calibration certificate

[N] Print notes

[D] Density compensation - Real=0, Std=1, *=2
Same as in the instrument. Read more in section 6.

If 2 (*) is chosen, these options become available:

[B] Set air static pressure (1-2000): ... hPa

[H] Set air temperature: ... °C

Then it is possible to manually set these values.

