Manual Swema 3

Version 5.95 CW

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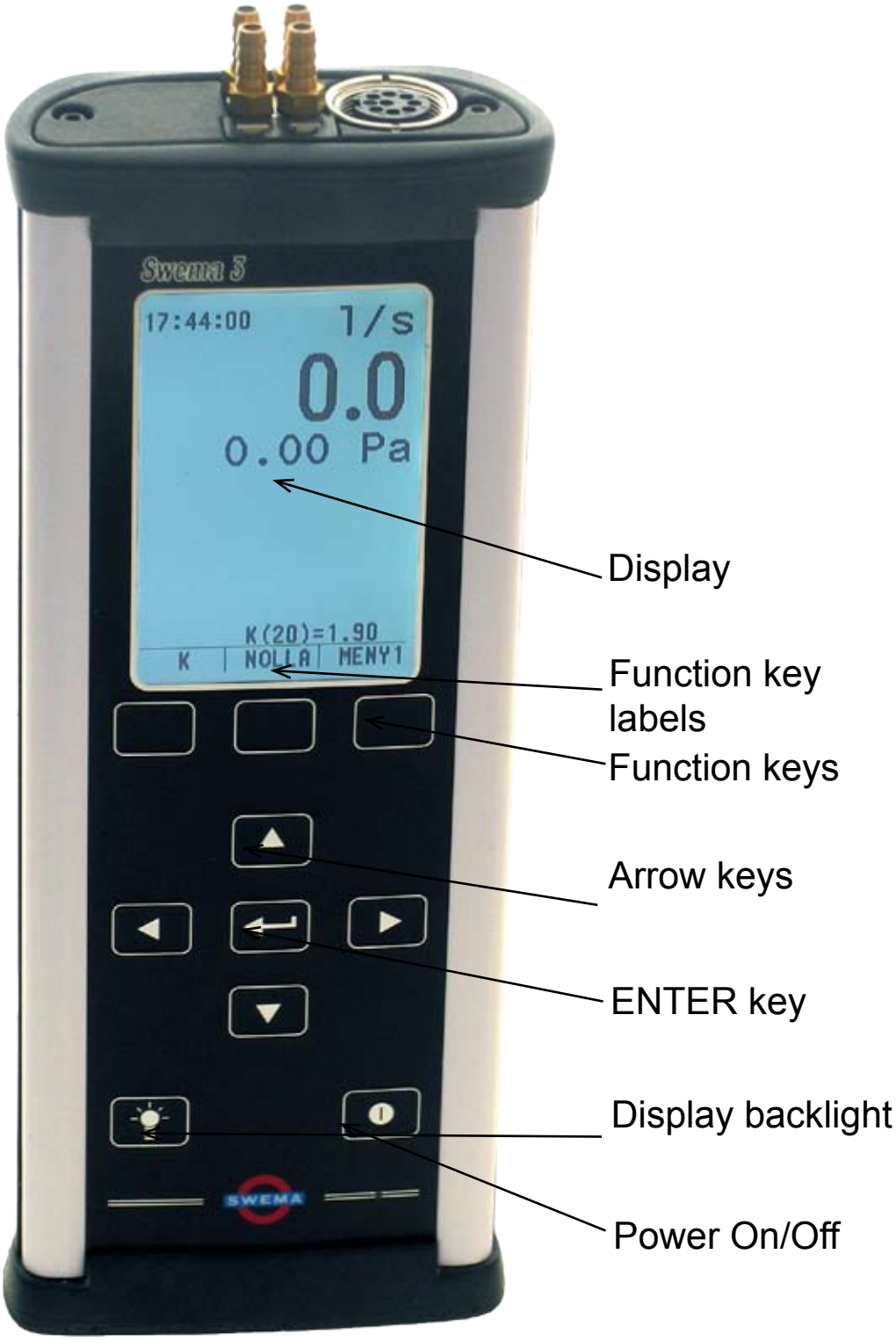
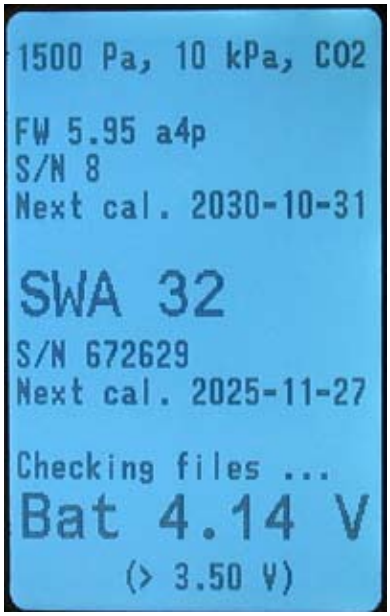
1. Overview


Swema 3
17:44:00
1/s
0.0
0.00 Pa
K(20)=1.90
K
NOLLA
MENY1
Display
Function key labels
Function keys
Arrow keys
ENTER key
Display backlight
Power On/Off

2. Start-up

Swema 3 has high computational capacity and can store measured and calculated measurement results in its internal memory for transfer to a PC. Swema 3 has interchangeable sensors, each individually calibrated. When the instrument is switched on, information is displayed for a few seconds or for as long as the ON button is held down. The instrument then switches to default measurement mode.
Configuration: Indicates which built-in sensors are installed in the instrument.
The built-in barometer and thermocouple connector are not displayed.
Firmware: software version
Instrument serial number (S/N)
Next calibration date for the instrument
External sensor name and serial number
Next calibration date for the external sensor
Battery voltage (if lower than 3.5 V, the instrument will shut down automatically)

Two built-in pressure sensors and one built-in CO_2 sensor.



The same start-up information is displayed, with the addition of information about the external sensor, in this case an SWA 32.

Press ENTER in measurement mode to register a measurement. When multiple points are measured, the average value is updated each time. Depending on the selected measurement mode, the instrument either stores a single measurement point, performs a calculation, or starts a logging session. When multiple points are collected, the display shows the average value, maximum value, minimum value, and the number of collected points. When the measurement is completed, press SAVE. The instrument then stores the value in the first available memory location under “Saved data”. Swema 3 emits a short sound and displays the memory location where the measurement was saved (see explanation of Menu 1, Saved data / Loggings and Files). In measurement mode, the measured value from an external sensor connected to the 8-pin connector is displayed. If no external sensor is connected, the built-in differential pressure sensor is displayed. At first start-up, the instrument starts the following measurement modes: DPF for the pressure sensor APF for the anemometer and AP for temperature, CO_2, and humidity sensors. Measurement modes and their settings are selected in Menu 1 and Menu 2.

3. Measurement Mode DPF with Internal Differential Pressure Sensor

If the k-factor is not set, only the differential pressure is displayed.

Set the k-factor.

When the k-factor is set, both airflow and differential pressure are displayed.

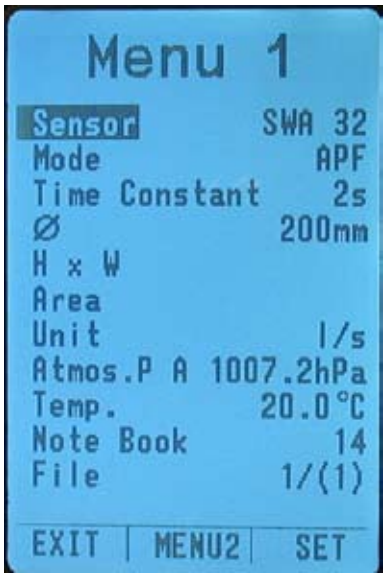
DPF is the basic mode for the differential pressure sensor. At first start-up, the k-factor = 0 and only the differential pressure is displayed. By changing the k-factor in the table using the function keys and arrow keys, a calculated airflow and differential pressure are displayed. Press ENTER to take a measurement value.

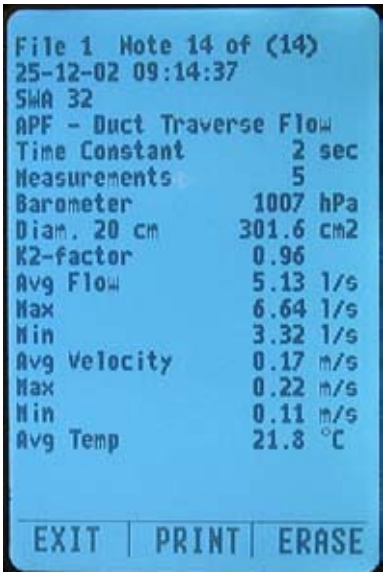
$q = k \cdot \Delta P^e$
DPF is used to measure airflow across terminals with a k-factor. The k-factor is provided by the manufacturer of the ventilation valves and terminals. The exponent e is normally 0.5 but can be changed in Menu 2 if the manufacturer recommends an other exponent. With exponent e = 0.5, the formula becomes: $q = k \cdot \sqrt{\Delta P}$ since raising to the power of one half is the same as taking the square root.

NOTE!
Always select a k-factor intended for calculation in l/s. It is then possible to select display in m³/h. Swema 3 will automatically convert to m³/h. If the manufacturer's k-factor for the terminal is intended for calculation in m³/h, the k-factor must be divided by 3.6 before being entered into Swema 3. Otherwise, the displayed airflow will be 3.6 times too high.

Device-table according to manufacturer (available in some instrument models)
By pressing DEVICE in the K-table, manufacturers of valves are listed. Select manufacturers by the ENTER-button. Step through the list of valves by presing arrow up or down. Right arrow stpe 10 valves at a time. Choose plenum box, valve size, installation and settings. Confirm by EXIT. If some k-factors for the same valve shall be inserted in the K-table use PREV.

4. Measurement Mode APF with External Anemometer SWA 32





APF (Average Point Flow) is used for measuring air flow in ducts and air flow through certain grilles. APF is the basic program for the hot-wire anemometer SWA 32. APF is also available with a differential pressure sensor and Pitot-static tube.
APF calculates airflow as air velocity × k_2 × area. The area can be entered in cm², duct height x width or diameter.
When calculating air flow during duct measurements, the air flow should be reduced using a k_2 factor according to recommended measurement methods (EN 16211 & NBI report), due to friction at the walls and / or blocking of the air flow caused by the anemometer.
Set the k_2 factor to ON in Menu 2 of Swema 3 for automatic compensation. Set it to OFF for no flow reduction. To check the current k_2 setting, do a measurement using ENTER, press SAVE, and view the measurement in Saved data in Menu 1.

5. Measurement Mode AP with External Temperature Sensor

AP (Average Point) is available for all sensors except the draft sensor SWA 03. An average value of the measurements taken using the ENTER button is displayed.

Measurement mode with SWA 14, SWA 50–54, or Type K thermocouple.

6. Density Compensation of Air flow and Air Velocity

Measurement results for air velocity and airflow can be displayed in two ways:
Actual or Standard.
Actual displays the value at the current air density. Air density depends on temperature and barometric pressure.
Standard displays the value converted to 20 °C and 1013 hPa.
When the option Density = Actual is selected in Menu 2, airflow and air velocity are corrected using barometric pressure from the built-in barometer and temperature from a connected Type K thermocouple. When saving, average values of temperature and air pressure are stored. These values are used to correct the displayed air flow and air velocity values. In Menu 1 the barometric pressure and temperature can be read and set.

7. Measurement Mode DPK, AS, ASF, and CO

DPK (Differential Pressure k-factor)
This mode is only available when measuring with a differential pressure sensor. When measuring pressure drop across a terminal, the k-factor corresponding to a specific airflow is calculated. The user enters the desired airflow in l/s, and Swema 3 calculates the k-factor corresponding to this air flow according to the formula:
$k = q / \Delta P^e$

AS (Auto Sampling)
AS is available for all sensors. Swema 3 continuously collects measurement values. Mode AS measures average velocity, maximum, minimum, temperature, and standard deviation at a single point, or when the user wishes to scan a surface, for example a flat supply air terminal.

ASF (Auto Sampling Flow)
ASF is available with SWA 32 and is the same as AS, but Swema 3 calculates air flow in l/s or m³/h with the area in cm². Sweeping over the measurement object is used to measure airflow and air velocity in fume hoods, intake grilles, and flat terminals. ASF is not intended for duct measurements diameter and duct coefficient parameters are omitted.

CO (Comfort)
This mode is only available when the direction-independent draft sensor SWA 03 is connected. Mode CO measures average velocity, average temperature, and standard deviation over a selectable time period and calculates DR (Draft Rate).

8. Measurement Mode LOG

LOG (Logging) is available with all sensors.
Measurement values are collected at a selectable interval and with a selectable time constant. Use LOG to perform measurements over longer periods of time (e.g. variations in airflow, temperature, or pressure over a 24-hour period). USB-C power supply is used when logging for more than 24 consecutive hours.
Set the time constant and interval in Menu 1.

Start and stop logging using the ENTER button. Swema 3 logs during the selected measurement time and stores the logged measurement values in a new file. If the interval is set to 10 seconds or more, the time of the next logging event is displayed. When logging is completed, press ENTER or the SAVE button (right MENU button). Swema 3 emits a short audible signal and displays the file number on the display for a few seconds.

To view the logged values, go to “Loggings”. To view other logging files, select the log file under “Files”.

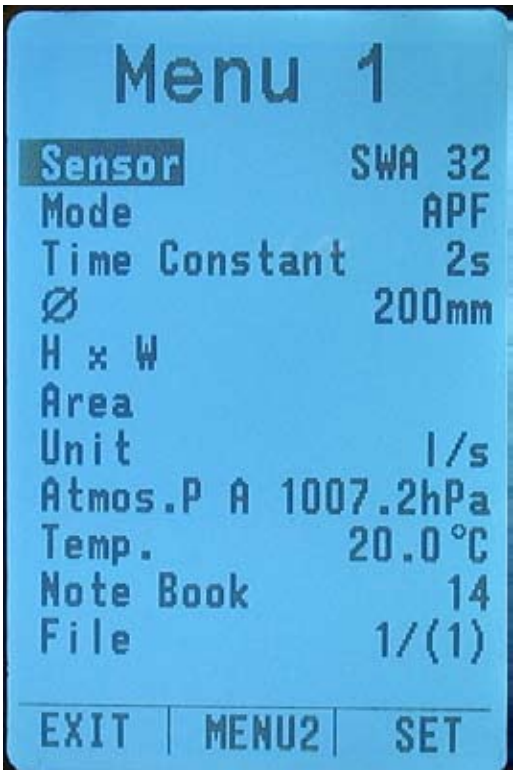
9. Measurement Mode LOGP

LOGP differs from LOG by storing a complete measurement protocol rather than individual values. Each protocol contains maximum, minimum, average values and standard deviation.
LOGP is specifically designed for use with SWA 03 to present the draft index in accordance with ISO 7730.
The user defines the measurement time for each series (protocol) and the logging interval between series Protocols).
LOGP is operated in the same way as LOG, with the following additions:
The number of seconds after start of the measurment is shown in the lower left corner during an active measurement series. During pauses between series, LOGP is displayed in the same position.

- If logging is stopped before the first series is completed, no data is saved.

10. Menu 1

Press MENU 1.
Move the cursor using the UP/DOWN arrow keys, press Select, ENTER, CHANGE, or the right arrow. Adjust the value using the arrow keys and confirm with ENTER, the left arrow, or EXIT.



Navigate through the menu using the UP/DOWN arrow keys. Press ENTER, Select, or the right arrow key to select. Change values using the UP/DOWN arrow keys. Press ENTER to confirm your selection.

Sensor Select the sensor to be used.
Mode Select measurement Mode.
Time constant, The damping or inertia of the instrument (see Time Constant and Filter for more information).

Ø (Mode APF)
To measure in a circular duct, set the diameter. Select between predefined standard diameters using the UP/DOWN arrow keys. To set a different diameter, select EDIT and adjust the diameter using the arrow keys.
In measurement mode it is also possible to select between predefined standard diameters using the UP/DOWN arrow keys.

H x B (Mode APF)
First set the Height, then the Width.

Area (Mode APF, ASF)
The desired area can be set in m². NOTE!
When measuring with a freely set area, no k_2 reduction is applied, even if the k_2 factor is set to ON in Menu 2.

Flow (Mode DPK)
Swema 3 calculates a k-factor. Select which memory position (1–20). Set the desired airflow. Press EDIT to modify the airflow value. Adjust the valve to the k-factor suggested by Swema 3. When the valve is set to the k-factor that is displayed by Swema 3 the valve is adjusted.

Sampling Rate (AS, ASF)
The time lenth of a displayed measurement value. A floating average is used.
For example, with a measurement sampling rate of 30 s, Swema 3 collects values twice per second for 30 seconds (60 measurement values) and displays their average. After 30 seconds, the oldest half-second value is replaced by a new one, and a new average is calculated and displayed, and so on.
AS always collects measurement values twice per second if a measurement frequency of 0.5 seconds or higher is selected. If a measurement frequency lower than 0.5 seconds is selected, Swema 3 will collect and update the display at that frequency.

Interval (LOG)
Set how often Swema 3 shall store a new measurement value. The stored value is the value displayed at the start of the interval. When using LOG with the built-in differential pressure sensor, the pressure is zeroed between logging points. An interval greater than 10 seconds and Auto Zeroing set to ON are required for this. If intervals shorter than 10 seconds are required, Auto Zeroing must be set to OFF, and no zeroing of the pressure sensor will be performed. Tip! Set the time constant to the same value as the interval to store an average value for the entire interval.

Measurement Time (CO, LOGP)
Measurement values are sampled during the measurement time. Each measurement value has a duration equal to the time constant and overlaps in the same way as for Measurement Frequency. Standard deviation, maximum, minimum, and average values are stored for the measurement time.

Logging Interval (LOGP)
Defines how often a new measurement series is started. If Logging interval is set to the same time as Measurement time, measurement series will be logged continuously without pauses.
Example: A measurement series is performed for 5 s followed by a pause of 10 s (5 s Measurement time + 10 s pause = 15 s Logging interval) before the next measurement series starts.

Baro. T
Barometric pressure is used for density compensation of airflow and air velocity. With a built-in barometer, the barometric pressure is obtained automatically (A). Manual (M) setting is also possible.
See Density compensation of air flow and air velocity compensation.

Temperature If the pressure sensor is used to display airflow or air velocity, this temperature is used for density compensation. If a Type K thermocouple is connected, its temperature is used automatically.
To display the current temperature in Menu 1, place the cursor on this line. If no thermocouple is connected, the temperature can be set manually using Temperature and the arrow keys. Default setting is 20 °C.
See Density compensation of air flow and air velocity compensation.

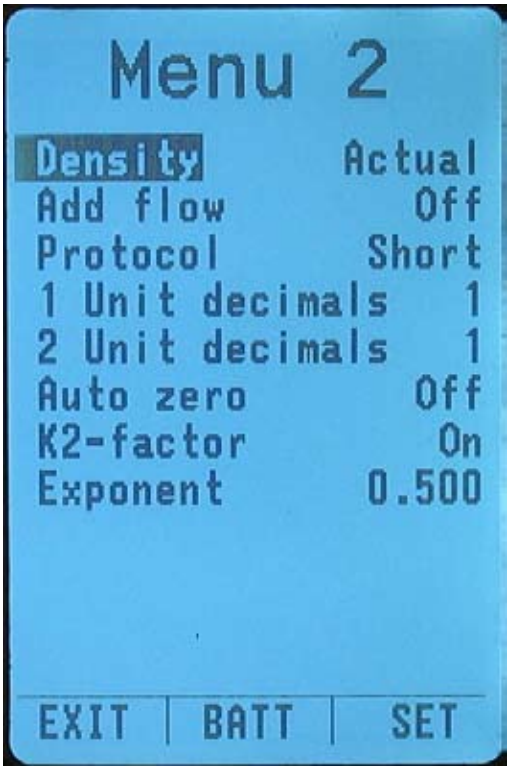
NOTE!
The thermocouple must be connected when the instrument is powered on. If it is not connected at start-up, the instrument will not detect the temperature sensor. If the thermocouple is disconnected while the instrument is powered on, the temperature will display −270 °C until the instrument is restarted, and there is a risk of incorrect compensation/calculation.

NOTE!
If a sensor with its own temperature sensor is connected (hot-wire anemometer, draft sensor, or relative humidity and temperature sensor), the temperature measured by that sensor is always used for compensation. In this case, connecting a thermocouple or manually changing the temperature has no effect on the measurement result.

Saved Data / Loggings
If any of the following modes have been selected for measurement: AP, APF, AS, ASF, DPF, BP, or CO, access to “Files”, which is “Saved data”, is available after these modes have been used.
If LOG or LOGP has been selected, direct access to “Files”, which is “Loggings”, is provided.
Open “Saved data” or “Loggings” by moving the cursor to them using the arrow keys and pressing ENTER or SELECT. Switch between measurements using the UP/DOWN arrow keys.
To transfer data to a PC, press PRINT. A long press prints all saved measurements. Use the PC software TeraTerm.
In “Saved data”, individual measurements or entire files can be deleted by pressing DELETE. In “Loggings”, the entire file is deleted when DELETE is pressed.

Files
Files are used to group measurements. In “Files”, it is possible to start a new file or select the current file. Measurements or loggings in the selected file can then be viewed by going to “Saved data” or “Loggings”.
To create a new file for “Saved data”, press ENTER in the “Files” menu. A new file for “Loggings” is created automatically when a new logging session is started using LOG or LOGP.
To print an entire file to a PC, press PRINT while inside “Files”. Switch between files using the UP/DOWN arrow keys. To print all files, hold PRINT pressed.
It is possible to delete all files or only the most recent file. To delete the most recent file, press DELETE when the last file in “Files” is selected. Select “OK” to delete the file or “ALL” to delete all files.
If “OK” is selected, the most recent file is cleared, but new measurements will subsequently be stored in the same file. The display then shows “New empty file X”, where X is the number of the deleted file. If an additional file is deleted, file X is removed completely and file X-1 becomes empty.

11. Meny 2



Navigate through the menu using the UP/ DOWN arrow keys.
Press ENTER, Select, or the right arrow key to select.
When Density is set to “Actual” in Menu 1, air flow or air velocity is compensated using barometric and temperature values.

Density
Actual or Standard.

Add Flow
On or Off. If set to On Swema 3 adds the airflow from all measurements in a file and presents the total air flow.

Protocol
Protocol Long or Short.
Long protocol contains all measurement values.
Short protocol contains average maximum and minimum values.
Long or short protocol when printing to PC.

Decimal unit 1
0, 1, 2 eller 3, select the number of decimals for the large digits. The number of decimals shown on the display follows the selected setting until a fifth digit is required.
When this occurs one decimal is removed since the display can show only 4 digits in normal mode.
When saving the measurement the same number of decimals as shown on the display is stored.

Decimal unit 2
0, 1 or 2, select the number of decimals for the small digits.

Auto Zero
Position-dependance and zero drift is eliminated by zeroing the differntial pressure sensor.
It is important that zero-pressure shows zero. Otherwise an offset will influence all measurements. An automatic valve disconnects the pressure and allows zeroing with pressure hoses connected.
ON (Default) Each time ENTER is pressed, the pressure is zeroed automatically using the internal valve (≈3 s).
Manual zeroing not required. (Prressing ZERO in measurement mode)
OFF: No automatic zeroing when pressing ENTER, enabling faster measurements. High sensor stability, auto-zeroing is not always needed.

k_2-factor
On or Off
When set to On the airflow is automatically multiplied by k_2 a correction factor. The correction is applied before the air flow is displayed and only if Diameter or HxB is set and mode APF is selected in Menu 1.

Exponent
Change the exponent e in the air flow formula using k factor in modes DPF and DPK.

$$q = k \cdot (\Delta P)^e$$

12. Batt-menu

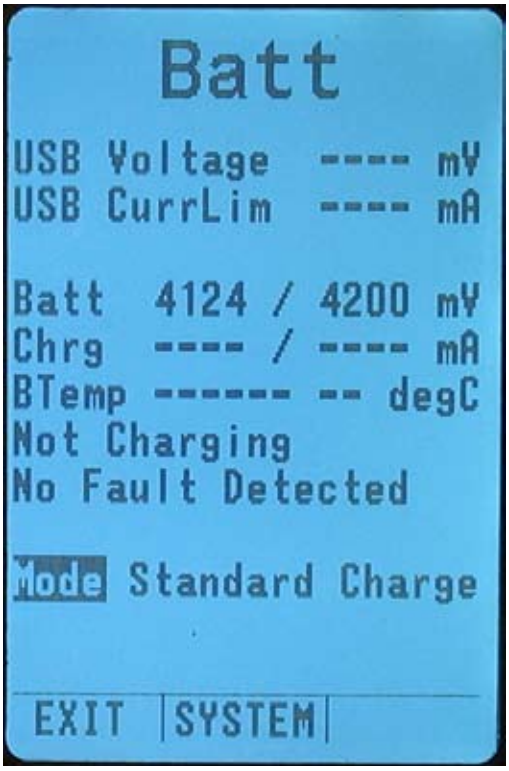
USB Voltage mV at the input of the USB C connector

USB CurrLim Maximum current that can be supplied from the cable and the power source, for example mains adapter or PC.

Batt Current battery voltage and maximum battery voltage

Chrg Current charging current slash maximum allowed charging current.

Btemp Battery temperature

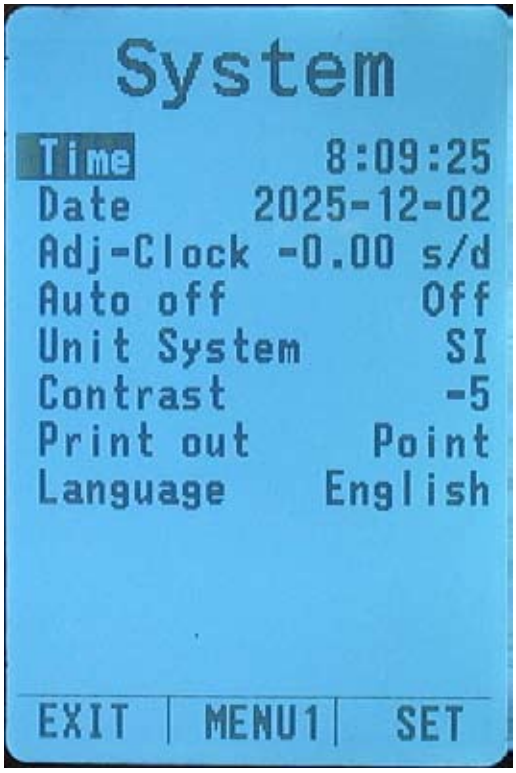


Indicates whether charging is active or not.

Indicates whether any fault is detected.

Mode
Charging method:
Minimal charging time - max 1300mA to 4200mV
Standard charging - max 1000 mA to 4200mV
Maximum operating time - max 750 mA to 4200mV
Maximum battery lifetime - max 500 mA to 4100mV

13. System - menu



Navigate through the menu using the UP/ DOWN arrow keys.
Press ENTER, Select, or the right arrow key to select.

Time Set the internal clock

Date Set the date

Time corr. Compensation if the clock runs inaccurately.
s / d Number of seconds to compensate per day.

Auto off Set the time after which the instrument automatically switches off if no button has been pressed.
During measurement in LOG or LOGP or when USB power is connected, automatic power off is disabled.

Unit System SI or US
Select the unit system preferred by the operator
Metric SI or American US.

Contrast Set the display contrast.

Printout Comma or Dot
Select whether PC output uses comma or dot as decimal separator.

Language Select operating language
English German Swedish Finnish French Danish Norwegian Russian Dutch or Po lish

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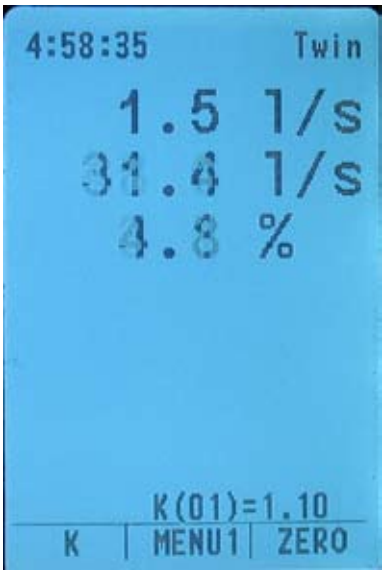
14. SwemaTwin - Bluetooth modem

SwemaTwin – Ventilation Balancing (available in some instrument models)
SwemaTwin transfers data from a Swema 3000 or SwemaMan 8 (reference unit) to the Swema 3 used for measurement. Both measured values and their ratio are displayed.
SwemaTwin enables one-person balancing via the proportional method.
See SwemaTwin manual for details.
To connect a För att ansluta till SwemaMan 8 behövs Bluetooth-kommunikation upprättas. Slå på SwemaMan 8, Slå på Sena modem som är kopplat till SwemaMan 8. Tryck på Pairing med änden av tex ett gem, på Sena-modemet. Nu är SwemaMan 8 redo att ansluta. Slå på Swema 3 och stega fram till menyn ”Comm”. Använd piltangenterna för att ställa in ”Twin M” - SwemaTwin Master och ”Scan” vilket betyder att Swema 3 ska vara Master enhet och visa Sitt eget värde, SwemaMan 8:s värde och förhållandet mellan sit egna värde delat med SwemaMan 8:s värde.
Tryck Enter - mitt-knappen för att sätta igång sökningen. Först visas att sökningen pågår. När en annan enhet hittats skrivs den också ut och därefter är instrumenten anslutna.
Lämna Comm-menyn för att visa SwemaTwin mätläge.

Kommunikationen upprättas med ovan inställning och ENTER tryck.

Välj Gå ur (Exit)

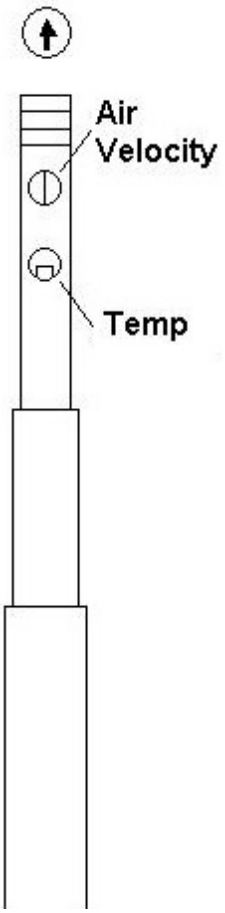


SwemaTwin mätläge

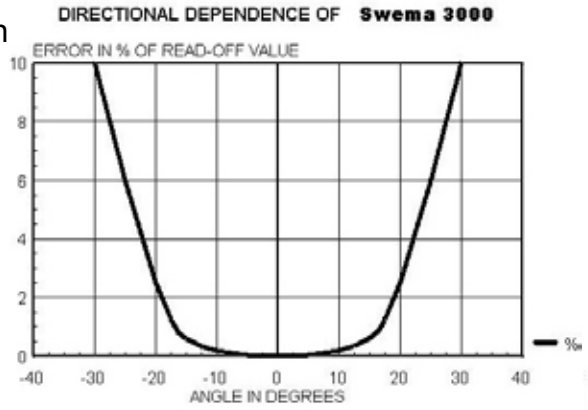
Misslyckad uppkoppling visas.

15. Sensors for Swema 3

Hot Wire Anemometers
Models: SWA 32 or SWA 32E. Ø 8–10 mm, 66 cm long; SWA 32E extendable to 116 cm.
Range: Air velocity 0–10 m/s (optional 10–30 m/s), temperature –20 to 80 °C.
Programs: APF, AP, AS, ASF, LOG and LOGP.



Extend the sensor to the required length — air must flow through both holes.
Note: Do not push by pulling the cable.
Align the arrow on the sensor head so the mark on the lowest telescopic section points in the same direction as the arrow; it must match the airflow direction. Air velocity readings vary with sensor hole orientation (see graph).



Differential Pressure
Models & Ranges:
Swema 3 L: –300 to 1500 Pa
Swema 3 LH: –300 to 1500 Pa and ±10 000 Pa
Programs: APF (with Pitot tube), DPF (K-factor), DPK (flow), AP, AS and LOG.

Draught sensors
SWA 03: 0,05...3,0 m/s (omni directional) and 10...34°C.
SWA 03 fulfils ISO 7726. Possible measuring modes: CO, AS, LOG and LOGP.

Relative Humidity and Temperature
All sensors 0....100%RH
Temperature: HygroClip2-S -40…..+150°C depending on sensor
Possible measuring modes: AP, AS and LOG.

Temperature Sensors
Black globe, SWA 53, SWT 315, SWT 215 and with temperature handle SWA 25 also SWT 14, 18, 22, 28, 39, 50, 51 and 53. Range: –50…280 °C depending on sensor.
Possible measuring modes: AP, AS and LOG.

CO_2
Some models have an internal CO2 senor.
Possible measuring MODEs are AP, AS och LOG. to save and log carbon dioxide values.
Possible measuring modes: AP, AS and LOG.

Leakage Testers
Leakage testers for ventilation ducts and for flats or entire buildings can be conected.