

## FCCP, FCIU: Monitor and indicator for fume cupboards

### How energy efficiency is improved

For reliable, energy-efficient control of fume cupboards

### Areas of application

Monitoring of fume cupboards in accordance with EN 14175-2 with regard to correct operation and ventilation for providing laboratory personnel with maximum safety. Demand-led control of fume cupboards in accordance with EN 14175-6 in conjunction with the ASV115 VAV compact controller.

### Features

- Operating indicator with visual and acoustic alarms in accordance with EN 14175-2
- Air-volume control of fume cupboards, in conjunction with the ASV115, in accordance with EN 14175-6
- A wide range of functions can be achieved using the FCIU interface unit, such as:
  - PI controller for controlling the air inflow speed via ASV115
  - Contact input for signalling front sash opening of greater than 500 mm
  - Light at fume cupboard switched on and off
  - External alarm forwarding via hardware contact
  - Separate input for connecting a second SGU100 front sash sensor
  - Facility for connecting up to two operating indicators for hatch-type fume cupboards
  - External day/night change-over function
  - Combined operation of SVU100 flow sensor and SGU100 front sash sensor is possible
  - Variable delay, or muting, for acoustic alarm
  - Can be used as a simple fume cupboard monitor without volume flow controller
- All adjustable parameters stored and retained in the event of a power failure
- Quick and easy start-up without a PC
- Parameterisation connection for easy access to the ASV115
- Frame for surface- or flush-mounting of operating indicator

### Technical description (FCCP)

- Up to five buttons for:
  - ON/OFF, light ON/OFF,  $V_{min}$ ,  $V_{max}$ , mute
- LEDs for signalling:
  - Operation,  $V_{min}$ ,  $V_{max}$ , normal operation, > 500 mm, alarm
- Power supply via FCIU
- Connecting sockets for ASV115 parameterisation
- Front membrane made from chemical-resistant polyethylene
- Power cable, 2.9 m long, with D-Sub (HD15) connector

### Technical description (FCIU)

- Power supply 24 V~
- Connections for:
  - 1x ASV115
  - 2x D-Sub (HD15) for FCCP
  - 2x SGU 100 front sash sensors or switches with gold-plated contacts
  - 1x SVU 100 flow sensor
- Outputs for:
  - Fume cupboard's actual value of air volume, 0 to 10 V
  - 1x relay: change-over, alarm for external low-voltage circuits
  - 1x relay: NO, 230 V for lighting
  - 1x output (0...10 V) for flow controller
- Inputs for:
  - 1x external volume flow setpoint, 0...10 V
  - 1x external actual value for air volume, 0...10 V
  - 2x contact inputs for front sash opening height > 500 mm
  - 1x contact input
  - 1x contact input for day/night change-over
  - 1x contact input for switching off the fume cupboard externally
  - 1x contact input for motion detector (reduced mode)
- External terminals for EIA-485 wiring

### Products

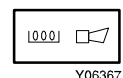
Type	Operation	Voltage
FCCP100F010	Alarm, mute	via FCIU
FCCP100F011	Alarm, mute, parameterisation access	via FCIU
FCCP100F015	Alarm, mute, parameterisation access	via FCIU
FCCP100F020	Alarm, mute, on/off, light	via FCIU



T10616



T10887



Y06367

**Products (continuation)**

Type	Operation	Voltage
FCCP100F021	Alarm, mute, on/off, light, parameterisation access	via FCIU
FCCP100F030	Alarm, mute, light, on/off, $V_{min}$ , $V_{max}$	via FCIU
FCCP100F031	Alarm, mute, light, on/off, $V_{min}$ , $V_{max}$ , parameterisation access	via FCIU
FCIU100F021	Interface unit to FCCP, ASV115 and fume cupboard sensors	24 V~
FCIU100F101	Interface unit to FCCP, ASV115 and fume cupboard sensors, formation of max. selection or totalisation, external setpoint setting	24 V~

**Technical data (FCCP)**

Electrical supply		Installation	
Power supply	24 V~ ± 20% via FCIU 18...38 V=	Dimensions W x H x D (mm)	160 x 21.8 x 16
Power consumption	3 VA	Standards and directives	
<b>Acoustic alarm</b>		Protection class	III
Sound pressure level	80 dB (A)	Protection type	IP 30 with EIA-485
Frequency	4 kHz	(when fitted)	IP 40 without EIA-485
Alarm duration	60 s	Additional information	
Switch-on delay	5 s	Fitting instructions	P100000765
<b>Visual alarm</b>		Material declaration	MD 43.160
Brightness	EN 842, punctiform	Dimension drawing	<a href="#">M10481</a>
Beamwidth	> 120°	Wiring diagram	<a href="#">A10493</a>
<b>Permitted ambient conditions</b>			
Operating temperature	0...50 °C		
Humidity	< 85% RH		
	no condensation		

**Technical Data (FCIU)**

Electrical supply		Permitted ambient conditions	
Power supply	24 V~ ± 20%	Operating temperature	0...50 °C
Power consumption	3.5 VA including FCCP100	Humidity	< 85% RH
<b>Inputs (<math>R_i \geq 100 \text{ k}\Omega</math>)</b>			no condensation
Command signal $C_{q-ext}$	0...10 V	Installation	
NO night	15 V=, 3 mA	Dimensions W x H x D (mm)	250 x 103 x 53
NO CLOSE	15 V=, 3 mA	Standards and directives	
Air-flow sensor	0...10 V	Protection class	II
End switch 500 mm	max. 15 V=, 3 mA	Protection type	IP 00
Front sash 1		Additional information	
End switch closed	max. 15 V=, 3 mA	Fitting instructions	P100002330
Front sash 2		Material declaration	MD 43.160
End switch 500 mm	max. 15 V=, 3 mA	Dimension drawing	<a href="#">M11390</a>
Front sash 1		Wiring diagram	<a href="#">B11643</a>
Change-over day/night	Contact		
<b>Outputs</b>			
Contact: alarm	Change-over switch (24 V~, 8 A)		
Relay switching output: lighting	Normally open contacts (250 V~, 8 A)		
Feedback $x_i$	0...10 V, load > 5 k $\Omega$		
Connections for:	1x ASV115		
	2x SLC (EIA-485)		
	2x CCP (master and slave)		
	2x SGU		
	1x SVU		

**Accessories**

Type	Description
	<b>FCCP</b>
0430240010*	Surface-mounting kit, including frame and fixing parts
0430240020*	Flush-mounting kit, including frame and fixing parts

\*) Dimension drawing or wiring diagram are available under the same number

### Operation

According to EN 14175-2, fume cupboards must be equipped with an operating indicator for monitoring that the outgoing air flow is correct. In order to do this, the quantity of air leaving the fume cupboard is recorded and compared to the outgoing air flow specified by the fume cupboard manufacturer so that the user can be notified of the malfunction, when the air volume is insufficient, by means of acoustic and visual alarms. In conjunction with the ASV115 compact controller and the SGU100 and SVU100 sensors, the FCCP and FCIU monitoring system provides energy-efficient operation and controls the ventilation system as per EN 14175-6. Depending on the components that are used, the following functions can be realised:

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

Integration into a parent building management system is effected by transferring analogue values or switching commands using relay contacts. This makes it possible to have centralised control and monitoring of the fume cupboard.

### Fume cupboard monitoring

Fume cupboards must be equipped with an independently operating monitoring device in accordance with EN 14175. This must have visual and acoustic signalling that indicates to the user that the fume cupboard is operating in an unsafe condition in the event of a malfunction in the ventilation system. In conjunction with FCCP100F010, FCIU100F101 and SVU100F005, this requirement must be met in order to protect the laboratory personnel. The monitoring device can be configured without a PC. It can be installed in new equipment and is easy to retrofit to older fume cupboards.

### Two-point control

Two-point control is the simplest type of demand-led control for fume cupboards. The opening of the front sash is monitored by two limit switches that are attached to the top and bottom of the fume cupboard. A new setpoint is specified for the damper actuator and the volume flow controller by switching the contacts. The setpoint can be used to switch between a minimum (front sash closed) and a maximum (front sash open) volume flow.

### Control depending on front sash position

Compared to fume cupboards with constant air quantities, fume cupboards with variable air quantities are a better solution as far as energy consumption is concerned. Up to 70% of the primary energy source can be saved, depending on the design. In the variant which detects the position of the front sash (SGU100), the air flow is controlled as a direct function of the opening of the front sash. In accordance with EN 14175-6, the target air volume is stabilised within no more than 4 s if the front sash is fully opened (within one second).

### Control depending on air inflow speed

Safe operation of fume cupboards is usually guaranteed if the entry speed of the air at the front sash is within a range of 0.3 to 0.5 m/s. The inflow speed is measured using an SVU100 air-flow sensor that detects the flow direction, which works on the principle of calorimetric measurement. The actual value is compared to the setpoint and used as a command variable for the air volume's control loop.

The system controls the fume cupboard to the specified constant inflow speed, independently of the front sash position (horizontal and/or vertical sash).

### Fully variable control

The combination of the sash sensor (SGU100) and the flow sensor (SVU100) provides fully variable control for fume cupboards with horizontal and vertical sashes. The greater value measured by the sensors (either the height of opening or the low inflow speed) is used to control the air flow. This provides maximum safety and minimum energy consumption.

### FCCP function overview

Button	Operation
$V_{max}$	Emergency operation. When the $V_{max}$ button is pressed, the exhaust air volume is increased to the parameterised volume $V_{max}$ , independently of the front sash position. N.B.: ASV115 can also be assigned the function 'Damper OPEN' instead of $V_{max}$ .
$V_{min}$	Reduced operation. When the $V_{min}$ button is pressed, the exhaust air volume flow is reduced to the parameterised volume flow $V_{min}$ , independently of the front sash position.
Mute	Manual acknowledgement of the acoustic alarm. The acoustic alarm is automatically muted after approx. 60 sec..
Light	Switches the light in the fume cupboard on and off. Operation is independent of the current status of the fume cupboard
I/O	Button for switching the fume cupboard on/off. When the fume cupboard is switched on, it is switched to its general operating status, i.e. the exhaust is opened and ventilation monitoring starts. When the fume cupboard is switched off, the damper of the controller is moved to the parameterised position (factory setting: CLOSED) and all monitoring functions are deactivated.

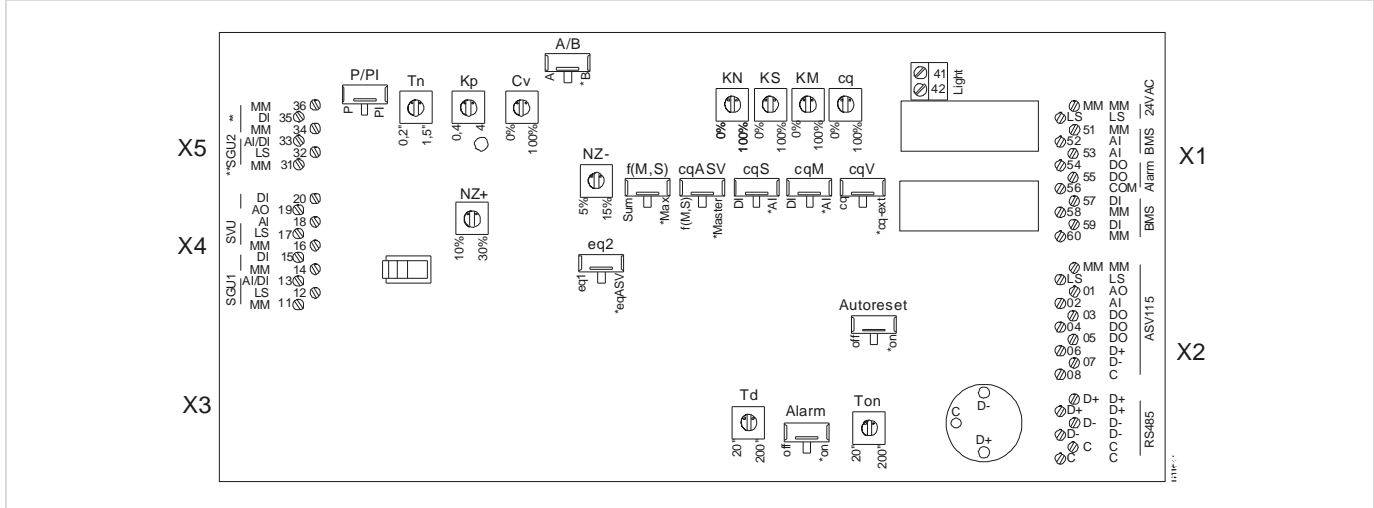
LED	Colour	Operation
Alarm	Red	Optical indication of alarms. Becomes active when the actual value deviates from the specified setpoint by more than 15%. If the maximum permissible difference in air volume is undercut (fault) or the limit value of 10% air volume is undercut, this is indicated by the regular flashing of the alarm LED. If the maximum permissible difference in air volume is exceeded, this is indicated by the alarm LED being continually lit.
> 500 mm	Yellow	LED is active if the front sash of the fume cupboard is opened by more than 500 mm and the contacts attached to the fume cupboard close.
Normal	Green	Status signal: indicates that the fume cupboard is operating properly.
$V_{max}$	Yellow	Indicates that the $V_{max}$ function has been activated
$V_{min}$	Red	Indicates that the $V_{min}$ function has been activated
I/O	Green	Indicates that the fume cupboard has been switched on
	Red	Indicates back-up operation (if battery is fitted)

Connection	Operation
COM	3-pin plug connection for configuring a connected ASV115 controller.

### FCIU operation

The FCIU interface unit provides the connection between the fume cupboard control unit and other system components. The device has various connections for this purpose. Depending on the application, it is not strictly necessary to use this unit. If the SGU100 sash-measuring system is employed, this can also be used to set the setpoint for the ASV115, without having an FCIU connected.

**Wiring diagram (FCIU)**



The power supply connections X1 also supply all the connected devices with power, so this must be taken into account when choosing the output of the transformer.

The following power consumption figures are typical:

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

A fully equipped FCIU100 has, therefore, a power consumption of minimum 23 VA.

The relay contacts at terminal 54 or 55 can be used to forward an alarm in the event of a fault occurring in the fume cupboard. These contacts function as a change-over switch. By means of the digital input at terminal 57, it is possible to change over between day and night modes using the building management system. If the night mode is activated, the air volume is reduced to the level set on the ASV115. If the fume cupboard is open at the time of the night mode and if the monitored variable (volume flow or flow actual value) is over 10 % of the measuring range, no alarm is triggered. The function for completely switching off the fume cupboard externally is available by using the digital input at terminal 59. This function is the same as on the FCCP100 - that is, 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).

**Interface Building Management System/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 ASV115
54 (DO)	Alarm for fume cupboard, NC relay contacts
55 (DO)	Alarm for fume cupboard, NO relay contacts
56 (COM)	Alarm for fume cupboard, relay contacts for common connection
57 (DI)	Digital input, NO contacts to ground, day/night change-over function
58 (MM)	Ground
59 (DI)	Digital input, NO contacts to ground, function for switching off the fume cupboard externally
60 (MM)	Ground

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

**Terminal ASV115**

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 connector on the X3 should be used to connect the FCCP100 function indicators for the fume cupboard.

**Note:** When connecting the FCCP100 to an ecos@5 automation station, you must connect the digital outputs of the FCCP 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.

If the slave connection is used, the relevant DIP switch on the FCCP100 should be put to the correct position as described in the fitting instructions P100000765. The acknowledgement of an alarm is always effected on the master FCCP100 operating unit. If operating units that do not have all the functions are included, the relevant connectors are unoccupied.

**Terminal FCCP100 master (below) / slave (above)**

X3	Description
01 (MM)	Ground
02 (LS)	24 V~ power supply
03 (AI 1)	Output for target/actual values for deviation (-e <sub>a</sub> )
04 (AI 2)	Output for alarm
05 (DI 1)	Input for contacts for sash opening > 500mm
06 (DO 1)	Input V <sub>max</sub> to ASV115 (master only)
07 (DO 2)	Input V <sub>min</sub> to ASV115 (master only)
08 (DO 3)	Input for lighting; switches relay (master only)
09 (MM)	Ground
10 (D+)	EIA-485 Tx
11 (D-)	EIA-485 Rx
12 (C)	EIA-485 ground

## FCCP, FCIU

The X4 connector is used to connect the fume cupboard's sensors. Either a sash-sensor system or an air-flow sensor can be used. Since it is not possible to use the actual value as the setpoint for the air volume's control loop when measuring and regulating the air flow, an additional PI-controller should be connected. This compares the setpoint with the actual value and makes from this the command signal for the VAV. The front sash opening > 500 mm is indicated via connector 15 in accordance with EN 14175.

### Connector for sensor on front sash 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; position of main sash (SGU100) via sash sensor system or contacts
14 (MM)	Ground
15 (DI)	Digital input, end switch 500 mm, NO 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 inlet speed (actual value) SVU100
19 (AO)	Analogue output, PI-controller output 0...10 V
20 (DI)	Digital input, occupancy detector, NO contacts to ground


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












### Connector for sensor for front sash 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; position of slave via sash sensor system or contacts
34 (MM)	Ground
35 (DI)	Digital input, end switch 500 mm, NO contacts to ground
36 (MM)	Ground

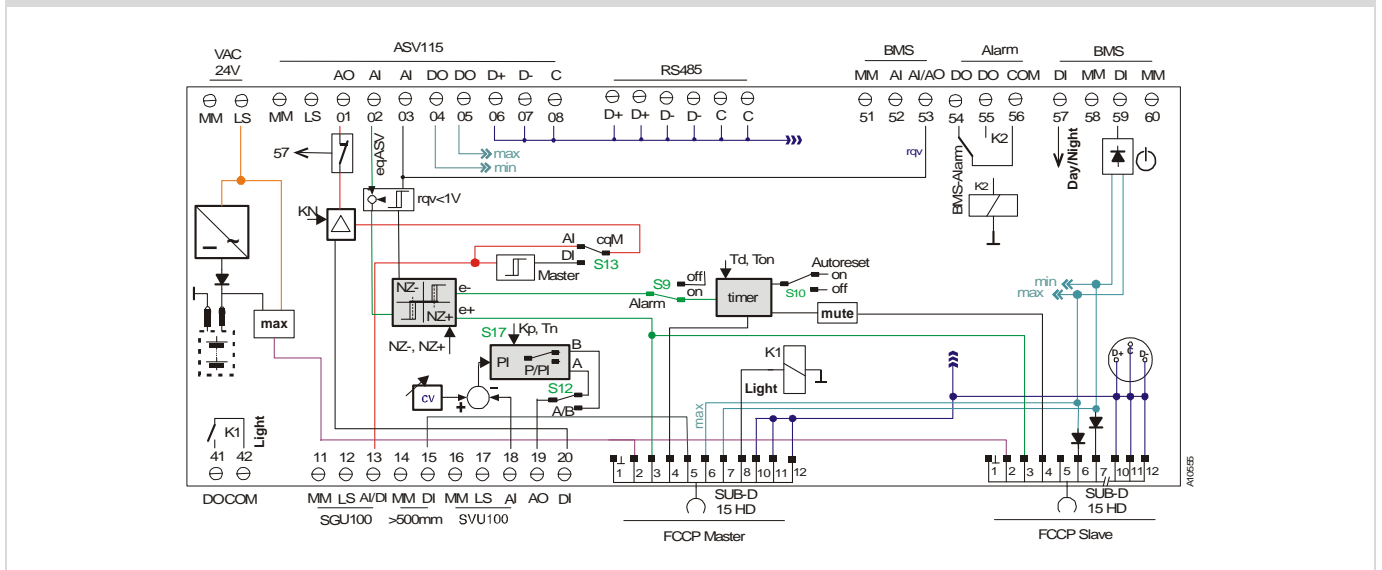
### Potentiometer and switches

Plant-specific settings on the FCIU can be done using the existing potentiometer (RV) and switches (S).

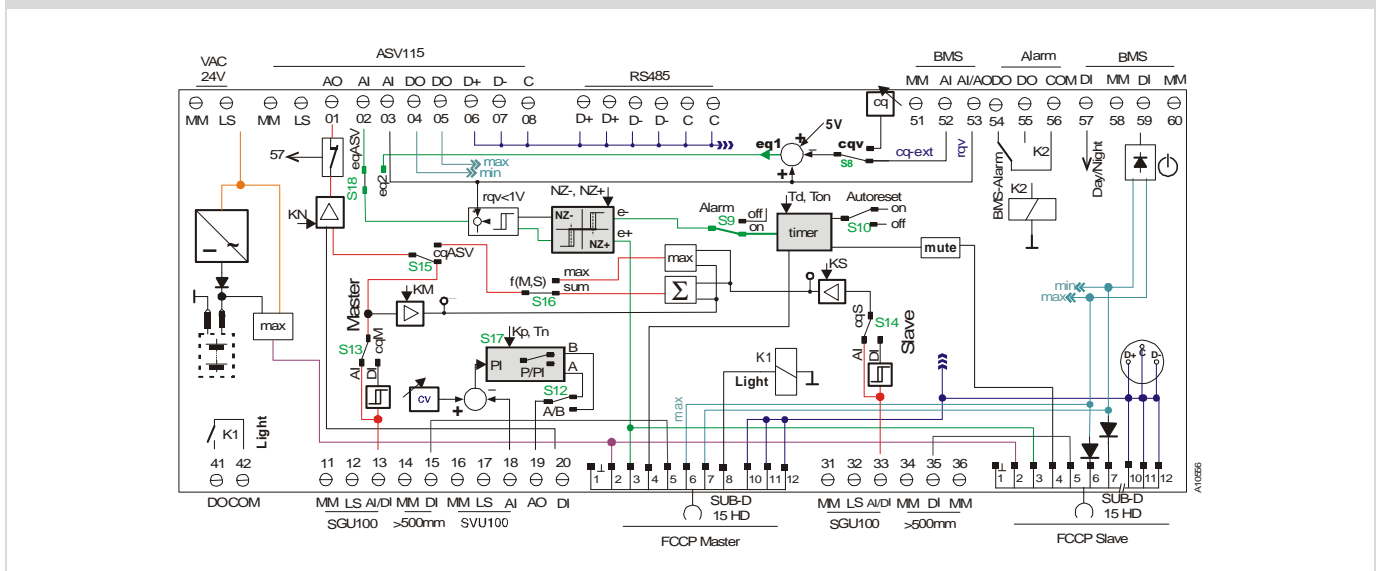
Code		Range	Description	
RV1	KM	0...100%	Weighting of the master sensor signal	100%
RV2	KS	0...100%	Weighting of the slave sensor signal	100%
RV3	NZ+	10...30%	Alarm given when $r_q > c_q$ ; air volume too high	20%
RV4	NZ-	5...15%	Alarm given when $r_q < c_q$ ; air volume too low	10%
RV5	$c_q$	0...100%	Internal setpoint for the summation point	100%
RV6	$T_d$	20"...200"	Delay time for the acoustic alarm	110"
RV7	$T_{on}$	20"...200"	Duration of acoustic alarm	110"
RV8	$c_v$	0...100%	Setpoint for the internal PI control loop when air flow is monitored	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 for setpoint reduction; activated by NO contacts at terminal 20 (flexible night set-back or connected movement sensor)	100%

			Description
<b>S8 Change-over for setpoint for alarms</b>			
C <sub>qv</sub>		C <sub>q-int</sub>	Internal setpoint of RV5
		C <sub>q-ext</sub>	External setpoint given by Building Management System (BMS)
<b>S9 Change-over for acoustic alarm</b>			
Alarm		On	Acoustic alarm sent to function indicator is inactive
		Off	Acoustic alarm sent to function indicator is inactive
<b>S10 Automatic deactivation of acoustic alarm</b>			
		On	When the set time T <sub>on</sub> (RV7) has elapsed, the acoustic alarm is deactivated automatically
		Off	Acoustic alarm must be acknowledged manually
<b>S12 Knob for selecting the control action</b>			
A/B		A	Works directly
		B	Works indirectly
<b>S13 Knob for selecting between sensor or switching input (sensor for master)</b>			
C <sub>qM</sub>		AI	0...10 V at input is forwarded directly
		DI	Closed contacts converted to 0...10 V
<b>S14 Knob for selecting between sensor or switching input (sensor for slave)</b>			
C <sub>qS</sub>		AI	0...10 V at input is forwarded directly
		DI	Closed contacts converted to 0...10 V
<b>S15 ASV115 command signal</b>			
C <sub>qASV</sub>		M	Command signal from sensor for master
		M/S	Command signal from sensor for master and slave
<b>S16 Change-over for maximum selection/sum for sensor for master and slave</b>			
		Max	When using SGU100 and SVU100
		Sum	When using two SGU100s
<b>S17 Change-over for control algorithm P/PI</b>			
		P	Controller works as a P-controller: potentiometer RV10 KP is active
		PI	Controller works as a PI-controller: potentiometers RV9 TN and RV10 KP are active
<b>S18 S16 Change-over for control deviation for alarms from ASV115 or from external source</b>			
		e <sub>qASV</sub>	Air volume control deviation -e <sub>q</sub> from ASV115
		e <sub>q1</sub>	Air volume control deviation -e <sub>q</sub> from internal reference point

Block diagram (FCIU100F021)



Block diagram (FCIU100F101)



**Engineering and fitting notes**

With an appropriate mounting frame (accessory), the FCCP laboratory extraction control unit can be directly attached to the fume cupboard for surface or flush mounting. Direct flush integration in the pillar of the fume cupboard is also possible. The client must provide the appropriate mounting kit order to do this. A template for the requisite cut-out is shown in fitting instructions P100000765. The laboratory extraction control unit is supplied with a 2.9 m long connecting cable that is equipped with connectors for ease of installation. The power supply is provided by the FCIU interface unit.

The FCIU interface unit can be screwed directly to the fume cupboard with the mounting rail provided. Installation onto a top hat rail (EN 60715) is also possible. The unit is supplied with 24 V~. An external transformer with adequate output must be provided.

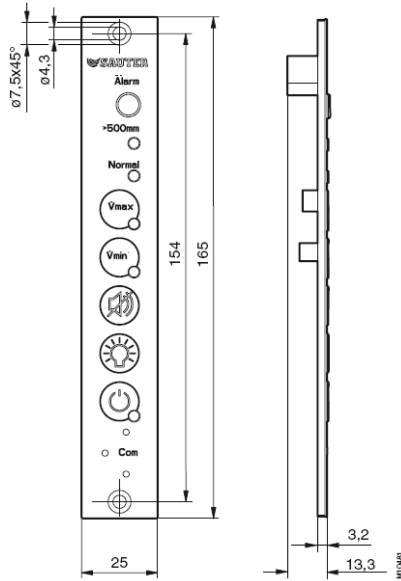
**Conductor and cable**

min. 0.75 mm <sup>2</sup> (AWG20)	max. 3 m for connected devices such as ASV115, sensors and fume cupboard control unit
max. 1.5 mm <sup>2</sup> (AWG16)	> 3 m for connections to the building management system (BMS)

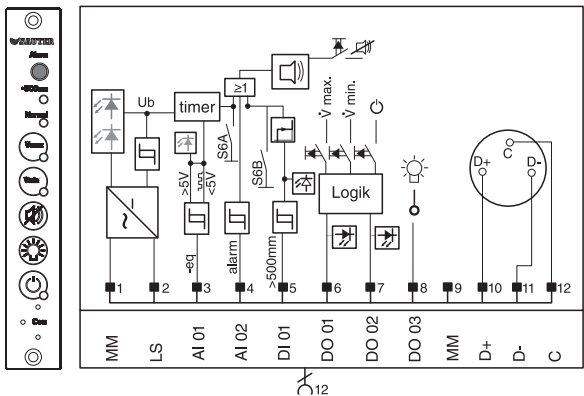
**Additional technical data**

CE Conformity as per	
EMC Directive 2004/108/CE	EN 61000-6-1/ EN 61000-6-2
	EN 61000-6-3/ EN 61000-6-4
Directive 2006/95/CE	EN 60730-1
Fume cupboards	EN 14175-2/ EN 14175-6
Visual danger signals	EN 842, 1996-06
Acoustic danger signals	EN 457, 1992-02

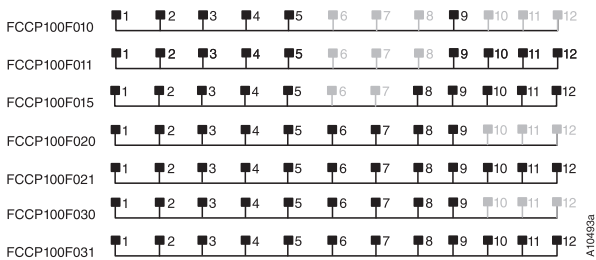
**Dimension drawing (FCCP)**



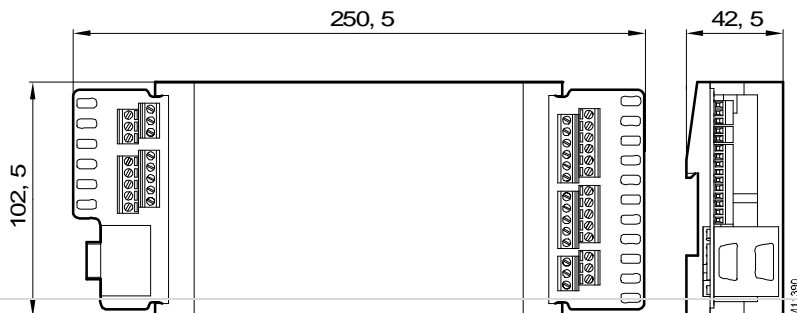
**Wiring diagram (FCCP)**



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



**Dimension drawing (FCIU)**





**Examples of use**

**Fume cupboard control and monitoring**

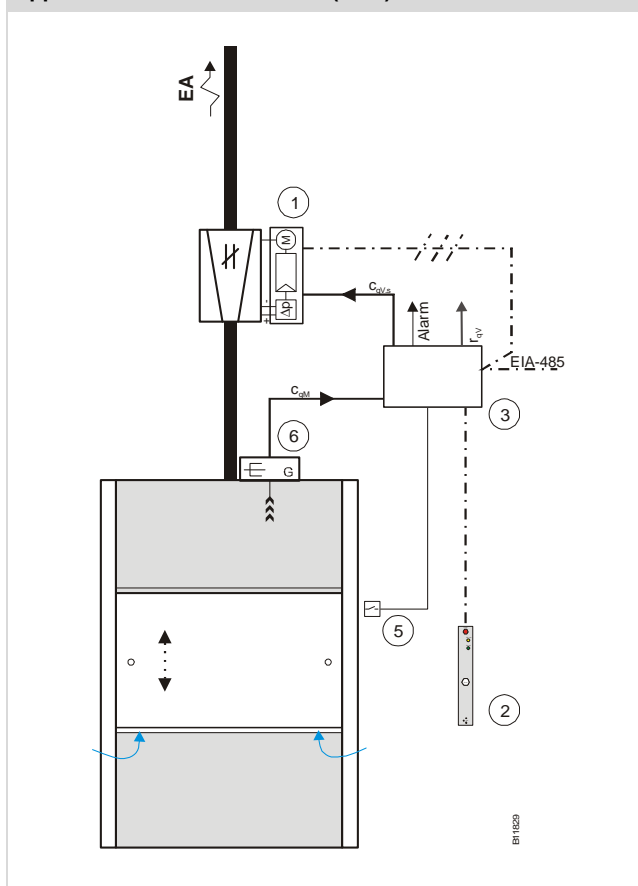
Two basic control strategies are available for demand-led fume cupboard control and monitoring: (i) measurement of front sash opening using a position sensor with direct setpoint adjustment for the controller in order to adjust the air volume; and (ii) measurement of the air inflow speed using a flow sensor, and adjustment of the air volume in order to maintain a specified air inlet speed in the fume cupboard.

**Example 1: Volume flow control and monitoring of fume cupboards by recording the front sash control**

Outgoing air quantity controlled proportionally to the sash opening of the fume cupboard.

A sensor fitted either to the front sash of the fume cupboard or on the counterweight of the front sash (6) determines the setpoint for the compact actuator (1). When the front sash is opened or closed, the air volume is continually regulated between its configured minimum and maximum levels. This ensures that the fume cupboard is run with the right quantity of air in any operating state.

**Application: front sash control (SGU)**

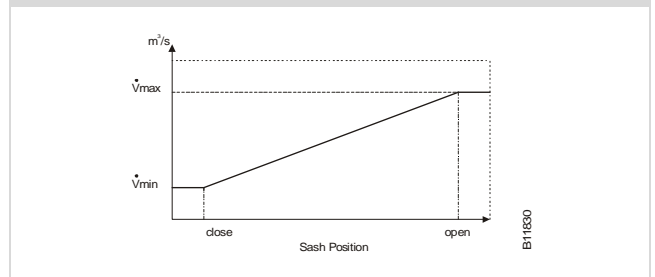


**Legend**

1	ASV115 VAV compact controller
2	FCCP100 control panel
3	FCIU100 interface unit
4	Air volume box
5	Contacts > 500 mm
6	SGU100 sash sensor

An optical and an acoustic alarm are triggered on the FCCP 100 control panel (2) whenever the difference between target and actual values exceeds 15%  $\dot{V}$ . This indicates to the operator that the fume cupboard is in an unsafe condition. The duration of the alarm or its response characteristic can be adjusted by means of a potentiometer and a switch.

**Functional diagram for front sash control**

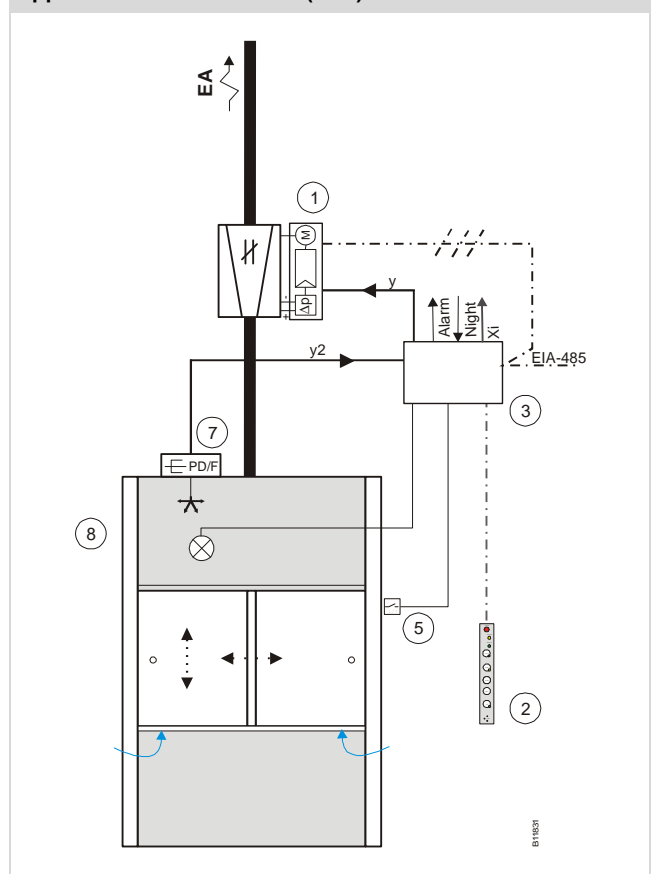


The limit switch (5) can be used to indicate whether the opening of the front sash exceeds 500 mm.

**Example 2: Volume flow control and monitoring of fume cupboards by recording the air inflow speed**

The air-flow sensor (7) fitted in the ceiling of the fume cupboard measures the air inlet speed in the fume cupboard. If the front sash is opened, the air inlet speed falls below the setpoint, though the air volume remains the same.

**Application: air flow control (SVU)**



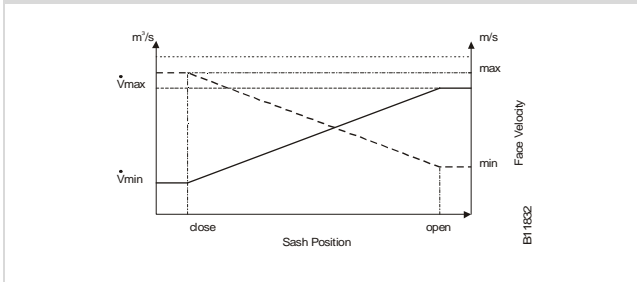
**Legend**

1	ASV115 VAV compact controller
2	FCCP100 control panel
3	FCIU100 interface unit
4	Volume flow box
5	Contacts > 500 mm
7	SVU100 sash sensor
8	Light

The PI-controller (3) gives a different setpoint to the controller (1) in relation to the control deviation. This causes the air volume to be regulated between its configured minimum and maximum levels until the required inlet speed (0.3...0.5 m/s) is attained. If the air

volume is too low or too high, an alarm is triggered at the monitoring facility (2).

**Functional diagram for air flow control**



The limit switch (5) can be used to indicate whether the opening of the front sash exceeds 500 mm.