Technical Datasheet
Fume Cupboard Controller iCM500

SCHNEIDER

SCHAKO Group

WHERE TO FIND WHAT

**iCM500
Fume Cupboard
Controller**

GENERAL PERFORMANCE DATA

Housing	
Degree of protection	IP 20
Material	Plastic
Color	RAL 9003
Dimensions (L x W x D)	158 x 84 x 40 mm
Weight	approx. 250 g
Terminal blocks	0.2 to 1.5 mm²
Power supply unit	
Input voltage range	90 to 264 V AC
Frequency range	47 to 63 Hz
Efficiency	> 80 %
Alternating current	0.7 A / 100 V AC 0.4 A / 230 V AC
Output voltage	24 V DC
Rated current	1.0 A
Rated power	24 W

SPECIAL FEATURES

- Variable microcontroller system for fume cupboards
- With 2.8" full color display 320 x 240 pixels / 18 bits
- Parameterization and retrieval of all system values via user interface or software PC2500
- Airflow sensor for measuring the face velocity
- Integrated function monitoring of safe fume cupboard operation according to DIN EN 14175-6
- Optical and acoustic alarm in case of malfunctions
- Optical warning for the operating state „sash position > 50 cm open"
- High-speed control algorithm
- Reaction time and upward control of the exhaust air volume flow ≤ 2 s ($\dot{V}_{min}$ to $\dot{V}_{max}$)
- Orientation independent differential pressure sensor 4 to 300 Pa for measuring the exhaust air volume flow [m³/h]

PRODUCT DESCRIPTION

Variable microcontroller system for controlling and monitoring the exhaust air volume flow or the face velocity of fume cupboards as a function of the vertical and horizontal sash position. Depending on the configuration, the following operating modes for the fume cupboard control are available:

Standard model:

- Face velocity control iCM500-F

With optional differential pressure sensor:

- Face velocity control iCM500-FW with sash position sensor
- Face Velocity control iCM500-FP with limitation to $\dot{V}_{min}$ and $\dot{V}_{max}$
- Sash position sensor control iCM500-W
- Fully variable control iCM500-V
- Constant control (1-/2-/3-point) iCM500-K
- Constant control (1-/2-/3-point) iCM500-KW with sash position sensor

The integrated function monitoring according to DIN EN 14175-6 provides maximum safety for the laboratory staff. An optical and acoustic alarm on the display of the iCM500 are triggered if the value falls below the respective setpoint value for exhaust air. The standard model is suitable for all types of fume cupboards and extractor systems. The standard model is delivered ex-factory with an airflow sensor.

FUNCTIONAL DESCRIPTION

The fume cupboard controller iCM500 constantly compares the actual values determined by the sensors used and controls the preset nominal value quickly and precisely.

The advanced extract air demand request immediately calculates the demand for extract air and provides this directly as a setpoint for the central extract air system. This decisively improves the control time of the room air control system (e.g. VAV supply air volume controller by SCHNEIDER Elektronik).

Advantages of the variable fume cupboard control depending on the sash opening height

The breakout protection from toxic substances of the fume cupboard in combination with minimum air consumption is guaranteed at each sash position. The sturdiness of the fume cupboard operation in terms of air ventilation is achieved by suitable parameter setting of the constant face velocity and can be adapted to any fume cupboard designs. The airflow sensor AFS100 is used as standard sensor for iCM500-F. A fully variable control by means of iCM500-V is enabled via the connection of three independent sensors (sash position sensor, orientation independent differential pressure sensor and airflow sensor). The device iCM500 checks the three sensors for plausibility and the correlation between the actual values of the differential pressure sensor, airflow sensor and sash position sensor. This constitutes a substantial improvement of the safety for the entire control system and for the user. Measuring errors and deviations are detected immediately and signaled by an alarm.

STANDARD MODEL iCM500-F

- Variable microprocessor-controlled system with 2.8" full color display 320 x 240 pixels / 18 bits
- Numeric display of the face velocity in m/s or ft/min
- Four freely parameterizable buttons for implementation of, for example, DAY/NIGHT switchover and UP/DOWN sash (only possible when using the automatic sash controller SC500)
- Three integrated function buttons light ON/OFF, iCM500 ON/OFF, alarm acknowledgment
- Connection to the building management system via analogue signal / digital contacts or Modbus RTU possible
- Cost-effective control in compact design for price-sensitive markets
- External power supply unit (90 to 264 V AC / 24 V DC) with European plug (-EU) or optional United Kingdom plug (-UK)
- All system data is saved power-failure-proof
- Parameterization and retrieval of all system values via an on-screen configuration menu or software PC2500
- Airflow sensor for measuring the face velocity
- Integrated function monitoring of safe fume cupboard operation according to DIN EN 14175-6 with optical and acoustic alarm
- Optical and, optionally, acoustic warning for the operating state „sash position > 50 cm"
- The emergency mode (Override) = $\dot{V}_{ovr}$ can be activated via one of the four freely programmable buttons
- The night reduction mode (reduced operation) = $\dot{V}_{red}$ can be activated via one of the four freely programmable buttons
- High-speed control algorithm
- Reaction time and upward control of the exhaust air volume flow ≤ 2 s ($\dot{V}_{min}$ to $\dot{V}_{max}$)
- Downward control time can be programmed to control the exhaust air volume flow ≤ 2 to 99 s ($\dot{V}_{max}$ to $\dot{V}_{min}$) to prevent pressure variations in the laboratory
- Closed-loop control circuit

OPTIONAL DIFFERENTIAL PRESSURE SENSOR

- Orientation independent differential pressure sensor 4 to 300 Pa with high long-term stability for measuring the exhaust air volume flow [m³/h]
- A measuring system with damper and high-speed actuator can be used to measure and control the volume flow
- Internal monitoring of all sensors for plausibility
- Suitable for all types of fume cupboards

FUNCTION INDICATOR

Functions:

- Optical and acoustic alarm for too low exhaust air
- Optical display for sufficient exhaust air
- Numeric display of the face velocity in m/s or ft/min; or volume flow in m³/h or l/s; or pressure in Pa or mBar
- Optical warning for the operating state „sash position > 50 cm open"
- Button for acknowledging the acoustic alarm
- Button for control ON/OFF
- Button for light ON/OFF (internal illumination of fume cupboard)
- Integrated user interface for parameterization
- Connector for parameterization via laptop (software PC2500)

OPERATING MODES

Depending on the configuration and the area of application, the following operating modes are available:

Standard model

The operating mode iCM500-F (standard model) regulates a constant face velocity (e.g. v = 0.5 m/s), independent of the sash position. This face velocity is controlled either via an motorized damper (laboratory fume cupboards are connected to central exhaust air system) or by means of an independent exhaust air fan equipped with frequency inverter. Air duct pressure variations are countered quickly, precisely and in a stable manner. The face velocity v (m/s) is freely parameterizable. The airflow sensor AFS100 developed by SCHNEIDER detects not only a horizontal sash movement but also a vertical sash movement of the fume cupboard.
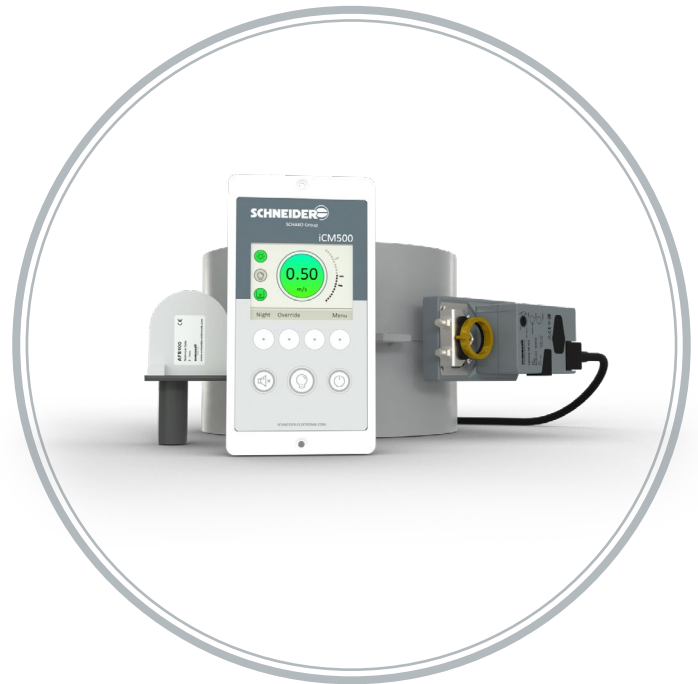
Operating modes with optional differential pressure sensor

When selecting operating modes for iCM500-FW / iCM500–FP / iCM500-W / iCM500-V / iCM500-K / iCM500-KW, the device must be additionally equipped with an integrated differential pressure sensor. This allow the connection of three independent sensors (sash position sensor, differential pressure sensor and airflow sensor). The differential pressure sensor with the damper and an integrated measuring device allow the control of an additional air volume flow limitation in the operating mode iCM500-FP and of the sash-dependent air volume flow in the control modes iCM500-K, iCM500-KW, iCM500-W and iCM500-V.
In the operating modes iCM500-W and iCM500-KW, the sash position sensor SPS100 is required in addition to the differential pressure sensor. In the operating mode iCM500-V, the airflow sensor AFS100 as well the sash position sensor SPS100 are required in addition to the differential pressure sensor.

This air volume flow measurement is based on the measurement of the effective pressure on a measuring system integrated in the form of a venturi nozzle or measuring cross.

SCHNEIDER prefers to use the venturi measuring principle. The airflow that is observed at a measuring system will generate a resistance pressure, called differential pressure, that is proportional to the air velocity. The measurement is performed with very high accuracy and stability over the entire measuring range from 4 to 300 Pa.

The operating modes iCM500-FW, iCM500-W, iCM500-V, iCM500-K and iCM500-KW ensure a stable and precise control and additionally allow the connected sensors to be checked for plausibility. This constitutes a substantial improvement of the safety for the entire control system and for the user. Measuring errors and deviations are detected immediately and signaled by an alarm.

iCM500-FW - face velocity with sash position sensor

The operating mode iCM500-FW always regulates at a constant face velocity (e.g. v = 0.5 m/s) as a function of the sash position. The face velocity is not measured but calculated on the basis of the opening area at the fume cupboard. Air duct pressure variations are countered quickly, precisely and in a stable manner. The air face velocity v (m/s) is freely parameterizable.
For the operating mode iCM500-FW, a sash position sensor SPS100 and a differential pressure sensor are required. This operating mode is only suitable for fume cupboards without horizontal sash window, since only the vertical sash adjustment on the fume cupboard is detected.

iCM500-FP - volume flow limitation $\dot{V}_{min}$ and $\dot{V}_{max}$

If the sash is closed and the face velocity is 0.5 m/s, the corresponding air volume flow is very low. If a higher air volume flow is necessary for the minimum air volume in the room, a limitation to the minimum air volume flow can be set. Likewise, the maximum air volume flow can be limited when the sash is open. Thus, the fume cupboard is in a safe range and definitely containment-proof. Limiting the exhaust air volume flow to $\dot{V}_{max}$ guarantees a high energy-saving effect in combination with maximum safety for the operating personnel. The load on the ventilation system is only as high as absolutely necessary for the operating state of the fume cupboard.

iCM500-W - sash position sensor dependent control

For fume cupboards without horizontal sash, only one sash position sensor is required for a precise vertical measurement of the sash position. The sash position sensor (cable potentio-meter) detects the vertical sash position with a resolution higher than 2 mm (0.2 %). The reproducible and continuous detection of the sash position allows very quick, accurate and stable control.

If turbulent and undefined airflows affecting the measuring precision and stability of the airflow sensor should take place in the laboratory room, the sash position sensor SPS100 is al-ways a better choice than the airflow sensor AFS100. The sash position measured via the sash position sensor is the setpoint value input for the controller iCM500-W which calculates the required exhaust air volume flow and regulates it as needed.

iCM500-V - fully variable control

This operating mode is the energetically most useful and best version of fume cupboard controller. The outstanding tech-nical feature of this control version is a fast and at the same time stable control algorithm.

The operating mode iCM500-V regulates the exhaust air volume flow continuously as a function of the sash position of the fume cupboard. The exhaust air volume flow of the fume cupboard is controlled either via an motorized damper (fume cupboards are connected to a central exhaust air system) or by means of an independent exhaust air fan equipped with frequency inverter. Air duct pressure variations are control-led quickly, precisely and in a stable manner. The exhaust air volume flows $\dot{V}_1$, $\dot{V}_2$ and $\dot{V}_3$ are freely parameterizable and determine the set points of the control curve.

$\dot{V}_1 = \dot{V}_{min}$
The first point of the exhaust air volume flow is $\dot{V}_1$, which indicates the exhaust air volume flow with fully closed sash.

$\dot{V}_2 = \dot{V}_{med}$
The second set point of the exhaust air volume flow is $\dot{V}_2$, which indicates the exhaust air volume flow with partially opened sash (e.g. sash = 50 cm). The control of the exhaust air volume flow according to demand takes place seamlessly as a function of the sash position between $\dot{V}_1$ and $\dot{V}_2$ (CLOSED ≤ sash ≤ 50 cm open).

$\dot{V}_3 = \dot{V}_{max}$
The third set point of the exhaust air volume flow is $\dot{V}_3$, which indicates the exhaust air volume flow with fully opened sash (e.g. sash = 90 cm open). The control of the exhaust air volume flow according to demand takes place seamlessly as a function of the sash position between $\dot{V}_2$ and $\dot{V}_3$ (50 cm ≥ sash ≤ 90 cm open).

The setpoints $\dot{V}_1$, $\dot{V}_2$ and $\dot{V}_3$ are freely parameterizable. $\dot{V}_2$ can be assigned to any sash position between sash fully closed and sash fully opend. This is done during a teach-in of the sash position sensor. By default, the working height of 50 cm is selected for this purpose.
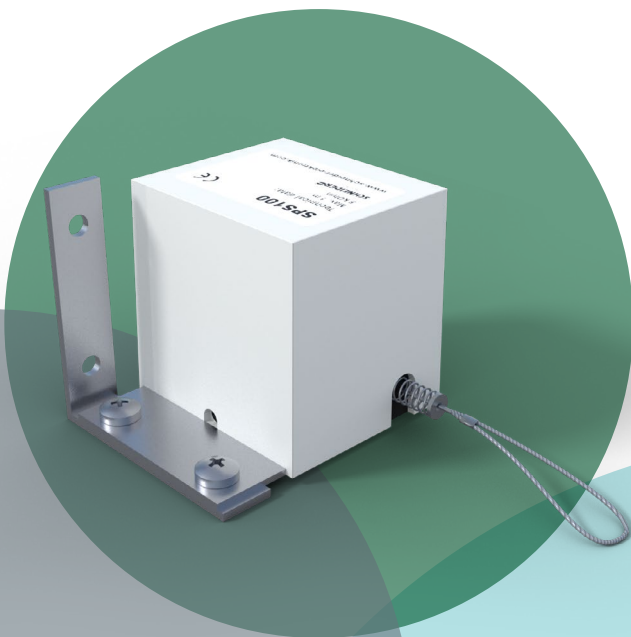
The control iCM500-V constantly checks the three sensors for plausibility. This means that it is checked whether the actual values of the differential pressure sensor and the airflow sensor are logically in line with the actual value of the sash position sensor. This is an additional safety feature for the entire control system and for the user.

iCM500-K / iCM500-KW - constant control

The operating mode iCM500-K regulates the exhaust air volume flow of the fume cupboard. The exhaust air volume flow of the fume cupboard is controlled either via an motorised damper (fume cupboards are connected to central exhaust air system) or by means of an independent exhaust air fan equipped with frequency inverter. Air duct pressure variations are controlled quickly, precisely and in a stable manner. The exhaust air volume flow $\dot{V}_1$ is freely parameterizable.

For the operating mode iCM500-K, limit switches for detecting the sash positions must be provided at the fume cupboard. Alternatively, three fixed control points can be defined with the sash position sensor SPS100; therefore, the version iCM500-KW must be selected.

1-point constant control

In 1-point constant control, the exhaust air volume flow is constantly controlled at $\dot{V}_1$, independently of the sash position.

2-point constant control

A 2-point constant control regulates the exhaust air volume flow depending of the sash position either at $\dot{V}_1$ (sash = CLOSED) or $\dot{V}_2$ (sash = OPEN). The sash position CLOSED is detected via a limit switch (iCM500-K) or the sash position sensor SPS100 (iCM500-KW).

3-point constant control

A 3-point constant control controls the exhaust air volume flow depending of the sash position at $\dot{V}_1$ (sash = CLOSED), $\dot{V}_2$ (sash < 50 cm open) or $\dot{V}_3$ (sash ≥ 50 cm open). The sash positions (closed and ≥ 50 cm) are each detected by a limit switch (iCM500-K) or a sash position sensor SPS100 (iCM500-KW).

FUNCTIONS

Fast upward control and slow downward control

In all operating modes, upward control in most cases takes place at the maximum control speed, i.e. upon opening the vertical or horizontal sash, the required volume flow follows the control and is increased without delay.

When the vertical or horizontal sash is closed, a downward control is possible at a control speed adjustable between 2 and 99 seconds. A slow downward control has the advantage of allowing the room supply air to be adjusted according to demand with sufficient time reserve, thus ensuring that the laboratory room is always maintained at negative pressure under all operating conditions. A slow downward control of the air volume flow improves the working safety for the laboratory personnel and avoids oszillation tendencies of the entire control system.

Test and diagnostic functions

For commissioning, diagnostics and simple troubleshooting, it is vital to have a comprehensive and precise overview of all measured actual values. All actual values are available in the on-screen menu. SCHNEIDER provides the service and commissioning personnel with the software PC2500:

Actual value unit

Exhaust air volume m³/h
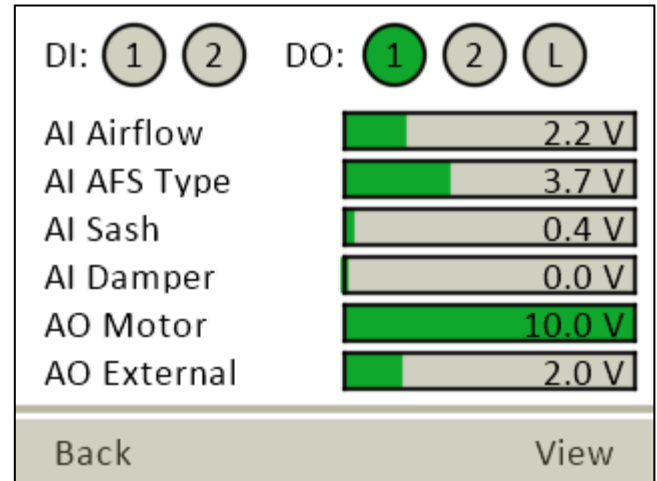Supply air volume m³/h
Face velocity m/s
Sash position (via sash position sensor) %
Exhaust air pressure (measured via venturi nozzle) Pa
Damper position %

Moreover the controller iCM500 is equipped with an integrated password-protected on-screen menu which can be reached directly via the function buttons.

The following test functions can be carried out:

These test and diagnostics functions substantially facilitate and simplify commissioning and troubleshooting.

Connection of the iCM500 to the building management system via Modbus RTU

The building management system (BMS) balances the air demand of the entire building and can additionally check all room controllers for plausibility. DAY/NIGHT switchover, visualization of fault messages and actual values and remote maintenance and remote fault diagnostics can be easily integrated. A detection of room-related air consumption and individual billing can also be implemented.

Further information regarding the connection via Modbus can be found in the Installation and operating manual fume cupboard controller iCM500.

Control of frequency inverter

The analog output of the control iCM500 can be configured to serve as setpoint for the frequency inverter and regulates the exhaust air fan in accordance with the actual volume flow or face velocity setpoint to be controlled. This functionality is used when the exhaust fan extracts air directly from the connected fume cupboard.

Application areas

Standard laboratory

Clean room

Nuclid laboratory

Animal laboratory

Training laboratory

ORDER CODE

01	02	03
Type	Operating mode	Power supply unit

01 - Type

iCM500: Fume cupboard controller for controlling the exhaust air volume flow or the face velocity control of fume cupboards as a function of the vertical and horizontal sash position with integrated function monitoring according to DIN EN 14175-6. With 2.4" full color display 320 x 240 pixels, 18 bits.

02 - Operating mode

F: Face velocity control

FP: Face velocity control with limitation to $\dot{V}_{min}$ and $\dot{V}_{max}$

W: Sash position sensor (only suitable for fume cupboards without cross-slide)

FW: Face velocity control with sash position sensor and calculation of the opening area of the laboratory fume cupboard (only suitable for fume cupboards without cross-slide)

V: Fully variable control

K: Constant (1/2/3 point), for on-site limit switches

KW: Constant (1/2/3 point), with sash position sensor

03 - Power supply unit

EU: Power supply unit with EU plug

UK: Power supply unit with UK plug

Example:

Fume cupboard controller for controlling the exhaust air volume flow or the face velocity control of laboratory fume cupboards as a function of the vertical and horizontal sash position with integrated function monitoring according to DIN EN 14175-6. With 2.4" full color display 320 x 240 pixels, 18 bits. Fully variable control via differential pressure sensor, airflow and sash position sensor, with power supply unit with EU-plug.

Type: iCM500-V-EU

| 01	02	03
iCM500	-V	-EU

Further technical information about our sensors can be found in the SPS100/SPS200 and AFS100 datasheets.

Products to be ordered separately (depending on the operating mode)

Order code	Sensors included in the scope of delivery	Damper with high-speed actuator and measuring system (to be ordered separately)
iCM500-F-EU	AFS100 (airflow sensor)	DK-DN-PPS-0-0-MM
iCM500-FP-EU	AFS100 (airflow sensor) P+ / P- (differential pressure sensor)	VD-DN-PPS-0-0-MM
iCM500-FW-EU	SPS100 (sash position sensor) P+ / P- (differential pressure sensor)	VD-DN-PPS-0-0-MM
iCM500-W-EU	SPS100 (sash position sensor) P+ / P- (differential pressure sensor)	VD-DN-PPS-0-0-MM
iCM500-V-EU	AFS100 (airflow sensor) SPS100 (sash position sensor) P+ / P- (differential pressure sensor)	VD-DN-PPS-0-0-MM
iCM500-K-EU	P+ / P- (differential pressure sensor) Limit switch to be provided on site	VD-DN-PPS-0-0-MM
iCM500-KW-EU	SPS100 (sash position sensor) P+ / P- (differential pressure sensor)	VD-DN-PPS-0-0-MM
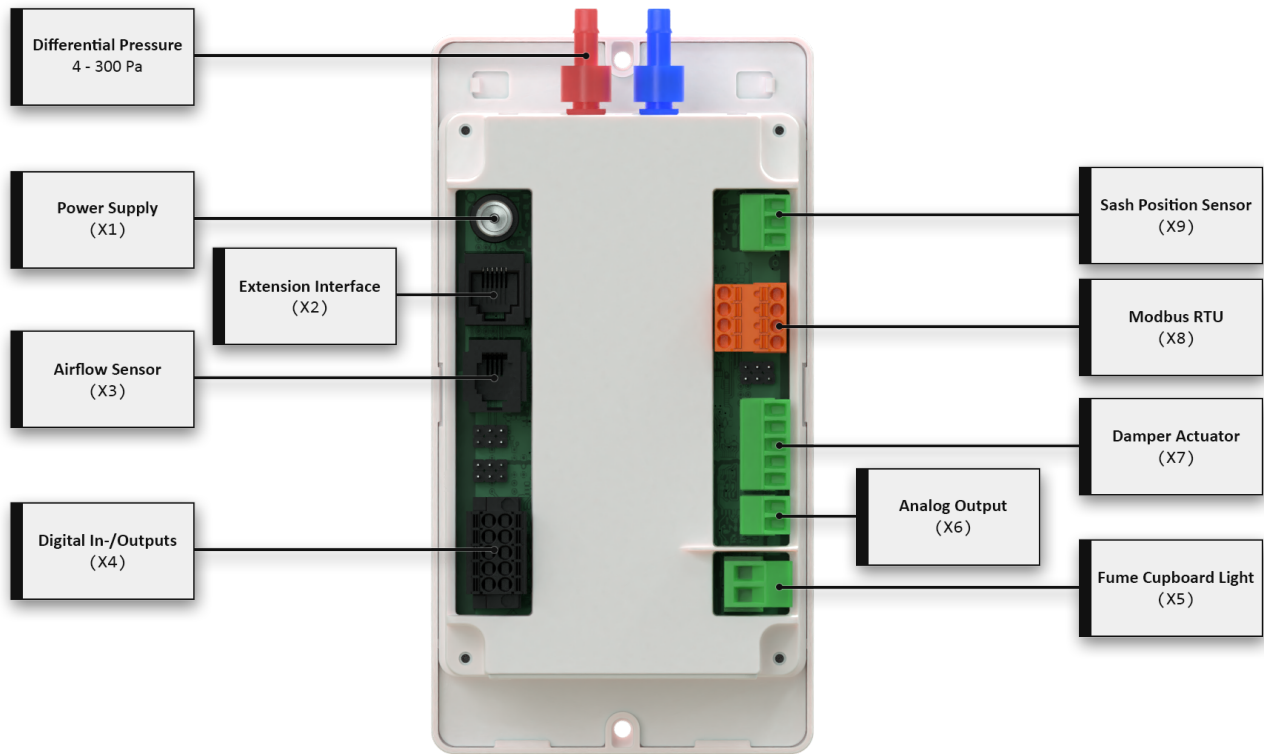
ELECTRICAL CONNECTIONS

Differential Pressure Sensor

- 4 to 300 Pa

Power Supply unit (X1)

- Connection 24 V DC / 1.0 A via power plug

Extension Interface (X2)

- RS485 interface for customer-specific functionalities

Airflow Sensor (X3)

- Connection airflow sensor

Digital Inputs / Relay Outputs (X4)

Digital ON/OFF for e.g.:

- Digital input for ON/OFF
- Digital input for DAY/NIGHT
- Relay output for ON/OFF
- Relay output for ALARM

Sash Position Sensor (X9)

- Terminal for sensor for detecting the sash position

Modbus RTU (X8)

- Connection to BMS via Modbus RS485 (galvanically isolated)

Damper Actuator (X7)

- Terminal for actuator connection for control via damper or measuring device with damper

Analog Output (X6)

- Terminal for output of actual value signal 0 to 10 V or control of a frequency inverter

Fume Cupboard Light (X5)

- Terminal for the fume cupboard light, control via integrated function button light ON/OF

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TECHNICAL DATA

Power Supply unit	Terminal: X1
Input voltage range	90 to 264 V AC
Frequency range	47 to 63 Hz
Efficiency	> 80%
Alternating current	0.7 A / 100 V AC 0.4 A / 230 V AC
Nominal voltage	24 V DC
Rated current	1.0 A
Rated power	24 W
Housing	**iCM500 control unit**
Protection type	IP 20
Material	Plastic
Color	RAL 9003
Dimensions (L x W x D)	158 x 84 x 34 mm
Weight	approx. 250 g
Terminal blocks	0.2 to 1.5 mm²
Relay Outputs	**Terminal: X4**
Number of	2
Contact type	Switchover / Changeover contact
Nominal voltage	24 V AC / 24 V DC
Rated current	5.0 A
Digital Inputs	**Terminal: X4**
Number of	2
Nominal voltage	24 V DC external 24 V AC external 24 V DC internal
Operating current	20 mA
Fume Cupboard Light	**Terminal: X5**
Number of	1
Contact type	Normally open contact / Operating contact
Nominal voltage	250 V AC
Rated current	6 A
Rated voltage	400 V AC

Analog Output	Terminal: X6
Output voltage	0 V to 10 V DC
Max. output current	10 mA
Load resistance	RL > 500 Ω
Actuator connection	**Terminal: X7**
Feedback signal, U	0 to 10 V DC
Setpoint, Y	0 to 10 V DC
Nominal voltage	24 V DC
Nominal current	0.54 A
Rated current	1.0 A

You can find further technical information about our fume cupboard controller iCM500 in the installation and operating manual.

HOUSING DIMENSION
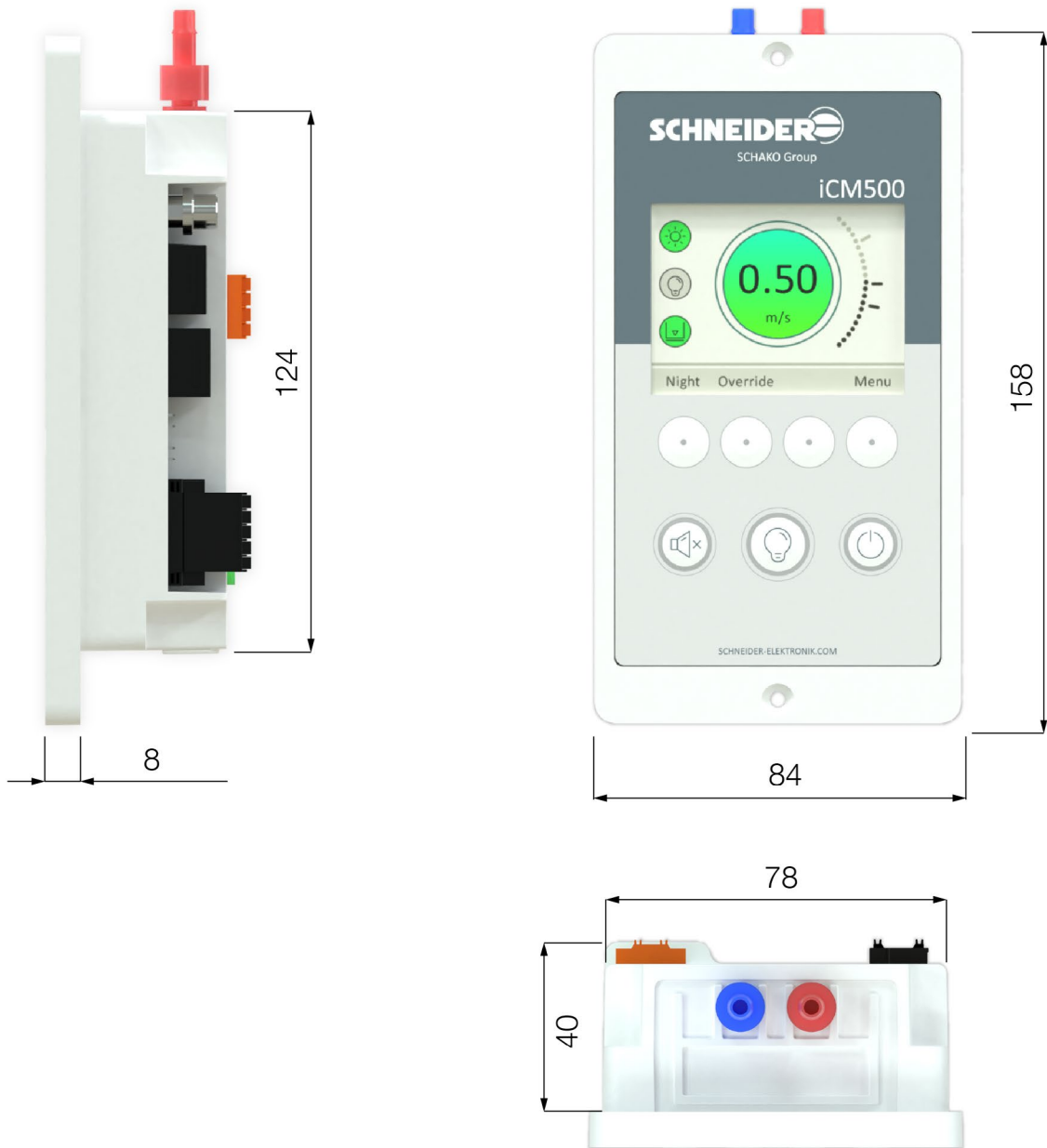
IMPORTANT!

The mounting dimensions, in depth, may increase after using the terminal blocks.

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ACCESSORIES

Control Damper
DK-250-PPS-0-0-MM

Venturi Nozzle
VD-250-PPS-0-0-MM

AFS100

SPS100/200

Related datasheets:

- Technical Datasheet Sash Position Sensor SPS100 / SPS200
- Technical Datasheet Airflow Sensor AFS100
- Operating and Installation Manual Fume Cupboard Controller iCM500

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Do you have any questions? We look forward to your message:

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