AFA 1000/E

Fume Cupboard ECON VAV Controller

Operating and Instruction Manual

Model AFA1000 / E – Mk2

- Digital display
- 3 Relay inputs
- 3 Relay outputs
- 3 Pushbuttons
- Com port
- VAV Control output

Used for alarm indication , monitoring and VAV control on Fume Cupboards

Issue: Jan 08

OPERATOR DISPLAY PANEL

VAV Output Bar Graph or Alarm Time Line

Velocity display m/sec or fpm

Control Pushbutton functions

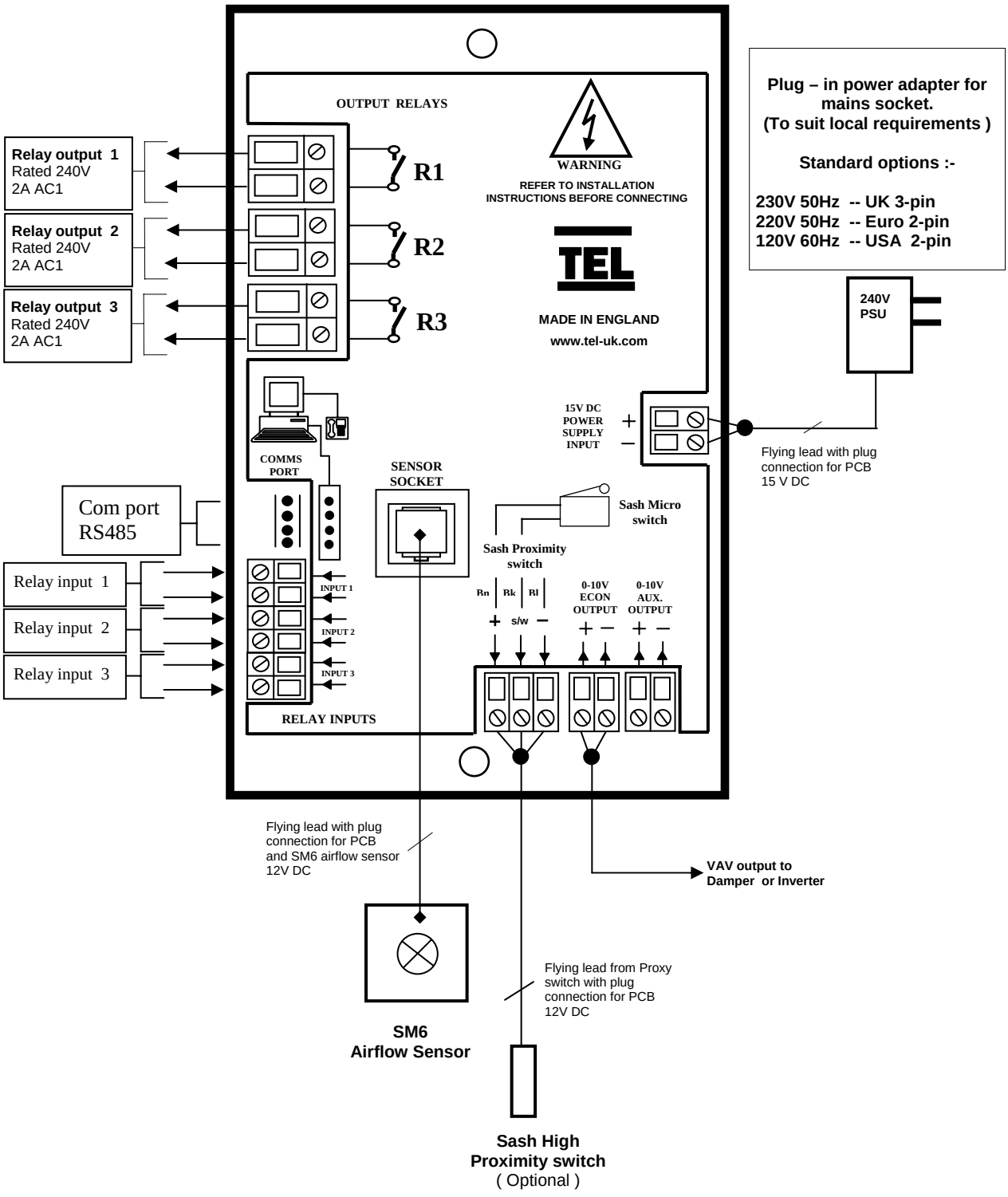
Control Pushbuttons

LED indicators

Function and up/down buttons for Menu Configuration and Calibration.
ENTER – also used as Mute button for audible alarm

Note :- Access to the Calibration and Configuration menus is password protected and is factory set. To access and or change the password contact the supplier for the Engineers Password and enter the Passwords in the Main Menu or alternatively use a Laptop connected to the Com port and the Upload/Download software provided

Connection details :-



1.1 General Description

All systems comprise of the following components :-

1 – SM6 Airflow Sensor,
1 – AFA1000 / E VAV Controller / Alarm unit,
1 – ECON power supply unit
1 - Electrical Damper actuator (when using Damper control)

If the Sash Alarm System option is included there will also be a sash micro switch or proximity switch.

Operator Features --- the controller / alarm has the following operator features :-

Digital Display

The digital display is a back-lit, full graphic unit with a visual display of approx 56 x 27 mm. The display operates through the software allowing the generation of figures, wording and Icons.

The display shows the fume cupboard face velocity in **m/sec** or **fpm** when enabled or the alternative with no velocity reading but showing **AIR FAIL / AIR SAFE** as continuous display. All of the above are configurable via the alarm key pad.

An ' **event time line** ' segmented into 20 x 3 minute segments will scroll across the display (when enabled) .This takes the form of a graphical ' blip' that will progress from the right hand side to the left hand side – representing events that have occurred during the past hour. The alternative to the event time line is a dynamic ' **bar graph** ' representing the **VAV 0-10V Control Output**

The display shows a **Horn** icon (with line through it) when the audible alarm is in the Muted condition

Sash High – will be displayed when the Sash alarm is enabled and the sash is raised above the max safe working opening.
This display will alternate on/off with the velocity reading.

Emergency – will be displayed when the Emergency input is activated (when enabled)
This display will alternate on/off with the velocity reading

Air Fail - will be displayed if the airflow is less than the Low air alarm point.
This display will alternate on/off with the velocity reading

High Air - will be displayed if the airflow is more than the High air alarm point.
This display will alternate on/off with the velocity reading

Set-back - will be displayed if the night set-back function is activated (when enabled)
This display will alternate on/off with the velocity reading

Disabled - will be displayed if the alarm disable function is activated (when enabled)
This display will alternate on/off with the velocity reading

Pushbutton 1 -- This button can be configured to act as a **Fan stop / start** button for the fume cupboard extract fan or as **Night Set-back Override**

Pushbutton 2 --This button can be configured to act as a **Lights ON / OFF** or **UV Lights On/OFF** for the fume cupboard or **Pump stop / start** button for a fume cupboard scrubber pump.
(Can be interlocked with Pushbutton 1)

Pushbutton 3 -- This button can be configured to act as a **VAV Purge ON/OFF** button or **VAV Min / Normal** or **VAV Min / Normal / Max**

Fan ON / OFF -- will be displayed if the Fan button is operated (when enabled).

Lights ON / OFF -- will be displayed if the Lights button is operated (when enabled).

UV Lights ON / OFF -- will be displayed if the UV Lights button is operated (when enabled).

Pump ON / OFF -- will be displayed if the Pump button is operated (when enabled).

Purge ON / OFF -- will be displayed if the Purge button is operated (when enabled).

MIN -- will be displayed if the MIN function is activated (when enabled).

RUN -- will be displayed if the Normal function is activated (when enabled).

MAX -- will be displayed if the MAX function is activated (when enabled).

LED Indicators ---- the alarm unit has three LED indicators :-

Red -- Alarm
Amber -- Caution
Green -- Safe

Audible Alarm sounder -- the alarm has an audible alarm sounder with local or remote Mute facility

Enter --- the controller / alarm has an Enter button -- this is multi-functional as follows :-

Press **Enter** momentarily when alarm is sounding will mute the alarm

Press **Enter** for 5 secs will gain access to **Calibration** and **Configuration** menus (both menus password protected)

+ / - -- the alarm has + / - buttons that can be used to scroll through the calibration and configuration menu or to select options or values

External Connections -- the alarm unit will have the following connection points :-

Input 1 --- volt free relay input configurable for normally closed or normally open relays

This input can be configured as :-

Alarm disable
Night set-back
Emergency
Sash High
High / Low

Input 2 --- volt free relay input configurable for normally closed or normally open relays

This input can be configured as :-

Alarm disable
Night set-back
Emergency
Sash High
High / Low

Input 3 --- volt free relay input configurable for normally closed or normally open relays

This input can be configured as :-

Alarm disable
Night set-back
Emergency
Sash High
High / Low

Output 1 --- volt free relay output configurable as normally closed or normally open relays.

Output 2 --- volt free relay output configurable as normally closed or normally open relays.

Output 3 --- volt free relay output configurable as normally closed or normally open relays.

Output 4 --- 0-10V (2-10V) control output – configurable direct or indirect action

Com Port --- to enable connection to Laptop or PC for full diagnostics , logging or setting up and for communications to building computer system (BMS)

Power supply --- low voltage DC power supply

Airflow Sensor --- connection socket for the face velocity airflow sensor.

1.2 VAV Control / Alarm Configuration and Calibration

The controller / alarm can be configured via a Laptop or PC using a variety of 'set up' programs each designed for a particular application with a combination of inputs , outputs and push buttons.
This configuration can be changed via the alarm key pad using the menu system if required or re-configured by re-connection of the laptop or PC.

This allows the fume cupboard manufacturer to stock standard units and configure the controller / alarms to suit the application.

The configuration of the various functions and the calibration of the controller / alarm display is menu driven. Access to the menu will be via password (4 digit number) and will be two level. The first level will be for calibration of the unit and the second level will be for 'engineers' to set up the configuration of the alarm.

NOTE:- If you enter the Calibration or Configure Menu by accident :-
press the + & - buttons at the same time to escape back to the Main Menu

The menus and sub–menus are in ' plain language ' and incorporate brief instructions where appropriate.

See menu operation document

1.3 Start up

When unit is powered up the following sequence of events occur :-

1. The 12V DC power is applied to the airflow sensor and a delay on timer is initiated.

2. The alarm then performs a self test on the display and all indicators etc (approx 5 sec)

3. At the end of the delay the unit performs one of two options :-

   a. If the alarm calibration has been previously complete – the unit goes to normal operating mode (Run)

   b. If the unit has not been calibrated the unit displays
   " Unit requires Set up -- press Enter to access Set up menu "
   The set up menu allows calibration or configuration via the password protection

During the set-up all alarms and output relays are inhibited.

1.4 Events / actions

Safe airflow

- Meter reading above warning level (eg > 0.45 m/sec)
- Green LED on

Warning airflow

- Meter reads between warning level and air fail level (eg > 0.40m/sec and < 0.45 m/sec)
- Amber LED on

Low airflow

- Meter reads below alarm level for longer than the warning to low air delay time
- **AIR FAIL** toggles on / off with display
- Red LED on (Flashing)
- Audible alarm sounds -- can be muted via Enter pushbutton
- Low air relay operates (if configured)

Reset :- when airflow rises 0.02m/sec above Low air level for longer than the low air to warning air delay time the Low air alarm resets automatically

High airflow
If configured :-

- **High Air** toggles on / off with display
- Audible alarm sounds – can be muted via Enter pushbutton.

Audible alarm Mute

- When the audible alarm is muted via the Enter button - an Icon (horn with forward slash) is shown on the display.

Sash High

- When the input configured as Sash High is activated
- Amber LED on
- **Sash High** – toggles on / off with velocity display
- Audible alarm sounds
- Audible can be muted via Enter pushbutton -- this silences the alarm and initiates a repeat timer (if configured). After the delay time the alarm re-sounds (and can be re-muted). During this time the Amber LED flashes on / off.
- Sash High relay operates (if configured)

Reset:- when Sash lowered to safe position and input de-activated.

High / Low

- When input configured as High/Low is activated
- Display Icon shows **High** or **Low**
- High / Low relay operates (if configured)

This function is designed for two speed fan operation or two position damper operation switched via a micro switch or proximity switch activated at a given position on the sash.

Night set-back

- When input configured as Night set-back is activated
- Night **Set-back** Icon displayed on meter
- Unit is driven to the **VAV MIN** operating position
- Audible alarm muted
- Mute Icon shown on display

Emergency

- When input configured as Emergency is activated
- Red LED on (Flashing) – (if configured)
- **Emergency** toggles on /off with display -- (if configured)
- Audible alarm sounds – can be muted via Enter pushbutton
- Emergency alarm relay operates (if configured)
- Unit is driven to the **VAV MAX** operating position

Note:- The external Emergency input can be a remote relay contact or a local Emergency Stop stay-put pushbutton.

Alarm disable

- When input configured as Alarm disable is activated
- Alarm **Disabled** displayed
- Red LED on (Flashing)
- Audible alarm muted
- Mute Icon shown on display

Pushbutton 1 -- Fan Stop / Start

- Fan start relay operates
- Display shows **Fan On/Off**
- Run up timer for 2nd relay – Amber LED flashes on / off (if configured)
- Run down timer for fan start relay --- Amber LED flashes on / off (if configured)
- Interlock with Pushbutton 2 (if configured)

or

Pushbutton 1 -- Override On / Off

- Relay operates (if configured)
- Red LED flashes on/off
- Audible alarm muted
- Meter displays **Override On/Off**
- Disables Night setback operation in **Override On** condition

Note:- In the **On** condition the unit ignores any Night Set-back input signals and remains in this condition until **Off** is selected

Pushbutton 2 -- Pump On / Off , Light On / Off , UV Light On / Off ,

- Relay operates
- Pump , Lights , UV Lights Icon shown on display (if configured)
- Interlock with Pushbutton 1 (if configured)

Pushbutton 3 -- Purge On/Off

- Relay operates -- (if configured)
- Red LED on (Flashing) – (if configured)
- **Emergency** toggles on /off with display -- (if configured)
- Audible alarm sounds -- can be muted via Enter pushbutton
- VAV output goes to Max
- Re-sets to VAV to normal Run condition after time delay

or

Pushbutton 3 -- Min / Normal

- VAV output switches between Min and Run conditions

or

Pushbutton 3 -- Min / Normal / Max

VAV output switches between Min , Run and Max conditions

Note:- When MIN is selected via pushbutton 3 the unit goes to a pre-set fixed low extract condition and displays **'Standby'**

2.1 Quick Start Installation

Follow the instructions below for installing and commissioning the unit. :-

1. Fit the AFA1000/E unit to the Fume Cupboard using the cut-out details provided with the unit --- see page 17

2. Fit the airflow sensor to the Fume Cupboard using the cut out and installation details provided --- see page 17 &18

3. Connect the 'telephone style' airflow sensor plug-in cable to the sensor and the back of the AFA1000/E unit --- see typical connection diagram on page 19

4. For Damper control plug in the flying lead with the 'telephone style' connector to the ECON power supply unit and the other end of the cable to the connection socket on the back of the AFA1000/E unit --- see typical connection diagram on page 19.

5. For Inverter control --- see typical connection diagram on page 20.

6. Plug in the Mains AC power plug on the flying lead to the ECON power supply unit. --- see typical connection diagram on page 19.

7. Power up the unit and wait at least 30 secs while the sensor temperature stabilises.

8. If the unit has not been calibrated the unit will display 'Requires setup' – press ENTER to continue and in the 'Main Menu' use the +/- buttons on the alarm facia to select 'SETUP' and then press the ENTER button.

9. In the Setup Menu select 'CONFIGURE' and press the ENTER button

10. At this stage you will be requested to enter the PASSWORD. Use the +/- buttons to select the individual digits in turn and then press ENTER. If the password is correct the unit will go to the 'Configure Menu'. If the password is not correct you will be requested to try again --- on the third wrong password entry the calibration menu will lock out for 10 mins

11. In the 'Configure Menu' select 'ECON configure ' and go to 'Manual / Automatic'. Select 'Manual' then open the Sash to the normal max safe working opening and use the +/- buttons to adjust the face velocity to the design value eg 0.5m/sec. When completed select 'Done' to return to the Main menu.

12. In the 'Main menu' select 'Setup' and go to 'Calibration'

13. At this stage you will be requested to enter the PASSWORD. Use the +/- buttons to select the individual digits in turn and then press ENTER. If the password is correct the unit will go to the calibration mode. If the password is not correct you will be requested to try again --- on the third wrong password entry the calibration menu will lock out for 10 mins

14. When in the calibration mode follow the instructions on the display screen to carry out the calibration of the unit.
See Calibration Notes below for hints on successful calibration.
When the calibration is complete the unit will return to the Main Menu.

15. In the 'Main menu' select 'Setup' then go to 'Configure' (using the password) followed by 'ECON configure' followed by 'Manual / Auto'. Select 'Automatic' followed by 'Done' to return to the 'Main menu'. Select 'Run' and the unit will operate in automatic control mode --- **See Operation Notes below for operational settings.**

2.2 Calibration Notes :-

1. When using a standard Fume Cupboard with Vertical Sliding sashes open the sash to the normal max safe working height to manually set the initial design face velocity in the 'Manual mode' and use this same position for the Low Air sample.

2. For the Higher Air sample close the sash to approx 50% of the opening used for the Lower Air sample while still in the 'Manual mode'. If the Higher air sample value is too close to the Lower Air sample the alarm will detect this and ask you to repeat with a higher value. To do this close the sash a little more and repeat the sample. Avoid closing the sash below 100mm.

3. The face velocity readings on the open sash may vary at different points on the measuring grid by up to 0.1m/sec. This is quite acceptable in terms of the fume cupboard performance so long as no individual point is below the designated Low Air alarm point .The figure entered for the calibration point can be taken as the average value of all the measuring grid readings or could be taken as the individual lowest point on the grid. For most Fume cupboards this low point is on the bottom row in the centre and is a convenient position to measure and for future reference when checking the alarm during annual maintenance.

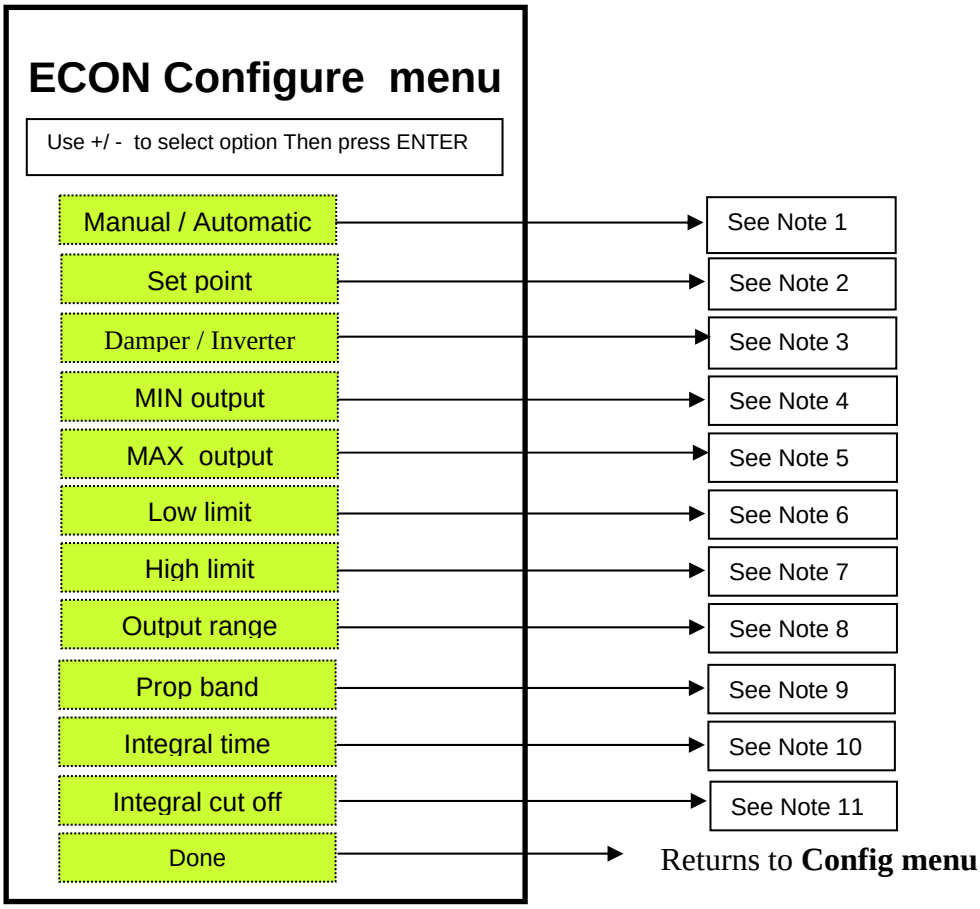
4. Take time when measuring the face velocities for the calibration procedure to allow for the velocities across the open sash to stabilise. If the velocities are changing or are turbulent during the sampling period the alarm will detect this and ask you to repeat the sample.

5. When using a Fume Cupboard with Horizontal Sliding sashes open the sashes to the normal max safe working opening for the Manual setting and the Low Air sample.

6. When calibrating or re-calibrating the alarm it is important to ensure that the 'Vent kit' is connected to the SM6 sensor on the fume cupboard. If the vent kit is not connected the sensor will not 'see' a change in the airflow during the calibration procedure and will ask you to " check the sensor ". This only applies during the calibration mode. If in normal running after successful calibration the vent kit becomes disconnected the air flow across the sensor will fall and the alarm will go into the AIR FAIL condition and the ECON damper will drive fully open – ie Fail safe.

2.3 Operation Notes :-.

There are various operational setting that need to be set to give good control of the fume cupboard face velocity. These setting are adjustable in the 'ECON configure menu'.
To get to the ECON Config Menu -- go to Setup / Configure / Econ Config



Note 1 – **Manual / Automatic**

This allows the control output voltage to be set to Manual control or Automatic control.
In **Manual** control the output is shown as 0 – 100% and can be adjusted using the +/- buttons. When the desired value is set –press Enter and the value will remain fixed at this point.
In **Automatic** control the output will continuously adjust automatically to make the displayed face velocity equal to the SET POINT (see below). Automatic is used for VAV control.

Note 2 – **Set Point**

This is used to enter the desired set point face velocity for the VAV control

Note 3 – **Damper / Inverter**

This is used to select either Damper control for the VAV or for Inverter speed control of the extract fan
Damper 0 - 0V (Direct action for normally open damper)
Inverter 10 – 0V (Reverse action)

Note 4 – **MIN output**

This is used when Pushbutton III is set to Min / Run / Max
Min output sets the damper (or Inverter) to a min extract volume when the fume cupboard is not is use and the MIN function is selected
Output range 0 – 100%

Note 5 – **MAX output**

This is used when Pushbutton III is set to Min / Run / Max
Max output sets the damper (or Inverter) to a max extract volume in an emergency when the MAX function is selected.
Output range 0 – 100%

Note 6 – **Low Limit**

This is used to set up the minimum extract rate from the fume cupboard in automatic VAV operation. As the Sash is lowered the damper will progressively close, (or extract fan slow down), to reduce the extract volume and maintain the set point face velocity. The Low Limit sets a minimum position to prevent the volume reducing too far.
As the Sash is lowered the displayed face velocity will be at the set point value until the damper reaches the Low Limit .As the sash is closed further the damper will not move and the displayed face velocity will increase. The increased velocity should represent a volume through the fume cupboard in the sash closed position equal to approx 15 - 20% of the design volume with the sash at the max safe working opening.

Note 7 – **High Limit**

This is used to set up the maximum extract rate from the fume cupboard in automatic VAV operation. As the Sash is raised the damper will progressively open, (or extract fan speed up), to increase the extract volume and maintain the set point face velocity. The High Limit sets a maximum position to prevent the volume increasing too far.
In most installations the High Limit is set to 100%

Note 8 – **Output Range**

This is used to select the correct range for Damper control for the VAV or for Inverter speed control of the extract fan
Damper 2 - 10V
Inverter 0 - 10V

Note 9 – **Prop Band**

The Prop Band (Proportional band) is the main control parameter for the automatic VAV control. It is in effect the ‘sensitivity’ of the control system. If this is set too low a very small change in the measured face velocity will result in a large change in the output and the damper (or Inverter) will become unstable. If this is set too high it will require a large change in the measured face velocity to give a small change in the output and the damper (or Inverter) will react very slowly.
The ideal setting for this value is to select a value that is as small as possible but that gives stable control of the damper or Inverter without ‘hunting’.
A practical explanation of how to set this value on a fume cupboard is given below in Note 12 – ‘Control Setup Guide’

Note 10 – **Integral Time**

The Integral Time is the second most important control parameters for the automatic VAV control. It is in effect the 'correction action' of the control system. Using proportional control only will result in an error between the actual measured face velocity and the set point face velocity. The Integral action looks at this error and adjusts the control output in a series of small steps to bring the measured value to the same as the set point value. The time taken to correct the measured value depends on how many times the controller makes the small adjustments over a period of time. The Integral action is shown on the menu as 'Reps per minute (repetitions per minute). The higher this figure the faster the actual correction time.
If this is set too low it will take a long time for the measured value to reach the set point. If it is set too high the measured value will correct very quickly but may 'overshoot' in each direction and cause 'hunting'.
The ideal setting for this value is to select a value as high as possible that gives stable control of the damper or Inverter without 'hunting'.
A practical explanation of how to set this value on a fume cupboard is given below in Note 12 – 'Control Setup Guide'

Note 11 – **Integral Cut Off**

The Integral Cut Off is a special parameter unique to our controller to give a rapid change in the control output when the sash is raised from the closed or partially closed position. This function looks at the 'rate of change' of the measured face velocity and if this reaches the set point will boost the opening of the damper or boost the speeding up of the Inverter driven extract fan (note: if using an Inverter the 'ramp up time' setting on the Inverter needs to be set to 1 sec)
This parameter should not require any on-site setting and is factory set to 0.2 m/sec/sec.

Note 12 – **Control Setup Guide**

To achieve good VAV control the prop band and integral time parameters will need to be adjusted.
When the CALIBRATION has been completed this control setup guide should help find the best values for each particular installation.

a. Initially set the **Integral Time** to 0 reps per minute. This will give proportional control only.
b. Set the **Prop Band** to 25%.
c. Set the Econ to Automatic and select RUN.
d. At the design sash height e.g. 500mm the face velocity will be close to the set point e.g. 0.5 m/s.
e. When the sash is lowered to 100mm the face velocity will increase. Adjust the **Prop Band** value in steps up or down until the face velocity at 100mm is approx. 0.75 m/s and check that the face velocity is stable (not oscillating).
The Prop Band value should be approx. 15 to 35 %.
If the Prop Band is set to a low value e.g. 10% the sensitivity will be high and the output may oscillate when the sash is lowered.
If the Prop Band is set to a high value e.g. 50% the sensitivity will be low and the face velocity at 100mm will be too high.
At this stage the measured face velocity will probably not be at the set point with the sash at 500mm.The function of this first step is to get stable control at 500mm and at 100mm (no 'hunting')
f. Once the correct Prop Band is determined we can set up the Integral Time to correct the measured face velocity to the set point Initially set the Integral Time to 5 reps per minute.
g. Now when the sash is lowered the Integral will reduce the face velocity back to the set point over a specified time.

h. If the ‘correction time’ is too slow increase the Integral Time reps per minute in steps of 5 until the face velocity controls back to the set point over an acceptable time.
If the Integral Time is set too low the face velocity will take too long to control back to the set point when the face velocity changes.
If the Integral Time is set too high the Integral may over-compensate and create overshoot and give unstable control.
The Integral time should be set approx. 10 – 30 reps per minute.

Note 13 – **Troubleshooting**

The stability of the control system and measured face velocity can be effected by three main items: –

a. Turbulent airflow across the face of the fume cupboard and airflow sensor
b. The Calibration of the airflow sensor.
c. The ‘sensitivity’ of the control loop (Prop Band & Integral Time settings)

It is important to establish the cause of the problem before attempting to adjust any parameters.

To do this put the control system into ‘Manual’ operation. and use a calibrated anemometer to measure and check the stability of the face velocity. In this condition the control damper or Inverter will be at a fixed position so any instability seen will be due to the extract system or to turbulent air across the fume cupboard. This can be check and corrected mechanically.
If the measured face velocity with the anemometer is stable but the displayed face velocity on the controller is reading a different value or is not stable this could be due to the calibration procedure carried out earlier or due to turbulent air across the airflow sensor. Correct any turbulence at the airflow sensor and then re-calibrate the controller taking time to ensure that the airflow sensor has stabilised at each sampling value.
If the above is OK the problem is probably due to the Prop Band and / or the Integral Time settings. In this case switch back to Automatic control and repeat the procedure in Note 12 above

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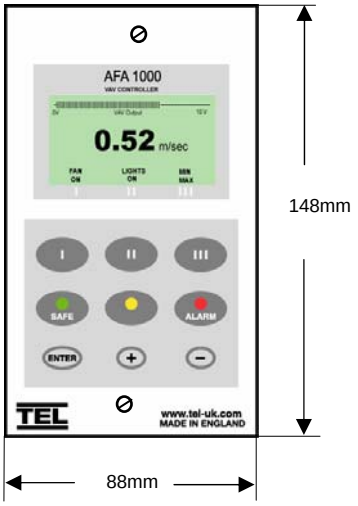
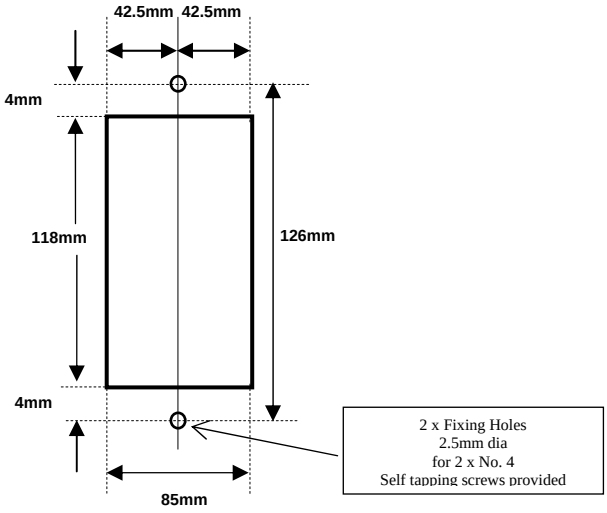
Note :- The above information shows how to set up and calibrate a single fume cupboard incorporating the AFA1000 / E VAV controller.
Most VAV fume cupboard installations use a common extract fan complete with a fresh air bleed system connected to multiple fume cupboards. It is important to consider the commissioning and setting up of the system as a whole before attempting to set up the individual fume cupboard controls. This is particularly important when the extract system has a diversity factor (ie the extract fan is only capable of operating a percentage of the fume cupboards connected at full volume).

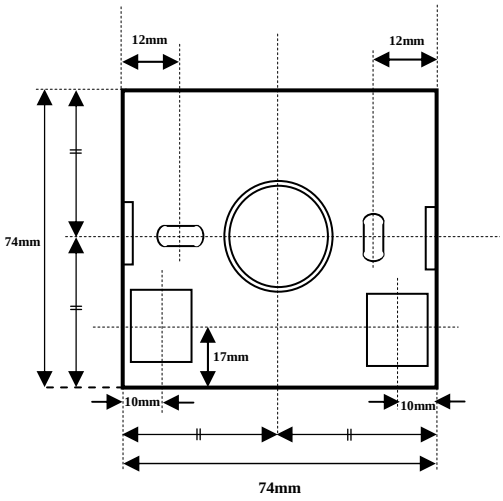
3.0 Dimensions



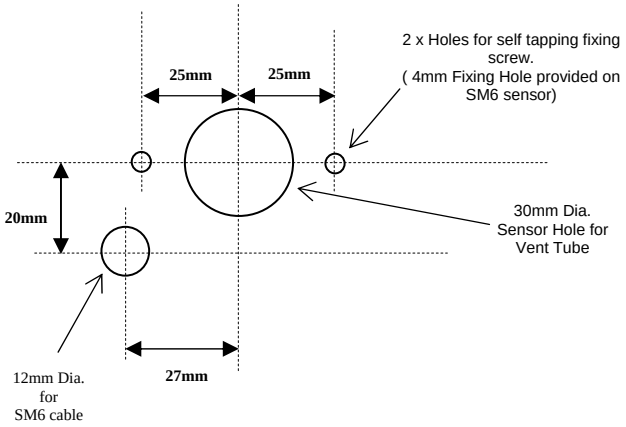
Alarm Panel Dimensions



Panel Cutout Dimensions
118mm x 85mm



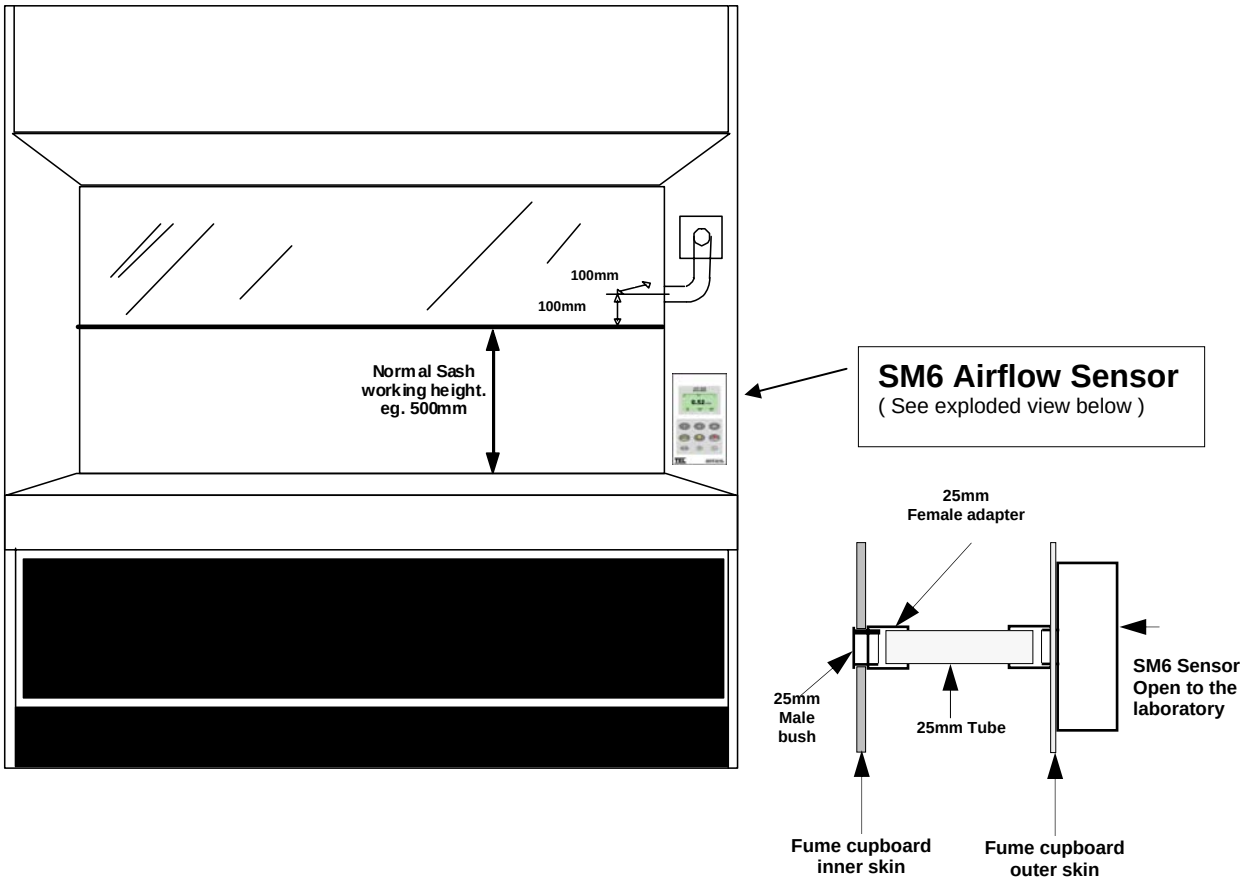
SM6 Sensor Dimensions (Rear view)



SM6 Sensor Panel Cutout Dimensions (Front view)

NOT TO SCALE

4.0 SM6 Airflow Sensor Installation



It is very important to position the SM6 airflow sensor in the correct position to give long term stable reading of the face velocity. Please read the INSTALLATION NOTES below and if in doubt contact us for further advice.

INSTALLATION NOTES :-

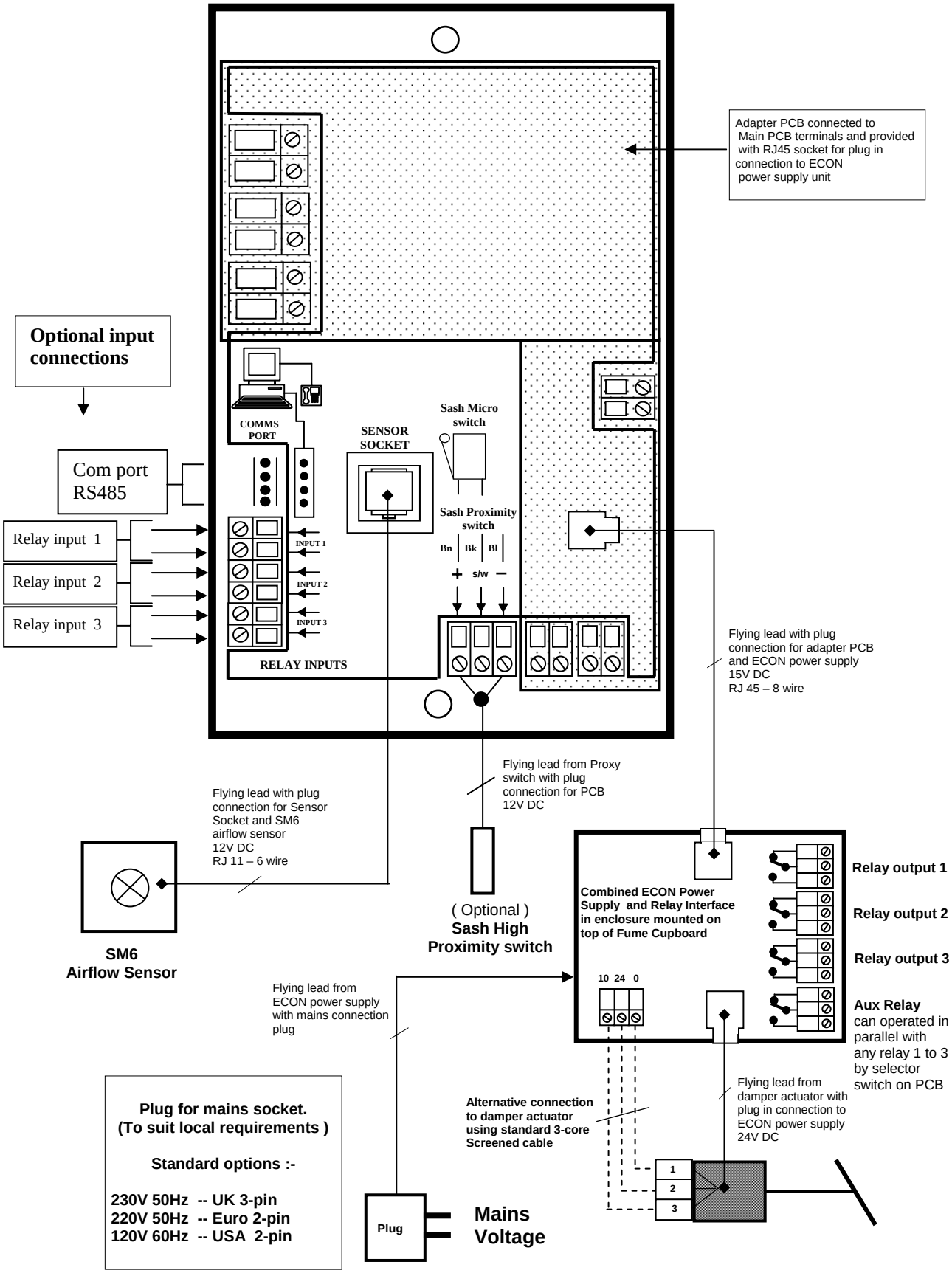
1. The SM6 sensor must be positioned where it can " see " the room pressure of the laboratory.The back connection spigot of the sensor is designed to accept a 25mm OD tube which should be connected to the inner chamber of the fume cupboard. (This tube and fittings is known as the " vent kit ")
   The **ideal position** for the end of the 25mm tube for most fume cupboards is 100mm back from the sash glass and 100mm higher than the normal sash opening height through the inner side wall.

2. If possible mount the sensor on the front of the fume cupboard and use a short length of tube. Tube lengths of more than 1metre or smaller diameter will restrict the airflow through the sensor. This will lead to too much sensitivity being required to calibrate the unit which can lead to some instability of the reading or incorrect readings at low velocitiesl.

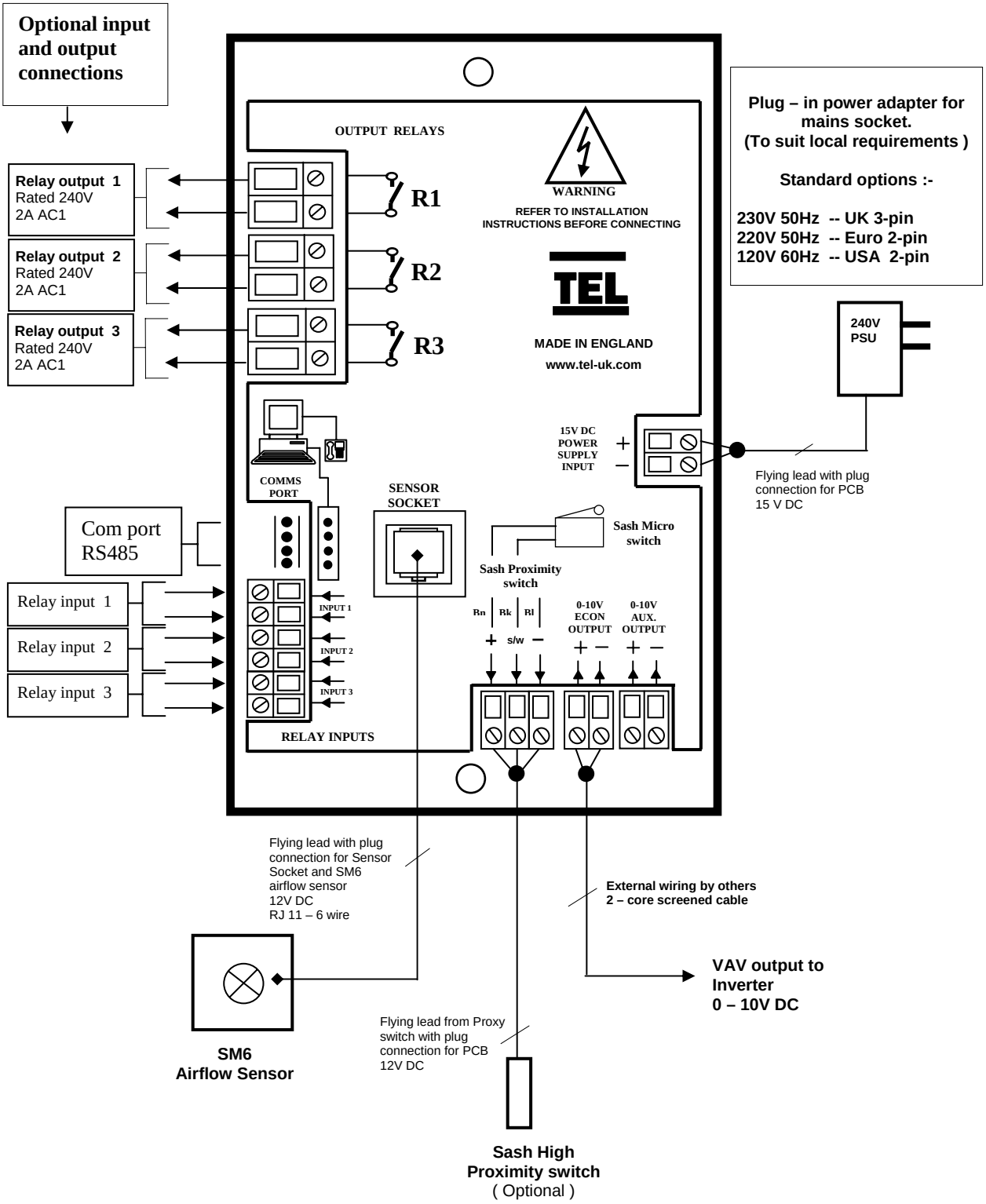
3. For fume cupboards with a single skin side wall or a double skin with a small gap between them it may not be possible to achieve the ideal sensing position using a flexible tube.
   With a single skin side wall it is possible to fix the sensor on the outside of the fume cupboard and connect directly to the inner chamber in the ideal position. This method can only be used for up to two fume cupboards when they are positioned side by side (using the two outer walls).
   An alternative method is to mount the sensor on the front of the fume cupboard and connect using a short flexible tube to a rigid wall tube attached to the inner side wall. The open end of this rigid wall tube should be positioned in the 'ideal position' ie. 100mm back from the sash and 100mm higher than the normal sash opening.
   Fume cupboards with a high internal height can present a difficulty because the tube length to reach the ideal position may be longer than 1 metre. In this case it is better to use a tube no longer than 1 metre which may result in a sensing position higher than the ideal.
   When fitting a sensor to a 'narrow wall' fume cupboard for the first time it may be necessary to try various combinations of rigid and flexible tube to find the best combination and position.

4. The sensor should not be mounted in a position were it is subject to draughts from the laboratory air input or ventilation system.

5.0 Typical Wiring Diagram --- DAMPER CONTOL with Power Supply / Relay Interface Unit



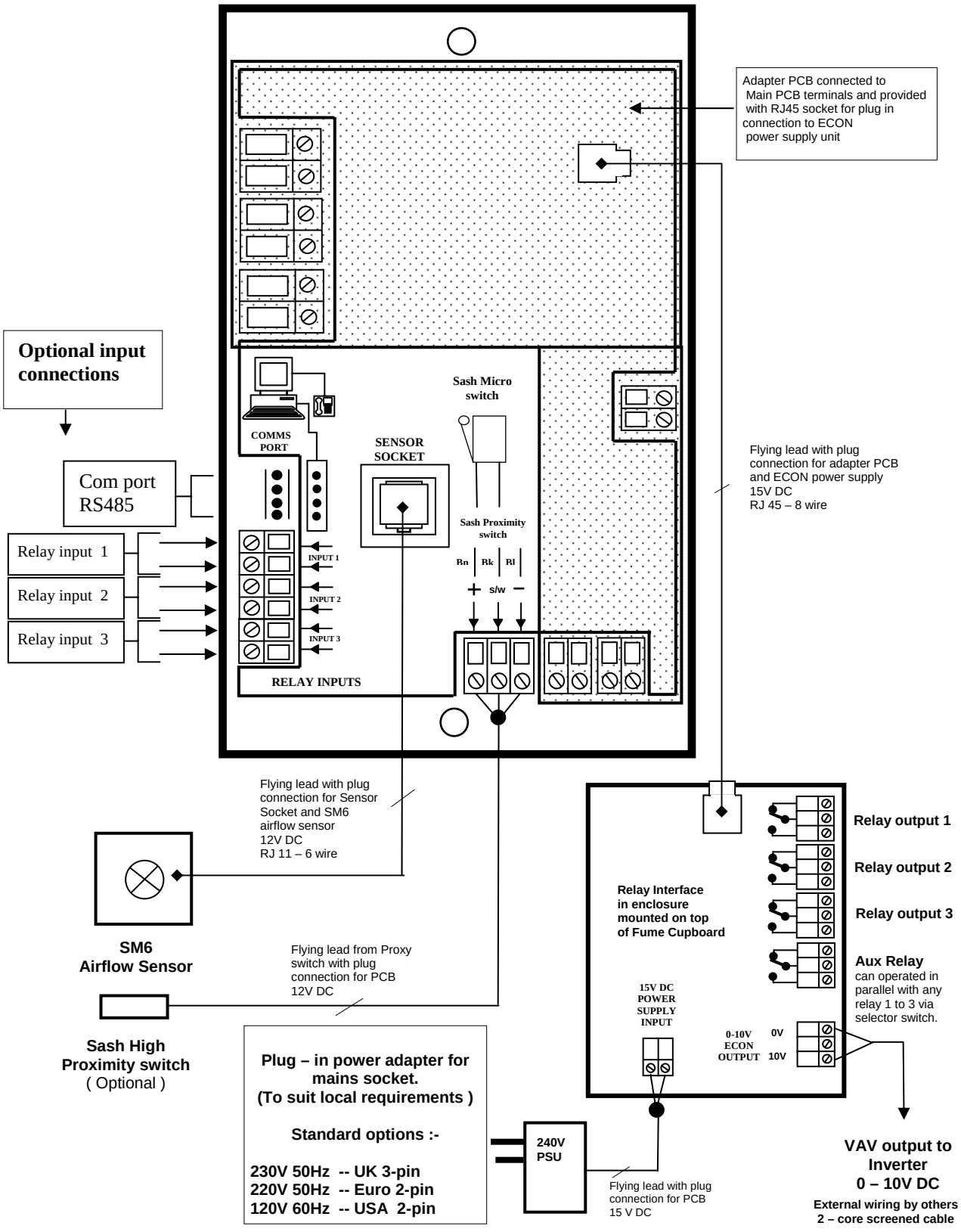
5.2 Typical Wiring Diagram – INVERTER CONTROL



5.3 Typical Wiring Diagram ---

INVERTER CONTROL with **Optional Relay Interface Unit**

Optional **Relay Interface Unit** in ABS enclosure mounted on top of Fume Cupboard to allow up to 3 external cable connections to be terminated.
Rated at 240V 5A



6.0 LIMITATION OF WARRANTY AND LIABILITY

Seller warrants that this product, under normal use and service as described in the operator's manual shall be free from defects in workmanship and material for a period of twelve (12) months, or the length of time specified in the operator's manual, from the date of shipment to the customer. This limited warranty is subject to the following exclusion :-

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b. With respect to any repair services rendered, Seller warrants that the parts repaired or replaced will be free from defects in workmanship and material, under normal use, for a period of 90 days from the date of shipment to the customer
c. Seller does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies.
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