

FCCP, FCIU: Fume-cupboard indicator and monitor

Improving energy efficiency

For secure and energy-efficient controlling of fume cupboards

Areas of use

Monitoring fume cupboards as per EN 14175-2 to check that it is functioning correctly and the ventilation is operated to provide maximum safety for the laboratory staff. Demand-led control of fume cupboards as per EN 14175-6 when used in combination with ASV115 compact VAV controller

Features

- Demand-led control of fume cupboards as per EN 14175-6 when used in combination with ASV115 compact VAV controller
- Function indicator with optical and audible notification as per EN 14175-2
- The FCIU interface unit provides a wide range of functions, such as:
 - PI controller for regulating the air inlet speed via ASV115
 - Contacts input for indicating when the front sash is open > 500 mm
 - Light on fume cupboard can be switched on/off
 - External alarm extension via hardware contacts
 - Separate input for connecting a second SGU100 sash sensor
 - Possible to connect one or two function indicators for hatch-type fume cupboards
 - Function for day/night change-over from external location
 - Combined operation of air-flow sensor (SVU100) and sash sensor (SGU100) is possible
 - Audible alarm can be delayed (variable) or muted
 - Can be used as a simple fume cupboard monitor without an air-volume controller
- All the set parameters are stored and protected against power failure
- Can be put into service quickly and easily, without using a PC
- Parameter connection for easy access to the ASV115
- Mounting frame for surface or recessed mounting of the function indicator

Technical description (FCCP)

- Up to five keys for the following functions:
 - ON/OFF, lighting ON/OFF, V_{min} , V_{max} , mute
- LEDs for indicating:
 - power, V_{min} , V_{max} , normal operation, > 500 mm, alarm
- Connectors for ASV115 parameterisation
- Front film of polyethylene (i.e. resistant to chemicals)
- Power cable (2.9 m) with D-sub (HD15) connector

Technical description (FCIU)

- Outputs for:
 - Actual value, air volume in fume cupboard 0...10 V
 - 1x change-over relay, alarm for external SELV circuits
 - 1x normally-open contact relay, 230 V for lighting
 - 1x flow controller output 0...10 V
- Inputs for:
 - 1x external air-volume setpoint, 0...10 V
 - 1x external air-volume actual value, 0...10 V
 - 2x contacts input for front-sash opening height > 500 mm
 - 1x contacts input
 - 1x contacts input for day/night change-over
 - 1x contacts input for switching off the fume cupboard from external location
 - 1x contacts input for motion detector (reduced mode)
- External terminals for EIA-485 wiring

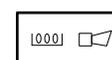
FCCP	
Power supply	
Power supply	24 V~, ±20%, via FCIU 18...38 V=
Power consumption	3 VA
Audible alarm	



FCCP100F031



FCIU100F***



FCCP100F***



FCCP	
Sound pressure level	80 dB (A)
Frequency	4 kHz
Alarm duration	60 s
Time delay	5 s
Optical alarm	
Brightness	EN 842, punctiform
Field of view	> 120°
Admissible ambient conditions	
Operating temperature	0...50 °C
Humidity	< 85% rh, no condensation
Fitting	
Dimensions W x H x D	160 × 21.8 × 16 mm
Standards and directives	
Protection class	III
Type of protection (when installed)	IP 30 with EIA-485 IP 40 without EIA-485

FCIU	
Power supply	
Power supply	24 V~, ±20%
Power consumption	3.5 VA incl. FCCP 100
Inputs (R_i ≥ 100 kΩ)	
Command signal C _{q-ext}	0...10 V
NO contacts, night	15 V=, 3 mA
NO contacts 'Close'	15 V=, 3 mA
Air-flow sensor	0...10 V
End switch 500 mm	max. 15 V=, 3 mA
Front sash 1: end switch 'Close'	max. 15 V=, 3 mA
Front sash 2: End switch 500 mm	max. 15 V=, 3 mA
Front sash 1: change-over day/night	Contact
Outputs	
contacts: Alarm	change-over (24 V~, 8 A)
Relay switching output: Lighting	NO contacts (250 V~, 8 A)
Feedback x _i	0...10 V; load > 5 kΩ
Connections for	1 × ASV115 2 × SLC (EIA-485) 2 × FCCP (master and slave) 2 × SGU100 1 × SVU100
Admissible ambient conditions	
Operating temperature	0...50 °C
Humidity	< 85% rh, no condensation
Fitting	
Dimensions W x H x D	250 × 103 × 53 mm
Standards and directives	
Protection class	II
Type of protection	IP 00

Overview of types

Type	Properties	Power supply
FCCP100F010	Alarm, mute	Via FCIU
FCCP100F011	Alarm, mute, parameter access	Via FCIU
FCCP100F015	Alarm, mute, light, parameterisation access	Via FCIU
FCCP100F020	Alarm, mute, ON/OFF, lighting	Via FCIU
FCCP100F021	Alarm, mute, ON/OFF, lighting, parameters	Via FCIU
FCCP100F030	Alarm, mute, lighting, ON/OFF, \dot{V}_{min} , \dot{V}_{max}	Via FCIU
FCCP100F031	Alarm, mute, lighting, ON/OFF, \dot{V}_{min} , \dot{V}_{max} , parameter access	via FCIU

Type	Properties	Power supply
FCIU100F021	Interface unit for FCCP, ASV115 and fume cupboard sensors	24 V~
FCIU100F101	Interface unit for FCCP, ASV115 and fume cupboard sensors, max. selection or sum formation, external setpoint	24 V~

Accessories

Type	Description
0430240010	Surface junction box set, incl. frame and fixing parts
0430240020	Recessed junction box set, incl. frame and fixing parts

Description of operation

In accordance with EN 14175-2, fume cupboards must be equipped with a function indicator for monitoring the correct return-air volume flow. For this purpose, the return-air volume of the fume cupboard is continuously detected and compared with the return-air volume flow specified by the fume cupboard manufacturer. If the volume flow is not adequate, the user is informed of this malfunction via a visible and audible notification. In combination with the ASV115 VAV compact controller and SGU100 and SVU100 sensors for fume cupboards, the FCCP and FCIU monitoring system ensures the most energy-efficient operation and controls in accordance with EN 14175-6.

Depending on the components used, the following functions are possible:

- 2-point control (constant volume flows)
- Control depending on the front sash position (sash sensor)
- Control depending on the air inflow speed (air-flow sensor)
- Fully variable control depending on the front sash position and the air inflow speed

Connection to a higher-level building management system is by means of exchanging analogue values or switching commands via relay contacts. This enables central controlling and monitoring of the fume cupboard.

Intended use

This product is only suitable for the purpose intended by the manufacturer, as described in the "Description of operation" section.

All related product documents must also be adhered to. Changing or converting the product is not admissible.

Fume cupboard monitoring

In accordance with EN 14175, fume cupboards must be equipped with an independently functioning monitoring facility. This must include visible and audible signals that inform the user of unsafe operation of the fume cupboard in the case of a malfunction in the ventilation system. With the combination of FCCP100F010, FCIU100F101 and SVU100F005, this requirement is fulfilled to ensure the safety of the laboratory personnel. The monitoring facility can be configured without a PC and is ideal for new fume cupboards and for easily retrofitting older fume cupboards.

2-point control

2-point controlling is the easiest way of performing demand-led regulation/controlling of fume cupboards. Here the opening of the front sash is recorded by two limit switches mounted on the top and bottom of the fume cupboard. When the contacts switch, the damper actuator or the volume flow controller is given a new setpoint. The setpoint can be used to switch between a minimum (front sash closed) and a maximum (front sash opened) volume flow.

Control depending on the front sash position

Compared with fume cupboards operated with constant amounts of air, fume cupboards with variable amounts of air provide the better solution in terms of energy. Depending on the concept, it is possible to save up to 70% of primary energy. In the version with position detection (SGU100) of the front sash, the required air volume flow is controlled directly according to the extent to which the front sash is opened. Based on EN 14175-6, when the front sash is fully opened (within one second) the target volume flow is stable within a maximum of 4 s.

Control depending on the air inflow speed

In general, fume cupboards can be operated safely when the inflow speed of the air at the front sash is in the range 0.3...0.5 m/s. The inflow speed is measured using a direction-sensitive SVU100 flow

sensor, which operates on a calorimetric principle. The currently measured actual value is compared with the desired setpoint and is specified as the command variable for the volume flow control loop. Independently of the sash position - horizontal and/or vertical sash – the system regulates the fume cupboard to the specified constant inflow speed.

Fully variable controlling

The combination of a sash sensor (SGU100) and a flow sensor (SVU100) allows fully variable control of fume cupboards with horizontal and vertical sashes. The volume flow is controlled using either the opening height or the inflow speed measured by the sensors, whichever value is the greater. This ensures maximum safety at the lowest energy consumption possible.

Summary of functions (FCCP)

Button	Function
\dot{V}_{\max}	Emergency mode. When the \dot{V}_{\max} button is pressed, the return-air volume flow is increased to the parameterised volume flow \dot{V}_{\max} independently of the front sash position. Note: The function “damper OPEN” can also be assigned to the ASV115 instead of \dot{V}_{\max} .
\dot{V}_{\min}	Set-back mode. When the \dot{V}_{\min} button is pressed, the return-air volume flow is decreased to the parameterised volume flow \dot{V}_{\min} independently of the front sash position.
Mute	Manual acknowledgement of the audible alarm. After approx. 60 s, the audible alarm is automatically muted.
Lighting	Switching the light on/off in the fume cupboard. This functions independently of the current state of the fume cupboard.
I/O	Button for switching the fume cupboard on or off. When the fume cupboard is switched on, it is activated in the general operating state, i.e. the return air is open and the air monitoring becomes active. When the fume cupboard is switched off, the damper of the VAV controller moves to the parameterised end position (factory setting CLOSED) and all the monitoring functions are deactivated.

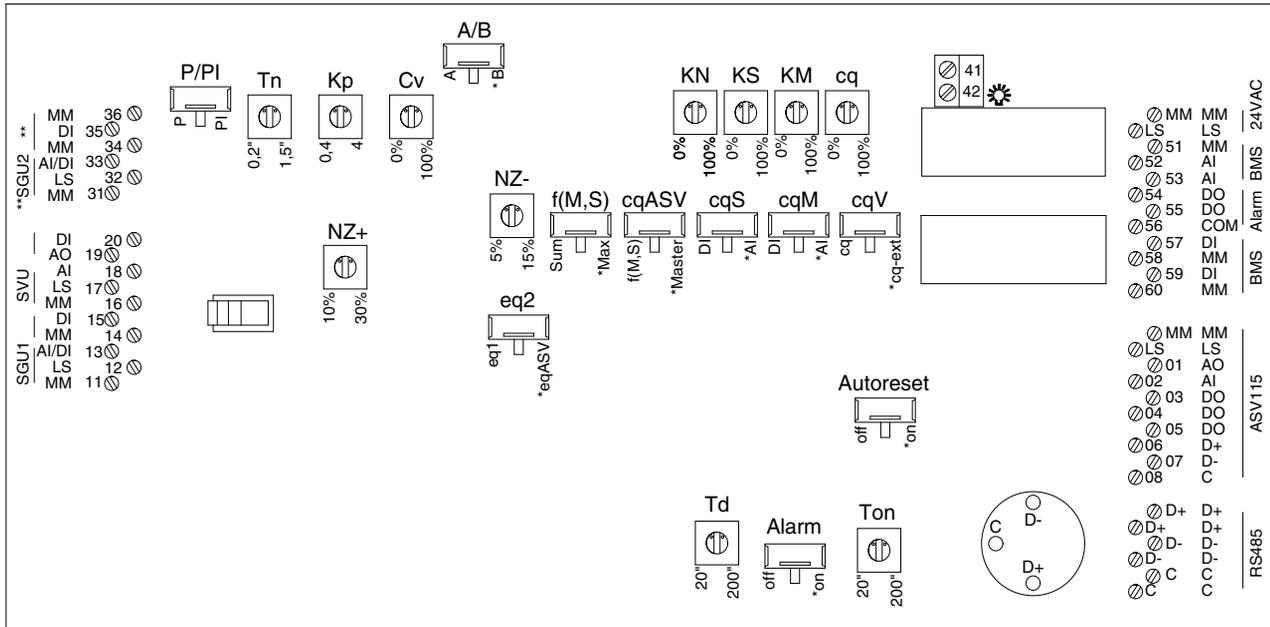
LED	Colour	Function
Alarm	Red	Visual alarm notification Becomes active when the actual value for volume flow differs from the current setpoint by more than 15%. If the volume flow falls below the maximum admissible volume flow difference (malfunction) or the limit value of 10% of the volume flow, the alarm LED flashes regularly. If the volume flow is exceeded, the alarm LED lights up continuously.
>500 mm	Yellow	The LED is active when the front sash of the fume cupboard is opened more than 500 mm and a contact on the fume cupboard closes.
Normal	Green	Status signal: Indicates that the fume cupboard is in a safe operating status.
\dot{V}_{\max}	Yellow	Indicates that the \dot{V}_{\max} function is activated
\dot{V}_{\min}	Red	Indicates that the \dot{V}_{\min} function is activated
I/O	Green	Indicates the switched on status of the fume cupboard
	Red	Indicates back-up power mode, if a buffer battery has been installed

Connection	Function
COM	3-pin plug connection for parameterising a connected ASV115 VAV compact controller.

Description of operation (FCIU)

The FCIU interface unit connects the fume cupboard control unit to other system components. For this, the device is equipped with various connections. Depending on the application selected, it is not absolutely necessary to use this unit. When the SGU100 sash sensor system is being used, it can also be used to define the setpoints for the ASV115 directly, without connecting a FCIU.

Connection diagram (FCIU)



All the connected devices are supplied with power via the terminals of connection X1 for the power supply. This must be considered when sizing the transformer. The following power consumptions are typical:

Typical power consumptions

ASV115	15 VA
SGU100	1 VA
SVU100	1 VA
FCCP100	2 VA
Battery charging unit	2.5 VA
FCIU100	1.5 VA

Therefore, a FCIU100 with the maximum equipment has a power consumption of at least 23 VA. The relay contact at terminal 54 or 55 can be used for the alarm notification in the case of a fume cupboard malfunction. This is a change-over contact. The digital input at terminal 57 can be used to switch between day mode and night mode from the building management system. When the night mode is activated, the volume flow is reduced to the volume flow parameterised on the ASV115. If the fume cupboard is open when the night set-back mode is activated and if the monitored variable (actual value of volume flow or of flow) is above 10% of the measuring range, no alarm is triggered. The function for completely switching off the fume cupboard from outside is performed using the digital input at terminal 59. This function is the same as on the FCCP100, i.e. the operating unit is switched off and the VAV controller moves the damper to the position parameterised with the CASE VAV priority control (default setting: damper CLOSED)

Note
 The full scope of functions for the FCIU100 is only available in combination with the FCCP100 and ASV115. In particular the FCIU100 outputs DO04 and DO05 (V_{min}/V_{max}) are intended to be used with ASV115. The FCIU100F021 does not have its own option for generating a control offset for the alarm on the FCCP100. The ASV115 is required for this.

Interface of BMS/main power supply

X1	Description
MM	Ground
LS	24 V~ system power supply
51 (MM)	Ground
52 (AI)	Analogue input 0...10 V, remote setpoint function (applications without ASV115)
53 (AI/AO)	Analogue input 0...10 V, remote setpoint function (applications without ASV115) Analogue output 0...10 V, actual value of the ASV115
54 (DO)	Fume cupboard alarm, opener relay contacts
55 (DO)	Fume cupboard alarm, closer relay contacts

X1	Description
56 (COM)	Fume cupboard alarm, shared connection relay contacts
57 (DI)	Digital input for normally-open contacts at ground, function for day/night changeover
58 (MM)	Ground
59 (DI)	Digital input for normally-open contacts at ground, OFF function for fume cupboard from externally
60 (MM)	Ground

Connection X2 is used to connect the ASV115 to the FCIU100. All signals are forwarded directly. The functions of the ASV115 are described in data sheet PDS 52.150

ASV115 connection

X2	Description
MM	Ground
LS	24 V~ASV115 power supply for actuator
01 (AO)	Analogue output 0...10 V
02 (AI)	Analogue input 0...10 V
03 (AI)	Analogue input 0...10 V
04 (DO)	Digital output 0/5 V
05 (DO)	Digital output 0/5 V
06 (D+)	EIA-485
07 (D-)	EIA-485
08 (C)	EIA-485 ground

The 15-pin D-Sub plugs at connection X3 must be used to connect the FCCP100 fume cupboard control unit.



Note

When connecting the FCCP100 to an ecos 5 automation station, the digital inputs of the FCCP must be connected to the universal inputs. The voltage levels for the OPEN and CLOSED states of the FCCP are max. 0.5 V and 3.5 V, and are therefore not suitable for connection to the digital inputs of the ecos 5.

When using the slave connection, you must put the relevant DIP switch on the FCCP100 into the correct position as described in fitting instructions P100000765. The acknowledgement of an alarm is always performed on the master FCCP100 operating unit. If operating units that do not have the complete range of functions are included, the relevant connections are not occupied.

FCCP100 master (below) / slave (above) connections

X3	Description
01 (MM)	Ground
02 (LS)	24 V~ power supply
03 (AI 1)	Output for setpoint/actual value difference ($-e_q$)
04 (AI 2)	Output for alarm
05 (DI 1)	Input for contact for sash opening > 500 mm
06 (DO 1)	Input V_{max} on ASV115 (only master)
07 (DO 2)	Input V_{min} on ASV115 (only master)
08 (DO 3)	Input for light, activates relay (only master)
09 (MM)	Ground
10 (D+)	EIA-485 Tx
11 (D-)	EIA-485 Rx
12 (C)	EIA-485 ground

The X4 connection is for connecting the fume cupboard sensors. Here a sash sensor system or, alternatively, an air-flow transducer can be used. As the actual value cannot be used as a setpoint for the volume flow control loop in the measurement and controlling of the air flow, an additional PI-controller must be interconnected. This compares the adjustable setpoint with the actual value and then provides the command signal for the VAV. Connection 15 is used to indicate a front sash opening of over 500 mm in accordance with EN 14175.

Connection of sash sensor 1 (master)

X4	Description
11 (MM)	Ground
12 (LS)	Power supply for sensor, 24 V~, max. 10 A
13 (AI/DI)	Analogue/digital input can be changed over; positioning of main sash window (SGU100) via sash sensor system or switching contacts
14 (MM)	Ground

X4	Description
15 (DI)	Digital input, limit switch 500 mm, normally-open contacts to ground
16 (MM)	Ground
17 (LS)	Power supply for sensor (SVU100), 24 V~, max. 10 VA
18 (AI)	Analogue input 0...10 V, air inflow speed (actual value) SVU100
19 (AO)	Analogue output, PI-controller output 0...10 V
20 (DI)	Digital input, motion detector, normally-open contacts to ground

It is possible to connect a second fume cupboard sensor to connection X5. This can be either a second sash sensor system or, alternatively, the control offset from the control loop for the air-flow speed.

Connection of sash sensor 2 (slave)

X5	Description
31 (MM)	Ground
32 (LS)	Power supply for sensor, 24 V~, max. 10 VA
33 (AI/DI)	Analogue/digital input can be changed over; slave positioning of sash window via sash sensor system or switching contacts
34 (MM)	Ground
35 (DI)	Digital input, limit switch 500 mm, normally-open contacts to ground
36 (MM)	Ground

Potentiometers and switches

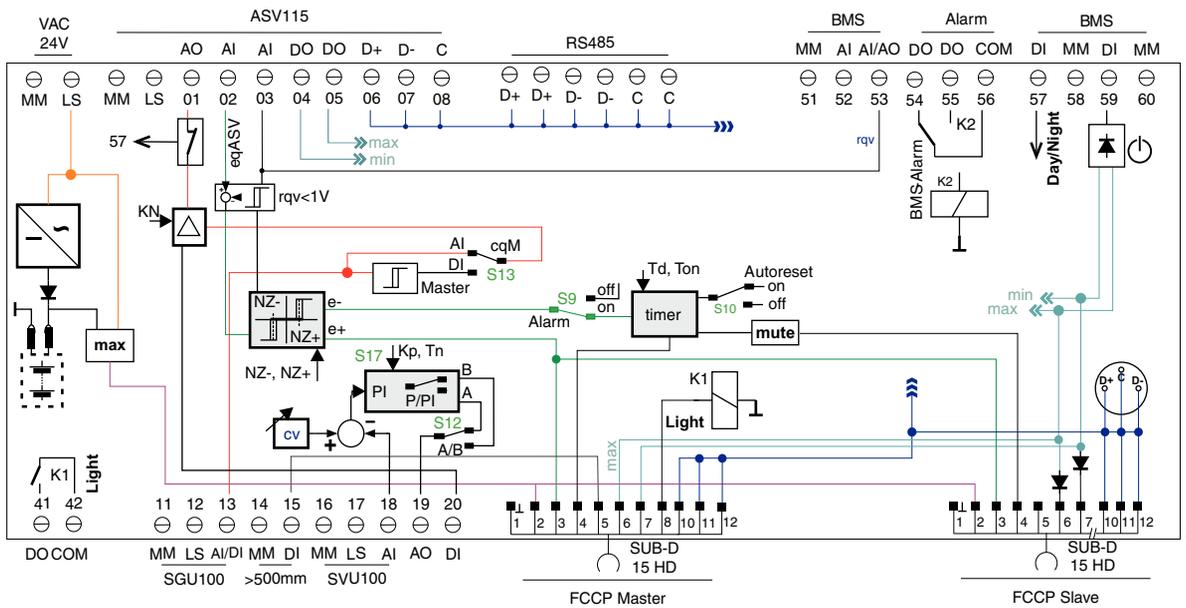
The available potentiometers (RV) and switches (S) can be used to make system-specific settings on the FCIU.

Designation	Range	Description	Symbol	
RV1	KM	0...100%	Weighting of the master sensor signal	100%
RV2	KS	0...100%	Weighting of the slave sensor signal	100%
RV3	NZ+	10...30%	Alarm trigger for $r_q > c_q$; volume flow too high	20%
RV4	NZ-	5...15%	Alarm trigger for $r_q < c_q$; volume flow too low	10%
RV5	c_q	0...100%	Internal setpoint for summation point	100%
RV6	T_d	20"...200"	Delay time for the audible alarm	110"
RV7	T_{on}	20"...200"	Duration of the audible alarm	110"
RV8	c_v	0...100%	Setpoint for the internal PI control loop for flow monitoring	50% (0.6 m/s)
RV9	T_n	0.2"...1.5"	Integration time constant for the I-controller	0.85"
RV10	K_p	0.4...4	Amplification factor for the P-controller	2.2
RV11	KN	0...100%	Setting of the setpoint reduction, activated by the normally-open contacts on terminal 20, (variable night set-back mode or connected motion detector)	100%

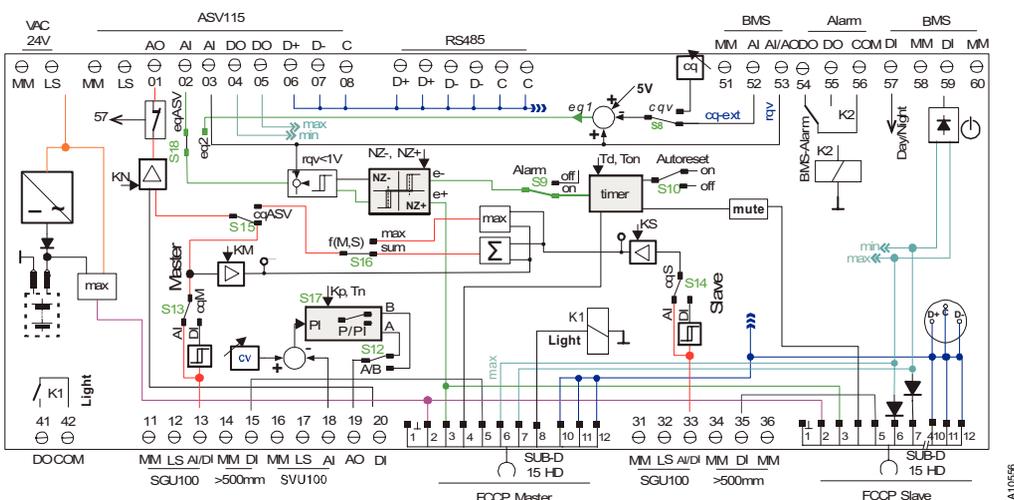
		Description
S8 change-over switch for setpoint for notification		
c_{qv}	c_{q-int}	Internal setpoint for RV5
	c_{q-ext}	External setpoint by building management system
S9 changeover switch for audible alarm		
Alarm	On	Audible alarm on function indicator is active
	Off	Audible alarm on function indicator is inactive
S10 automatic deactivation of the audible alarm		
	On	After the defined duration for the tone (RV7) has elapsed, the audible alarm is deactivated automatically
	Off	Audible alarm must be acknowledged manually
S12 selection switch for the direction of operation		
A/B	A	Acts directly
	B	Acts indirectly
S13 mode switch between sensor or switching inputs (master sensor)		
c_{qM}	AI	0...10 V at input is forwarded directly
	DI	Closed contact is converted to 0...10 V
S14 mode switch between sensor or switching inputs (slave sensor)		
c_{qS}	AI	0...10 V at input is forwarded directly
	DI	Closed contact is converted to 0...10 V

	Description
	S15 ASV115 command signal
CqASV	M Command signal from master sensor
	M/S Command signal from master and slave sensor
	S16 change-over switch for maximum selection / sum (master and slave sensor)
	Max When using SGU100 and SVU100
	Sum When using two SGU100s
	S17 change-over switch for control algorithm P/PI
	P Controller operates as P-controller – potentiometer RV10 KP active
	PI Controller operates as PI-controller – potentiometers RV9 TN and RV10 KP active
	S18 change-over switch for control offset for notification from ASV115 or from external specification
	e _{qASV} Volume flow control deviation -e _q of ASV115
	e _{q1} Volume flow control deviation -e _q from internal comparison point

Block diagram (FCIU100F021)



Block diagram (FCIU100F101)



Engineering and fitting notes

The FCCP fume cupboard control unit can be fitted directly onto the fume cupboard with the corresponding mounting frame (accessories) for surface or recessed mounting. It is also possible to integrate it flush into the pillar of the fume cupboard. For this, the installer has to provide the relevant fitting equipment. A template for the required opening is shown in fitting instructions P10000765. The fume cupboard control unit is supplied with a 2.9 m connection cable equipped with connectors for easy fitting. The power supply is via the FCIU interface unit.

The FCIU interface unit can be screwed directly onto the fume cupboard using the mounting rail supplied. Alternatively, it can be mounted onto a top-hat rail (EN 60715).

The unit is powered with 24 V~. A transformer with a sufficient power output must be provided externally.

Disposal

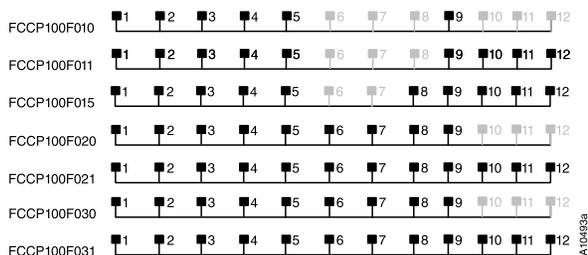
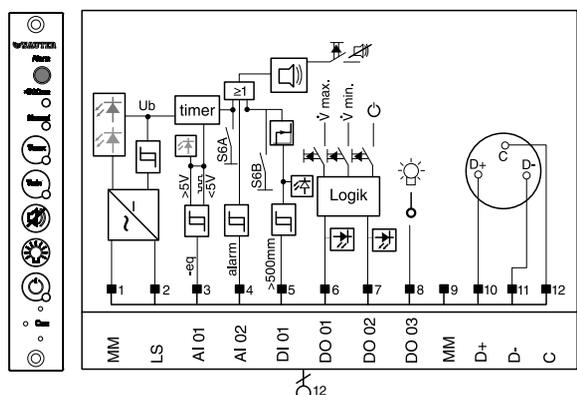
When disposing of the product, observe the currently applicable local laws.

More information on materials can be found in the Declaration on materials and the environment for this product.

Wiring

Cross-section	Length
Min. 0.75 mm ² (AWG20)	Max. 3 m for connected devices such as ASV115, sensors and fume cupboard control unit
Max. 1.5 mm ² (AWG16)	> 3 m for connections to the building management system

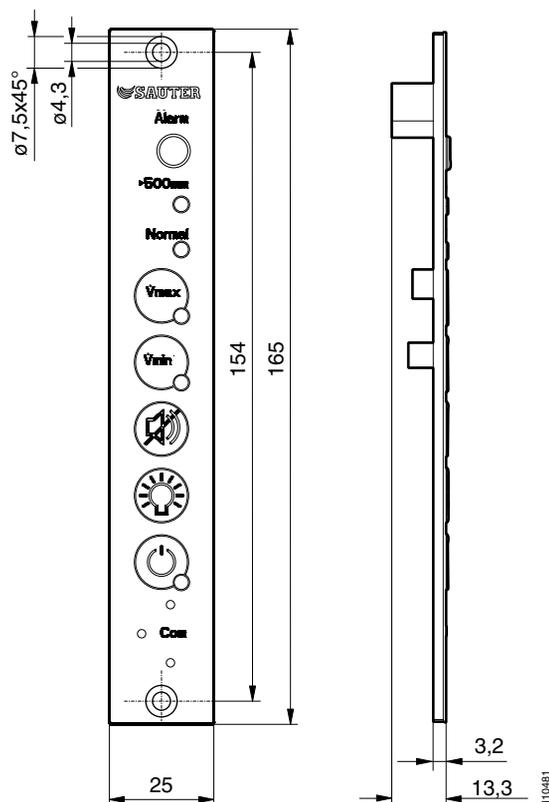
Connection diagram (FCCP)



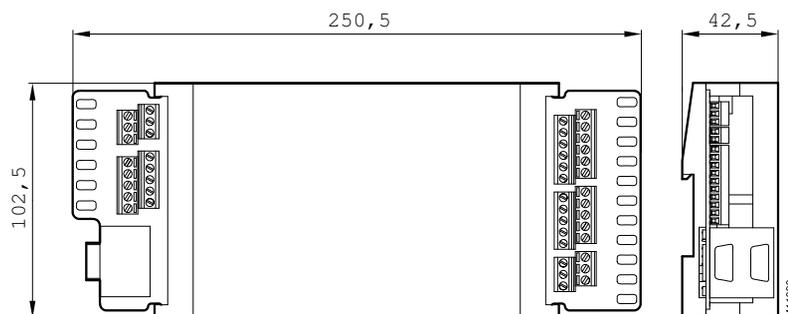
Key

1	MM	BK
2	LS	BN
3	AI 01	RD
4	AI 02	OG
5	DI 01	YE
6	DO 01	GD
7	DO 02	BU
8	DO 03	VT
9	MM	GY
10	D+	WH
11	D-	PK
12	C	GN

Dimension drawing (FCCP)



Dimension drawing (FCIU)



Example applications

Fume cupboard controlling and monitoring

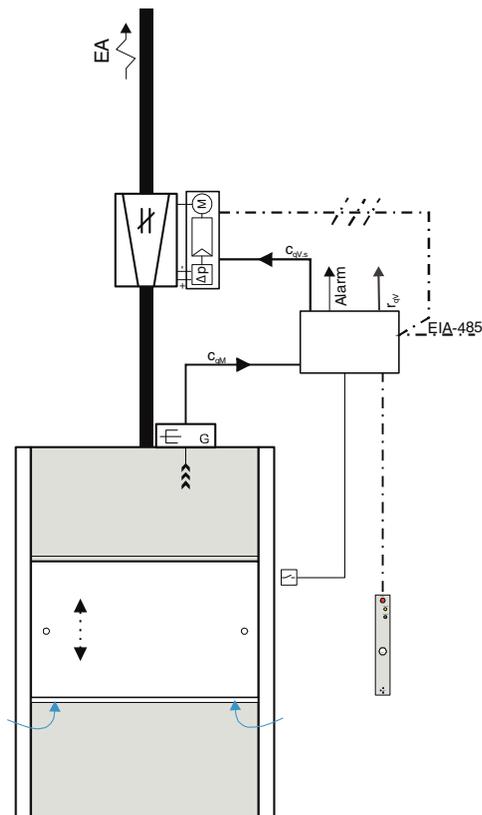
For demand-based volume flow controlling and monitoring in fume cupboards, basically two control strategies are available. Measuring the sash opening via a position sensor with direct setpoint adjustment of the VAV controller for adjusting the volume flow, and the detection of the air inflow speed using a flow sensor and adjustment of the volume flow to maintain a defined air inflow speed to the fume cupboard.

Example 1: Volume flow controlling and monitoring in fume cupboards by detecting the sash position

Return-air volume in proportion to the sash opening of the fume cupboard.

A sensor (6) fitted to the front sash of the fume cupboard, or on the counterweight of the front sash, to detect its position defines the setpoint for the VAV compact controller (1). When the front sash is opened or closed, the volume flow is continuously adjusted between its parameterised minimum and maximum volume flow. This ensures that the fume cupboard is operated with the correct quantity of air in every operating status.

Application for controlling the front sash (SGU)

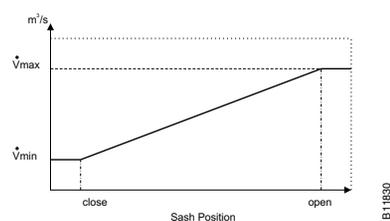


Key

1	ASV115 VAV compact controller
2	FCCP100 fume cupboard control unit
3	FCIU100 interface unit
4	VAV box
5	Contact > 500 mm
6	SGU100 sash sensor

If the actual value differs from the setpoint by more than 15% \dot{V} , a visible and audible alert is triggered on the FCCP100 operating and indicating unit (2). This tells the operator that the fume cupboard is not in a safe condition. The potentiometer and the switch can be used to adjust the alarm duration or the response behaviour for the notification.

Functional diagram for front sash regulation

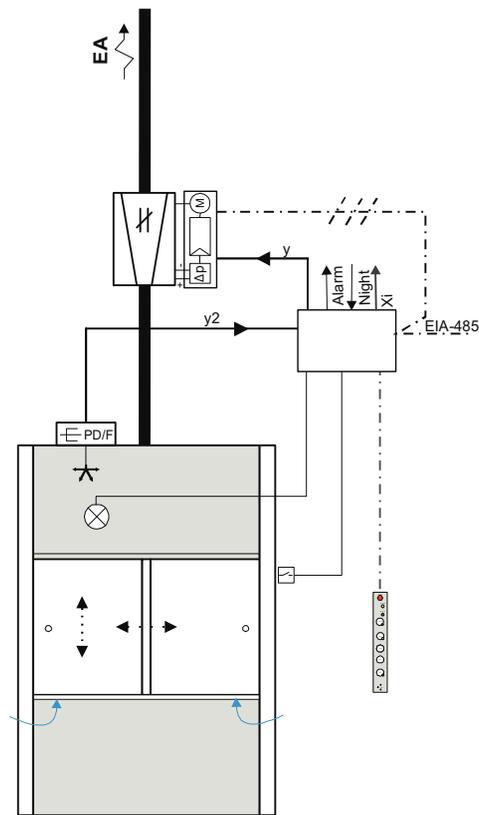


The limit switch (5) can be used to indicate the opening of the front sash by more than 500 mm.

Example 2: Volume flow controlling and monitoring in fume cupboards by detecting the air in-flow speed

The flow sensor (7) installed in the ceiling of the fume cupboard detects the air inflow speed to the fume cupboard. When the front sash is opened, the inflow speed is reduced, with the volume flow the same, to below the defined setpoint.

Application for flow controlling (SVU)

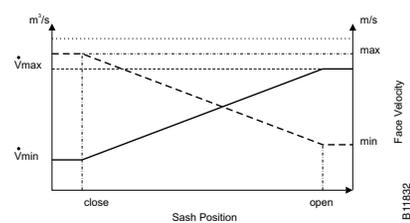


Key

1	ASV115 VAV compact controller
2	FCCP100 fume cupboard control unit
3	FCIU100 interface unit
4	VAV box
5	Contact > 500 mm
7	SVU100 air-flow transducer
8	Lighting

Depending on its control offset, the PI-controller (3) defines a changed setpoint for the VAV controller (1). As a result, the volume flow is adjusted between its parameterised minimum and maximum values until the required inflow speed (0.3...0.5 m/s) is reached. If the volume flow is too low or too high, an alarm is triggered by the monitoring device (2).

Functional diagram for flow controlling



The limit switch (5) can be used to indicate the opening of the front sash by more than 500 mm.