AFA1000/E MK2/PIR
VAV Airflow Controller

With Presence detector

Installation & Operating Manual

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1. SAFETY

1 SAFETY

1.1 Safety Practices

This document describes the general safety practices and precautions that must be observed when operating the Airflow Controller.

This advice is intended to supplement, not supersede, the normal safety codes in the user's country. The information provided does not cover every safety procedure that should be followed. Ultimately, maintenance of a safe laboratory environment is the responsibility of the user and the user's organisation.

Please consult all documentation supplied with the Airflow Controller before starting to work. Carefully read the safety information in this document and in the other documentation supplied. When setting up the equipment or performing analysis or maintenance procedures, strictly follow the instructions provided.

1.2 Warning Notices

Within this User Guide WARNINGS are used to highlight information or instructions that must be followed in order to avoid personal injury to yourself or other people in the vicinity, eg. switch off the mains voltage before any maintenance.

WARNINGS appear as below:

⚠ **WARNING**	**Switch off the mains voltage and remove the mains cord before maintenance.**

1.3 Precautions

The following precautions must be observed when using the Airflow Controller and associated systems:

- Be sure that the voltage of the Airflow Controller equipment corresponds to the voltage available where it is to be installed.
- Never remove the side or back panels of the Airflow Controller without first shutting down the equipment and disconnecting the mains cord.

1.4 General Operating Conditions

The Airflow Controller and equipment have been designed and tested in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The Airflow Controller conforms to IEC61010-1 (Safety Requirements for electrical equipment for measurement, control and laboratory use) as it applies to IEC Class 1 (earthed) appliances, and therefore meets the requirements of EC directive 73/23/EEC.

If possible, avoid any adjustment, maintenance or repair to the eqipment whilst covers are open or it is operative. However, if any adjustment, maintenance or repair is necessary while the covers are open, this must be done by a skilled person who is aware of the hazards involved.

Whenever circumstances arise that mean an Airflow Controller may be unsafe, make it inoperative. In particular, an Airflow Controller may be unsafe if it:

- Shows visible damage.
- Fails to perform correctly.
- Has been subjected to severe transport stresses.
- Has been subjected to prolonged storage in unfavorable conditions.

1.5 Environmental Conditions

The Airflow Controller should only be used under the following conditions:

- Indoors.
- In ambient temperatures between 5°C and 40°C.
- With relative humidity below 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.
- Electrical supply fluctuations not exceeding +10% of the nominal voltage.

WARNING	**The protection provided by the equipment may be impaired if the environmental conditions do not lie within these parameters.**

1.6 Electrical Safety

The Airflow Controller and associated equipment are designed to protect the user from potential electrical hazards. This section describes some recommended electrical safety practices.

⚠ WARNING	**Lethal voltages are present at certain points within the equipment.** **When the equipment is connected to mains power, removing the equipment covers is likely to expose live parts.** **Even when the power switch is off, high voltages can still be present – capacitors within the equipment may still be charged even if the equipment has been disconnected from all live voltage sources.**

The Airflow Controller and associated equipment must be correctly connected to a suitable electrical supply. The supply must have a correctly installed protective conductor (earth or ground) and must be installed and checked by a qualified electrician before initial power up.

⚠ WARNING	**Any interruption of the protective conductor inside or outside the Airflow Controller System, or disconnection of the protective conductor terminal is likely to make the equipment dangerous.** **Intentional interruption of the protective conductor is prohibited.**

⚠ WARNING	**If the mains power cord has to be replaced, ensure that the replacement cord is appropriately rated and approved for the intended use.**

⚠ WARNING	**To prevent potential personal injury and damage to the equipment, switch OFF all components in the system and disconnect them from the mains power supply before altering, or making any new electrical connections.**

When working with the Airflow Controller System:

- Connect the equipment to a correctly installed mains power outlet that has a protective conductor connection.
- Do not operate the equipment with any covers or internal parts removed.
- Disconnect the equipment from all live voltage sources before opening it to make any adjustments, replacements, maintenance or repair. If the opened equipment must be operated for further adjustment, maintenance or repair, this must only be done by a supplier's Service Engineer.

If it is possible that the equipment is no longer electrically safe for use, make the equipment inoperative and secure it against any unauthorised or unintentional operation.

The electrical safety of the equipment is likely to be impaired if:

- It has any signs of visible damage.
- If it has been subjected to prolonged storage in unfavourable conditions.
- If it has been subjected to severe stress during transportation.

1.7 Electrical Protection

Observe the following electrical protection precautions:

- Insulation: Class I rating for external circuits. Only connect equipment that meets the requirements of IEC 61010-1, IEC 60950 or equivalent standards.
- Installation Category: The equipment is able to withstand transient over-voltages typically present on the mains supply. The normal level of transient over-voltages is impulse withstand (overvoltage) Category II of IEC 60364-4-443.
- Pollution Degree 2: Normally only non-conductive pollution occurs. Occasionally, however, temporary conductivity caused by condensation must be expected.

1.8 EMC Compliance

EC Directive

The Airflow Controller System is designed and tested to meet the requirements of the EC directive 89/336/EEC and 93/68/EEC and complies with the EMC standard EN61326 (EMC standard for electrical equipment for measurement, control and laboratory use) and EN55011 (ISM) Class A (RF emissions).

FCC Rules and Regulations

The Airflow Controller System is classified as a digital device used exclusively as industrial, commercial or medical test equipment. It is exempt from the technical standards specified in Part 15 of the FCC Rules and Regulations based on Section 15.103 (c).

1.9 Warning Labels

Warning labels attached to the equipment draw attention to specific hazards - refer to this guide and other documentation provided with the equipment for more details concerning potential hazards and any precautions or other actions that must be taken.

2. OVERVIEW OF THE AIRFLOW CONTROLLER

2 OVERVIEW OF THE AIRFLOW CONTROLLER

2.1 Operator Display Panel

VAV output bar graph or Alarm Time Line with ECON operation status

Velocity display m/sec or fpm or Plain Text “Air Safe / Air Fail”

Control Pushbutton Icons

Control Pushbutton

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 use the Upload/Download software provided.

2.2 Display Features

The VAV Controller display has the following features:

The digital display is a backlit, full colour high resolution graphic unit with a visual display area of approx 45 x 34mm. The display operates through the software allowing the generation of figures, wording and icons. The display background colour can be provided as either Blue or Black.

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.

The displayed face velocity colour will change when in an alarm condition:-

Air Safe = White / Low or High Air Alarm = Red / Warning Air Alarm = Amber.

An **'event time line '** segmented into 60 x 1 minute segments will scroll across the display (when enabled) .This takes the form of a graphical scale ranged over 0-1.00 m/sec that will progress from the right hand side to the left hand side of the screen – representing the airflow value at each segment. The segment colour will change if the value is in the range of an airflow alarm:-

Air Safe = White / Low or High Air Alarm = Red / Warning Air Alarm = Amber.

The alternative to the event time line is a dynamic **'bar graph'** representing the VAV output position.

The **Output Status** is permanently displayed under the event time line or bar graph. The status is displayed as **'Manual'** or **'Automatic'**. If the controller is configured to dual set point mode the status is displayed as **'Manual', 'High Set Point'** or **'Low Set Point'**

The display shows an up or down **arrow** Icon in the bottom right hand corner of the screen when an input function is set to Hi / Lo (2 speed operation). The Up arrow indicates High speed and the Down arrow indicates Low speed.

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

The display backlight will dim to a fixed low level when certain functions are active to save energy:-

Fan Off - display backlight reduces until Fan On is selected.
Backlight will resume to normal level whilst Set Up or Diagnostics menus are accessed.

Setback Input is active - display backlight reduces until input is not active.
Backlight will resume to normal level whilst Set Up or Diagnostics menus are accessed.

Min pushbutton function - display backlight reduces until Pb3 is set to Run or Max.
Backlight will resume to normal level whilst Set Up or Diagnostics menus are accessed.

2.3 Displayed Alarms and Events

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

Ext Alarm - will be displayed when the external alarm input is activated (when enabled) Ext Alarm will alternate on/off with the velocity reading

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

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

Set-back - will be displayed if the night set-back function is activated .Setback will alternate on/off with the velocity reading and the display backlight will dim.

Standby - will be displayed if the Pushbutton 3 MIN function is activated .Setback will alternate on/off with the velocity reading and the display backlight will dim.

Alm Dis - will be displayed if the alarm disable function is activated (when enabled) Alarm Disable will alternate on/off with the velocity reading

Close Sash - will be displayed if the sash is raised and the operator is not present (when enabled) Close Sash will alternate on/off with the velocity reading

Emergency - will be displayed if the Emergency input is activated or if MAX or Purge pushbuttons are pressed. Emergency will alternate on/off with the velocity reading

High Set Point - will be displayed in High Set point (Occupied) mode.

Low Set Point - will be displayed in Low Set point (Unoccupied) mode.

Up/Down Arrow - will be displayed if Hi/Lo 2 Speed operation is enabled.

OFF - will be displayed if pushbutton 1 is set to Fan On/Off and hide airflow is enabled if the Fan is switched off. The display backlight will dim in a Fan off condition.

Start Up - will be displayed if pushbutton 1 is set to Fan On/Off and the start up timer is enabled **xxx seconds** if the Fan is switched on. The remaining start up time is displayed.

Automatic - will be displayed when the Econ output is set to Automatic control.

Manual - will be displayed when the Econ output is set to Manual output.

Mute Icon - will be displayed whenever the audible alarm is muted.

2.4 Additional Alarms and Events

Mains Fail - will be displayed if the power fails to the monitor (when enabled)
*Note – this is an optional extra feature that requires an additional battery unit

Low Temp - will be displayed if the fume cupboard temperature drops below the low temp alarm point (when enabled). This display will alternate on/off with the velocity reading.
*Note – this is an optional extra feature that requires an additional temperature sensor

High Temp - will be displayed if the fume cupboard temperature rises above the high temp alarm point (when enabled)
*Note – this is an optional extra feature that requires an additional temperature sensor

2.5 LED Indicators

The alarm unit has three LED indicators:

RED – Alarm

Amber – Caution

Green – Safe

The RED Alarm LED will be permanently illuminated if pushbutton 1 is set to Fan On/Off and is switched off.

2.6 Audible Alarm Sounder

The AFA1000/E has an audible sounder with local or remote mute facility. The audible alarm can be permanently disabled in the cal config menu.

The display will show a Mute Icon in the bottom left hand side of the screen whenever the audible alarm is muted or disabled.

2.7 Pushbuttons

The AFA1000/E has 3 menu configurable pushbuttons. Each pushbutton can be configured to a different function. The pushbutton Icon and status is shown on the display above the pushbutton.

a. Pushbutton 1

Fan On/Off – will be displayed when the pushbutton is set to FAN operation.

Setback O/R – will be displayed when the pushbutton is set to Night Setback Override operation.

b. Pushbutton 2

Lights On/Off – will be displayed when the pushbutton is set to Lights operation.

UV Lights On/Off – will be displayed when the pushbutton is set to UV Lights operation.

Services On/Off – will be displayed when the pushbutton is set to Australian Standards operation.

Pump On/Off – will be displayed when the pushbutton is set to Pump operation.

c. Pushbutton 3

Scrubber On/Off – will be displayed when the pushbutton is set to Scrubber operation.

Purge On/Off – will be displayed when the pushbutton is set to Purge VAV operation.

MIN – will be displayed when the pushbutton is set to Min/Run/Max VAV operation.

RUN– will be displayed when the pushbutton is set to Min/Run/Max VAV operation.

MAX – will be displayed when the pushbutton is set to Min/Run/Max VAV operation.

d. Enter

The 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).

e. +& -

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

2.8 Diagnostics Menu

The AFA1000/E has a diagnostics menu that shows current Input and Output status, Coms data and also includes an Alarm Test function.

To access the diagnostics menu press the '+' and '-' buttons together whilst in the run screen.

The diagnostics sub menu will appear showing the following options-

a. Alarm Test
b. Coms data
c. I/O Status
d. Done

Use the +/- buttons to scroll and Enter to select the required parameter.

a. Alarm Test - the Screen will show "Testing Safe LED" and the Green Safe LED will illuminate. The screen will then show "Testing Warning LED" and the Amber Warning LED will illuminate. The screen will then show Testing Alarm" and the Red Alarm LED will illuminate and the audible alarm will sound.

The screen will then return to the Diagnostics menu.

b. Coms data - the Screen will show the coms setting data for the relevant selected protocol:-

Protocol = None/TEL/Modbus/BACnet
ID = Slave ID for Modbus or Device Instance for BACnet
Baud Rate = Shows selected Baud Rate
Parity = Shows selected Parity

Tx & Rx = the display will show the current data packets sent and received, the displayed value will rollover to zero when the maximum count is reached.

c. I/O Status - when selected the following options are shown:-

Input Data
Output Data
Sensor Data
Done

Input Data:-

Input 1 - 0 / Off / On / Not Used
Input 2 - 0 / Off / On / Not Used
Input 3 - 0 / Off / On / Not Used

0 = Analogue Input e.g. Sash Position sensor Input Voltage (0-5VDC)
Off = Input Open
On = Input Closed
Not Used = Input not assigned

Output Data:-

Output 1 - Off / On A Out 1 - 10.0
Output 2 - Off / On A Out 2 - 10.0
Output 3 - Off / On

Output Off = Output Open or not assigned
Output On = Output Closed
A Out 1 = Analogue Output 1 voltage (0-10VDC)
A Out 2 = Analogue Output 2 voltage (0-10VDC)

Sensor Data:-

Airflow 00.0 % Volume 000
Sash Position mm
Temperature °C

Airflow % = Output of airflow sensor in %, 100% = no airflow
Volume = Measured or calculated volume in l/sec or CFM (when enabled)
Sash Position = Sash Opening in mm or inches (when enabled)
Temperature = Temperature in °C or °F - (when enabled)

Done - returns to Diagnostics menu.

d. Done - when selected the controller returns to the run screen.

2.9 External Connections

The AFA1000/E has the following Inputs:-

Input 1

Volt free input configurable for normally closed, normally open relays or Analogue 0-5VDC Input
This input can be configured as:-

Digital Input Functions (Closed or Open volt free contact):-

Alarm disable	Night set-back
External alarm	Emergency
Sash High	High / Low
Sash Warning	Mains Fail
Fan Stop	Mute

Analogue Input Functions:-

Temperature	Sash Position

Input 2

Volt free input configurable for normally closed, normally open relays or Analogue 0-5VDC Input
This input can be configured as:-

PIR Occupancy Sensor
Auxiliary PIR used for dual set point control based on Fume Cupboard occupancy.

Input 3

Volt free input configurable for normally closed, normally open relays or Analogue 0-5VDC Input
This input can be configured as:-

Digital Input Functions (Closed or Open volt free contact):-

Alarm disable	Night set-back
External alarm	Emergency
Sash High	High / Low
Sash Warning	Mains Fail
Fan Stop	Mute

Analogue Input Functions:-

Temperature	Sash Position
Volume Pressure	Damper Feedback

The AFA1000/E has the following Outputs:-

Relay Output 1
Volt free relay output configurable as normally closed or normally open relays.

Relay Output 2
Volt free relay output configurable as normally closed or normally open relays.

Relay Output 3
Volt free relay output configurable as normally closed or normally open relays.

Note - Changeover Relays are available with Econ power supply Relay Interface unit. The Relay Interface has an AUX relay output that can be selected to duplicate the action of R1, R2 or R3 via dip switch setting.

Econ Output 1
0-10VDC / 2-10VDC control output – configurable for direct or indirect action.

Econ Output 2
0-10VDC 2-10VDC output configurable as volumetric 0-10VDC output (when using sash position sensor or volumetric measuring sensor) or as a second control output – configurable for direct or indirect action.

Com Port
RS 485 to enable connection to Laptop or PC for full diagnostics, logging or setting up and for communications to building computer system (BMS)

See section 8 for other specific information on Modbus RTU and BACnet options and settings.

Power supply
Low voltage DC power supply from Econ power supply (damper control type) or Mains power adaptor.

Airflow Sensor
RJ12 Connection socket for the face velocity airflow sensor.

Optional Inputs

Temperature Sensor
Bespoke Temperature sensor for connection into inputs 1, 2 or 3 to give temperature display with high and low temperature alarms.

Volume Pressure Sensor
Auxiliary pressure cell PCB that fits into the Econ power supply Relay Interface unit and is dedicated to input 2. Used for measuring volume on orifice restriction or bell mouth venturi type restrictor.

Sash Position Sensor
Auxiliary sash position sensor used for volumetric output and sash high alarms with dedicated input on the Econ power supply.

Mains Fail battery unit
Auxiliary plug in battery unit for Mains Fail alarm, not for use if the Econ power supply is fitted (Inverter type control only).

See **Menu Block Diagram** document for other specific operations and indications.

3. FUNCTIONS & OPERATION

3 FUNCTIONS & OPERATION

3.1 Airflow Functions

The AFA1000/E airflow display can be set up using the pushbutton menus to display airflow in units of m/sec or fpm and can also be set to show plain text “Air Safe” & “Air Fail” only.

The AFA1000/E has 3 programmable airflow alarms.

Safe airflow

- Airflow reading above warning level (e.g. > 0.45 m/sec)
- Green Safe LED on

Warning airflow

- Airflow reads between warning level and air fail level (e.g. > 0.4 m/sec and < 0.45 m/sec)
- Amber Warning LED on

Low airflow

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

Reset: -- when airflow rises 0.02 m/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:
- Airflow reading above high level (e.g. > 1.50 m/sec)
- **High Air** toggles on / off with display
- Red Alarm LED on (Solid)
- High air relay operates (if configured)

Audible Alarm Mute

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

The audible alarm can be permanently disabled in the pushbutton menu.

3.2 Pushbutton Functions

The AFA1000/E has 3 programmable pushbuttons. The pushbutton Icon is displayed in the screen above the relevant pushbutton and are identified as Pushbutton I, Pushbutton II, & Pushbutton III

Each Pushbutton has a Power Up Memory function that will set the pushbutton function back to the last status following a power fail cycle e.g. If the Fan is On when the power fails the AFA1000/E power up with the Fan pushbutton set to On.

The AFA1000/E pushbuttons are typically set with Pushbutton I used for Fan On/Off, Pushbutton II used for Lights On/Off and Pushbutton III used for VAV control.

Pushbutton I

Off

- Pushbutton I set to Fan On / Off and is Off
- Pushbutton Fan Stop parameter set to Hide Airflow
- Screen Backlight dims to low power mode
- Red Alarm LED on (Solid)

Start Up
10 Seconds

- Pushbutton I set to Fan On / Off and is On
- Pushbutton Fan Start time parameter set to >0 seconds
- All alarm functions and outputs are inhibited during the start up time period.

Start up Timer: -- the start up timer is used to allow the fan to run up to full speed before the AFA1000/E alarm functions are active so that false Low Air alarms are not sent to the BMS.

Pushbutton II

Lights On / Off

- Pushbutton II set to Lights On / Off
- Lights On /Off Relay operates

UV Lights On / Off

- Pushbutton II set to UV Lights On / Off
- UV Lights On /Off Relay operates

Pump On / Off

- Pushbutton II set to Pump On / Off
- Pump On /Off Relay operates

Pushbutton III

Scrubber On / Off

- Pushbutton III set to Scrubber On / Off
- Scrubber On /Off Relay operates

Purge On / Off

- Pushbutton III set to Purge On / Off
- **Emergency** toggles on / off with display
- VAV output goes to Max regardless of sash position.
- Red Alarm LED on (Flashing)
- Audible alarm sounds -- can be muted via Enter pushbutton
- Purge On /Off Relay operates (if configured)

VAV Min / Run /Max or VAV Min / Normal functions:-

Min

- Pushbutton III set to VAV Min/Run/Max - and is set to Min.
- **Standby** toggles on / off with display
- VAV output goes to Min value regardless of sash position.
- Red Alarm LED on (Flashing)
- Audible alarm muted

Run

- Pushbutton III set to VAV Min/Run/Max - and is set to Run.
- Airflow value displayed
- VAV operation active
- Airflow alarms enabled

Max (VAV Min/Run/Max only)

- Pushbutton III set to VAV Min/Run/Max - and is set to Max.
- **Emergency** toggles on / off with display
- VAV output goes to Max regardless of sash position.
- Red Alarm LED on (Flashing)
- Audible alarm sounds -- can be muted via Enter pushbutton

3.3 Input Functions

The AFA1000/E has 3 programmable Inputs that can be set to analogue (0-5VDC), digital open or digital closed operation.

Analogue input functions

Temperature

- Any Input set to Analogue - Temperature
- Temperature is displayed alongside airflow velocity in °C or °F

- **Low Temp** toggles on / off with display if temperature < Low Temp Alarm point
- Red Alarm LED on (Flashing)
- Audible alarm sounds -- can be muted via Enter pushbutton
- Low Temp relay operates (if configured)

- **High Temp** toggles on / off with display if temperature > High Temp Alarm point
- Red Alarm LED on (Flashing)
- Audible alarm sounds -- can be muted via Enter pushbutton
- High Temp relay operates (if configured)

Sash Position Sensor

- Any Input set to Analogue - Sash Position
- Used to give calculated volumetric output signal based on sash position and airflow velocity
- Can also be used to give Sash High Alarm

- **Sash High** toggles on / off with display if sash height > calibrated position
- Amber LED on Solid (Flashing when alarm muted)
- Audible alarm sounds -- can be muted via Enter pushbutton
- Sash High relay operates (if configured)

Volume Pressure

- Input 2 or 3 set to Analogue - Volume Pressure
- Used to give volumetric output based on duct measurement using restrictor device

Damper Feedback

- Input 2 or 3 set to Analogue - Damper Feedback
- Used for sash position control (AFA3000) model only

Digital input functions

Alarm disable

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

Night set-back

- When input configured as Night set-back is activated
- Night **Set-back** Icon displayed
- Unit is driven to the **VAV MIN** operating position
- Audible alarm muted
- Mute Icon shown on display
- Low Air alarm muted if set to Maintain low air
- Reduced Low Air & Warning alarms active if set to Reduce low air

External alarm

- When input configured as External alarm is activated
- Red LED on (Flashing) – (if configured)
- **External Alarm** toggles on /off with display -- (if configured)
- Audible alarm sounds – can be muted via Enter pushbutton
- External alarm relay operates (if configured)

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

Sash High

- When input configured as Sash High is activated
- Amber LED on Solid (Flashing when alarm muted)
- **Sash High** toggles on / off with display if sash height > calibrated position
- Audible alarm sounds -- can be muted via Enter pushbutton
- Sash High relay operates (if configured)
- Alarm re-activates after time delay if repeat time enabled

High / Low

- When input configured as High/Low is activated
- Display Icon shows Up (High) or Down (Low) arrows
- 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.

Close Sash

- When the input configured as Close Sash is activated
- Red LED on
- **Close Sash** – toggles on / off with velocity display
- Audible alarm sounds (after pre-set time)
- Audible can be muted via Enter pushbutton -- this silences the alarm if configured.

Reset when Sash lowered to closed position and input de-activated or operator is present

Mains Fail (Optional extra feature)

- When the input configured as Mains Fail is activated
- Red LED on
- **Mains Fail** is displayed
- Audible alarm sounds
- Audible can be muted via Enter pushbutton -- this silences the alarm if configured.

Note - Not for use with Relay Interface unit -- AFA1000/E only.

Personnel Sensor

- When the input configured as Personnel Sensor is activated
- VAV dual Set Point active - (Occupied = High Set Point, Un-occupied = Low Set Point)

Note - When Low set point active the Reduced Low Air and Warning air Alarms are active.

Fan Stop

- When the input configured as Fan Stop is activated
- **Off** is displayed
- Red LED on (Solid)
- Audible alarm muted
- When the input configured as Fan Stop is de-activated
- **Start Up** Timer is displayed
- Audible alarm and relays inhibited until Start up time has elapsed

Note - Used if the AFA1000 is a Slave unit with a common fan (Remote master On/Off signal is used)

Mute

- When the input configured as Mute and is activated
- Red LED on (Solid)
- Audible alarm muted
- Mute Icon shown on display

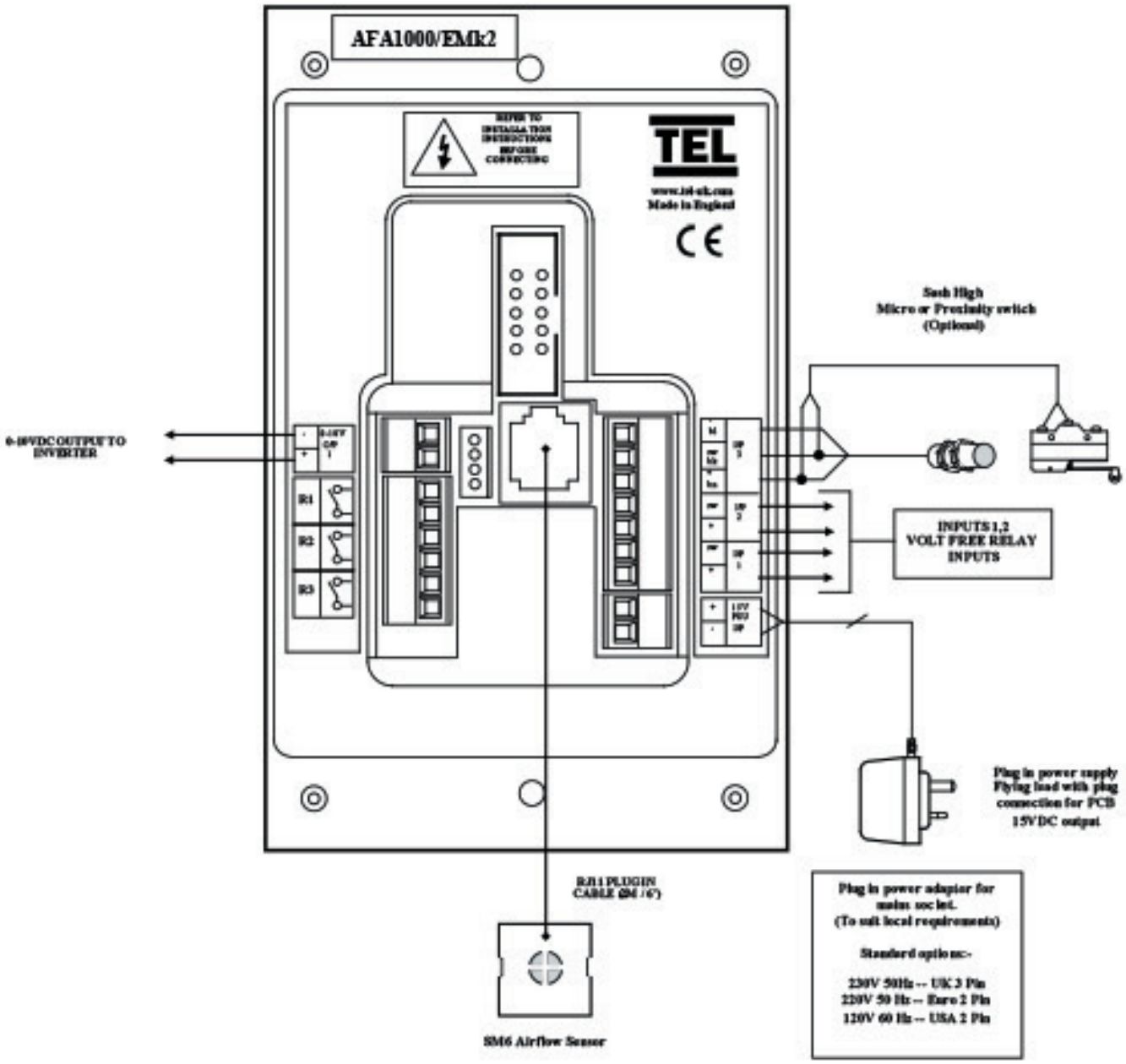
Note - The Mute function disables the pushbutton mute so that any audible alarm can only be muted using the input e.g. remote key switch.

4. COMPONENTS

4 COMPONENTS

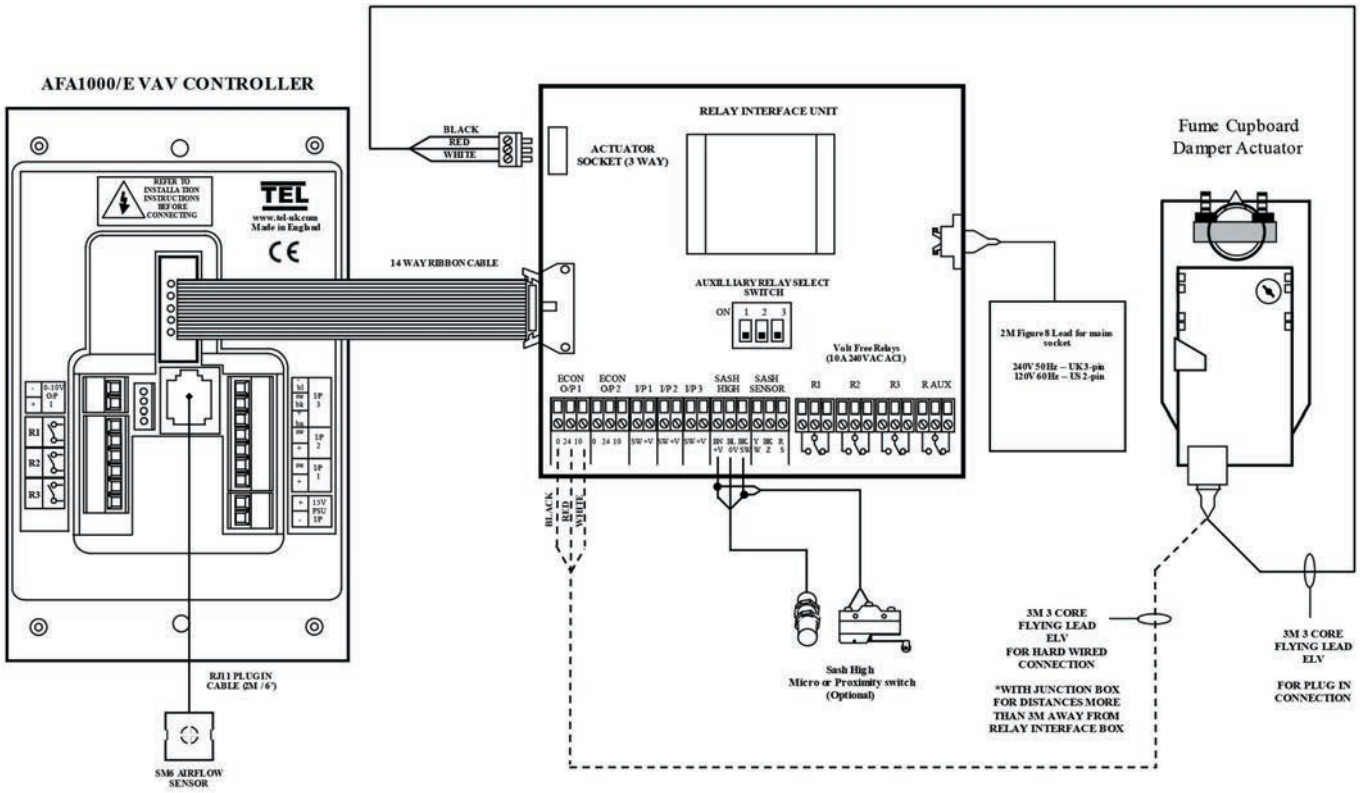
4.1 Components for Inverter Control

1 – AFA1000/E/MK2 VAV Controller
1 – Airflow Sensor c/w 2M RJ45 Sensor Cable
1 – Plug in type low voltage power supply with 5M Cable
1 – PIR Personnel Sensor (Please see auxiliary components for connection diagram)



4.2 Components for Damper Control

1 – AFA1000/E/MK2 VAV Controller
1 – Airflow Sensor c/w 2M RJ45 Sensor Cable
1 – Econ Power Supply Unit c/w 2M Ribbon Cable
1 – Electrical Damper Actuator c/w 3M Flying Lead
1 – PIR Personnel Sensor (Please see auxiliary components for connection diagram)



4.3 Auxiliary Components

The following auxiliary components are available for the AFA1000/E controller:-

Sash High Proximity Switch - Used for Sash High Alarm

Sash High Micro Switch - Used for Sash High Alarm

Sash Position Sensor - (Sprung potentiometer) - Used for Volumetric Output and Sash High Alarm

Personnel Sensor - Passive Infra Red sensor - Used for Dual Set Point Control and Close Sash Alarm

Mains Fail Battery Unit - Used for Mains Fail Alarm (Inverter control type only).

Volume Pressure Sensor - Used for Volumetric output using a separate venturi device or orifice plate type restrictor.

Temperature Sensor - Used for Temperature display and alarms.

5. INSTALLATION

5 INSTALLATION

5.1 Installation of standard components

The following section outlines the installation of the various components of the Airflow VAV controller system.

As the size and format of individual Fume Cupboards varies considerably, specific instructions are not possible, though the principles outlined below should remain valid in all cases.

The AFA1000/E controller can be mounted on either side of the Fume Cupboard; consideration should be made for the cable lengths when fitting the Econ Power supply unit.

The Econ VAV damper can be mounted in any orientation but consideration should be made for access to the damper for future maintenance.

1. Fit the AFA1000/E controller to the Fume Cupboard using the cut-out details provided with the unit --- see page 25. Ensure that the controller fits into the cut out before securing with the fixing screws.

Separate mounting boxes and adaptor plates are available for retro-fitting to older Fume Cupboards.

2. Fit the Econ Power supply to the top of the Fume Cupboard ensuring that the location allows the 14 Way Ribbon cable to reach the AFA1000/E controller.

Longer Ribbon Cables are available on request.

3. Fit the airflow sensor to the Fume Cupboard using the cut out and installation details provided --- see page 35 & 36. When possible ensure that the Airflow sensor is mounted on the same side of the Fume Cupboard as the AFA1000/E so that the standard 2M sensor cable will reach the sensor and controller.

4. 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 30.

Longer Sensor Cables are available on request.

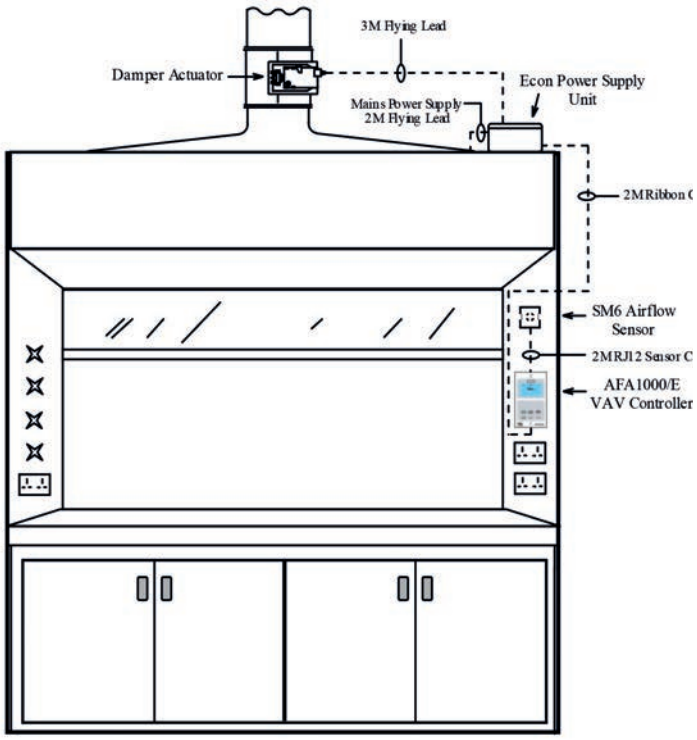
5. For Damper control terminate the Damper actuator cable into ECON Output 1 terminals in the Econ Power supply using a 20mm Cable Gland to secure the cable to the power supply box.--- see typical connection diagram on page 30.

6. For Inverter control --- see typical connection diagram on page 29.

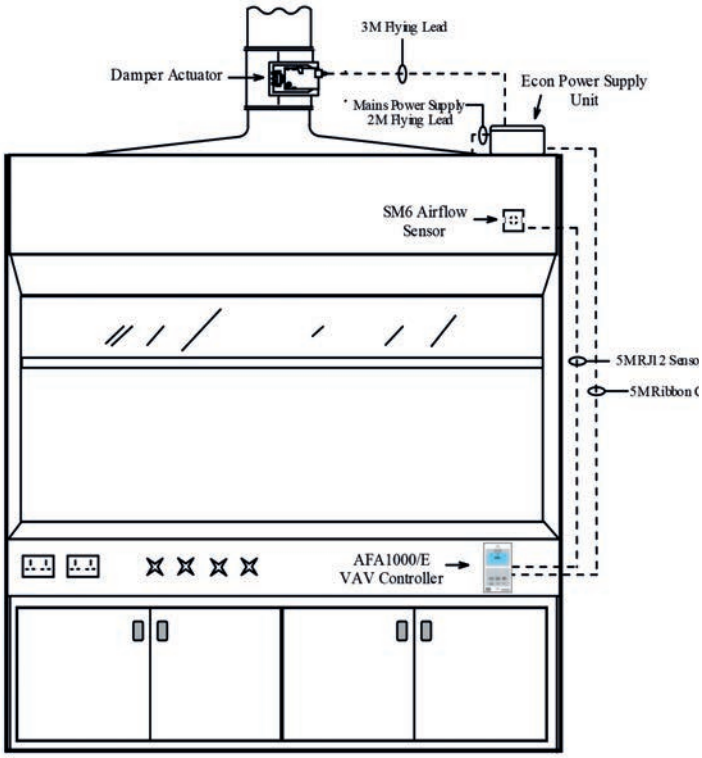
7. Plug in the Mains AC power plug on the flying lead to the ECON power supply unit. --- see typical connection diagram on page 30.

5.2 Typical Installation diagram

a. Typical Double wall style Fume Cupboard

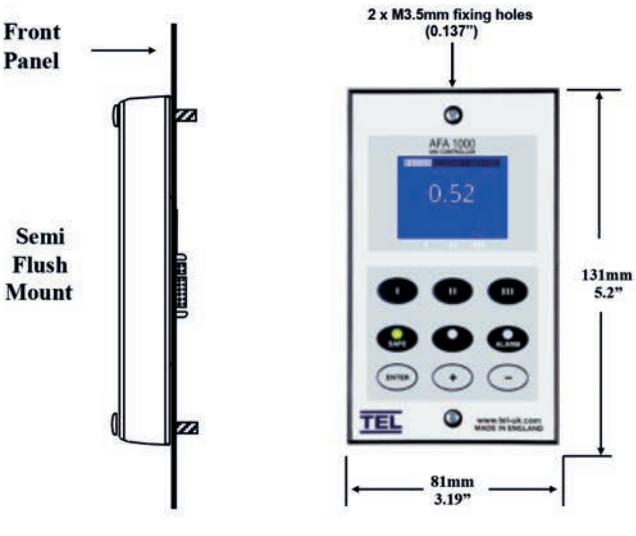


b. Typical Euro Single Wall style Fume Cupboard

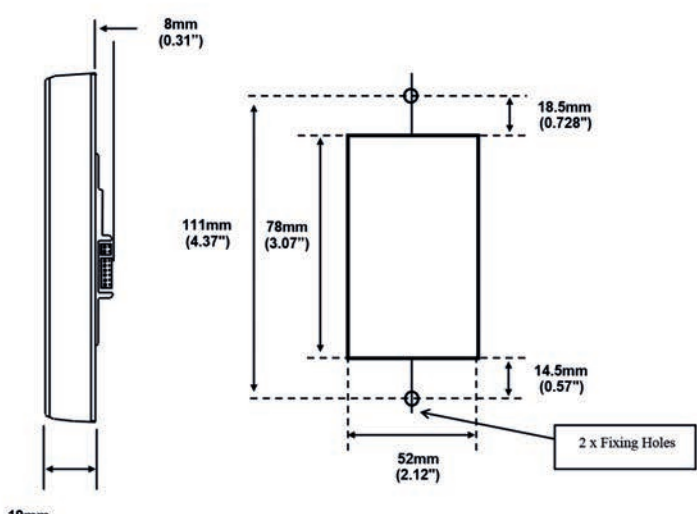


5.3 Dimensions and Cut Out details

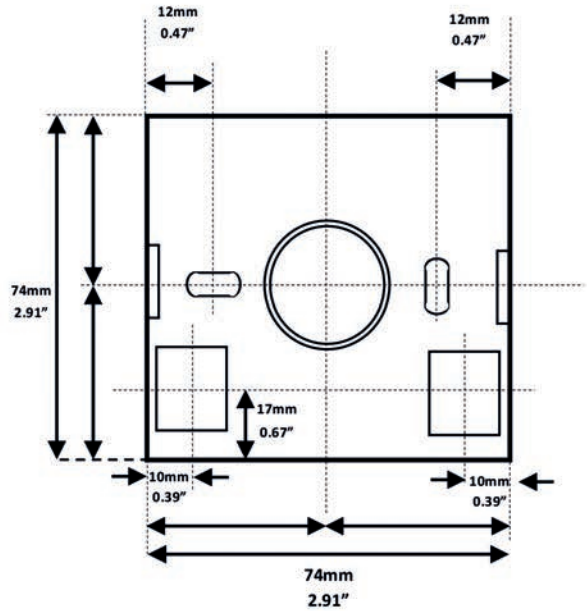
NOT TO SCALE



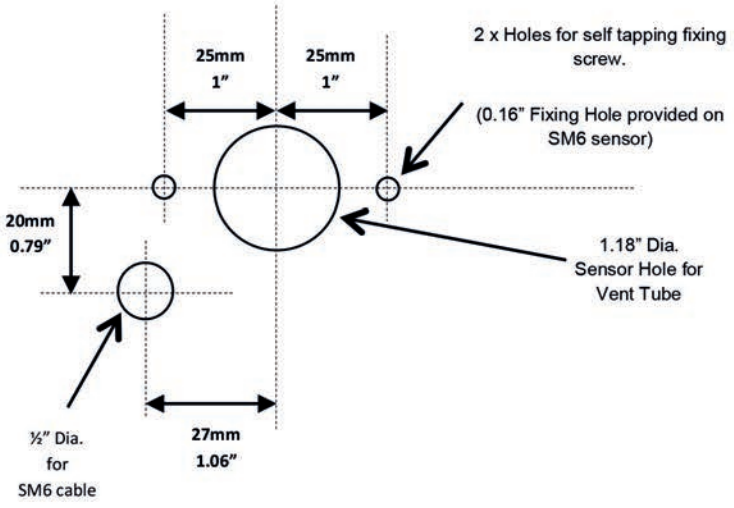
AFA1000/E/MK2 Dimensions



Panel Cut out Dimensions

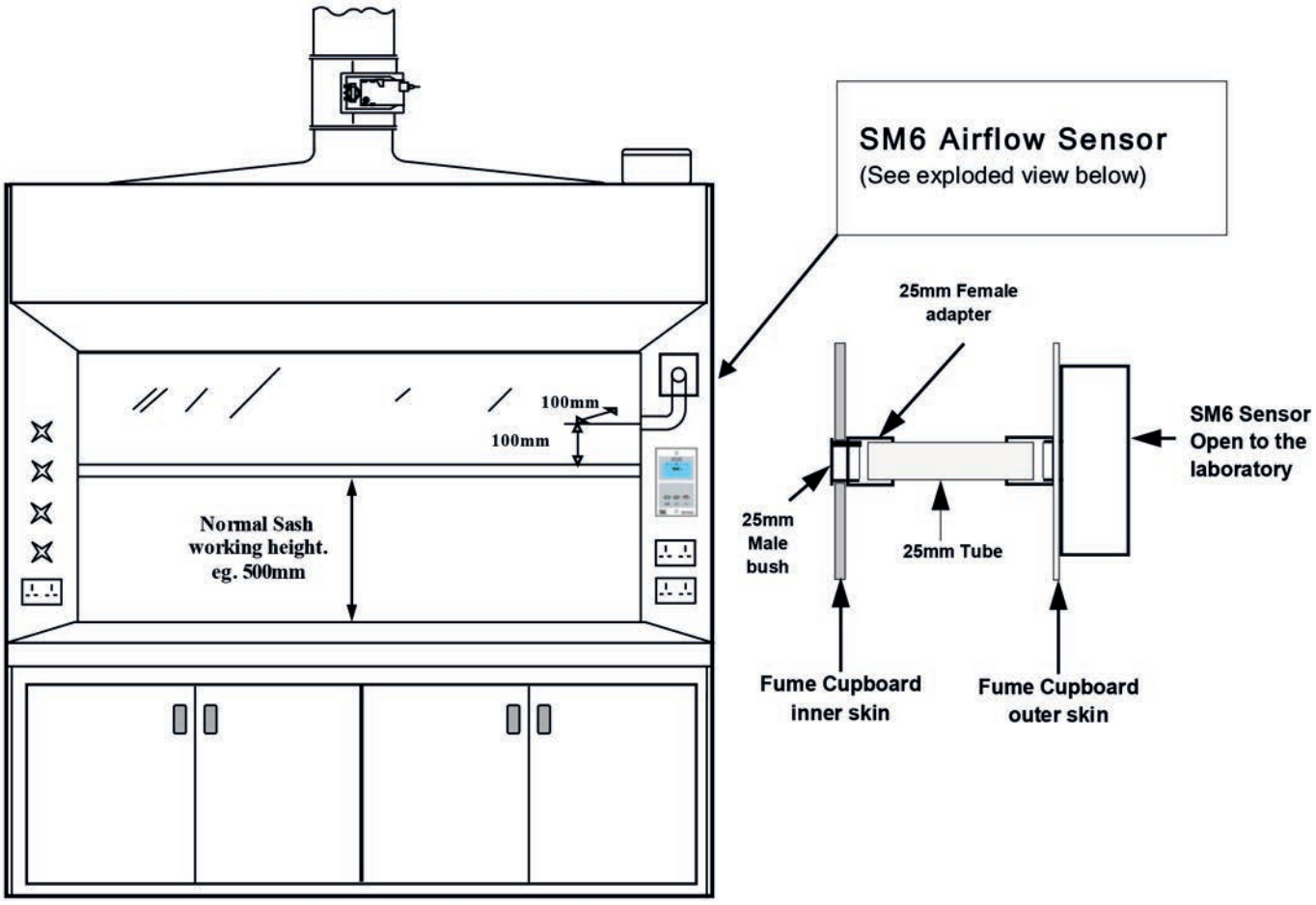


SM6 Sensor Dimensions (Rear view)



SM6 Sensor Panel Cutout Dimensions (Front View)

5.4 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 1M 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 velocities.

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 1M. In this case it is better to use a tube no longer than 1M 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.

6. CONFIGURATION & CALIBRATION

6 CONFIGURATION & CALIBRATION

6.1 Configuration

The VAV Controller 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 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 controllers to suit the application.

The configuration of the various functions and the calibration of the controller face velocity 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 Block Diagram** operation document.

6.2 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 period the unit performs one of two options:

    a. If the controller calibration has been previously completed – 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

Note - If the unit has been set with a Fan Stop / Start pushbutton the controller can be set to Run mode before it is calibrated to allow the Fan to be Started. To Enter the menu from the Run screen press and hold the ENTER button for 5 seconds or until the main menu appears.

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

6.3 Calibration

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select ECON CONFIGURE, then select MANUAL / AUTO and press Enter, select MANUAL and press Enter to continue.
4. Open the sash to the normal operating height and measure the face velocity using a calibrated instrument. Using the + / - buttons adjust the Manual output so that the face velocity is equal to the design velocity, e.g. 0.50m/sec (100fpm) , then press Enter, then select DONE and press Enter again. Note - this manually sets the output to a fixed value to allow the airflow sensor calibration.
5. Using the + / - buttons select SET UP, then select CALIBRATION, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
6. With the sash open to the normal operating height again measure the face velocity using a calibrated instrument. Using the + / -buttons enter the measured face velocity then press Enter, the controller will then sample the airflow for 5 seconds.
7. If the airflow sample is unstable the controller will display "Deviations too High", follow the instructions to repeat the sample or quit the calibration.
8. If the sample is accepted, lower the sash by half and measure the face velocity using a calibrated instrument. Using the + / - buttons enter the measured face velocity and press Enter, the monitor will then sample the airflow for 5 seconds.
9. If the calibration is successful the controller will return the Main Menu, select RUN to go to normal operating mode and check the velocity reading is accurate and stable.
10. If the airflow sample is unstable the controller will display "Deviations too High", follow the instructions to repeat the sample or quit the calibration.
11. The controller will display "Increase higher airflow sample" if the second sample value is too close to the first value entered, close the sash a little and repeat the higher sample. The minimum difference between the samples that the controller will accept is 0.3m/sec (60fpm).
12. The controller will display "Sensor diff too low" if the controller doesn't detect any difference in the sensor output between the 2 airflow samples, check that the sensor hose is connected and repeat the calibration.
13. If the calibration is stable and accurate Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
14. Using the + / - buttons select SET UP, then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
15. Using the + / - buttons select ECON CONFIGURE, then select MANUAL / AUTO and press Enter, then select AUTO and press Enter to continue, then select DONE and press Enter.
16. The controller will return to the MAIN MENU, select RUN to go to normal operating mode.

See Calibration Notes for hints on successful calibration.

6.4 Calibration Notes

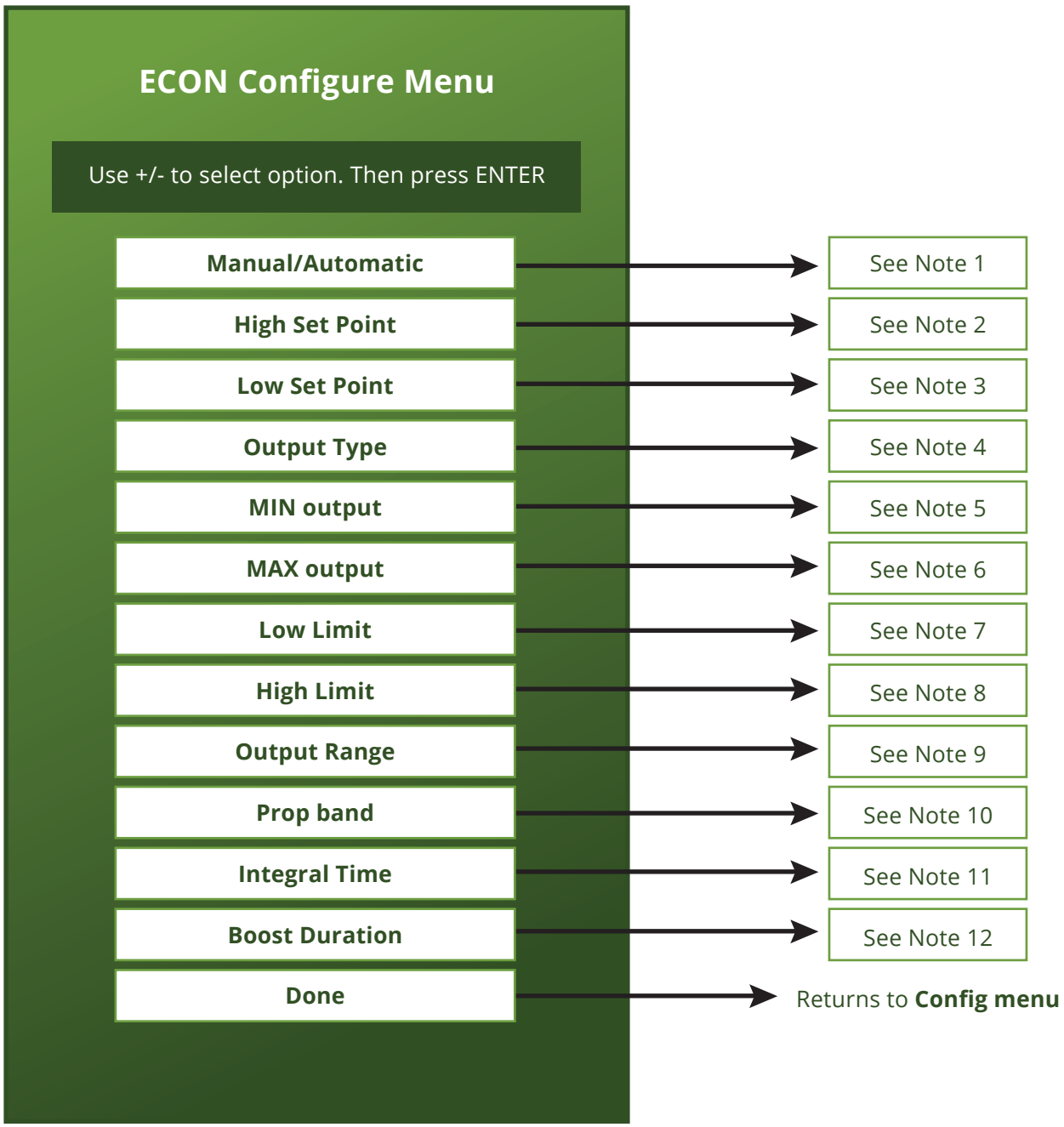
1. When using a standard Fume Cupboard with Vertical Sliding sashes open the sash to the normal max safe working height for the Low Air sample.
2. For the Higher Air sample close the sash to approx 50% of the opening used for the Lower Air sample. If the Higher air sample value is too close to the Lower Air sample the alarm will detect this and ask you to repeat with a higher value.(The minimum difference between the Low & High air samples is set to 0.3 m/sec)To do this close the sash a little more and repeat the sample. Avoid closing the sash below 150mm.
3. The face velocity readings on the open sash may vary at different points on the measuring grid by up to 0.1 m/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 stabilize. 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 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 show "Sensor Difference too low - Check 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.
7. When calibrating the Controller for Dual Set point operation consideration should be made for accuracy at both set points. The Low Air sample should be taken at the approximate Low set point value (e.g. 0.3 m/sec) and the High Air sample should be taken at the approximate High Air set point value (e.g.0.6 m/sec) considering the min 0.3 m/sec difference required between the calibration values.

If the airflow display is unstable following the calibration due to environmental turbulence or sensor position and cannot be rectified then it is possible to adjust the sensitivity of the displayed value using the Display Smoothing parameter in the cal config menu. The controller will display the velocity value as a rolling average over time and is adjustable over 1 to 100 seconds. Note - the control output is not affected by the display smoothing so will provide fast response control based on the sensor output. If the control output is unstable due to turbulence on the sensor then the output can be tuned to give stable control in the Econ Config menu, see 6.5 Control Set up.

6.5 Control Settings

There are various control settings that need to be considered to give good control of the Fume Cupboard face velocity. These setting are adjustable in the 'ECON configure menu'.

To access 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.

Note - If the Output type is set to Valve the manual output is relative to damper position, if the Output type is set to damper or Inverter the manual output is relative to volume,

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.

The controller will display "Manual", "Automatic", High Set Point" or" Low Set point" above the output bar graph at the top of the screen to show the current output status.

Note 2 – High Set Point

This is used to enter the desired set point face velocity for the VAV control and is also used to enter the desired High set point face velocity in occupied mode when Dual Set point control is used.

Note 3 – Low Set Point

This is used to enter the desired Low set point face velocity in unoccupied mode when Dual Set point control is used.

Note 4 – Output Type

The 0-10VDC control output can be set to the following options:-

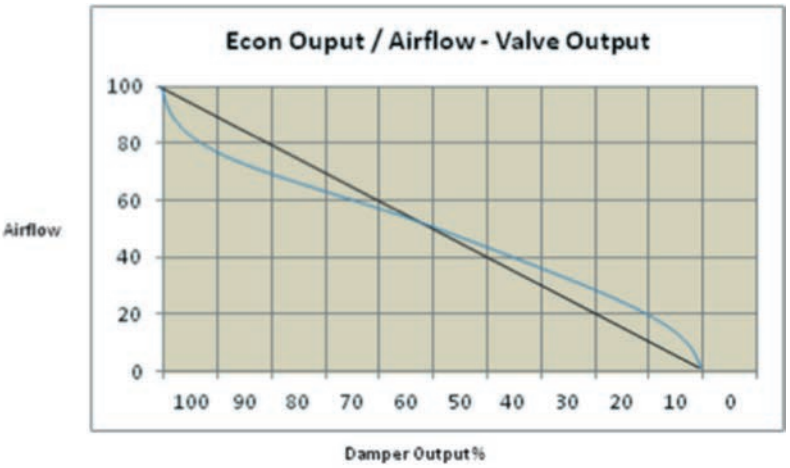
a. Damper
b. Inverter
c. Valve

a. Damper - the damper output is linearized for a butterfly type damper so that the output is proportional to volume not damper position. The linearized output gives increased speed of response when the sash is opened. This setting should be used for TEL supplied Econ VAV dampers. The output is direct so that 0V = Max volume

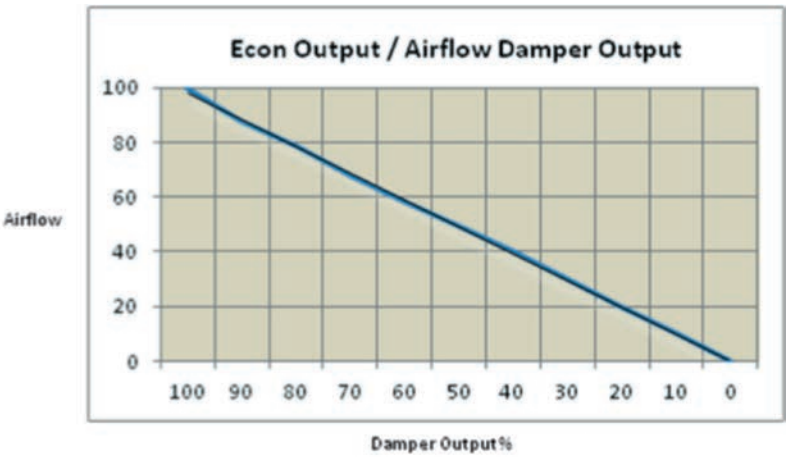
b. Inverter - the Inverter output is proportional to volume when used with an Inverter and is reversed so that 10V = max volume,

c. Valve - the valve output is proportional to damper position e.g. 50%= 45 Degrees on a 90 Degree actuator. The output is direct so that 0V = Max volume

Typical butterfly damper curve to face velocity (Valve Output).



Typical linearized butterfly damper curve to face velocity (Damper Output).



Note - Performance is dependent on damper and Fume Cupboard leakage.

Note 5 – 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 in use and the MIN function is selected. Output range 0 – 100%.

Note 6 – 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 7 – 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 - 25% of the design volume with the sash at the max safe working opening.

Note - Typical minimum volume requirement is set to achieve 6 ach/hr room ventilation when all sashes are closed.

Note 8 – 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.

Note - In most installations the High Limit is set to 100%

Note 9 – Output Range

This is used to select the correct output voltage range for Damper control for the VAV or for Inverter speed control of the extract fan

Damper 2 - 10V Valve 2 - 10V Inverter 0 - 10V

Note 10 – 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 in 5.6 Control Setup Guide.

Example of Prop Band gain settings

P Band %	Set Point m/sec	Integral Secs	Output = 0% @	Output = 100% @
50	0.50	0	0 m/sec	1.00 m/sec
30	0.50	0	0.20 m/sec	0.80 m/sec
10	0.50	0	0.40 m/sec	0.60 m/sec

The Prop Band gain is 0-100% of full scale (1.00m/sec) so a Prop Band of 50% = 0.5m/sec, the output will be at zero when the airflow is 0.5m/sec below the set point and be at 100% when the airflow is 0.5m/sec above the set point.

Note 11 – Integral

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 in Seconds. Increasing the value will give a faster 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 in 5.6 Control Setup Guide.

Note 12 – Boost Duration

This function is used in conjunction with the Sash position sensor for VAV control. When the sash is opened the output will drive to a calculated position for a brief time period before the output switches back to face velocity control. The Boost Duration is the time period that the output is held before switching back to face velocity control.

This parameter should not require an on-site setting and is factory set to 5 seconds.

6.6 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 seconds. This will give proportional control only.

b. Set the **Prop Band** to 30%.

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/sec.

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/sec 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 value. Initially set the Integral Time to 10 seconds.

g. Now when the sash is lowered the Integral will reduce the face velocity back to the set point overa specified time.

h. If the 'correction time' is too slow increase the **Integral Time** (seconds) 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 seconds.

The controller has an Auto Tune correction algorithm that increases the speed of response once the measured airflow value drops below the set point value if the Prop band and Integral settings are incorrect. The algorithm is only active when the measured airflow is below the set point and the Integral value is set greater than zero.

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).

6.7 Dual Output - Econ Output 2

The AFA1000/E has a second 0-10V control output that is available when the Econ power supply unit is fitted.

The secondary output can be configured using the pushbutton menu for 3 functions:-

Function	Additional Requirements	Description of Operation
Bleed Damper	Econ Power supply	0-10VDC Output to control a secondary damper e.g. Fresh Air Bleed or Supply Air damper.
Volume Pressure	Econ Power supply, Pressure Cell PCB, Duct restrictor device	0-10VDC volumetric output based on duct volume measurement.
Volume	Econ Power supply, Sash Position Sensor	0-10VDC volumetric output based on sash position and face velocity calculation.

6.8 Bleed Damper

The Bleed damper function is used to operate a secondary output based on the Econ Output 1 voltage and can be scaled and offset to give the required output direction and range.

For example, using the second output as a Fresh Air or Room Air Bleed control voltage signal.

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select ECON CONFIGURE, then select OUTPUT TYPE and press Enter, select VALVE and press Enter to continue. This sets Econ output 1 so that the output is based on damper position so that the behavior of both outputs will be the same, then select DONE and press ENTER.
4. Using the + / - buttons select DUAL OUTPUT and press ENTER, then select BLEED DAMPER and press Enter.
5. Using the + / - buttons select the BLEED DAMPER parameter and press ENTER, this will introduce a Sub Menu for the Bleed Damper settings.
    - **a.** Max Output - this sets the maximum output voltage in Auto control.
    - **b.** Min Output - this sets the minimum output voltage in Auto control.
    - **c.** Man/Auto - this sets a Manual fixed output or selects calibration for Auto control.
6. Using the + / - buttons select MAN/AUTO and press ENTER, select MANUAL and press ENTER, then using the -/+ buttons adjust the manual output so that the Bleed or Room air damper is fully closed and then press ENTER, then select DONE and ENTER.

    This sets the secondary output closed so that the Econ output can be set up and calibrated as described in sections 6.3 to 6.4.

Once the airflow sensor has been calibrated and the Econ control set up and put into Auto control the Bleed damper output can be Calibrated as follows:-

7. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.

8. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.

9. Using the + / - buttons select BLEED DAMPER and press Enter. The Bleed damper sub menu will appear.

10. Using the + / - buttons select MAN/AUTO and press Enter, then select AUTOMATIC and press ENTER.

11. Following the ON SCREEN INSTRUCTIONS move the sash to the first position, (the normal working height, e.g. 500mm). Using the +/- buttons adjust the output % shown on the screen to drive Output 2 to the required position e.g. 0% fully closed and press ENTER.

12. Following the ON SCREEN INSTRUCTIONS move the sash to the second position, (sash closed position, e.g. 100mm). Using the +/- buttons adjust the output % shown on the screen to drive Output 2 to the required position e.g. 100% fully open and press ENTER, the select DONE and RUN.

This will set the output so that Econ output 2 will be 0% when the sash is at 500mm and 100% when the sash is closed.

If the output needs to be reversed enter 100% for the first calibration point and 0% for the second calibration point during the Auto setting calibration.

If the output needs to be trimmed or limited the Max and Min output parameters in the Bleed Damper sub menu can be adjusted without having to recalibrated the Auto setting:-

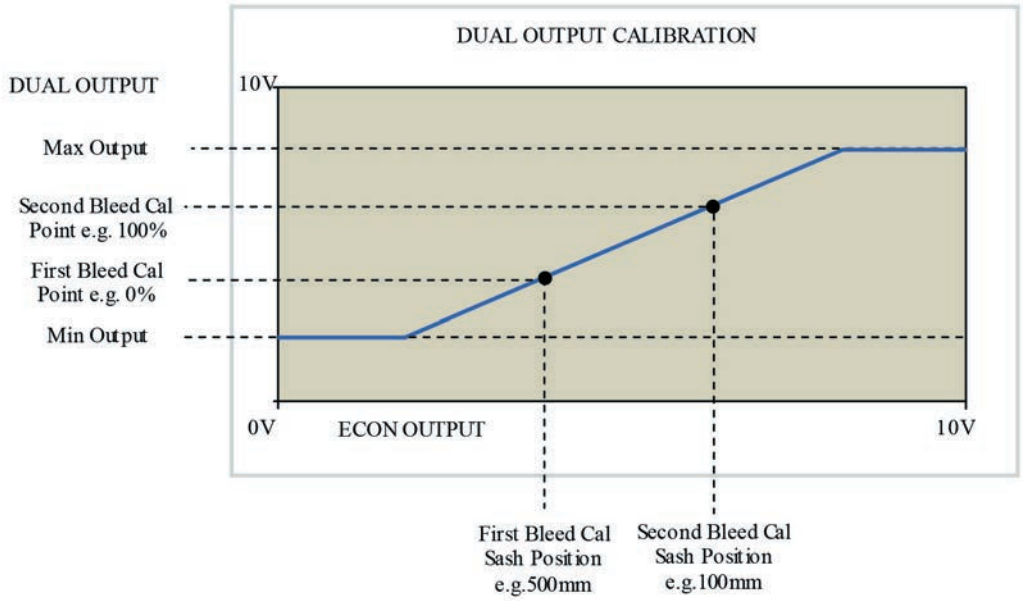
Min Output - adjust the minimum output voltage in %, if Econ output 1 is set to 2-10V then 0%= 2V, 50%=6V, 100% = 10Vetc.

Max Output - adjust the maximum output voltage in %, if Econ output 1 is set to 2-10V then 0%= 2V, 50%=6V, 100% = 10Vetc.

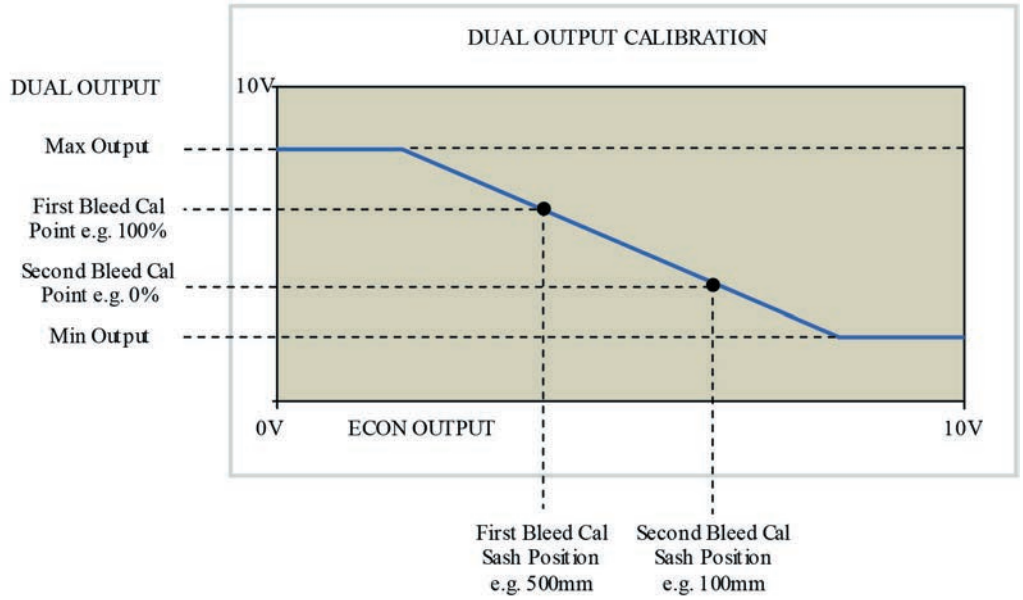
The Bleed damper output is 0-10V and does not consider the Econ Low Limit and Output range values. If the Dual output needs to be 2-10V set the Min Output to 20%.

Econ output 1 is active whilst in the Bleed damper Auto calibration menu so wait a few seconds for the damper to settle once the sash has been moved to enter the first and second calibration values.

Dual Output Calibration to give Direct Output (same as Econ output 1 direction).



Dual Output Calibration to give Reverse Output (opposite to Econ output 1 direction).



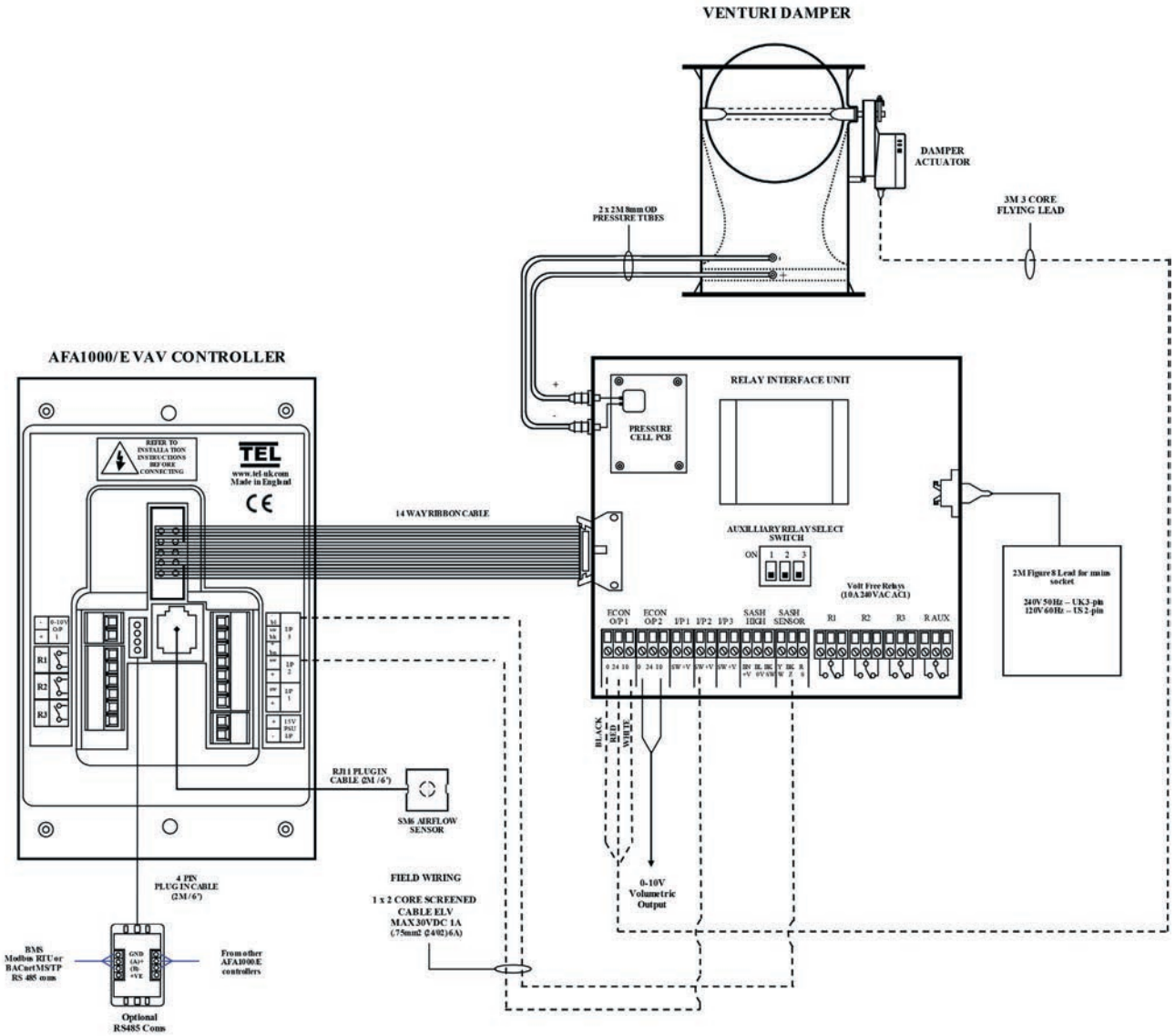
6.9 Volume Pressure

The Volume Pressure function is used to provide a volumetric 0-10VDC output relative to the Fume Cupboard extract volume. The controller power supply is fitted with a pressure cell PCB and connects to a bell mouth venturi type restrictor in the duct. The restrictor can be provided as a separate item or built into the Econ damper section.

3rd party restrictor devices or orifice plates can also be used with the pressure cell PCB.

The volumetric output is provided as an analogue 0-10VDC signal on Econ Output 2 and is also available on the RS485 coms output.

1. Connection Diagram - Standard Fume Cupboard



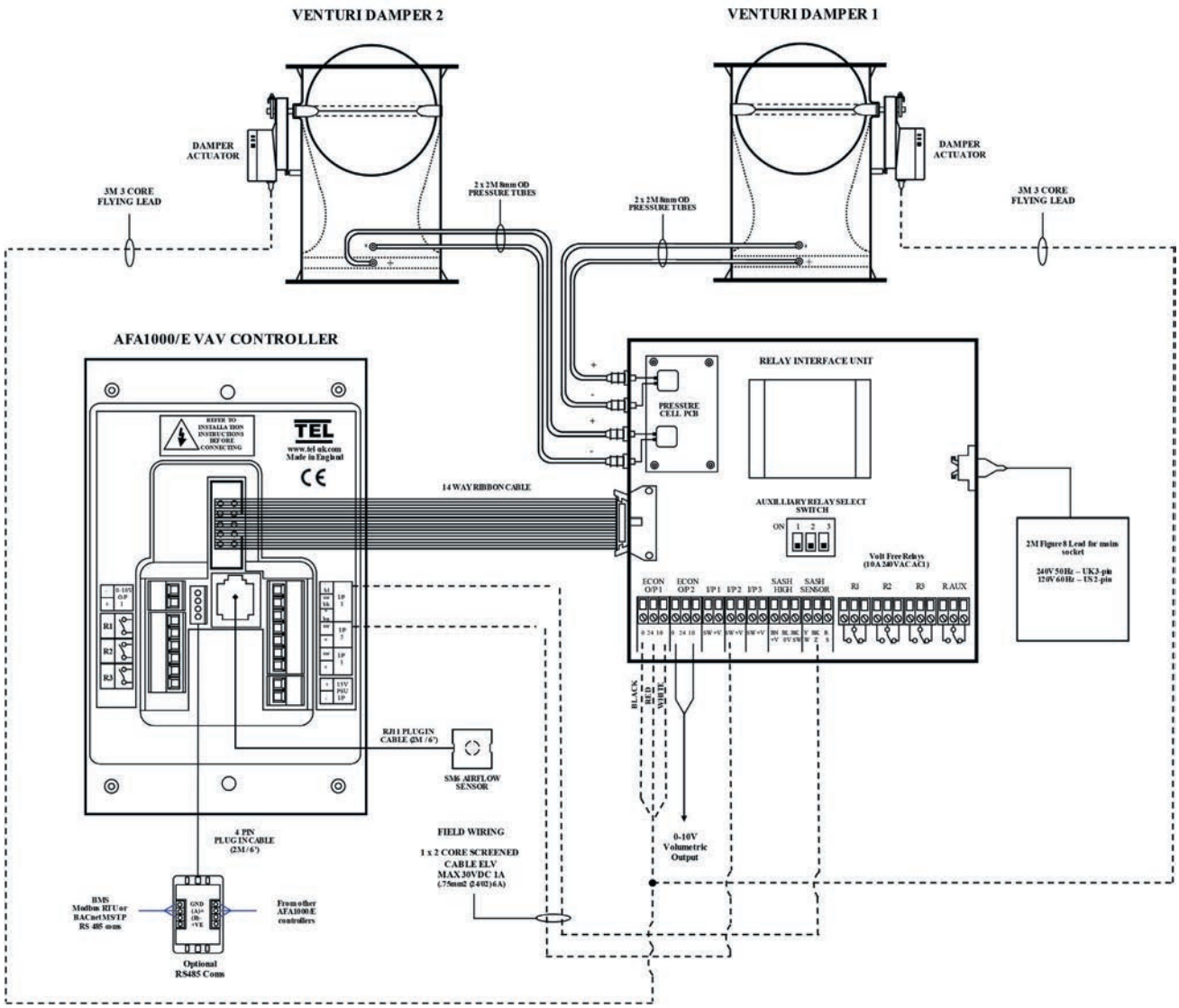
A second pressure cell and Venturi damper can be used if the Fume Cupboard is very wide and has 2 duct connections to the main duct header.

The AFA1000 controller will add the 2 volumes together to give a single total volume output.

3rd party restrictor devices or orifice plates can also be used with the pressure cell PCB.

The volumetric output is provided as an analogue 0-10VDC signal on Econ Output 2 and is also available on the RS485 coms output.

2. Connection Diagram - Wide Fume Cupboard



To Setup the Volume pressure output using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select INPUT 2, and then press Enter, then using the +/- buttons select ANALOGUE and press Enter, then using the +/- buttons select VOLUME PRESSURE and press Enter to continue.
4. Using the + / - buttons select DUAL OUTPUT and press Enter, then select VOLUME PRESSURE and press Enter.
5. Using the + / - buttons select the VOLUME PRESSURE parameter and press Enter, this will introduce a Sub Menu for the VOLUME PRESSURE settings.

	Parameter	Description	Range
A	Input Range	Input range from Pressure Cell	0-50,100,250,500
B	Output Range	Volumetric Output volume range for 0-10VDC	0-1000 l/sec
C	Input Filter	Time Average filter	1 to 100 Seconds
D	K Factor	Constant for Venturi Device	00.00 to 100.00
E	F Factor	Offset for Fume Cupboard leakage	100 to 200%
F	Air Density	Air Density constant	1.0 to 1.2 kg/m3

6. Using the + / - buttons select INPUT RANGE and press ENTER, then using the -/+ buttons adjust value to match the settings on the pressure cell PCB, and then press Enter. (Default 0-50).
7. Using the + / - buttons select OUTPUT RANGE and press ENTER, then using the -/+ buttons adjust value to match the Fume Cupboard volume range and then press Enter. (Default 0-1000).

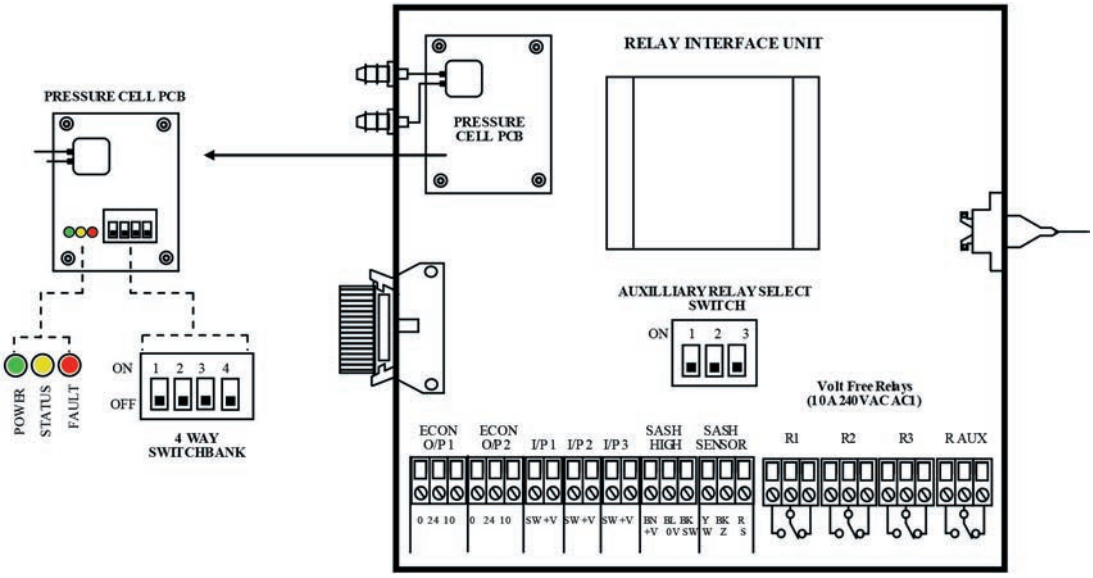
   E.g. changing to 500l/sec will give 0-10V over 0-500l/sec, (10V = 500l/sec).
8. Using the + / - buttons select INPUT FILTER and press ENTER, then using the -/+ buttons adjust value so that the volumetric output is stable and then press Enter. (Default1 second).

   Note - the filter will give a rolling average over time to compensate for turbulent duct readings.
9. Using the + / - buttons select K Factor and press ENTER, then using the -/+ buttons adjust value so that the correct constant correction value is displayed then press Enter. (Default 45.80 for TEL device).
10. Using the + / - buttons select F Factor and press ENTER, then using the -/+ buttons adjust value so that the correct leakage correction value is displayed then press Enter. (Default 100%).

    Note - the volume is measured in the duct and may not represent the face velocity calculated volume due to leakage, using the F factor compensation the controller will display relative Fume Cupboard volume. E.g. set to 110% for 10% leakage.
11. Using the + / - buttons select AIR DENSITY and press ENTER, then using the -/+ buttons adjust value so that the correct value is displayed then press Enter, then select DONE and Run. (Default 1.2kg/m3). E.g. change to 1.0kg/m3 if a 3rd party restrictor is used that doesn't consider air density.

Pressure Cell PCB settings and Calibration

Pressure Cell PCB Location



The pressure cell PCB has a 4 way switch bank and 3 LED's.

SW1	SW2	SW3	SW4	MODE	RANGE	DEFAULT
OFF	OFF	OFF	TARE	Output proportional to VOLUME	5V@100Pa,10V@400Pa	✔
ON	OFF				5V@250Pa,10V@1000Pa	
OFF	ON				5V@500Pa,10V@2000Pa	
ON	ON				5V@1000Pa,10V@4000Pa	
OFF	OFF	ON	TARE	Output proportional to PRESSURE	5V@100Pa,10V@200Pa	
ON	OFF				5V@250Pa,10V@500Pa	
OFF	ON				5V@500Pa,10V@1000Pa	
ON	ON				5V@1000Pa,10V@2000Pa	
			OFF/ON			

SW1 & SW2 are used to select the pressure range.
SW3 is used to select Volume or Pressure output.
SW4 is used to Tare (Zero) the pressure cell.

The output proportional to pressure setting is used for testing purposes and not for operational use (SW 3 should be se to OFF).

Calibration (Tare)

1. Power up the Econ power supply with the cover on the enclosure and wait 5 minutes for the pressure cell to stabilize.
2. Ensure that the extract fan is switched OFF.
3. The LED's will show the following:-

MODE	POWER LED	STATUS LED	FAULT LED	Vout1	Vout2
Sensor Fault	ON	OFF	ON	10V	10V
Requires Calibration	ON	FLASH	FLASH	10V	10V
Calibration in Progress	ON	FLASH	OFF	0V	0V
Warming up period	FLASH	OFF	OFF	0V	0V
OK	ON	ON	OFF	P/Vol OP	P/Vol OP

4. Set SW4 to the ON position, the Status LED will flash for 5 seconds whilst the cell output is zeroed and the Fault LED will go solid.
5. Once the calibration is complete the Status LED will go solid.
6. Set SW4 to the OFF position.
7. The Power and Status LED's should be ON and the Fault LED should be OFF (OK).

   Note - the pressure cell calibration is required to compensate for altitude, orientation of power supply box etc so is recommended to give best accuracy.

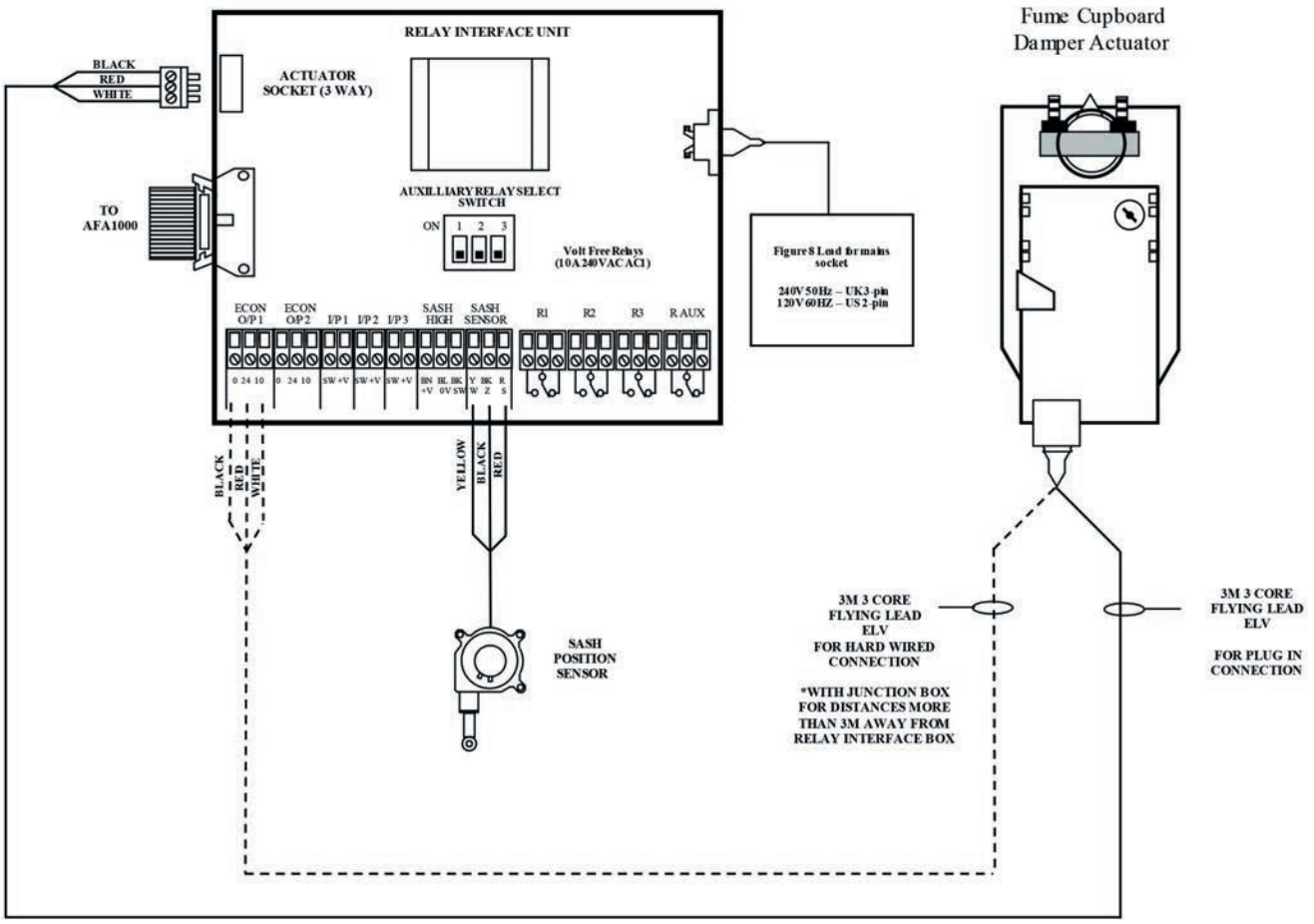
Testing

Once the cell has been calibrated and the extract fan is running the measured volume can be displayed in the diagnostics menu I/O Status - Sensor data screen described in section 2.8.

6.10 Volume (Sash Position Sensor)

The Volume function is used to provide a volumetric 0-10VDC output relative to the Fume Cupboard extract volume using a sash position sensor and can only be used on a Bench type Fume Cupboard with a single vertical sash.

Typical connection diagram



Sash Position Sensor

The sash position sensor is fitted with a mounting bracket which can be fitted in four different orientations to enable the sensor draw wire to be correctly aligned.

1. Offer up the sensor to determine the best fixing position on the fume cupboard framework.

   For best results, the sensor draw wire should run straight out of the sensor housing in line with the cable housing extension. In cases where the wire has run at an angle to the sensor, ensure the angle is as small as possible to ensure that the wire does not rub on any part of the sensor body including the cable housing extension.

2. Mark the fixing holes in the framework and attach the sensor.

   The fixing bracket has two 0.37mm (0.015") diameter fixing holes.

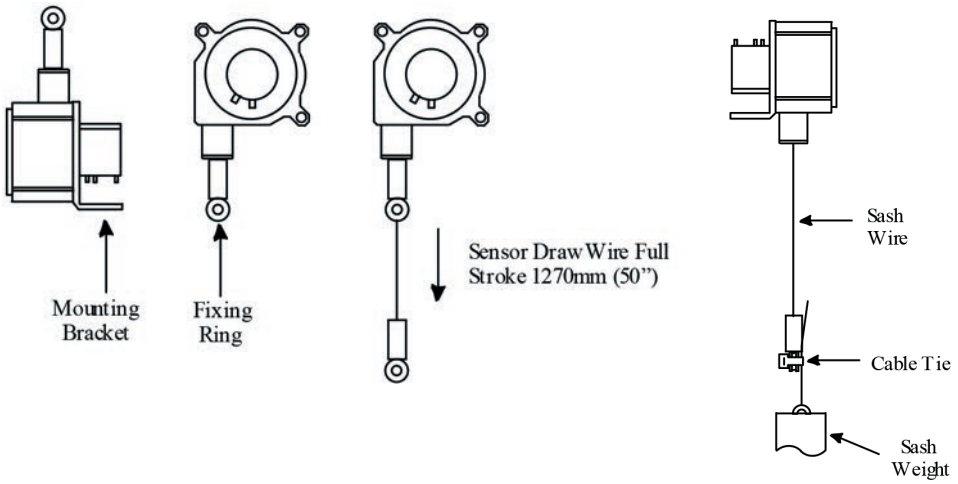
   Note: Ensure that the sensor is in a suitable position to ensure that the draw wire does not over extend. The sensor draw wire maximum stroke is 1270mm (50").

3. Attach the draw wire to either:

   • The sash using a suitably sized screw - the draw wire has a 9.53mm (0.38") diameter fixing ring with a 4.85mm (0.18") diameter fixing hole in its centre.

   • The sash cable using a cable tie, ensuring that the fixing ring does not run over pulleys etc.

   • The counterweight using a cable tie.



Once the sensor is fitted manually move the sash to ensure the sensor runs freely and does not snag.

To Setup the Volume output using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select INPUT 2, and then press Enter, then using the +/- buttons select ANALOGUE and press Enter, then using the +/- buttons select SASH POSITION and press Enter to continue.
4. Using the + / - buttons select the DUAL OUTPUT parameter and press Enter, then select VOLUME and press Enter.
5. Using the + / - buttons select the VOLUME OUTPUT parameter and press Enter, this will introduce a Sub Menu for the VOLUME OUTPUT settings.

	Parameter	Description	Range
A	Sash Width	Enter the internal Fume Cupboard width	0-7000mm
B	Sash Gap	Volumetric Output volume range for 0-10VDC	0-1000mm
C	Max Volume	Enter the maximum Fume Cupboard volume or required range	1 to 1000l/sec

6. Using the + / - buttons select SASH WIDTH and press ENTER, then using the -/+ buttons enter the measured internal width, and then press Enter. (Default 0-1200mm).
7. Using the + / - buttons select SASH GAP and press ENTER, then using the -/+ buttons set the measured gap value and then press Enter. (Default 25mm).

   E.g. gap between sash and soffit panel (e.g.25mm)
8. Using the + / - buttons select MAX VOLUME and press ENTER, then using the -/+ buttons adjust value so that the volumetric output range is equal to the required Fume Cupboard volume range and then press Enter. (Default1000l/sec). Then select DONE and RUN.

   E.g. -1000l/sec will give 10VDC @ 10000l/sec, setting the Max Volume to 500l/sec will give 10VDC @ 500l/sec etc.

   When the above settings are entered the sash position sensor will then require calibration:-
9. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
10. Using the + / - buttons select SET UP, and then select CALIBRATION, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
11. Using the + / - buttons select SASH POSITION SENSOR, and then press Enter.
12. Following the ON SCREEN INSTRUCTIONS open the sash to the normal working height e.g. 500mm and using the +/- buttons enter the sash height and press Enter.
13. Following the ON SCREEN INSTRUCTIONS lower the sash to approximately half way e.g. 250mm and using the +/- buttons enter the sash height and press Enter, then select DONE and then RUN.

Testing

Once the sash position sensor has been calibrated and the extract fan is running the measured volume and sash height can be displayed in the diagnostics menu I/O Status - Sensor data screen described in section 2.8.

7. AUXILIARY FEATURES & CONNECTIONS

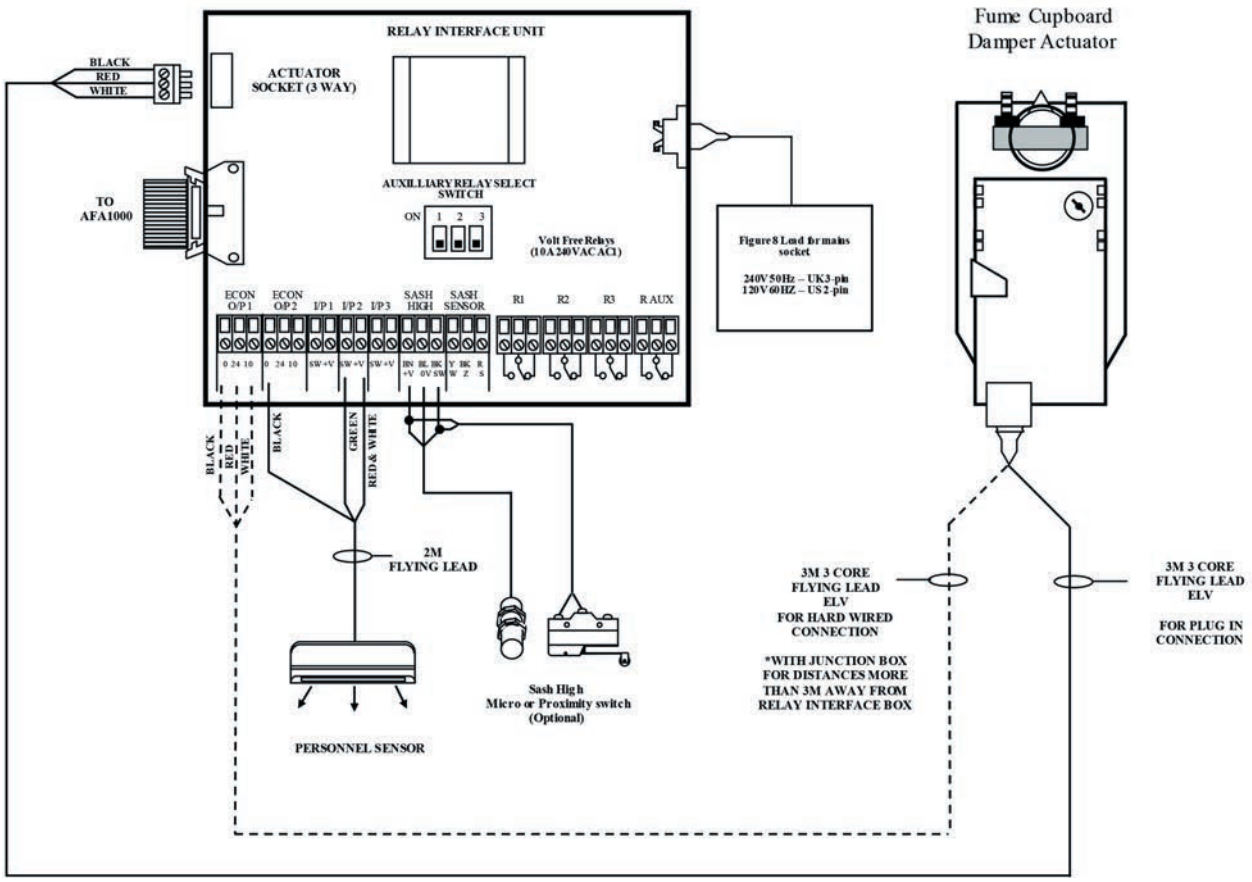
7 AUXILIARY FEATURES & CONNECTIONS

7.1 Dual Set point (Occupancy) operation

The Dual Set Point function is designed to operate with a PIR occupancy sensor so that the controller operates to a lower Econ control velocity set point and reduced alarm points when the Fume Cupboard is unoccupied.

When the dual set point function is active the controller will display “High Set Point”, “Low Set Point” or “Manual” above the output status bar graph indicating the current occupancy condition.

Typical connection diagram



To Setup the Dual Set point mode using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select INPUT 2, and then press Enter, then using the +/- buttons select CLOSED CONTACT and press Enter, then using the +/- buttons select PERS. SENSOR and press Enter to continue.
4. Using the + / - buttons select the ECON CONFIG menu and press Enter.
5. Using the + / - buttons select the HIGH SET POINT parameter and press Enter, then using the +/- buttons adjust the value to the required High (Occupied) set point and press Enter to continue.
6. Using the + / - buttons select the LOW SET POINT parameter and press Enter, then using the +/- buttons adjust the value to the required Low (Un-occupied) set point and press Enter to continue, then using the +/- buttons set the required activation delay time, then press Enter to continue.

Note - the activation delay time is a delay period that activates once the fume cupboard is un-occupied before the controller changes to Low set point operation, this is to allow the user to briefly return to the fume cupboard without the controller reducing the set point (0-300 seconds time range).

7. Using the + / - buttons select the CAL CONFIG menu and press Enter.
8. Using the + / - buttons select the LOW AIR ALARM parameter and press Enter, then using the +/- buttons adjust the value to the required (Occupied) alarm point and press Enter to continue.
9. Using the + / - buttons select the WARNING AIR ALARM parameter and press Enter, then using the +/- buttons adjust the value to the required (Occupied) alarm point and press Enter to continue.
10. Using the + / - buttons select the REDUCED LOW AIR ALARM parameter and press Enter, then using the +/- buttons adjust the value to the required (Un-occupied) alarm point and press Enter to continue.
11. Using the + / - buttons select the REDUCED WARNING parameter and press Enter, then using the +/- buttons adjust the value to the required (Un-occupied) alarm point and press Enter to continue, then select DONE and then RUN.

Note - the typical alarm points are as follows:-

STATUS	Set Point Value	Low Air Alarm	Warning Air Alarm	Reduced Low Air Alarm	Reduced Warning Air Alarm
High Set Point	0.50m/sec	0.40m/sec (80%)	0.45m/sec (90%)		
Low Set Point	0.30m/sec			0.24m/sec (80%)	0.27m/sec (80%)

PIR Sensor

The Personnel Sensor is a Passive Infra-Red (PIR) occupancy detector which detects the presence or absence of the fume cupboard operator and is used to change the control set point when the fume cupboard is unoccupied.

On power up, the Personnel Sensor 'learns' the reflection characteristics of the environment within its field of view and stores this information as reference background data. The sensor then 're-learns' the background every three minutes, so that if a stationary object, such as a stool, is left in the field it will become part of the background and 'ignored' by the sensor.

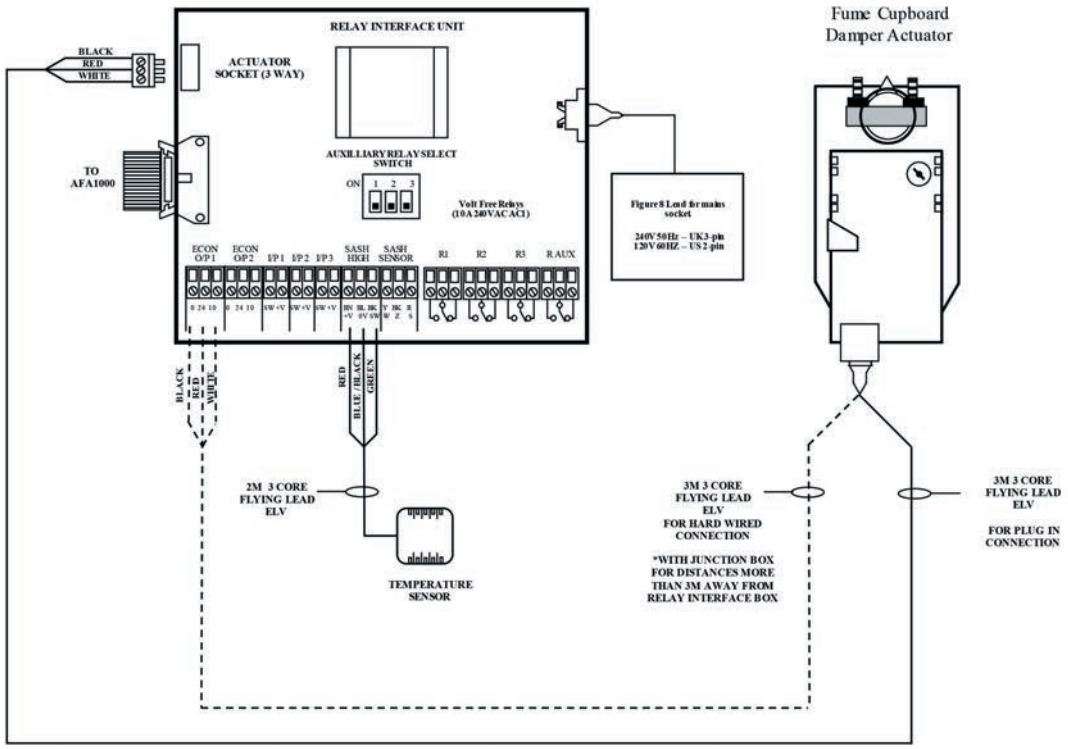
Refer to the manufacturer's data sheet or separate PIR specification sheet for installation details.

7.2 Optional Input function - Temperature Sensor

The AFA1000/E can be fitted with a temperature sensor to display the fume cupboard temperature and give high and low temperature alarms. The temperature display can be hidden from view or shown alongside the airflow velocity.

High and Low temperature alarms can be set with relay outputs.

Typical connection diagram



To Setup the Temperature input using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select INPUT 3, and then press Enter, then using the +/- buttons select ANALOGUE and press Enter, then using the +/- buttons select TEMPERATURE and press Enter to continue.
4. Using the + / - buttons select the TEMPERATURE menu and press Enter, this will introduce a sub menu for the TEMPERATURE settings:-

	Parameter	Description	Range
A	Temp Units	Display units	°C or °F
B	Low Temp Alarm	Sets the Low temperature alarm point	0.0 to High Alarm value
C	High Temp Alarm	Sets the High temperature alarm point	100.0 to Low Alarm value
D	Show Temp	Turns the Temperature display On/Off	Yes/No
E	Offset	Allows the measured value to be offset	-5.0 °C to +5.0 °C

Note - the temperature sensor is accurate to <0.5 °C, the offset parameter can be used if the displayed value needs to be changed to match a 3rd party instrument or other equipment etc.

5. Using the + / - buttons select the TEMP UNITS parameter and press Enter, then using the +/- buttons set to °C or °F and press Enter to continue
6. Using the + / - buttons select the LOW TEMP ALARM parameter and press Enter, then using the +/- buttons adjust the value to the required alarm point and press Enter to continue.
7. Using the + / - buttons select the HIGH TEMP ALARM parameter and press Enter, then using the +/- buttons adjust the value to the required alarm point and press Enter to continue.
8. Using the + / - buttons select the SHOW TEMP parameter and press Enter, then using the +/- buttons set to ON or OFF and press Enter to continue.
9. Using the + / - buttons select the OFFSET parameter and press Enter, then using the +/- buttons adjust the value to the required display offset and press Enter to continue, then select DONE and press Enter to continue.
10. n the CONFIGURE MENU Using the + / - buttons select the LOW TEMP RELAY parameter and press Enter, then using the +/- buttons select the required RELAY OUTPUT and press Enter to continue.
11. In the CONFIGURE MENU Using the + / - buttons select the HIGH TEMP RELAY parameter and press Enter, then using the +/- buttons select the required RELAY OUTPUT and press Enter to continue, then select DONE and RUN.

Testing.

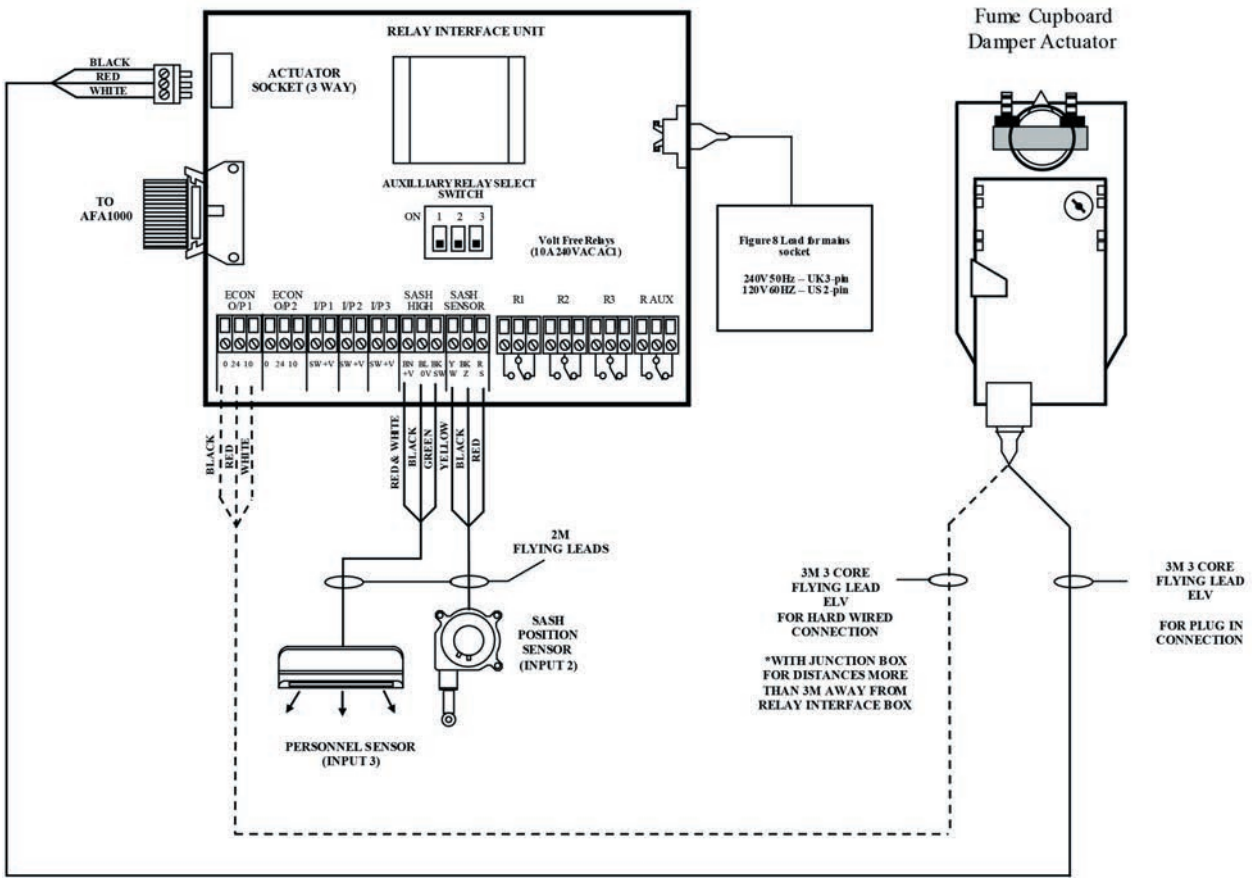
Once the Temperature sensor function has been set up the measured Temperature can be displayed in the diagnostics menu I/O Status - Sensor data screen described in section 2.8..

7.3 Optional Input function - Close Sash Alarm

A Close Sash alarm can be set up on the controller to inform the user that the sash has been left open when the Fume Cupboard is unoccupied. The alarm can be set with a time delay before activation to allow the user to briefly leave and return to the Fume Cupboard and can also be set with a repeat alarm if the sash is left open for prolonged periods of time.

The alarm function uses a PIR occupancy sensor and can be used with either a sash position sensor or micro switch input to detect the sash position.

Typical connection diagram with sash position sensor



To Setup the CLOSE SASH ALARM with Sash Position Sensor using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select INPUT 2, and then press Enter, then using the +/- buttons select ANALOGUE and press Enter, then using the +/- buttons select SASH POSITION and press Enter to continue.
4. Using the + / - buttons select INPUT 3, and then press Enter, then using the +/- buttons select CLOSED CONTACT and press Enter, then using the +/- buttons select SASH WARNING and press Enter to continue.
5. Using the + / - buttons select the SASH CLOSED INPUT parameter and then press Enter, then using the +/- buttons select SASH POS SENSOR and press Enter, then using the +/- buttons set the SASH CLOSED HEIGHT and press Enter to continue.

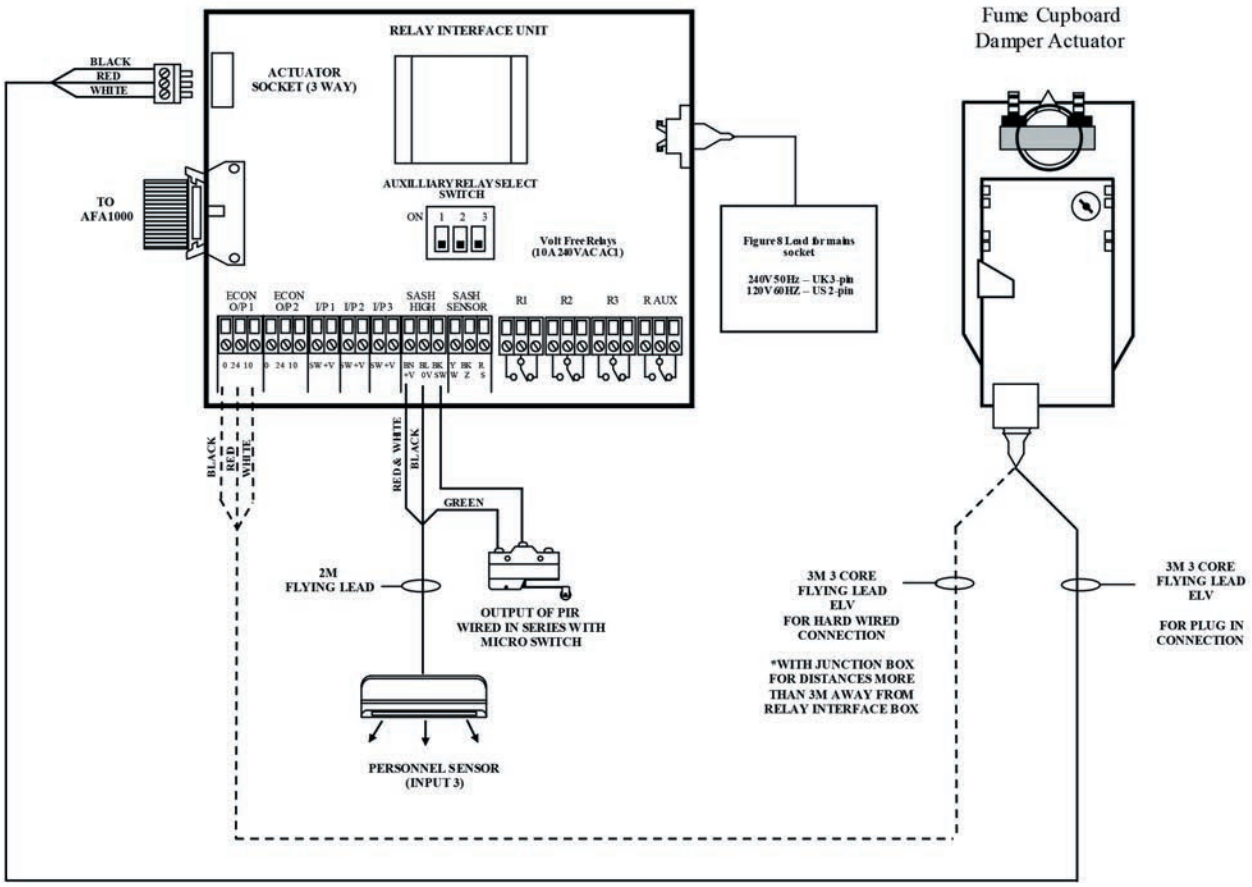
   Note - the SASH CLOSED HEIGHT is the height that the sash will be considered to be closed, e.g. 100mm = sash closed alarm not active when the sash is =<100mm.
6. Using the + / - buttons select the SASH WARNING TIMER parameter and then press Enter, then using the +/- buttons set the required SASH WARNING time delay and press Enter, then using the +/- buttons set the SASH WARNING repeat timer to ENABLED or DISABLED as required and press Enter to continue, if set to ENABLED then using the +/- buttons set the SASH WARNING alarm repeat time as required and press Enter to continue, the select DONE and press Enter to continue.

   e.g. Sash closed height set to 100mm. Sash warning delay set to 1 minute, Sash warning repeat timer set to 5 minutes, if the sash is > 100mm the CLOSE SASH alarm will activate once the fume cupboard is unoccupied for 1 minute, once muted the alarm will re sound after 5 minutes. The alarm will reset if the fume cupboard is then occupied or the sash is =<100mm.
7. Using the + / - buttons select SET UP, and then select CALIBRATION, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
8. Using the + / - buttons select SASH POSITION SENSOR, and then press Enter.
9. Following the ON SCREEN INSTRUCTIONS open the sash to the normal working height e.g. 500mm and using the +/- buttons enter the sash height and press Enter.
10. Following the ON SCREEN INSTRUCTIONS lower the sash to approximately half way e.g. 250mm and using the +/- buttons enter the sash height and press Enter, then select DONE and then RUN.

Testing.

Once the Sash position sensor has been calibrated the Sash Height can be displayed in the diagnostics menu I/O Status - Sensor data screen described in section 2.8.

Typical connection diagram with micro switch



The micro switch connections will depend on the switch activation. The output of the PIR is wired in series with the switch so the output should be active (switch contact closed) when the sash is open:-

	Switch Mounting	Switch Connections	Notes
A	Switch closes when sash is open	C & NO	Refer to micro switch for switch connection details
B	Switch closes when sash is closed	C & NC	

To Setup the CLOSE SASH ALARM with a Sash Micro Switch using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select INPUT 3, and then press Enter, then using the +/- buttons select CLOSED CONTACT and press Enter, then using the +/- buttons select SASH WARNING and press Enter to continue.
4. Using the + / - buttons select the SASH CLOSED INPUT parameter and then press Enter, then using the +/- buttons select SASH SWITCH and press Enter to continue.
5. Using the + / - buttons select the SASH WARNING TIMER parameter and then press Enter, then using the +/- buttons set the required SASH WARNING time delay and press Enter, then using the +/- buttons set the SASH WARNING repeat timer to ENABLED or DISABLED as required and press Enter to continue, if set to ENABLED then using the +/- buttons set the SASH WARNING alarm repeat time as required and press Enter to continue, the select DONE and press Enter to continue.

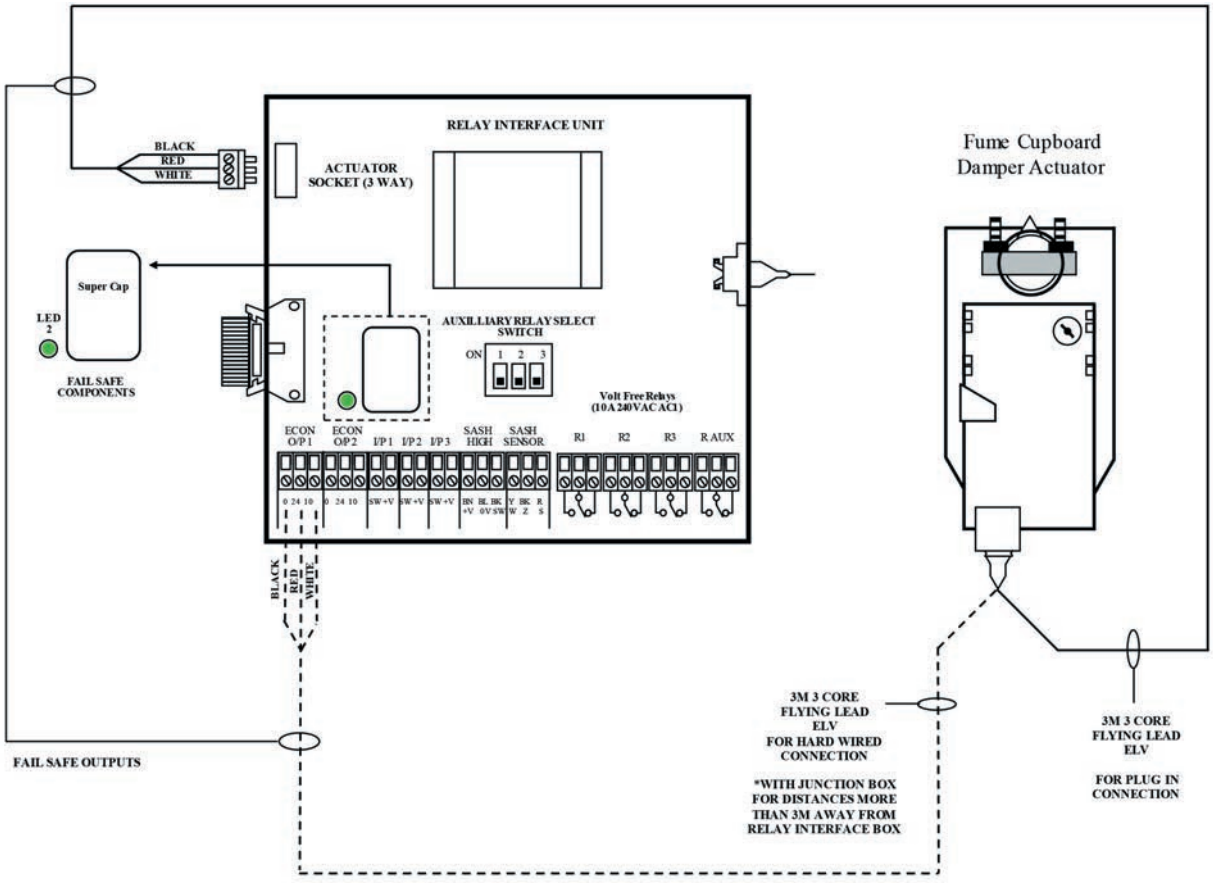
   e.g. Sash closed switch height set to 100mm. Sash warning delay set to 1 minute, Sash warning repeat timer set to 5 minutes, if the sash is > 100mm the CLOSE SASH alarm will activate once the fume cupboard is unoccupied for 1 minute, once muted the alarm will re sound after 5 minutes. The alarm will reset if the fume cupboard is then occupied or the sash is =<100mm.

7.4 Fail Safe damper operation

The Econ power supply is fitted with a Super cap quick charge fail safe feature that will drive the Fume Cupboard damper actuator open in the event of mains power loss (Econ output 1 only). This feature allows non fail safe actuators to be fitted to the Fume Cupboard damper.

Specification	Ratings and requirement for fail safe feature
Actuator Voltage	22-28VDC
Actuator Torque	Max 4NM
Actuator Power consumption whilst driving	Max 13W
Butterfly damper max pressure drop across damper	1000 Pascal's
Multivane damper max pressure drop across damper	500 Pascal's
	Fail Safe operation
Fail Safe charge time	Max 30 seconds from fully discharged state
Fail Safe operation time	Max 5 seconds @ 0.25W 24VDC for 4NM actuator
Charging indication	LED 2 (Green) Dim
Fail Safe active	LED 2 (Green) Bright
Recommended damper Actuator = Belimo LMQ24A-SR-TEL	

Fail Safe component location and outputs



8. RS485 COMS OUTPUT

8 RS485 COMS OUTPUT

8.1 Overview and connections

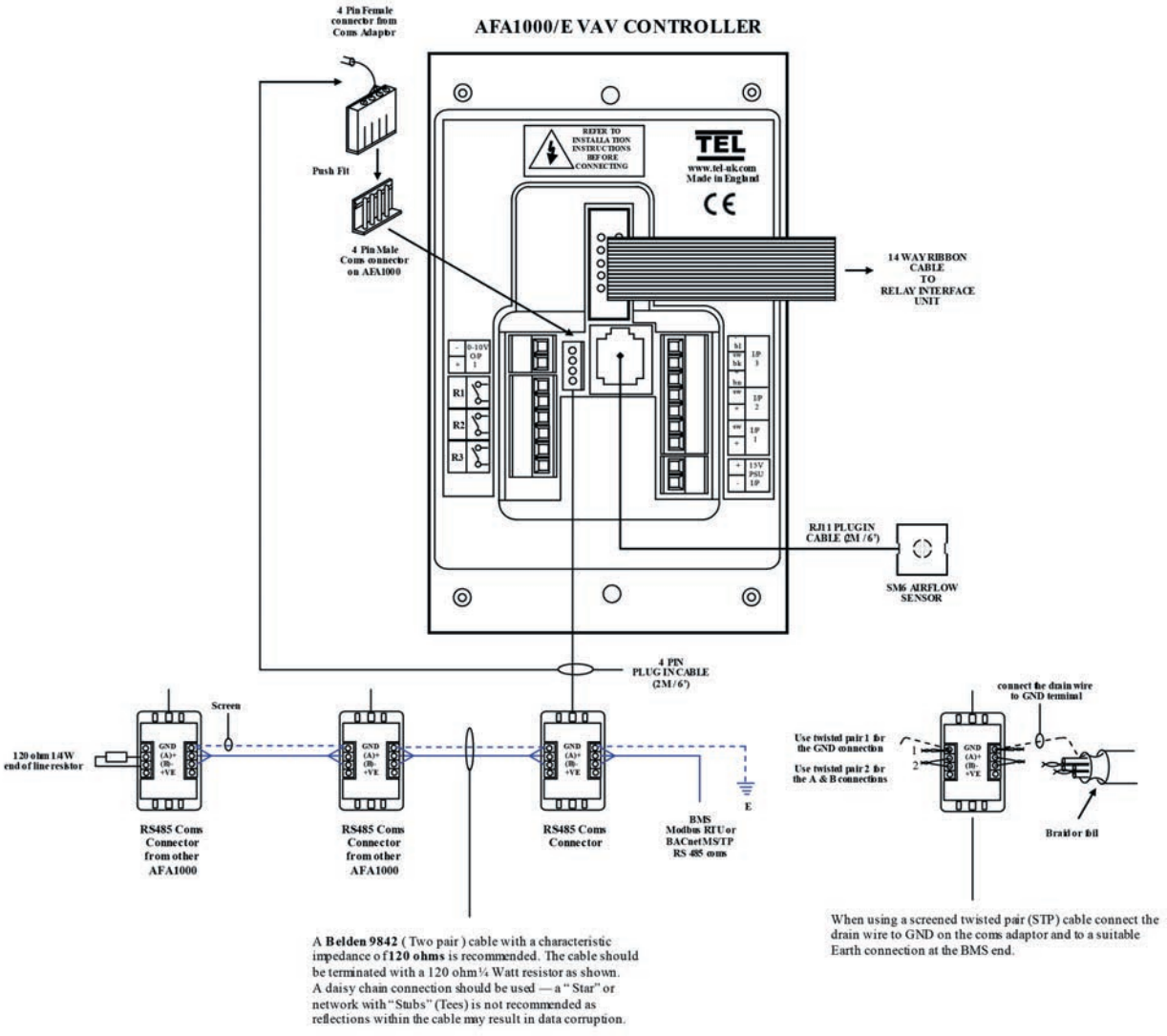
The AFA1000 series has on board RS485 coms with 3 protocols:-

Protocol	Description
TEL	Protocol for connection to TEL Configure Manager PC software and room controls
Modbus	Modbus RTU protocol
BACnet	BACnet MS/TP protocol (To connect to BACnet IP a 3rd party router is required)

See separate coms registers for further technical, compliance and register information:-

AFA1000/E Modbus Registers
AFA1000/E BACnet Registers

Typical connection diagram



8.2 Configuration settings

Note - when changing Protocols the AFA1000 should be power cycled once re-configured to ensure the changed take effect.

The TEL protocol has fixed parameters so cannot be adjusted in the field, to select the TEL protocol using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select PROTOCOL and press Enter, then using the +/- buttons select TEL and then press Enter to continue, then select DONE to return to the CONFIG MENU, then select DONE and RUN.

To Setup the AFA1000 with MODBUS protocol using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select PROTOCOL, and press Enter, then using the +/- buttons select MODBUS and then press Enter to return to the CONFIG MENU.
4. Using the + / - buttons select MODBUS SETTINGS and then press Enter, a sub menu will appear with the following parameters:-

	Parameter	Description	Range	Default
A	Slave ID	Set the slave ID for the unit	1-255	1
B	Baud Rate	Set the network Baud Rate	1200/2400/4800/9600/1440/19200/38400/57600	9600
C	Parity	Set the required parity	None/Even/Odd	None

5. Using the + / - buttons select the SLAVE ID parameter and then press Enter, then using the +/- buttons select the required ID and press Enter to continue.
6. Using the + / - buttons select the BAUD RATE parameter and then press Enter, then using the +/- buttons select the required rate and press Enter to continue.
7. Using the + / - buttons select the PARITY parameter and then press Enter, then using the +/- buttons select the required rate and press Enter to continue then select DONE to return to the CONFIG MENU, then select DONE and RUN.

To Setup the AFA1000 with BACnet protocol using the pushbutton menus:-

1. Press Enter from the "Requires set up" screen or if the controller is in the Run screen Press and Hold the Enter button for 5 seconds until the Main Menu is displayed.
2. Using the + / - buttons select SET UP, and then select CONFIGURE, then enter the password (the factory default password is 0-0-0-0), press Enter to continue.
3. Using the + / - buttons select PROTOCOL, and press Enter, then using the +/- buttons select BACnet and then press Enter to return to the CONFIG MENU.
4. Using the + / - buttons select BACnet SETTINGS and then press Enter, a sub menu will appear with the following parameters:-

	Parameter	Description	Range	Default
A	Device Instance	Set the slave ID for the unit	0000000 to 4194303	0000000
B	Station ID	Set the network ID	0-127	1
C	Baud Rate	Set the required Baud Rate	1200/2400/4800/9600/1440/ 19200/38400/57600	38400
D	Parity	Set the required Parity	None/Even/Odd	None
E	Max Masters	Set the max masters (max devices on the network)	0-127	1

5. Using the + / - buttons select the DEVICE INSTANCE parameter and then press Enter, then using the +/- buttons select the required Instance and press Enter to continue.
6. Using the + / - buttons select the STATION ID parameter and then press Enter, then using the +/- buttons select the required ID and press Enter to continue.
7. Using the + / - buttons select the BAUD RATE parameter and then press Enter, then using the +/- buttons select the required rate and press Enter to continue.
8. Using the + / - buttons select the PARITY parameter and then press Enter, then using the +/- buttons select the required rate and press Enter to continue.
9. Using the + / - buttons select the MAX MASTERS parameter and then press Enter, then using the +/- buttons select the required number of Masters and press Enter to continue, then select DONE to return to the CONFIG MENU, then select DONE and RUN.

8.3 Testing and troubleshooting

The AFA1000 diagnostics menu can be used to check the coms settings and operation once the AFA1000 coms parameter settings have been set up.

From the run screen press the + & - buttons together to access the diagnostics screen.

The diagnostics sub menu will appear showing the following options-

a. Alarm Test
b. Coms data
c. I/O Status
d. Done

Using the +/- buttons to scroll select **Coms data** and press Enter.

b. Coms data - the Screen will show the coms setting data for the relevant selected protocol:-

Protocol = None/TEL/Modbus/BACnet
ID = Slave ID for Modbus or Device Instance for BACnet
Baud Rate = Shows selected Baud Rate
Parity = Shows selected Parity

Tx & Rx = the display will show the current data packets sent and received, the displayed value will rollover to zero when the maximum count is reached.

BACnet protocol troubleshooting guide

	Protocol	Fault	Remedy
A	BACnet	Device not present on Network	Ensure the AFA1000 is in Run mode or Diagnostics screen, the coms are interrupted when the AFA1000 is in the pushbutton menus.
			Power cycle the AFA1000, this is required if the Protocol has been changed.
			Ensure Max Masters is set to the number of devices on the network, if the value set is larger than the actual number of devices the coms will be slowed so may cause time out issues.
			Ensure the network is BACnet MS/TP not BACnet IP (a separate router is required for IP).
			Using the diagnostics menu check the coms settings are correct (see below).
Diagnostics menu			
		Tx & Rx = 0	AFA1000 is not connected to the network (initial set up).
		Tx & Rx >0 but fixed values	AFA1000 has lost connection to the network.
		Rx is counting but Tx is a fixed value	AFA1000 is connected to the network but the Master (BMS) is offline or not polling the AFA1000.

Modbus protocol troubleshooting guide

	Protocol	Fault	Remedy
B	Modbus	Device not present on Network	Ensure the AFA1000 is in Run mode or Diagnostics screen, the coms are interrupted when the AFA1000 is in the pushbutton menus..
			Power cycle the AFA1000, this is required if the Protocol has been changed.
			Ensure the network is Modbus RTU.
			Using the diagnostics menu check the coms settings are correct (see below).
Diagnostics menu			
		Tx & Rx = 0	AFA1000 is not connected to the network (initial set up).
		Tx & Rx >0 but fixed values	AFA1000 has lost connection to the network.
		Rx is counting but Tx is a fixed value	AFA1000 is connected to the network but the Master (BMS) is offline or not polling the AFA1000.

8.4 Config Manager

TEL software package CONFIG MANAGER is available for uploading and downloading parameter configuration files to the AFA1000. The config manager software is Windows based software that runs on a PC or Laptop and requires a RS232/485 converter and TEL coms adaptor to communicate with the RS485 coms port on the AFA1000.

The software is free to download and the coms adaptor is available to buy from TEL.

Most 3rd party RS232/485 converters will work with the AFA1000, the recommended converter is the following 1 port isolated converter part number:- EasySYNC ES-U-2101-M which is also available to buy from directly from TEL.

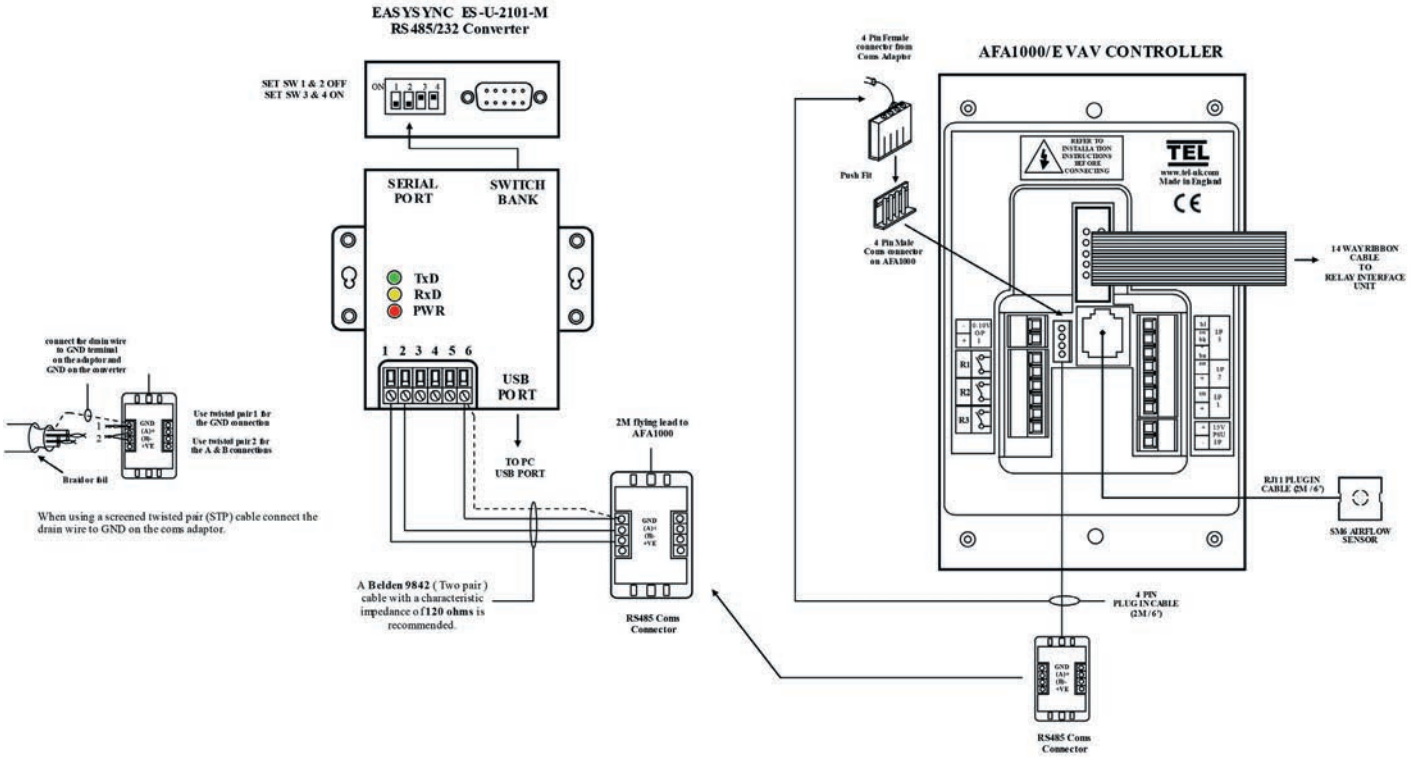
Recommended minimum PC requirements:-

Windows XP or later, 2GHz processor, 3.00GB Ram, 1MB free storage space.

Config Manager uses the TEL protocol on the AFA1000.

See separate Config Manager manual for further information.

Connection Diagram with RS232/485 converter



9. WARRANTY

9 WARRANTY

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