



AFA 5000/RSC-2

Room Space Controller

Installation and Operator Manual

Issue 2

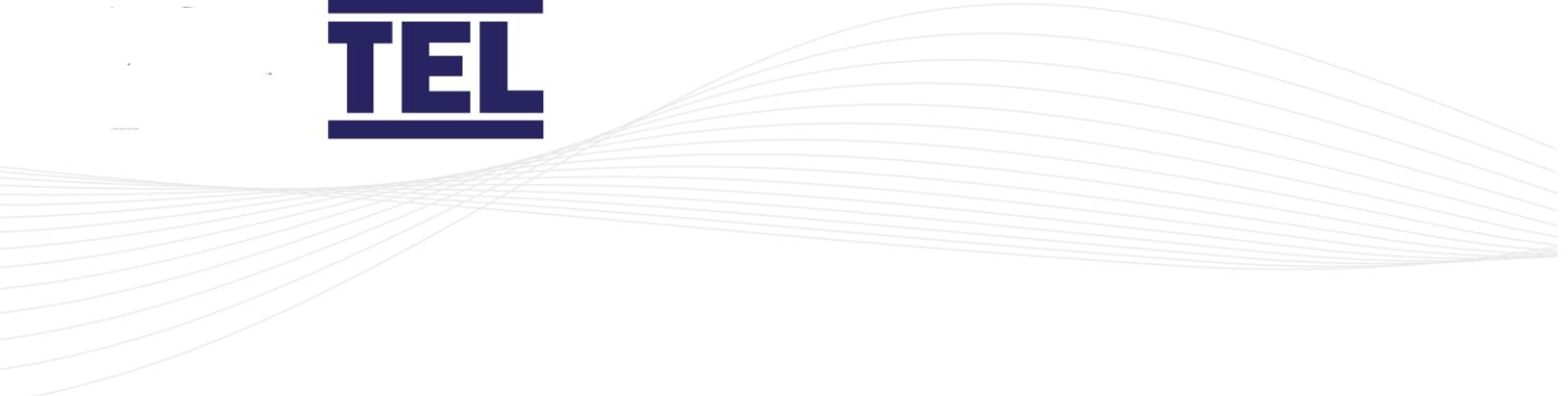


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1. *Introduction*

The TEL AFA5000-RSC-2 is an intelligent Touch screen Room space controller used to control and monitor the mechanical HVAC ventilation and air quality in a room space without the need for a BMS system. The controller comprises of a wall or panel mounting high resolution 7" touchscreen and remote I/O control interface box.

The controller can be configured to operate the Room space ventilation based on differential room pressure, air quality control, volumetric control or any combination of the control philosophies and can be configured in the field using the on-board password protected menus or USB interface.



1.1 *Features*

- Full colour high resolution 7" Touchscreen, Surface or Panel mount.
- 15 programmable Analogue Inputs
- 14 programmable Analogue Outputs
- 6 programmable Digital Inputs
- 4 programmable Relay Outputs
- 2 Dedicated 10K3 Thermistor sensor inputs
- USB interface for uploading / downloading settings and installing software upgrades
- RS485 coms connection for up to 64 TEL AFA VAV Fume Cupboard controllers
- Ethernet BACnet and Modbus IP coms for BMS interface
- Optional RS485 BACnet MS/TP and Modbus RTU expansion unit for BMS interface
- Built in Time clock with Setback Operation with working day and holiday options
- Eco mode settings for Occupancy and Setback operation
- Trending performance Graphs of each function
- Alarm Logging

2. Safety

2.1 Safety practices

This guide is a supplement to the safety codes of the user's country. Not every safety procedure that should be followed is covered by this guide. Maintaining a safe laboratory environment is the responsibility of the user.

Review product documentation prior to use and follow instructions carefully.

If the Room controller is not used or operated in accordance with this manual, the protection provided by the devices may be impaired.

2.2 Precautions

- Ensure the equipment voltage corresponds to the voltage available at the installation position.
- Do not remove equipment panels without shutting down the equipment and disconnecting the power supply.

2.3 Warnings

2.3.1 Warning notices

WARNINGS must be followed in order to avoid personal injury.

2.3.2 Warning labels

WARNINGS appear as follows:



Switch off the mains voltage and remove the mains cord before maintenance.

Always follow the instructions given by warning labels on the equipment. For further information refer to this guide and other documentation provided.

2.4 *Operating conditions*

2.4.1 *General operation*

The Room controller and associated equipment have been designed and tested in accordance with the International Electrotechnical Commissions (IEC) safety requirements. The Room 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 2014/30/EU.

Adjustment, maintenance or repair of the equipment whilst covers are open or the equipment is in operation is only to be done by skilled persons who are aware of the potential hazards.

Make unsafe equipment inoperative.

Examples of unsafe equipment:

- Appears damaged
- Fails to perform correctly
- Has undergone transport stresses
- Has been stored incorrectly

2.4.2 *Environmental conditions*

Ensure the equipment is used under the following conditions:

- Indoors
- Temperature, 5°C to 40°C
- Relative humidity below 80% for temperatures up to 31°C, decreasing linearly to 50% at 40°C
- Electrical supply fluctuations not to exceed +10% of nominal voltage



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

2.5 *Electrical safety*



Lethal voltages are present at certain points within the equipment.

When the equipment is connected to mains power, removing the equipment's covers is likely to expose live parts.

Even when the power switch is off, high voltage can still be present.

Capacitors within the equipment may still be charged even if the equipment has been disconnected from all live voltage sources.

Connect the Room controller and associated equipment correctly to a suitable electrical supply. The supply must have a correctly installed protective conductor (earth or ground), which must be installed and checked by a qualified electrician before initial power up.



Any interruption of the protective conductor inside or outside the Room controller, or disconnection of the protective conductor terminal is likely to make the equipment dangerous.

Never interrupt the protective conductor.



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



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 Room controller:

- Do not operate equipment with any covers or internal parts removed.
- Disconnect the equipment from live voltage sources before adjustments, replacements, maintenance or repairs are carried out. If the equipment must be operated during adjustment, maintenance or repair, only a supplier's Service Engineer is to carry out the procedure.

- Ensure equipment that is not electrically safe is made inoperative. Secure the equipment against unauthorised or unintentional operation. Examples of electrically unsafe equipment conditions are as follows:
 - Appears damaged
 - Has undergone transport stresses
 - Has been stored incorrectly

2.6 *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 can 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.
External circuits:	External circuits which are connected to the Room controller, except mains connection, shall be insulated by double or reinforced insulation from the mains.

2.7 EMC compliance

2.7.1 EC Directive

The Room controller is designed and tested to meet the requirements of the EC directive 2014/30/EU 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).

2.7.2 FCC Rules and Regulations

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

3. *Installation: Room Controller*

This section outlines the installation of the various components of the room controller system. The layout of individual rooms varies considerably, so specific instructions are not possible, however the principles outlined are valid for all installations.

3.1 *Location*

The Touchscreen can be flush or surface mounted. However, when deciding on the location for the Touchscreen and I/O control box, consider the following items:

- The 3 metre RJ45 cable must reach from the socket on the back of the screen to the socket on the side of the I/O control box.

Note: Longer RJ45 screen cables are available on request.

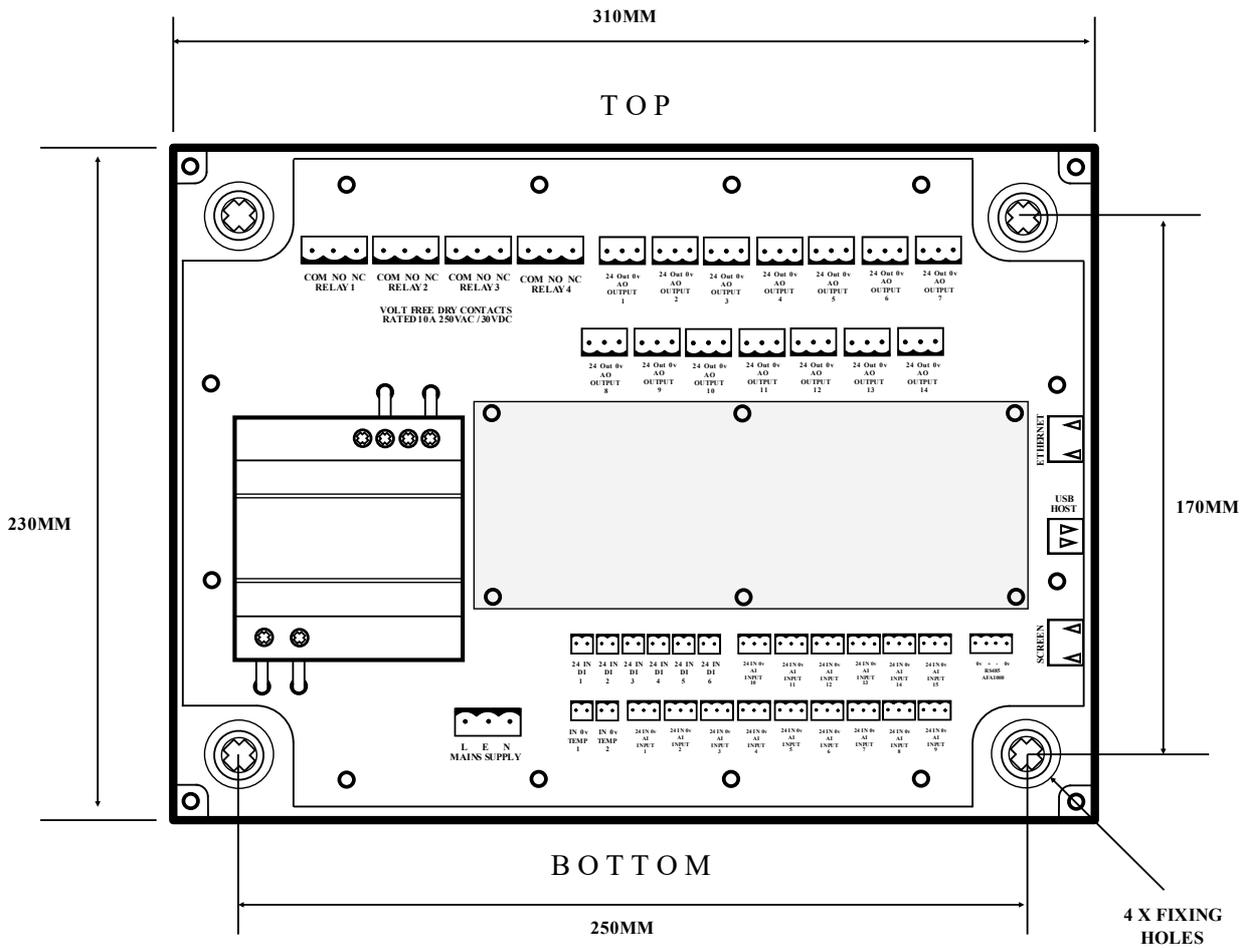
- The I/O control box will require a local 3A Fused power supply.
- The I/O control box may be connected to various valves, dampers or sensors above the ceiling, adequate space should be allowed for cable runs, cable protection and glanding.
- the I/O control box maybe connected to an Ethernet and RS485 coms network which may require isolated cable runs.
- Future access to the I/O control box may be required for software updates via the USB port on the box.

3.2 *Installation: I/O Control Box*

1. There are 10 x M20 Knockouts on both Top and Bottom sides of the Enclosure, remove the Knockouts and fit the required number of Cable Glands before the enclosure is mounted.
2. Fit the box to the wall using suitable fixings for the surface it is to be mounted on. Note, the Control PCB does not need to be removed to mount the enclosure as there is easy access to the fixing holes, but extra care should be taken not to damage any of the PCB components.
3. The enclosure can be mounted in any orientation but should be mounted the correct way up where possible, with the RJ45 screen connection and USB port on the right-hand side edge.



3.2.1 I/O Control Box Dimensions.



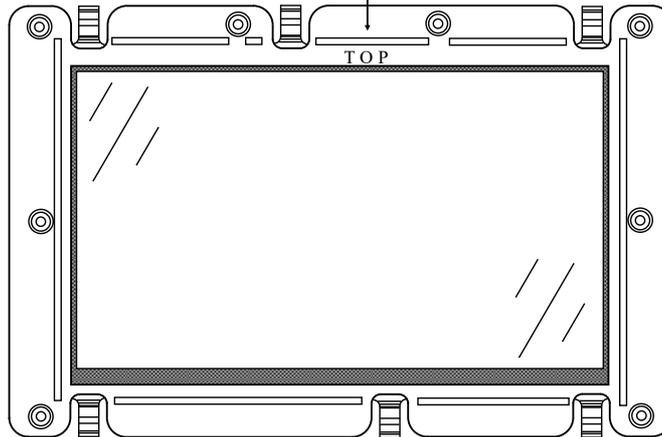
3.3 *Installation: Touchscreen*

The Touchscreen can be flush mounted, or surface mounted using the supplied mounting plate. The mounting plate has a removable plug for cable entry and can be mounted so that the cable entry is at the top or at the bottom side of the plate.

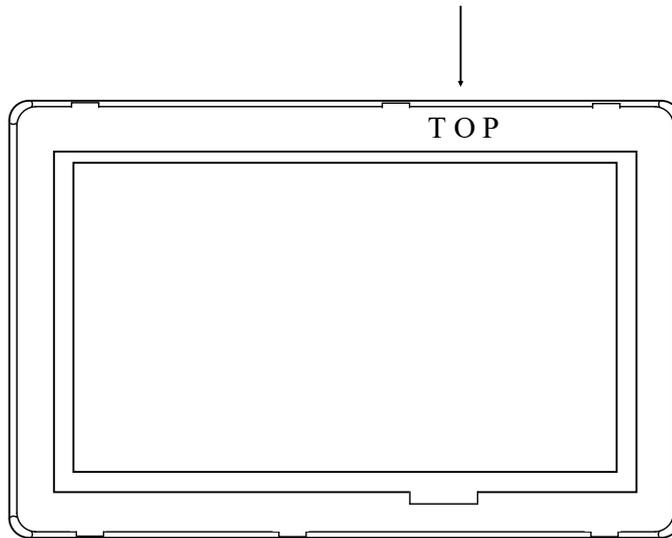
3.3.1 *Flush Mounting the screen.*

1. Fit the RJ45 screen cable into the back of the screen before mounting, ensure the connector has clicked into place.
2. Remove the screen bezel and mount the screen into the cut out and fix using 8 suitable countersunk screws (not provided) ensuring that the screw heads are not proud of the countersunk bevel in the screen moulding so that the bezel will fit correctly back onto the screen moulding. Ensure that the fixing screws are suitable for the type of surface that it is fixed into. Do not overtighten the screws.
3. Ensure that the screen is mounted the correct way up noting the "T O P" legend on the top of the front of the screen moulding or checking that the text on the legend on the rear of the screen is the correct way up.
4. Ensure that the bezel is fitted the correct way up noting the "T O P" legend on the inside of the bezel.

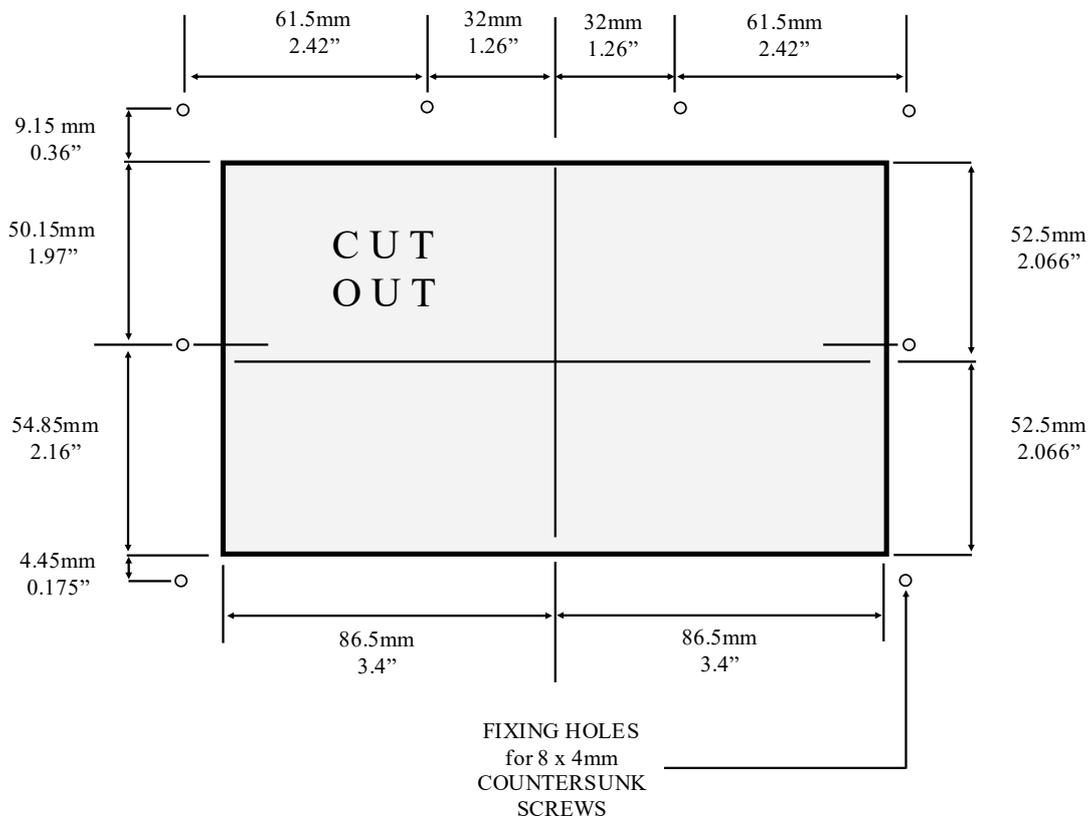
TOP
Legend on the screen mounding



TOP
Legend on the inside of the screen bezel



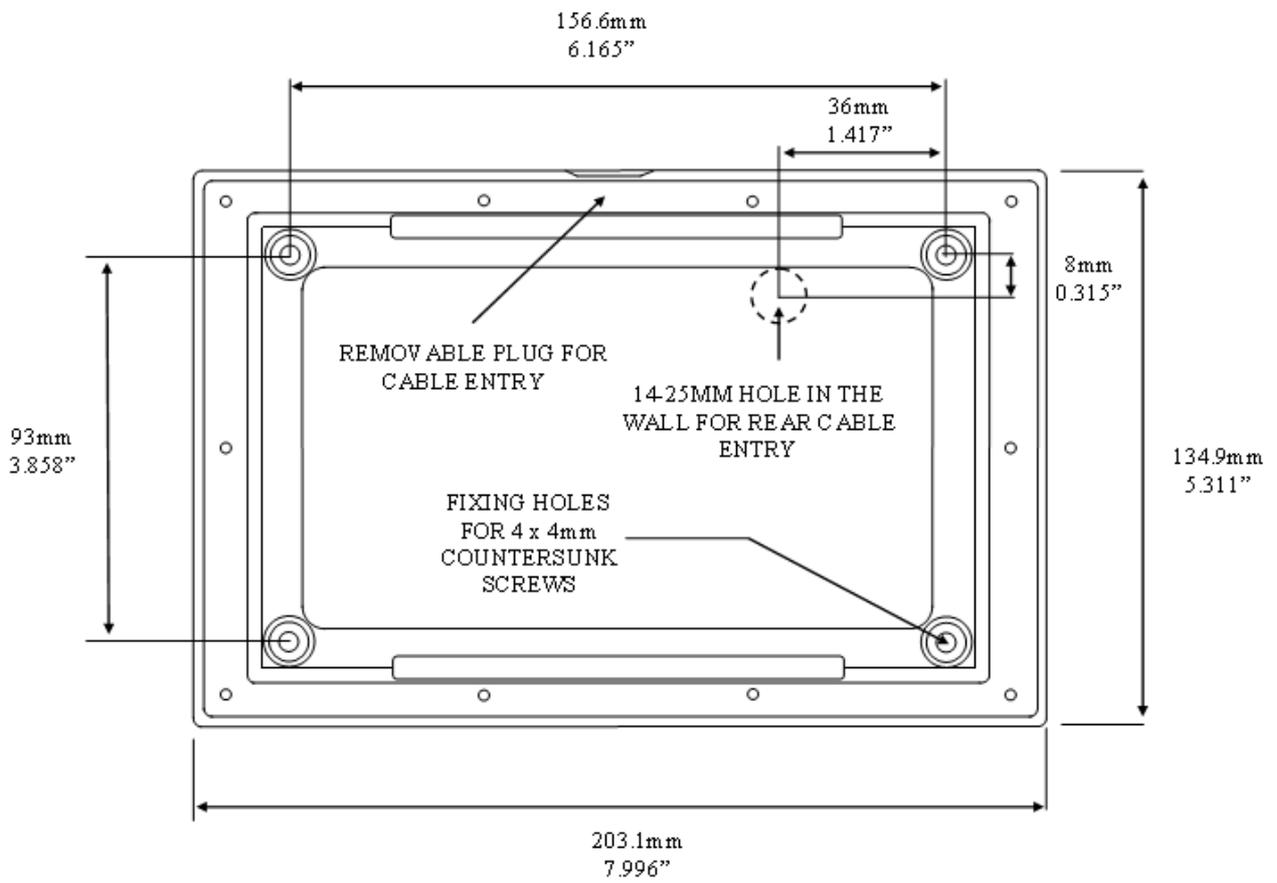
Flush Mount Cut Out.



3.3.2 *Surface Mounting the screen.*

1. Remove the cable entry plug in the mounting plate if the cable is to be fitted externally to the wall. The plug slides out to the rear of the plate. Do not remove the plug if the cable is rear entry.
2. Hold the mounting plate against the wall and mark out the 4 x fixing holes, ensuring the plate is level, and ensuring the cable entry slot is the correct way up for top or bottom cable entry or use the fixing hole details provided below.
3. If the cable is rear mounted, a hole will need to be drilled in the wall as shown below, the hole should be at least 14mm diameter up to a maximum of hole diameter of 25mm.
4. Fix the mounting plate to the wall using suitable fixing screws for the surface it is mounted to.

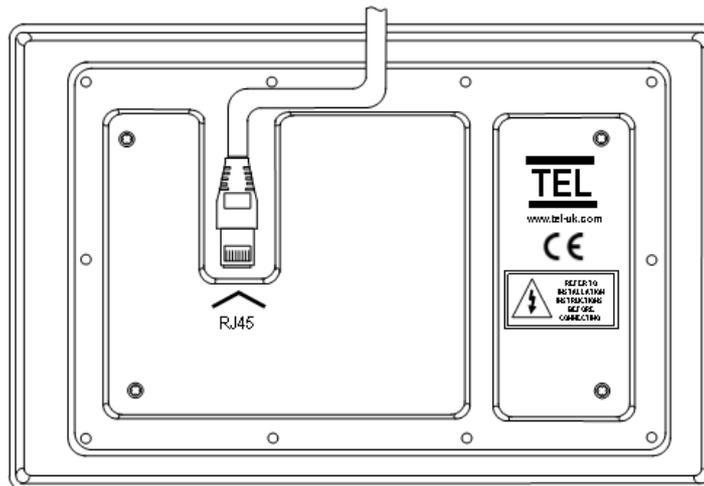
Surface Mounting Plate.



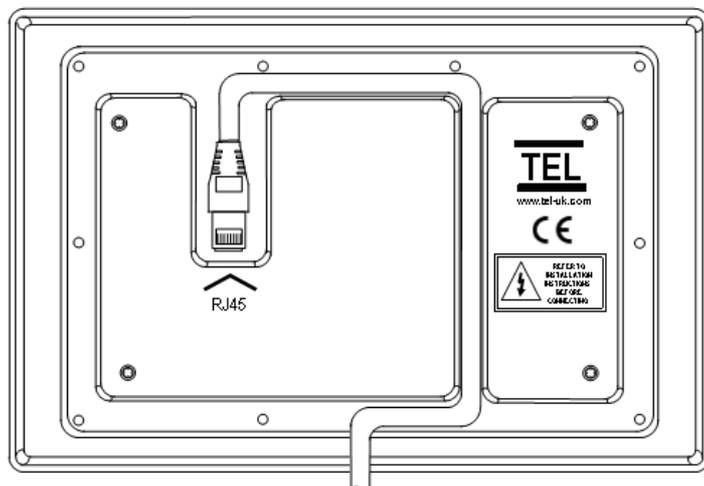
Cable Entry.

Feed the cable through the mounting plate ready to connect into the RJ45 socket on the back of the screen, taking care to route the cable correctly through the mounting plate before the screen is fixed to the plate.

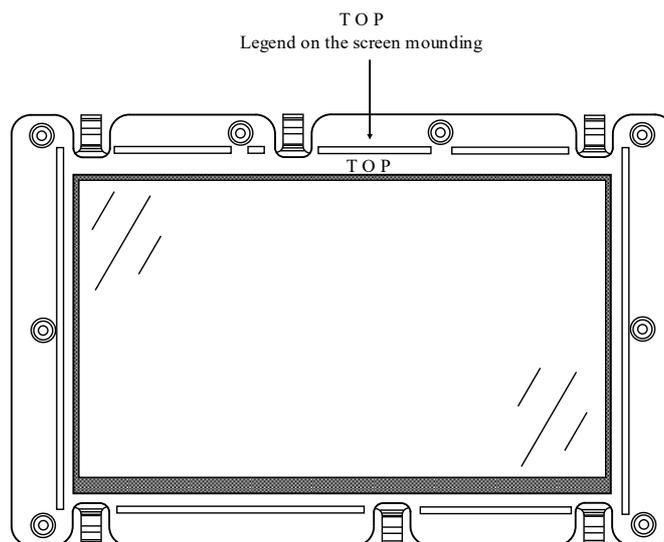
CABLE ROUTE FOR TOP ENTRY



CABLE ROUTE FOR BOTTOM ENTRY

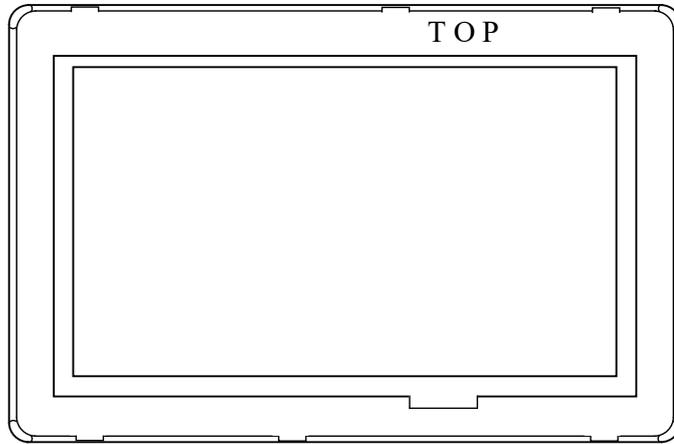


1. Fit the RJ45 screen cable into the back of the screen before mounting, ensure the connector has clicked into place.
2. Remove the screen bezel and mount the screen into the plate and fix using the 8 countersunk screws provided ensuring that the screw heads are not proud of the countersunk bevel in the screen moulding so that the bezel will fit correctly back onto the screen moulding. **Do not overtighten the screws.**
3. Ensure that the screen is mounted the correct way up noting the "T O P" legend on the top of the front of the screen moulding or checking that the text on the legend on the rear of the screen is the correct way up.
4. Ensure that the bezel is fitted the correct way up noting the "T O P" legend on the inside of the bezel.

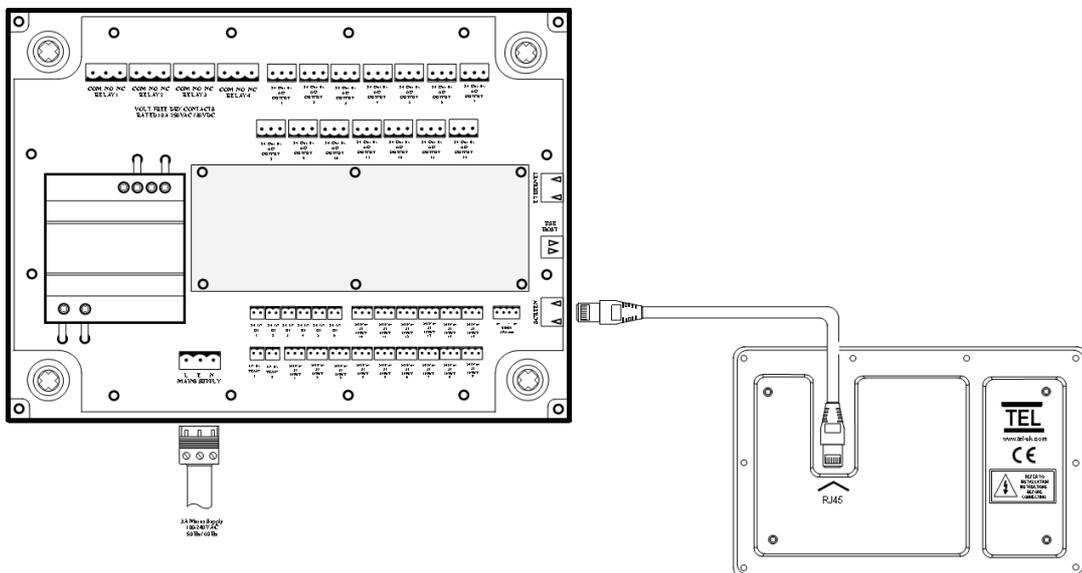




TOP
Legend on the inside of the screen bezel



5. Run the cable through the trunking and connect the other end of the cable to the screen connector on the I/O Control box.



3.4 *I/O Control Box Connections*

3.4.1 *Important Notes.*

1. Before connecting any controls cables ensure that the I/O Control Box is firmly fixed in place and any required cable glands are fitted to the enclosure.
2. Ensure that the mains power supply is switched off and isolated before removing the cover to avoid the risk of electric shock or damaging the controller.
3. Ensure that the Touchscreen is fitted, and the RJ45 cable is connected to the screen.

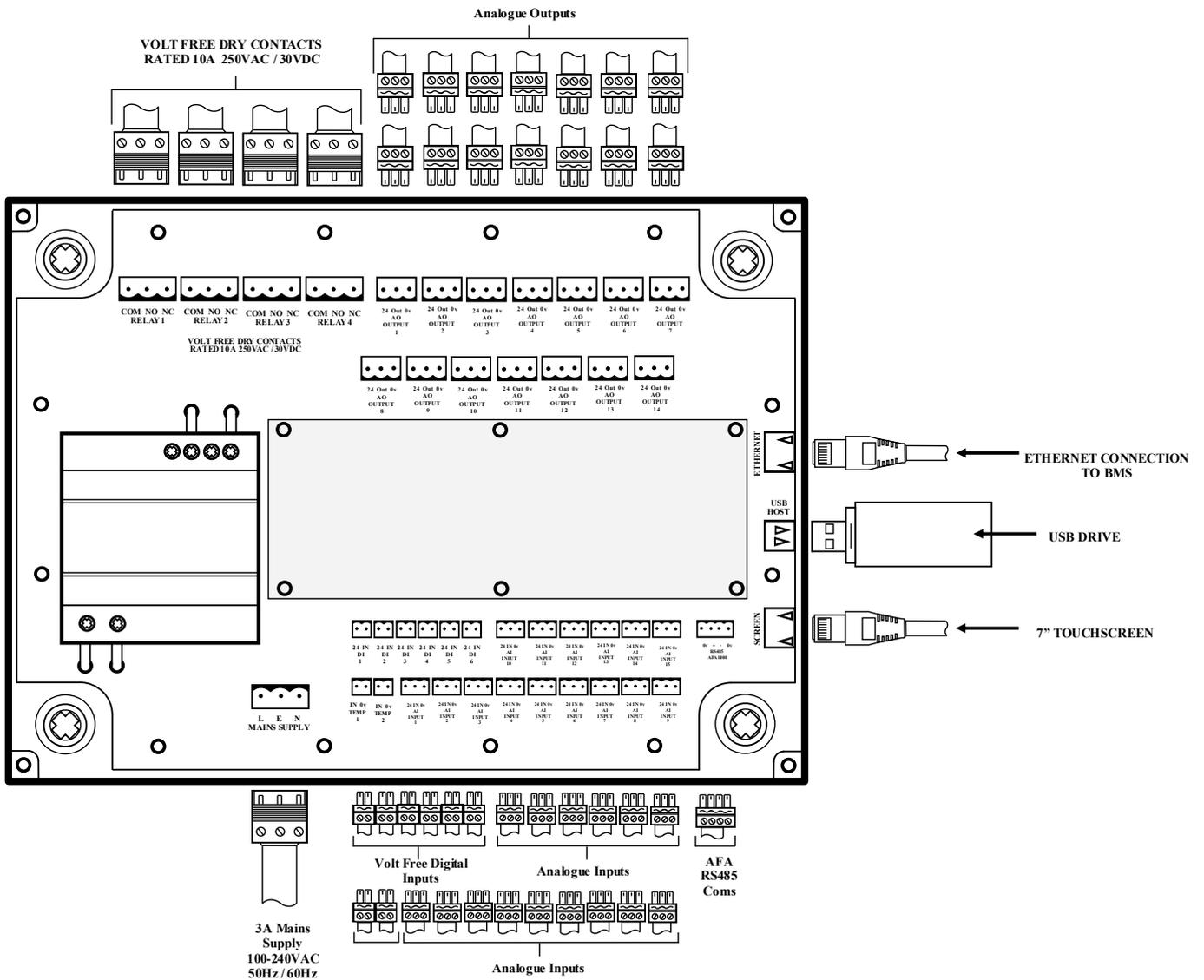
3.4.2 *Connections Overview.*

The AFA5000 controller is a multi-function controller that uses programmable Inputs and Outputs to give maximum flexibility, the Inputs and Outputs may be already factory pre-programmed, but can also be programmed in, using the USB interface or may be set up using the password protected menus. Only trained and competent engineers should attempt to set or adjust the controller in the field.

A map of the programmed I/O functions can be seen on page 1 of the Diagnostics screens accessible by the Engineers screen in the Settings menus. The Diagnostics screen will show the functions assigned to each input and output and show any settings conflicts.



PCB Terminal Connections.

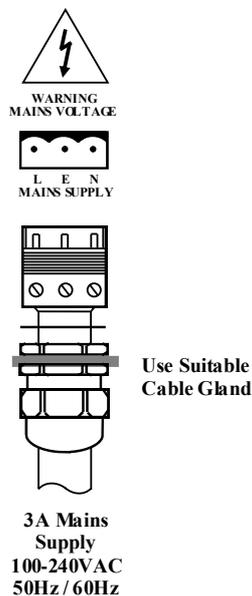


Refer to the separate product Cut Sheet for the I/O specifications.

3.5 Connection Diagrams

1. Mains Power.

The AFA5000 controller has on board Inrush current limiting, for the Inrush current limiter to operate ensure that the Live and Neutral wires are correctly terminated, otherwise Inrush currents of up to 90A for a few milliseconds may occur and trip the Mains power breaker. The I/O Control PCB is fitted with a 3.15A fuse for short circuit protection. Bootlace crimps or ferrules should be used on the conductors when possible.



The Mains power connector is a 2 part terminal block, the connector can be removed to be terminated.

The cable should be securely connected using a suitable cable gland.



2. Touchscreen.

The AFA5000 I/O Control Box connects to the screen using a RJ45 cable, the connector should click into place. Ensure the cable is connected to the RJ45 socket marked "SCREEN" on the side of the Control Box. If the screen cable is disconnected at any time the AFA5000 will continue to operate if the controller has been previously commissioned.

3. USB Port.

The AFA5000 controller has a USB port that is used for firmware upgrades or downloading and uploading configuration settings. The USB device is accessed through the Settings menus and can be left either connected or disconnected when not in use. The controller will only access the USB device when instructed to through the password protected menus.

4. RS485 Coms – TEL Fume Hood VAV Controllers.

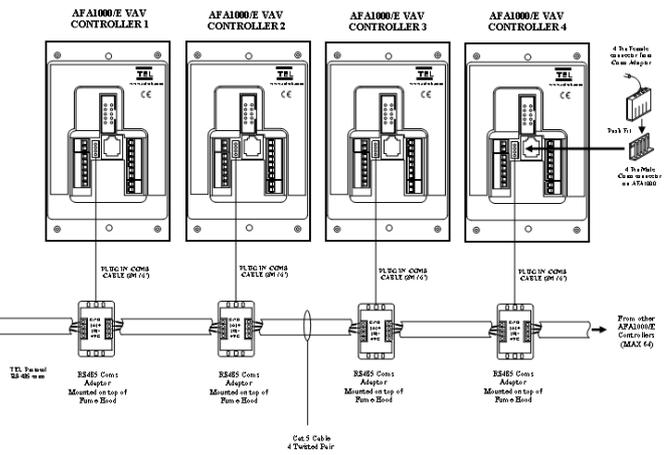
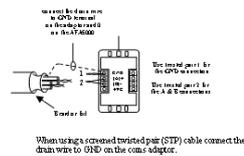
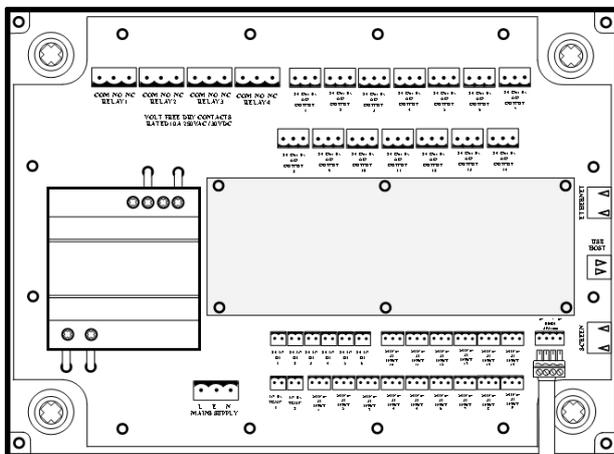
The AFA5000 controller has a dedicated RS485 coms port for connecting to up to 64 TEL AFA4000/E VAV controllers. The coms network uses the TEL protocol set in the AFA4000/E controllers. The AFA5000 can connect to both AFA1000 and AFA4000 models of Fume Hood VAV controllers.

The AFA5000 can provide Fume Hood airflow velocity, volume and alarm status when connected to the AFA1000 series of Fume Hood VAV controllers, additional Auto Sash Closer status and alarm data can be provided when connected to the AFA4000 series and compatible TEL Auto Sash Closer.

Refer to the separate AFA5000 Coms Registers for full details of available data.

CONNECTION DETAILS

AFA5000 RS485 Terminals	Fume Hood RS485 Coms Adaptor Terminals	CAT 5 Cable, 4 Twisted Pair	Twisted Pair, 2 Core
0V	GND	Pair 1	Drain Wire / Shield
+	(A)+	Pair 2	Pair 1
-	(B)-		

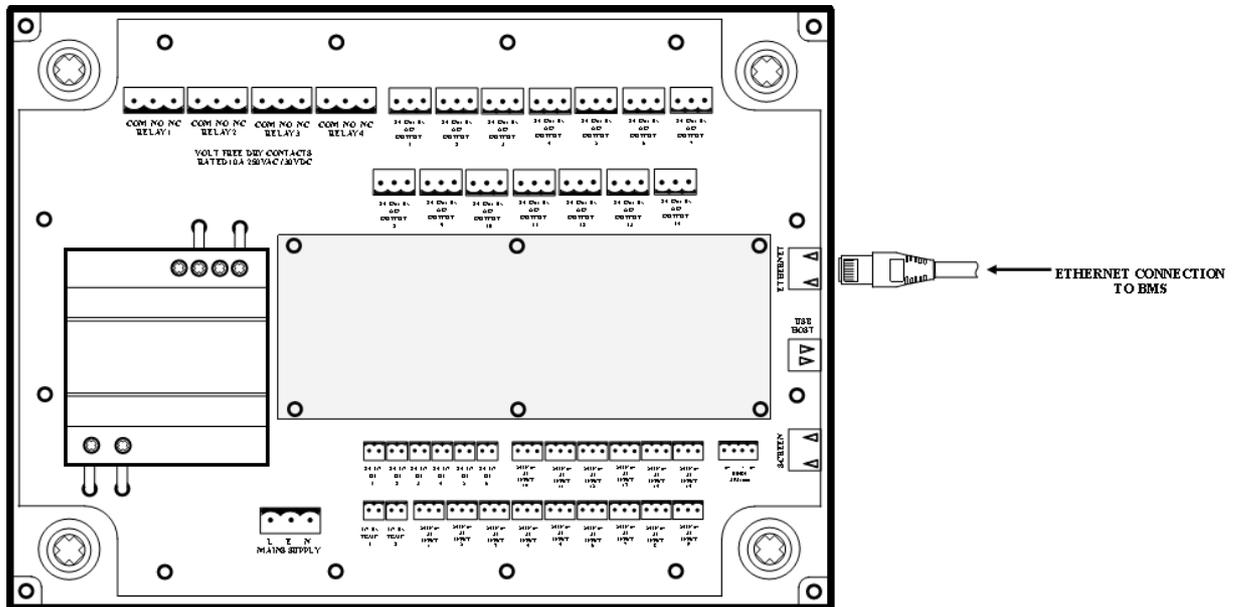




5. BMS / BAS Coms Connections.

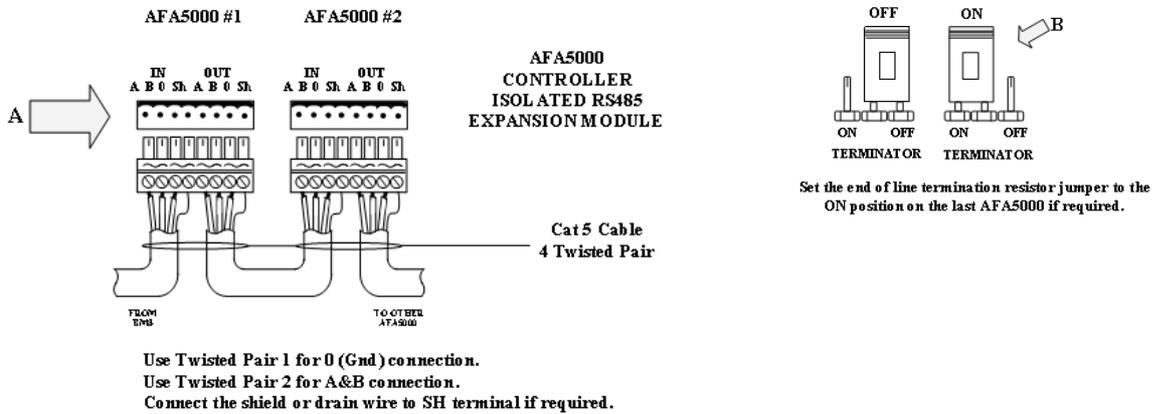
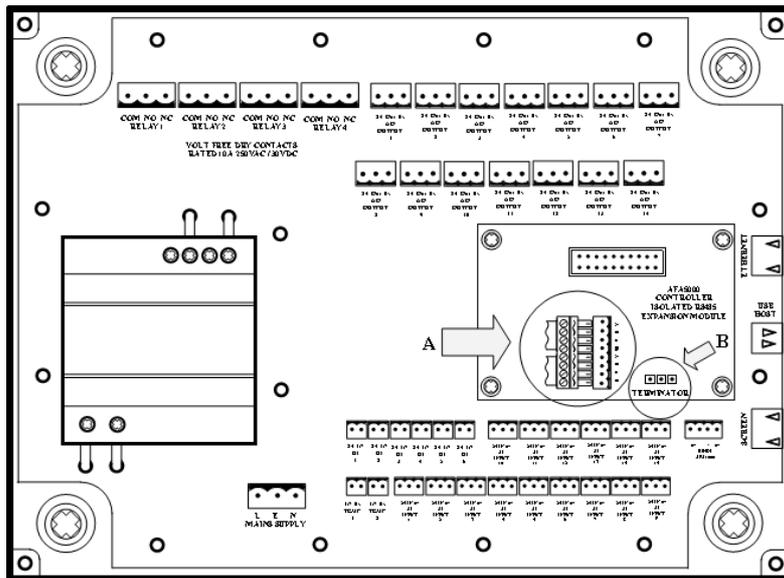
The AFA5000 controller has a RJ45 Ethernet port for BMS connection, the port is 10/100 Base – T. The controller has both Modbus and BACnet IP protocols on board and can be setup using the password protected menus.

Ensure the network cable is connected to the socket marked “ETHERNET” on the enclosure.



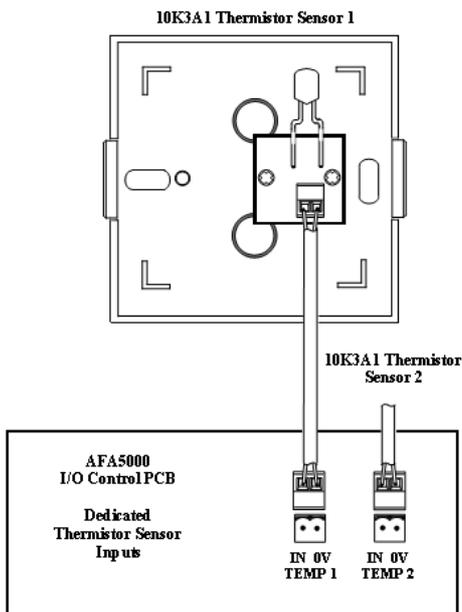


The AFA5000 has an optional RS485 expansion PCB with both Modbus RTU and BACnet MS/TP protocols on board. The protocols are only selectable when the AFA5000 detects the expansion board is fitted and connected.



6. Thermistor type Temperature sensors.

The AFA5000 has 2 dedicated Thermistor sensor inputs, these are 2-way terminal blocks marked Temp 1 and Temp 2. The inputs are for 10K3A type sensors only. The sensors can be used for measuring Room, Supply Air or Return Air Temperatures and are selectable in the settings menus.



7. Analogue Inputs and Outputs.

The AFA5000 has 15 programmable Analogue Inputs and 14 programmable Outputs. The Inputs terminals are 0V, 24VDC and 0-10VDC input, the output terminals are 0V, 24VDC and 0-10VDC output. The 0-10V Signals can be set up as 0-10, 2-10, 10-2 and 10-0V and can be offset and scaled if required.

The following table shows the Input and Output functions that can be assigned: -

ANALOGUE INPUT AND OUTPUT FUNCTIONS

Function	Analogue Input	Analogue Output	Connections
Room Temperature Sensor	1-15, max 6 (averaged or highest)		0V, 24V, 0-10V Input
Supply Air Temperature Sensor	1-15, max 6 (averaged or highest)		0V, 24V, 0-10V Input
Return Air Temperature Sensor	1-15, max 6 (averaged or highest)		0V, 24V, 0-10V Input
CO2 Sensor	1-15, max 6 (averaged or highest)		0V, 24V, 0-10V Input
Humidity Sensor	1-15, max 6 (averaged or highest)		0V, 24V, 0-10V Input
VOC Sensor	1-15, max 6 (averaged or highest)		0V, 24V, 0-10V Input
Room Pressure Sensor	1-15, max 1		0V, 24V, 0-10V Input
Supply Air Volume Feedback	1-15, max 6		0V, 0-10V Input
Supply Air Volume Flow grid (Pressure sensor)	1-15, max 6		0V, 24V, 0-10V Input
Supply Air Volume Venturi (Pressure sensor)	1-15, max 6		0V, 24V, 0-10V Input
Exhaust Air Volume Feedback	1-15, max 6		0V, 0-10V Input
Exhaust Air Volume Flow grid (Pressure sensor)	1-15, max 6		0V, 24V, 0-10V Input

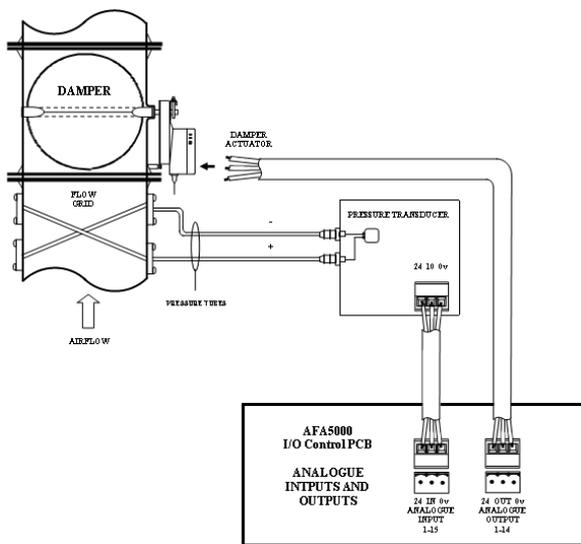
Exhaust Air Volume Venturi (Pressure sensor)	1-15, max 6		0V, 24V, 0-10V Input
Supply Air VAV Box (Demand control)		1-15, max 6	0V, 24V, 0-10V Output
Supply Air VFD (PID control)		1-15, max 6	0V, 0-10V Output
Supply Air Damper (PID control)		1-15, max 6	0V, 24V, 0-10V Output
Supply Air Damper (PID control)		1-15, max 6	0V, 24V, 0-10V Output
Exhaust Air VAV Box (Demand control)		1-15, max 6	0V, 24V, 0-10V Output
Exhaust Air VFD (PID control)		1-15, max 6	0V, 0-10V Output
Exhaust Air Damper (PID control)		1-15, max 6	0V, 24V, 0-10V Output
Cooling Analogue Output		1-15, max 1	0V, 24V, 0-10V Output
Reheat Analogue Output		1-15, max 1	0V, 24V, 0-10V Output
Humidity Analogue Output		1-15, max 1	0V, 24V, 0-10V Output

Note – the AFA50000 24VDC power supply is designed for the Analogue input power requirements, e.g. powering Temperature and Pressure sensors. The power supply has spare capacity to operate a maximum of 2 actuators up to 24VA each. Additional actuators should be powered from their own remote power supplies. Each 24VDC output is fused at 1A.

Typical Volumetric I/O Connections

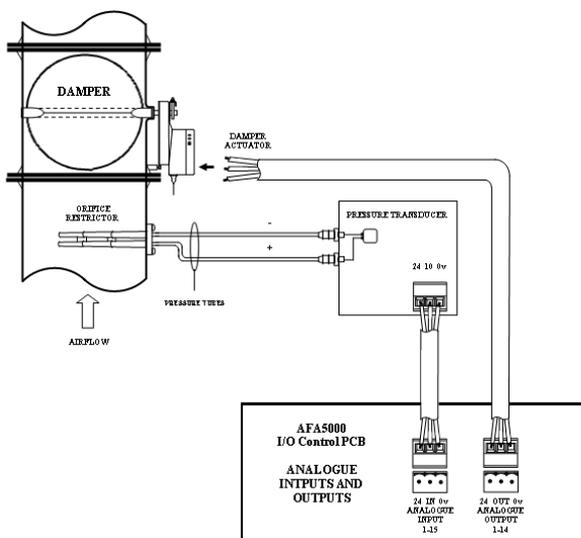
Supply Air I/O with flow grid

AFA5000 Settings: Ventilation / Supply Air / Inputs / Sensor Type = Flow Grid / Enter Duct Area etc



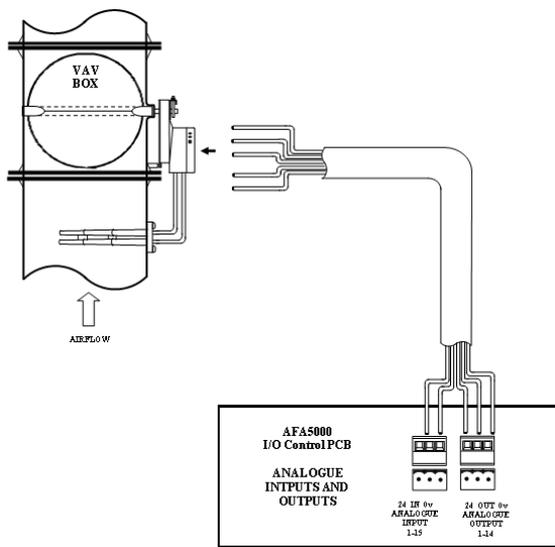
Supply Air I/O with Orifice / Venturi type restrictor

AFA5000 Settings: Ventilation / Supply Air / Inputs / Sensor Type = Static Pressure / Enter K Factor, Air Density

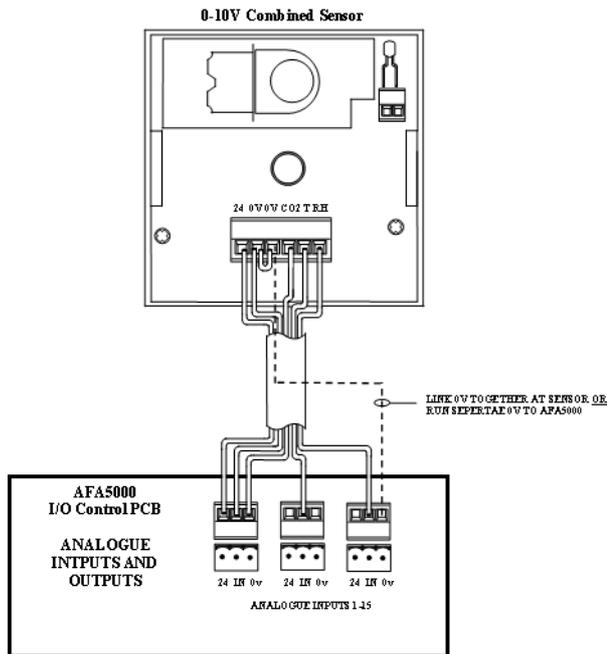


Supply Air I/O with VAV Box

AFA5000 Settings: Ventilation / Supply Air / Inputs / Sensor Type = Feedback / Enter Range, Voltage etc



Typical Sensor Connections



Ensure the correct sensor type is connected to the configured input, refer to the diagnostics menus for the map of configured I/O functions accessible via the Engineering screens in the Settings menu.

Note, each analogue input and output is factory calibrated to an accuracy of +/- 1mV, each input can be individually offset if the measured value needs to be adjusted, this is done in the function / input menu.

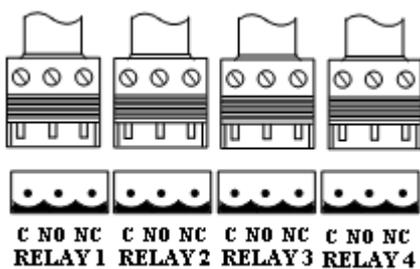
Multiple air quality sensors can be connected to average the readings in larger spaces.

8. Output Relays

The AFA5000 has 4 programmable single pole change over volt free output relays. The relays can be configured for individual tasks or can be used for grouped alarm functions, for example, Supply Air Input 1 Low volume alarm and Supply Air Input 2 Low volume alarm may be configured to Alarm Group 1, Alarm Group 1 can then be assigned to any or all of the 4 output relays.

OUTPUT RELAY FUNCTIONS

Function	Alarm Group	Output Relay 1	Output Relay 2	Output Relay 3	Output Relay 4
Any Alarm	Can be any Alarm Group 1-4	Any or all Alarm Groups			
	Control Mode				
Humidity	Relay Output	Stage 1 or 2			
Cooling	Relay Output	Stage 1 or 2			





4. *Commissioning and Operation*

The following guide is a simplified overview of the controller menu structure and functions. The AFA5000 should be commissioned by a trained or approved competent engineer.

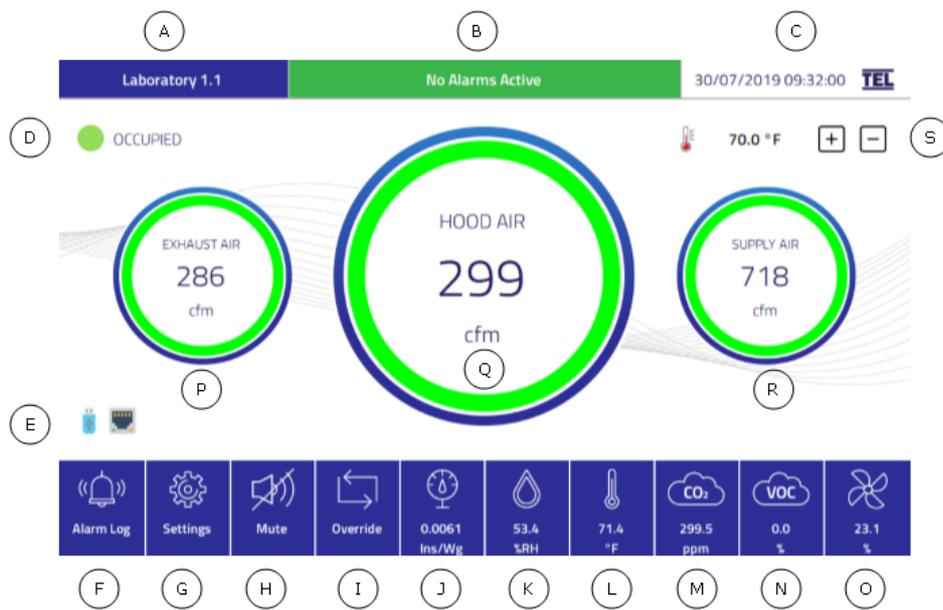
The AFA5000 controller can be fully configured using the on-board menu structure or by using the settings manager.

The settings manager allows default or factory settings files stored in the controller to be uploaded to reset or restore the controller. USB stored files can also be uploaded.

Settings can be exported and saved to the USB drive; the file then can be used to set other controllers to the same settings or stored remotely for future reference.

Before uploading new settings, it is advisable to first save the current settings to the USB drive as once the new settings are uploaded the previous settings will be lost.

4.1 Touchscreen Overview and Operation.



TOUCHSCREEN

KEY	FUNCTION	OPERATION
A	Location indication	Menu writeable location
B	Alarm Status window	Scrolls current active alarms
C	Date / Time	Used for time scheduler operation
D	Eco Mode indication	Shows current Occupancy & Setback status
E	USB & Ethernet connectivity	Displays if USB drive or Ethernet is connected
F	Alarm Log	Press to show current alarm log
G	Settings Icon	Press to enter Menu structure
H	Mute Icon	Press to Mute the audible alarm
I	Override Icon	Press to Override Setback (Timed feature)
J	Room Pressure Icon	Shows current status, press to show Graph data



K	Humidity Icon	Shows current status, press to show Graph data
L	Room Temperature Icon	Shows current status, press to show Graph data
M	CO2 Icon	Shows current status, press to show Graph data
N	VOC Icon	Shows current status, press to show Graph data
O	Exhaust Diversity Icon	Shows current status, press to show Graph data
P	Left Dial, configurable	Shows current status, press to show Graph data
Q	Centre Dial, configurable	Shows current status, press to show Graph data
R	Right Dial, configurable	Shows current status, press to show Graph data
S	Room Temperature Set Point adjust	Menu configurable to allow limited changes

The controller is fully configurable, the above functions, function icons and dials can be enabled and disabled in the menus.

The ventilation functions, supply air, exhaust air, fume hood and air changes can only be shown in the dials, the air quality functions have set icons at the bottom of the screen but can also be displayed as a dial function.

4.2 Alarms and Events

The Dial LED Halo will be Green when the function is not in an alarm condition, if an alarm is active the LED Halo will turn to Red. The function Icon at the bottom of the screen will also turn Red in an alarm condition.



The alarm log will show the date and time the alarm activated, an alarm function ID and description of the alarm. The alarm log will clear on a power cycle or can be cleared by pressing the dustbin icon.

Multiple pages of alarms may be written in the log, the Up and Down arrow icons will scroll through the pages.

Press the red Cross icon in the top right-hand corner to return to the run screen.

Note, multiple alarms may occur during commissioning and installation, the alarm log should be reset once the controller is fully commissioned and in full operation.

Date	Time	EventID	Description
30/07/2019	08:22:03	AFACE004	Comms Error AFA 04 » ID: 4 "AFA 04"
30/07/2019	08:22:03	AFACE003	Comms Error AFA 03 » ID: 3 "AFA 03"
30/07/2019	07:21:55	0	POWER UP

4.3 Historical Graphs.

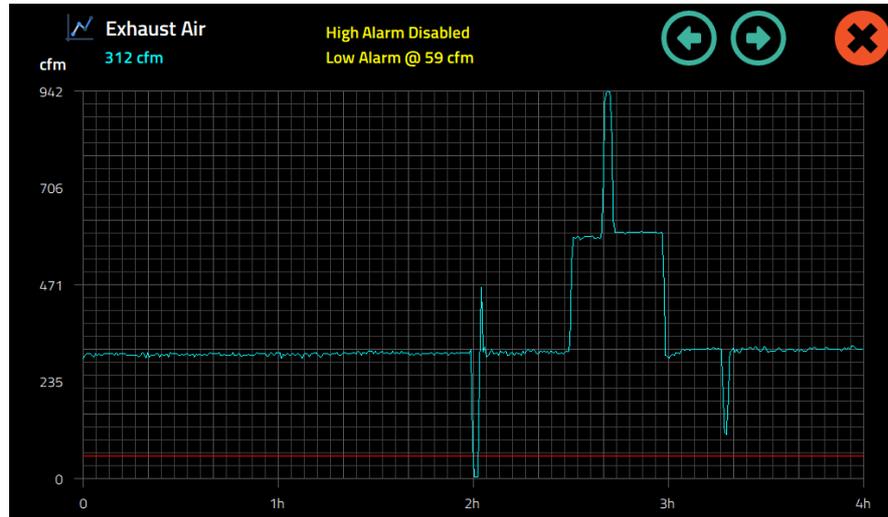
Each Dial and Icon function has a performance Graph that can be accessed by pressing the Dial or Icon. Once a Graph is displayed, the other function Graphs can be accessed using the Left and Right arrows on the top right-hand side of the screen.

The Graph time scale is settable in the Dashboard settings page. The graph data range is dynamic relating to the set scale of the function.

The Function name, current value and units are displayed in the top left-hand side of the page, and the function alarm status is shown in the top centre of the page. If alarms are enabled, Red alarm level plot lines will be displayed on the Graph.

The Graph plot will reset if a value is changed and not saved in the menus, on a power cycle or if the data range / scaling is reset in the menus.

Press the Red Cross Icon to return to the run screen.



The Graph X axis has 60 segments, if the timescale is set to 1 hour each segment will be plotted in one minute and will contain the previous averaged sampled data for that time period.

The Graph Y axis has 30 segments, if the function scale is set to 600 each segment will represent 20 units etc.

The Graph timescale can be set to 3,6,12 or 24 minutes, or 1,2,4,8,12 or 24 hours. The minutes timescales are useful as a commissioning aid to monitor and fine tune control response and algorithms. Once the controller is commissioned and fully operation the timescale should be reset to the required operational value.

4.4 *Eco Modes.*

The AFA5000 controller has 3 operation modes, each with individual function set points and low and high alarm points. The touchscreen indicates the current mode in the top left-hand corner next to the mode Status LED.

The operation modes are Setback and Occupancy (Occupied / Unoccupied).

a. Setback Mode.

Setback Mode is triggered either by the built-in time scheduler, digital input activation or via the BAS coms. Setback mode is used for out of hours operation, typically set to operate overnight and at weekends.

Setback mode can be overridden manually or automatically depending on the settings. Manual override is done by pressing the Override button on the bottom of the screen, this activates a set time period of override, the Eco status will show Setback Override and a countdown timer will appear until the controller reverts to Setback mode. Pressing the button again during the countdown period will reset the timer to restart.

Automatic Override is done with Occupancy Override, where if the room stays occupied at the Setback activation time, Setback mode will be overridden until the room is unoccupied. Once the controller is in Setback mode, and the room becomes occupied, the controller will then change to Override mode until the room is unoccupied again. There are delay timers in the menus to allow the room to be occupied for a period before Override activates, and to allow the room to be unoccupied for a period before it reverts to Setback mode.

In Setback mode the screen backlight will dim to save energy and prolong the screen lifespan.

b. Occupancy Mode.

The controller will be connected to PIR sensors in the room to detect Occupancy. When the room is Occupied, the controller will display Occupied with a Green LED. When unoccupied, the controller will display Unoccupied with an Amber LED.

In Unoccupied mode the screen backlight will dim slightly to save energy and prolong the screen lifespan.

ECO MODE OPERATION

MODE	ECO MODE SCREEN INDICATION	BACKLIGHT	OPERATION
Occupied	OCCUPIED – Green LED	Normal	Normal Operation
Unoccupied	UNOCCUPIED – Amber LED	Dim 1	Reduced level set points
Setback	SETBACK – Red LED	Dim 2	Further reduced set points
Setback Override (Occupancy Override)	SETBACK OVERRIDE Green LED	Normal	Normal Operation
Setback Override (Pushbutton Override)	SETBACK OVERRIDE Green LED Countdown Timer active	Normal	Normal Operation





4.5 Room Temperature Set Point Adjustment.

The AFA5000 controller Room Temperature set point is used for both Cooling and Heating functions. The set point uses dead bands that are settable in the menus. For example, a set point of 70 F with a dead band of +/- 2 F means the cooling will operate at 72 F, the heating will operate at 68F.

The controller can be set to display a "User" Temperature set point screen adjustment, the amount of adjustment allowed is settable in the Dashboard menus along with the function enable / disable setting.

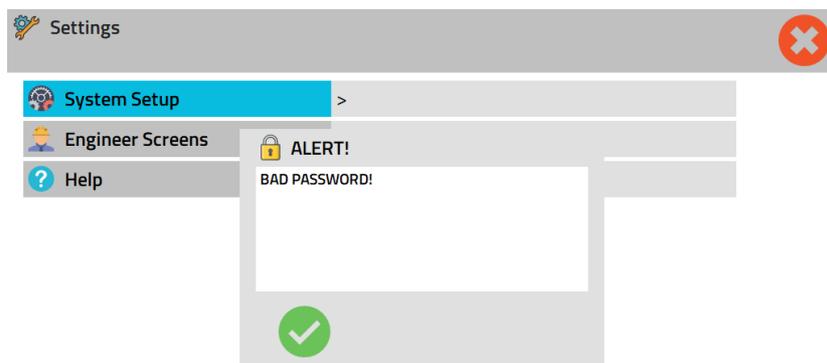
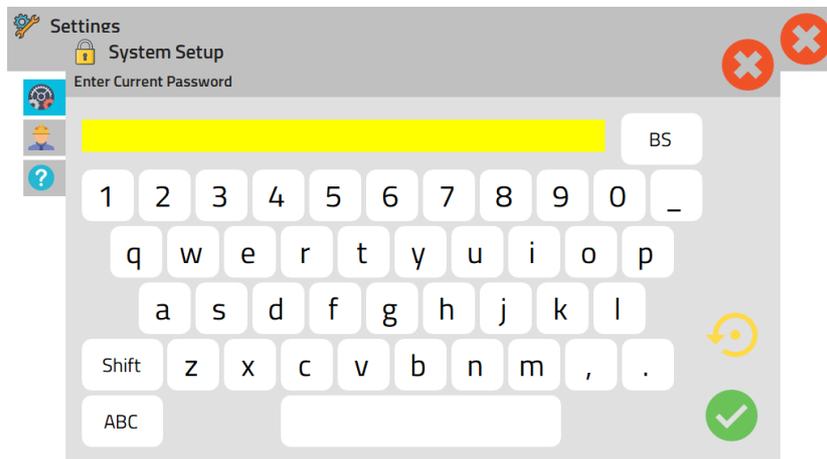
When enabled, the current set point is displayed, with + and – buttons. If the set point is increased the displayed set point turns Red, if the set point is reduced the displayed set point turns Blue.

The set point increments are in steps of 0.5 C or 1.0 F.



4.6 Set Up – Accessing the Menus.

The AFA5000 menu system is password protected, when a password is required an alphanumeric keypad will appear. If an incorrect password is entered, "Bad Password" will be shown and once acknowledged the controller will revert to the settings menu.



Passwords can be changed in the Engineering and settings menus; the current password will be required before a new password can be entered and saved.

To Access the menus, press the **SETTINGS** button on the bottom of the screen.

The Settings menu will contain:

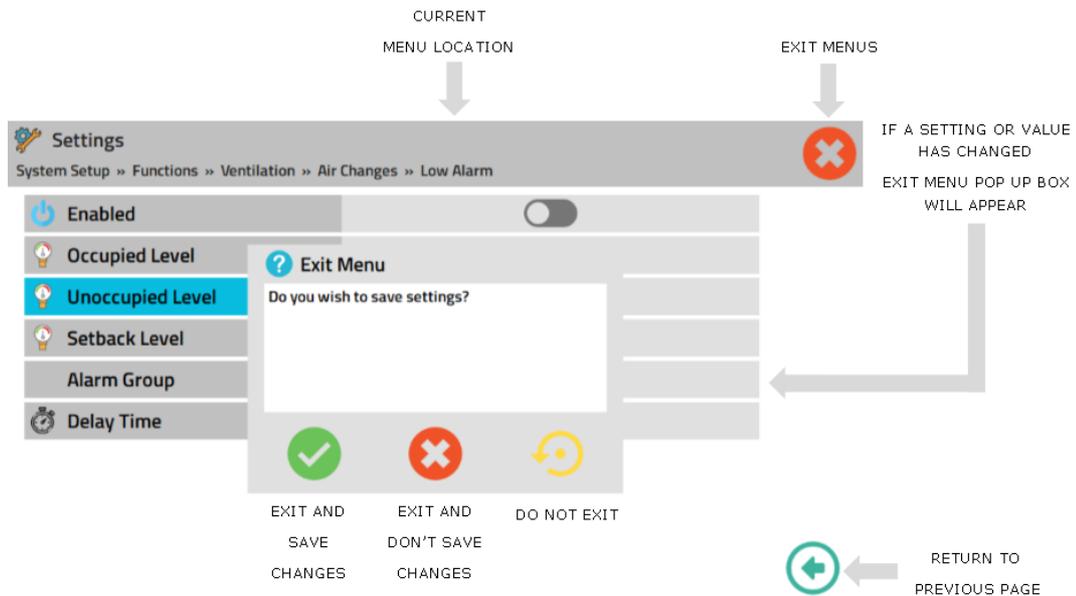
- *System Setup* > select for access to all functions (Password Protected)
- *Engineer Screens* > select for diagnostics screens (Password Protected)
- *Help* > select for serial number, firmware and hardware information

When navigating the menus, it is possible to go back and forth through the entire menu system, the top of the page will show the current location in the menus in the form of a bread crumb trail. The menu system can be exited from any page by pressing the Red cross on the top right of the page.

If no changes have been made, the controller will immediately return to the run screen.

If a value or setting has been changed, and the Exit cross is pressed, a "Do you wish to save settings" pop up will appear giving 3 options:

- a. Green Tick – Save changes and exit
- b. Red Cross – Ignore changes and exit
- c. Yellow Back Icon – Do not exit, remain in the menus.



Some of the menu pages will contain multiple settings that will be shown on more than one page, when there are more settings in the menu, a down arrow will be shown on the right-hand side of the page. Pressing the arrow will navigate to the bottom of the page.

When on the bottom of the page, an up arrow will appear. Pressing the arrow will navigate back to the top of the page.

The menu can be exited or navigated back to the previous menu page from either the top or bottom of the page.

Settings ✕

System Setup » Functions » Ventilation » Supply » Inputs » Supply Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	Ai02
Sensor Type	Flow Grid
Voltage Range	0-10V
Filter	10 sec
Offset	0 cfm
Pressure Range	0.4015 Ins/Wg
Air Density	1.20 kg/m ³
Duct Area	0.049 m ²
Low Alarm	>



NAVIGATE TO
BOTTOM OF PAGE



Settings ✕

System Setup » Functions » Ventilation » Supply » Inputs » Supply Air 1

Analogue Input	Ai02
Sensor Type	Flow Grid
Voltage Range	0-10V
Filter	10 sec
Offset	0 cfm
Pressure Range	0.4015 Ins/Wg
Air Density	1.20 kg/m ³
Duct Area	0.049 m ²
Low Alarm	>
High Alarm	>



NAVIGATE BACK
TO TOP OF PAGE





4.7 Set Up - Loading and Saving Settings.

The AFA5000 contains the following settings: -

Clear All Settings - set in firmware, all functions disabled (Out of the box reset).

Default Settings – set by manufacturer or installer to specific project requirements (optional).

The controller can be restored to either of these settings without the need of a USB drive, the settings are stored in the controller.

New Default settings can be stored in the controller if it is setup in the field.

When a USB drive is fitted, settings can be uploaded or downloaded onto the USB drive to import or export settings to or from other controllers. The controller will only allow settings to be imported or exported once it has detected a USB drive is fitted. A "USB not fitted" error message will appear if the import or export settings is selected without a USB drive in place.

To Access the Manage Settings page press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Manage Settings"*



Select from the following options:

- *Import Settings* > select to load from USB drive
- *Export Settings* > select to save to USB drive
- *Clear All Settings* > select to load from controller
- *Load Default Settings* > select to load from controller
- *Save Default Settings* > select to save to controller

All the above options are password protected, the password will be required to continue.

Import Settings – if a valid config file is found, a pop up will appear with a list of files to select from. When a file is selected, another pop up will appear with “Confirm Load from File” and shows the selected file name, the pop up has buttons option to confirm, exit or return to the list of files.

If there are no valid config files found on the USB drive, a “No files found” message will appear.

Export Settings – an Alphanumeric keyboard will appear, enter the required file name and confirm, exit or return to the menu without saving. The file will be saved on the USB drive as a .cfg format, the file can be stored on a laptop or PC and re-named but will need to keep the .cfg format to be re-used in the controller.

Note – the USB drive can be fitted or removed at any time other than when importing or exporting files, only remove the drive once the Manage Settings menu has been exited, the file or drive may corrupt if the USB is removed whilst in use.



Clear All Settings – when selected, a warning pop up will appear prompting the current settings to be saved first, consideration should be made if the current set up will be required in the future. The current passwords will be kept so that they can be used in the Cleared condition. The pop up has buttons to confirm or exit before loading, an “Aborted” message will appear if the page is exited without loading.

Load Default Settings – when selected, a warning pop up will appear prompting the current settings to be saved first, consideration should be made if the current set up will be required in the future. The current passwords will be kept so that they can be used in the default set up condition. The pop up has buttons to confirm or exit before loading.

Save Default Settings – when selected, a confirmation pop up will appear. The current passwords will be kept so that they can be used in the Default set up condition. The pop up has buttons to confirm or exit before saving.

Note – If any passwords have been forgotten or lost, an Engineers back door password is available from the manufacturer or supplier on request, this will gain access to the menus to allow the passwords to be changed.



4.8 Set Up – Firmware Updates.

The AFA5000 firmware can be updated from the USB drive.

An updated firmware file may contain 3 different updates, the Controller firmware, the Graphics resources and the Graphics firmware. The amount of time the update may take to load and verify will depend on the amount of changes in the update, typically between 5 to 15 minutes.

To Access the Firmware Updates page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Firmware Updates"*

Enter the password then select from the list of files.

If a valid file is found and selected, the screen will display technical update status information whilst the controller checks and verifies each file and checks forwards and backwards compatibility.

Once the update has finished the controller screen will reset to the run mode.

Previous settings will be maintained if the update does not change the functionality.

Note - The AFA5000 is backwards compatible and can accept older or newer file revisions. The current firmware details are shown on the Help page of the Set Up menu.

4.9 Set Up – Manually Configuring the Controller, Function Overview.

Although it is possible to fully configure the controller in the field using the menus, it is not recommended unless done by a trained or experienced engineer as knowledge of the functions or operation of the controller will not be gained from the menus.

The following table show a brief outline of the functionality.

Function	Description
Ventilation	<ul style="list-style-type: none"> • RS485 Coms connection to TEL AFA VAV controllers max 64
Fume Hoods	<ul style="list-style-type: none"> • Analogue input from external devices • Digital input from external device • Provides Volumetric and Alarm information to the AFA5000 • Provides TEL Auto sash closer information to the AFA5000
Ventilation	<ul style="list-style-type: none"> • Analogue input from external devices max 6
General Exhaust	<ul style="list-style-type: none"> • Analogue output to external devices max 6 • Digital input from external device • Purge Digital Input • Used to give minimum air changes and / or air quality control
Ventilation	<ul style="list-style-type: none"> • Analogue input from external devices max 6
Supply Air	<ul style="list-style-type: none"> • Analogue output to external devices max 6 • Used to give offset Volumetric control based on Hood and Gex volumes or Room pressure
Ventilation	<ul style="list-style-type: none"> • Menu settable room area
Air Changes	<ul style="list-style-type: none"> • Used to monitor and display Ach/Hr based on supply or total exhaust volumes (menu selectable)



Function	Description
Pressure	<ul style="list-style-type: none">• Differential Room Pressure sensor input• Used to monitor or alarm room pressure status• Used to give Pressure override control if set limits exceeded
Humidity	<ul style="list-style-type: none">• RH sensor inputs• Used to monitor or alarm RH status• Output to directly control RH• Interlock with Gex to control RH level using air changes• 2 Stage relay output to control RH
CO2	<ul style="list-style-type: none">• CO2 Sensor inputs• Used to monitor or alarm room CO2 status• Interlock with Gex to control CO2 level using air changes
VOC	<ul style="list-style-type: none">• VOC Sensor inputs• Used to monitor or alarm room VOC status• Interlock with Gex to control VOC level using air changes
Room Temperature	<ul style="list-style-type: none">• Temperature sensor inputs• Used to monitor or alarm Room Temperature status
Room Temperature Cooling	<ul style="list-style-type: none">• Output to directly control Temperature• Interlock with Gex to control Temperature using air changes• 2 Stage relay output to control Temperature
Room Temperature Heating	<ul style="list-style-type: none">• Dedicated Output to control Temperature
Supply Air Temperature	<ul style="list-style-type: none">• Temperature sensor inputs• Used to monitor Supply Air Temperature status – BAS only
Return Air Temperature	<ul style="list-style-type: none">• Temperature sensor inputs• Used to monitor Supply Air Temperature status – BAS only
Fire Alarm	<ul style="list-style-type: none">• Digital input or BAS Coms activation• Used to override ventilation control to set values



Function	Description
ECO Mode	<ul style="list-style-type: none">• Digital PIR Input
Occupancy	<ul style="list-style-type: none">• Used to operate Occupied / Unoccupied modes• Reduced Set points and Alarm Points• Overrides Setback mode (when enabled)
ECO Mode	<ul style="list-style-type: none">• Digital input, Scheduler or BAS Coms activation
Setback	<ul style="list-style-type: none">• Reduced Set points and Alarm Points• Override button (when enabled)
ECO Mode	<ul style="list-style-type: none">• Menu Settable Scheduler
Setback Time	<ul style="list-style-type: none">• 7-day operation
Scheduler	<ul style="list-style-type: none">• Up to 5 Holiday Periods settable
BAS Coms	<ul style="list-style-type: none">• Ethernet IP or RS485 with optional expansion unit• DHCP option
Date /Time	<ul style="list-style-type: none">• Manual set up or NTP with Ethernet connection• Used for Scheduler operation
Dashboard	<ul style="list-style-type: none">• Configurable Dials and Icons• Configurable Units• Configurable Screen brightness and Audible alarm

4.10 *Set Up – Manually Configuring the Controller, Dashboard.*

The dashboard can be configured to the specific project requirements.

To Access the Dashboard page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Dashboard"*

Select from the following options:

- *Colour Scheme* > select light or dark Blue.
- *Location* > select to enter the location shown on the screen
- *Graph Timescale* > select the required pre-set time
- *Brightness* > select the required Brightness
- *Audible Alarm* > set the slider to ON to enable the alarm (press anywhere on the tab to toggle the slider on/off)

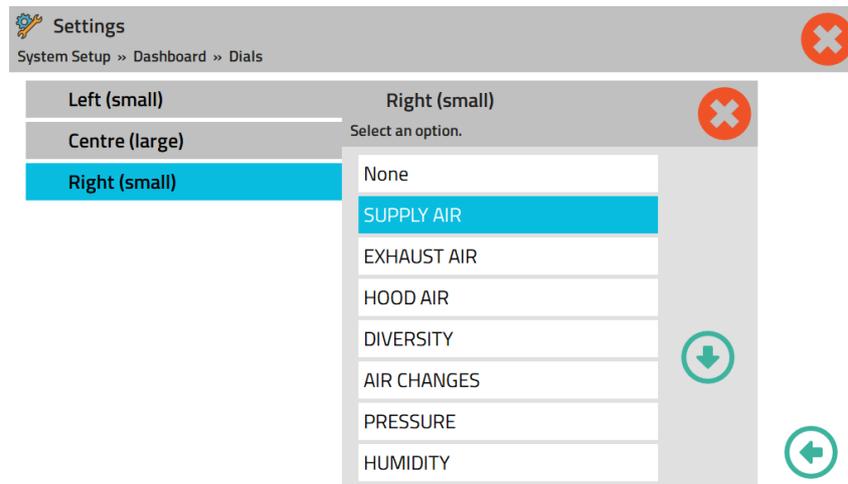
Settings	
System Setup >> Dashboard	
Colour Scheme	Dark Blue
Location	Laboratory 1.1
Graph Timescale	4 Hours
Brightness	100
Audible Alarm	<input type="checkbox"/>
Units	>
Dials	>
Icons	>
Adjust Room Temperature	>

- *Units* > select the required function Units

Settings	
System Setup >> Dashboard >> Units	
Volumetric Flow Rate	cfm
Velocity	m/sec
Pressure	Ins/Wg
Temperature	°F
Density	kg/m ³
Area	m ²
Volume	m ³
CO ₂	ppm
VOC	%
Voltage	V

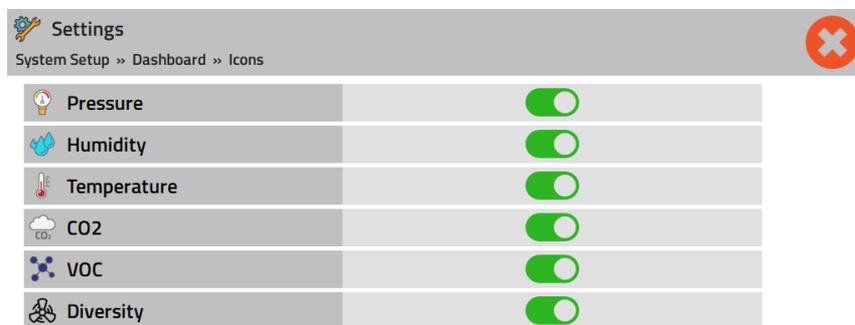
Note, the selected unit conversions will be used for the menu functions, graphs, run screen and will also be used for the data provided on the BAS coms.

- *Dials* > select the required Dial functions



Note, each Dial can be set to no function, or be set to a specific function. When set to none, the Dial will not appear on the screen. Use the down button to see all the function options.

- *Icons* > enable or disable the required Icon functions



Note, when an Icon is disabled, the Icon information / present value will appear blank on the screen. Icon Functions can be assigned to both Dials and Icons.

- *Adjust Room Temperature* > enable the User screen adjustment and set the adjustment limit.

4.11 Set Up – Manually Configuring the Controller, Functions.

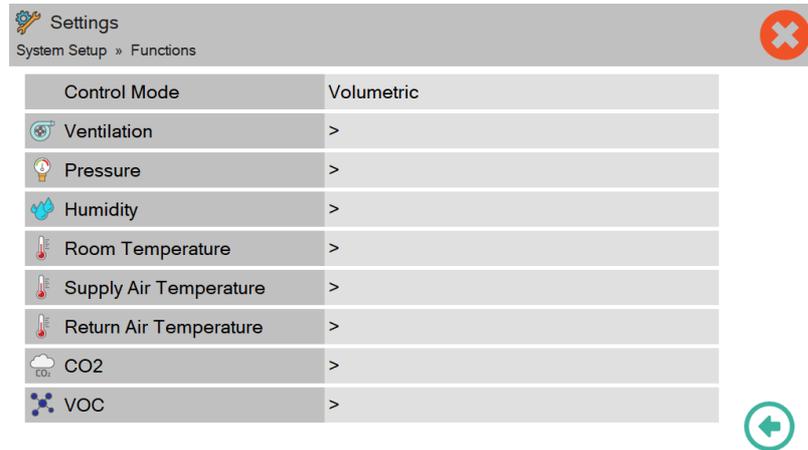
The Functions tab contains the Control functions for Ventilation and Air quality. In the Ventilation section, the individual functions contain all the Input, Output, Control and Alarm settings together.

To Access the Functions page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password >select "Functions"*

Select from the following options:

- *Ventilation* > select for Hoods, Supply Air, Exhaust Air and Air changes
- *Pressure* > select for Pressure sensor and Override control
- *Humidity* > select for Humidity sensor and control
- *Room Temperature* > select for sensor, heating and cooling settings
- *Supply Temperature* > select for sensor settings
- *Return Temperature* > select for sensor settings
- *CO2* > select for CO2 sensor and control
- *VOC* > select for VOC sensor and control



The control mode shows the current control mode operation and is not adjustable.

Any of the functions can be configured as inputs only if monitoring and alarms are required.

Note - When multiple Ventilation Control functions are required, setting them up and testing them individually will give a better understanding of the operation and performance. If all the functions are configured at the same time, it is advisable to disable them and enable and test them individually or enabling one at a time and building up the control structure.

4.12 Ventilation Functions, Supply Air.

The supply Air function allows for a maximum of 6 analogue inputs and 6 outputs. Each input can be set to be set up as direct feedback e.g. output from a VAV box, flow grid or static pressure. Each input has a low and high alarm for each Eco mode, and a total alarm for each Eco mode.

Each output can be individually scaled and set to Manual or Auto operation.

The supply air control can be set to Demand or PID control. Demand control is for VAV box or external control device use.

To Access the Supply Air page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions -Ventilation -Supply Air"*

Select from the following options:

- *Capacity > set the Supply air Capacity*
- *Control > select for Supply air Control settings*
- *Inputs > select to set the number and type of inputs required*
- *Outputs > select to set the number and type of outputs required*
- *Alarms > select for Alarm settings*

Capacity – enter the actual total capacity of the supply air inputs. The capacity setting is used to scale the total input to the working range, where the measured range can be a lot higher.

Control – enable or disable the control. When enabled, enter the control mode, either demand or control (PID), the set points for each Eco mode and the alarm points for each Eco mode, and the Slew Rate.



Control Notes.

The Supply Air Set Point is an Offset value, this is how much more or how much less supply air is required than the total exhaust air in the room, the set point can be negative or positive.

In Demand mode, the controller output will be relative to the required volume scaled over the Vav Box Min and VAV Box Max setting in the Output tab. E.g. if the VAV box output range is 0-1000CFM and the controller requires 500CFM, the output will be 5V. The output range will be the Vmin and Vmax values on the VAV Box.

The input will be scaled over the range set in the Input tab, this will be the Vmin and Vnom values on the VAV Box.

In Control mode, the controller uses PID control settings to control the output.

The pre-set values should be close to the required value in the field but can be changed to speed up, slow down or stabilise the output if required.

Note, the displayed value is derived from the input source, instability may be caused by bad sensor positions etc, setting the output to manual and reading the displayed value will show the stability of the input, this will save time tuning the control.

FUNCTION	PRESET VALUES	OPERATION
P (GAIN)	10	Reduce to slow down the output response
I (INTEGRAL)	50	Reduce to slow down the output response
D (DERIVATIVE)	50	Increase to slow down the output response

To tune the control, use the Integral setting, this will have the most effect, do not change the P or D unless satisfactory control cannot be achieved by changing the I setting only. A large P or D value will make the control unstable. Step changes of 10 units will typically give noticeable response change.

The slew rate is a ramp function on the output, set time period over the full scale.

Inputs – enter the number of inputs required. Additional Input setting tabs will appear as the number of inputs is increased.

Select individual input tabs to set up each input. Selecting different input types will change the input setting options on the input, the options will be relevant to the type of input selected.

Select from the following options:

- *Feedback* > select for VAV box or direct voltage feedback
- *Flow Grid* > select for flow grid type measurement
- *Static Pressure* > select for venturi / restrictor type measurement

Select the number of inputs.

The screenshot shows a software interface for configuring inputs. At the top, a breadcrumb trail reads 'System Setup » Functions » Ventilation » Supply » Inputs'. Below this, a tab labeled 'Number of Inputs' is active. Underneath the tab, the text 'Supply Air 1' is visible. A dropdown menu is open, showing a list of options: 'None', '1', '2', '3', '4', '5', and '6'. The option '1' is currently selected and highlighted in blue. To the right of the list are three circular navigation buttons: an upward arrow, a downward arrow, and a checkmark. A red 'X' button is located in the top right corner of the configuration area. A green left-pointing arrow button is located to the right of the dropdown menu.

Select from 3 Input Types.

System Setup » Functions » Ventilation » Supply » Inputs » Supply Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	AiO2
Sensor Type	Flow Grid
Voltage Range	0-10V
Filter	10 sec
Offset	0 cfm
Pressure Range	0.4015 Ins/Wg
Air Density	1.20 kg/m ³
Duct Area	0.049 m ²
Low Alarm	>

System Setup » Functions » Ventilation » Supply » Inputs » Supply Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	AiO2
Sensor Type	Feedback
Voltage Range	0-10V
Filter	10 sec
Offset	0 cfm
Minimum Range	0 cfm
Maximum Range	1295 cfm
Low Alarm	>
High Alarm	>

System Setup » Functions » Ventilation » Supply » Inputs » Supply Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	AiO2
Sensor Type	Static Pressure
Voltage Range	0-10V
Filter	10 sec
Offset	0 cfm
Pressure Range	0.4015 Ins/Wg
Air Density	1.20 kg/m ³
K Factor	50.00 (Metric) >
Low Alarm	>

Flow Grid Settings

Analogue Input	<ul style="list-style-type: none">• Select Input 1-15
Enabled	<ul style="list-style-type: none">• Enable / Disable the input
Voltage Range	<ul style="list-style-type: none">• Select pressure sensor output voltage, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none">• Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none">• Set an offset to adjust the displayed value
Pressure Range	<ul style="list-style-type: none">• Select pressure sensor measuring range
Air Density	<ul style="list-style-type: none">• Set the Air Density value
Duct Area	<ul style="list-style-type: none">• Set the Duct Area
Low Alarm	<ul style="list-style-type: none">• Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none">• Set and enable the High volume alarm

Feedback Settings

Analogue Input	<ul style="list-style-type: none">• Select Input 1-15
Enabled	<ul style="list-style-type: none">• Enable / Disable the input
Voltage Range	<ul style="list-style-type: none">• Select input voltage range, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none">• Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none">• Set an offset to adjust the displayed value
Minimum Range	<ul style="list-style-type: none">• Select pressure sensor measuring range (Vmin)
Maximum Range	<ul style="list-style-type: none">• Select pressure sensor measuring range (Vnom)
Low Alarm	<ul style="list-style-type: none">• Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none">• Set and enable the High volume alarm

Static Pressure Settings

Analogue Input	<ul style="list-style-type: none"> Select Input 1-15
Enabled	<ul style="list-style-type: none"> Enable / Disable the input
Voltage Range	<ul style="list-style-type: none"> Select pressure sensor output voltage, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none"> Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none"> Set an offset to adjust the displayed value
Pressure Range	<ul style="list-style-type: none"> Select pressure sensor measuring range
Air Density	<ul style="list-style-type: none"> Set the Air Density value
F Factor	<ul style="list-style-type: none"> Set the K factor and the Units (e.g. set CFM if K is relative to CFM)
Low Alarm	<ul style="list-style-type: none"> Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none"> Set and enable the High volume alarm

Outputs – enter the number of outputs required. Additional Output setting tabs will appear as the number of outputs is increased.

Select individual input tabs to set up each output.

System Setup » Functions » Ventilation » Supply » Outputs » Supply Air 1
✕

Analogue Output	Ao01
Manual Mode	<input type="checkbox"/>
🔒 Voltage Range	0- 10V
📘 Control Mode	Control (PID) : set in Control Menu
📏 Min Limit	0.0 %
📏 Max Limit	100.0 %
🕒 Filter	0 sec



System Setup » Functions » Ventilation » Supply » Outputs » Supply Air 1 

Analogue Output	Ao01
Manual Mode	<input checked="" type="checkbox"/>
 Voltage Range	0-10V
Manual Output	37.5 %
 Filter	0 sec



Output Settings

Analogue Output

- Select Output 1-14

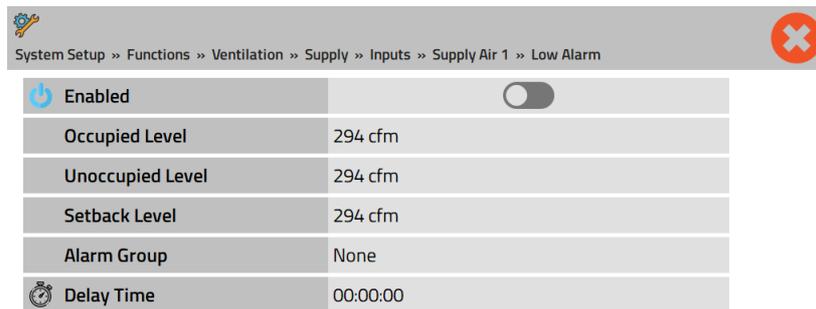
Manual Mode ON

- Select output voltage range 0-10/2-10/10-2/10-0V
- Set Manual Output % value
- Set Output filter (time averaging)

Manual Mode OFF

- Select output voltage range 0-10/2-10/10-2/10-0V
 - Control Mode is displayed (Demand or PID)
 - Set Min Output Limit % value if required
 - Set Max Output Limit % value if required
 - Set Output filter (time averaging)
-

Alarms – select individual input tabs to set up each Alarm or select the Total Alarm tab to set the Total Supply air Low and High volume alarms.



System Setup » Functions » Ventilation » Supply » Inputs » Supply Air 1 » Low Alarm	
Enabled	<input checked="" type="checkbox"/>
Occupied Level	294 cfm
Unoccupied Level	294 cfm
Setback Level	294 cfm
Alarm Group	None
Delay Time	00:00:00

Low and High Alarm Settings

Enabled	<ul style="list-style-type: none"> • Enable or disable the alarm
Occupied Level	<ul style="list-style-type: none"> • Set the Occupied alarm level
Unoccupied Level	<ul style="list-style-type: none"> • Set the Unoccupied alarm level
Setback Level	<ul style="list-style-type: none"> • Set the Setback alarm level
Alarm Group	<ul style="list-style-type: none"> • Assign an Alarm Group 1-4 if required
Delay Time	<ul style="list-style-type: none"> • Set the Alarm delay time

4.13 *Ventilation Functions, Exhaust Air.*

The exhaust Air function allows for a maximum of 6 analogue inputs and 6 outputs, 1 digital input and a Purge switch input to remotely change the exhaust set point.

Each analogue input can be set to be set up as direct feedback e.g. output from a VAV box, flow grid or static pressure. Each input has a low and high alarm for each Eco mode, and a total alarm for each Eco mode.

The Auxiliary digital and Purge switch input can be an open or closed contacts.

Each output can be individually scaled and set to Manual or Auto operation.

The exhaust air control can be set to Demand or PID control. Demand control is for VAV box or external control device use.

Note – some air quality inputs can also control the exhaust air, this is explained at the end of the exhaust air section.

To Access the Exhaust Air page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions -Ventilation -Exhaust Air"*

-

Select from the following options:

- *Capacity >* set the Exhaust air Capacity
- *Control >* select for Exhaust air Control settings
- *Inputs >* select to set the number and type of inputs required
- *Outputs >* select to set the number and type of outputs required
- *Aux Input switch >* select the input, input type and volume
- *Purge Switch >* select the input, input type and set point
- *Alarms >* select for Alarm settings



Capacity – enter the actual total capacity of the exhaust air inputs. The capacity setting is used to scale the total input to the working range, where the measured range can be a lot higher.

Control – enable or disable the control. When enabled, enter the control mode, either demand or control (PID), the set points for each Eco mode and the alarm points for each Eco mode, and the Slew Rate.

Control Notes.

The Exhaust Air Set Point is a required minimum total room exhaust value, this considers the room exhaust and Fume Hood volumes.

In Demand mode, the controller output will be relative to the required volume scaled over the Vav Box Min and VAV Box Max setting in the Output tab. E.g. if the VAV box output range is 0-1000CFM and the controller requires 500CFM, the output will be 5V. The output range will be the Vmin and Vmax values on the VAV Box.

The input will be scaled over the range set in the Input tab, this will be the Vmin and Vnom values on the VAV Box.

In Control mode, the controller uses PID control settings to control the output.

The pre-set values should be close to the required value in the field but can be changed to speed up, slow down or stabilise the output if required.

Note, the displayed value is derived from the input source, instability may be caused by bad sensor positions etc, setting the output to manual and reading the displayed value will show the stability of the input, this will save time tuning the control.

FUNCTION	PRESET VALUES	OPERATION
P (GAIN)	10	Reduce to slow down the output response
I (INTEGRAL)	50	Reduce to slow down the output response
D (DERIVATIVE)	50	Increase to slow down the output response

To tune the control, use the Integral setting, this will have the most effect, do not change the P or D unless satisfactory control cannot be achieved by changing the I setting only. A large P or D value will make the control unstable.

Step changes of 10 units will typically give noticeable response change.

The slew rate is a ramp function on the output, set time period over the full scale.

Analogue Inputs – enter the number of inputs required. Additional Input setting tabs will appear as the number of inputs is increased.

Select individual input tabs to set up each input. Selecting different input types will change the input setting options on the input, the options will be relevant to the type of input selected.

Select from the following options:

- *Feedback* > select for VAV box or direct voltage feedback
- *Flow Grid* > select for flow grid type measurement
- *Static Pressure* > select for venturi / restrictor type measurement

Select the number of inputs.

The screenshot shows a multi-step configuration interface. At the top, a breadcrumb trail reads 'System Setup >> Functions >> Ventilation >> Exhaust >> Inputs'. Below this, a tab labeled 'Number of Inputs (sum)' is active, showing a sub-tab for 'Exhaust Air 1'. A dropdown menu is open, displaying options: 'None', '1', '2', '3', '4', '5', and '6'. The option '1' is currently selected and highlighted in blue. To the right of the list are navigation icons: a red 'X' at the top, a green up arrow, a green checkmark, and a green left arrow.

Select from 3 Input Types.

System Setup » Functions » Ventilation » Exhaust » Inputs » Exhaust Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	Ai01
Sensor Type	Flow Grid
Voltage Range	0-10V
Filter	5 sec
Offset	-235 cfm
Pressure Range	0.2007 Ins/Wg
Air Density	1.20 kg/m ³
Duct Area	0.031 m ²
Low Alarm	>

System Setup » Functions » Ventilation » Exhaust » Inputs » Exhaust Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	Ai01
Sensor Type	Feedback
Voltage Range	0-10V
Filter	5 sec
Offset	-235 cfm
Minimum Range	0 cfm
Maximum Range	848 cfm
Low Alarm	>
High Alarm	>

System Setup » Functions » Ventilation » Exhaust » Inputs » Exhaust Air 1

Enabled	<input checked="" type="checkbox"/>
Analogue Input	Ai01
Sensor Type	Static Pressure
Voltage Range	0-10V
Filter	5 sec
Offset	-235 cfm
Pressure Range	0.2007 Ins/Wg
Air Density	1.20 kg/m ³
K Factor	91.00 (Metric) >
Low Alarm	>



Flow Grid Settings

Analogue Input	<ul style="list-style-type: none">• Select Input 1-15
Enabled	<ul style="list-style-type: none">• Enable / Disable the input
Voltage Range	<ul style="list-style-type: none">• Select pressure sensor output voltage, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none">• Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none">• Set an offset to adjust the displayed value
Pressure Range	<ul style="list-style-type: none">• Select pressure sensor measuring range
Air Density	<ul style="list-style-type: none">• Set the Air Density value
Duct Area	<ul style="list-style-type: none">• Set the Duct Area
Low Alarm	<ul style="list-style-type: none">• Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none">• Set and enable the High volume alarm

Feedback Settings

Analogue Input	<ul style="list-style-type: none">• Select Input 1-15
Enabled	<ul style="list-style-type: none">• Enable / Disable the input
Voltage Range	<ul style="list-style-type: none">• Select input voltage range, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none">• Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none">• Set an offset to adjust the displayed value
Minimum Range	<ul style="list-style-type: none">• Select pressure sensor measuring range (Vmin)
Maximum Range	<ul style="list-style-type: none">• Select pressure sensor measuring range (Vnom)
Low Alarm	<ul style="list-style-type: none">• Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none">• Set and enable the High volume alarm

Static Pressure Settings

Analogue Input	<ul style="list-style-type: none"> Select Input 1-15
Enabled	<ul style="list-style-type: none"> Enable / Disable the input
Voltage Range	<ul style="list-style-type: none"> Select pressure sensor output voltage, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none"> Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none"> Set an offset to adjust the displayed value
Pressure Range	<ul style="list-style-type: none"> Select pressure sensor measuring range
Air Density	<ul style="list-style-type: none"> Set the Air Density value
F Factor	<ul style="list-style-type: none"> Set the K factor and the Units (e.g. set CFM if K is relative to CFM)
Low Alarm	<ul style="list-style-type: none"> Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none"> Set and enable the High volume alarm

Outputs – enter the number of outputs required. Additional Output setting tabs will appear as the number of outputs is increased.

Select individual input tabs to set up each output.

System Setup » Functions » Ventilation » Exhaust » Outputs » Exhaust Air 1
✕

Analogue Output	Ao02
Manual Mode	<input type="checkbox"/>
Voltage Range	0-10V
Control Mode	Control (PID) : set in Control Menu
Min Limit	0.0 %
Max Limit	100.0 %
Filter	0 sec



System Setup » Functions » Ventilation » Exhaust » Outputs » Exhaust Air 1

Analogue Output	Ao02
Manual Mode	<input checked="" type="checkbox"/>
Voltage Range	0-10V
Manual Output	100.0 %
Filter	0 sec



Output Settings

Analogue Output

- Select Output 1-14

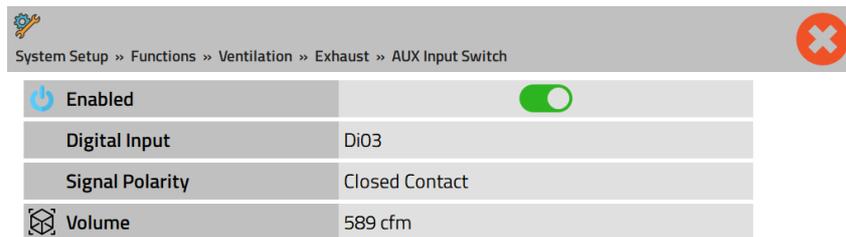
Manual Mode ON

- Select output voltage range 0-10/2-10/10-2/10-0V
- Set Manual Output % value
- Set Output filter (time averaging)

Manual Mode OFF

- Select output voltage range 0-10/2-10/10-2/10-0V
- Control Mode is displayed (Demand or PID)
- Set Min Output Limit % value if required
- Set Max Output Limit % value if required
- Set Output filter (time averaging)

Aux Digital Input switch – enable and select the input and polarity. Set the volume the input will represent.



Aux Digital Input Switch

Enabled	<ul style="list-style-type: none"> • Enable / Disable the input
Digital Input	<ul style="list-style-type: none"> • Select Input 1-6
Signal Polarity	<ul style="list-style-type: none"> • Select Open or Closed contact
Volume	<ul style="list-style-type: none"> • Set the required volume that the input represents

Purge switch – enable and select the input and polarity. Set the Purge set point.

System Setup » Functions » Ventilation » Exhaust » Purge Switch
✕

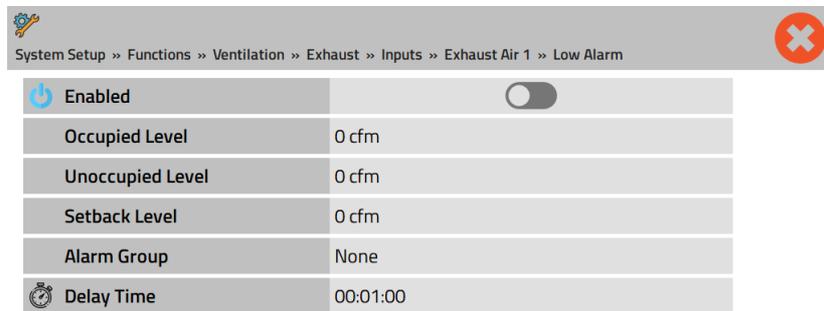
Enabled	<input checked="" type="checkbox"/>
Digital Input	DI06
Signal Polarity	Closed Contact
Add Volume to SP	883 cfm



Purge Switch

Enabled	<ul style="list-style-type: none"> • Enable / Disable the input
Digital Input	<ul style="list-style-type: none"> • Select Input 1-6
Signal Polarity	<ul style="list-style-type: none"> • Select Open or Closed contact
Volume	<ul style="list-style-type: none"> • Set the required volume (to be added to the exhaust air set point)

Alarms – select individual input tabs to set up each Alarm or select the Total Alarm tab to set the Total Exhaust air Low and High volume alarms.



System Setup » Functions » Ventilation » Exhaust » Inputs » Exhaust Air 1 » Low Alarm	
Enabled	<input type="checkbox"/>
Occupied Level	0 cfm
Unoccupied Level	0 cfm
Setback Level	0 cfm
Alarm Group	None
Delay Time	00:01:00



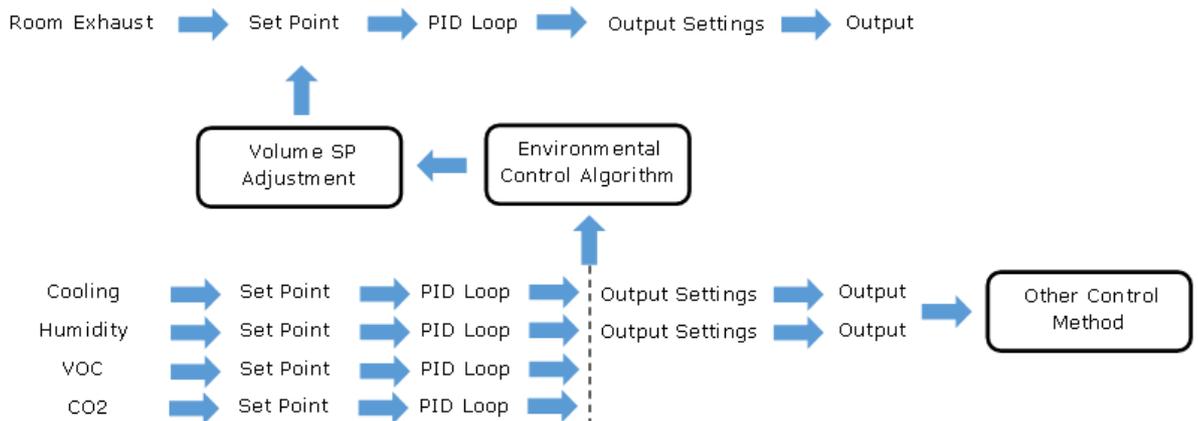
Low and High Alarm Settings

Enabled	<ul style="list-style-type: none"> • Enable or disable the alarm
Occupied Level	<ul style="list-style-type: none"> • Set the Occupied alarm level
Unoccupied Level	<ul style="list-style-type: none"> • Set the Unoccupied alarm level
Setback Level	<ul style="list-style-type: none"> • Set the Setback alarm level
Alarm Group	<ul style="list-style-type: none"> • Assign an Alarm Group 1-4 if required
Delay Time	<ul style="list-style-type: none"> • Set the Alarm delay time

Air Quality Control – along with the Exhaust air Set point, the Exhaust can be used to increase air changes in the room to maintain various air quality set points. Some air quality functions can be individually assigned to Exhaust air loop or other methods.

The controller has a built in Environmental control algorithm that automatically scales each assigned Exhaust air function and calculates a volumetric value that is then added or subtracted to the Exhaust air Set point to increase or reduce the air changes in the room as necessary.

The adjusted Exhaust air Set point is governed by the current Fume Hood volume and capacity of the Supply air so that the room will not over pressurise and to ensure capacity is available for the Fume Hoods when required. Other factors such as Purge switch, Fire alarm, Room pressure override are also taken into consideration in the control algorithm.



To add a function to the control loop set the Mode to Exhaust Air. Refer to the individual function settings further in the manual.

4.14 Ventilation Functions, Fume Hoods.

When used with TEL AFA1000 & AFA4000 series VAV controllers, the AFA5000 can connect to a maximum of 64 Fume Hoods using an RS485 network with the TEL protocol.

The controller can also connect with TEL Auto sash closers when used with the appropriate AFA4000 variant to provide additional Fume Hood data.

The AFA5000 can be set to get Extended properties from the AFA1000 or AFA4000 controllers to provide additional control functionality and BMS data – see *Get Extended properties and Sash Control sections below*.

Each Fume Hood controller can be individually named with an ID of up to 15 characters.

The AFA5000 has additional Analogue and Digital Auxiliary inputs so that Fume Hoods with 3rd party controls or a separate flow measuring device can be used to connect to the Fume Hood input.

To Access the Fume Hood page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions -Ventilation -Hoods"*

Select from the following options:

- *Capacity >* set the total capacity of the Fume Hoods
- *AFA Units >* set the number of and details of each Hood
- *Aux Inputs >* set the number and details of Auxiliary Analogue inputs
- *Aux Input Switch >* set the details of Auxiliary Digital input
- *Alarms >* select for alarm settings

Settings	
System Setup » Functions » Ventilation » Hoods	
Capacity	2200 m ³ /hr
AFA Units	>
AUX Inputs	>
AUX Input Switch	>
Alarms	>

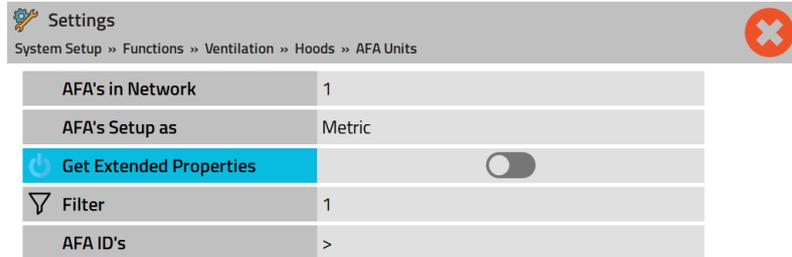


Capacity – enter the total Hood volume

AFA Units – enter the AFA4000 and Fume Hood data

Select from the following options:

- *AFA's in Network* > set number of connected AFA1000 or AFA4000 controls
- *AFA's Setup as* > select the units that are set in the AFA1000 or AFA4000
- *Get Extended Properties* > select to fetch additional data
- *Filter* > Set the Input filter (time averaging)
- *Sash Control* > select for Sash Control
- *AFA ID's* > setup each AFA



AFA Units

Get Extended Properties Disabled

AFA's in Network

- Select number 1-64

AFA's Setup as

- Select Metric or Imperial to match AFA1000 or AFA4000 units

Extended properties

- Disabled

Filter

- Set the filter time

AFA IDs

- Select from the list AFA01, AFA02 etc.

- Set Name – maximum 15 Characters

- Set Slave ID – 1 to 128

- Set Internal Volume m3/ft3 (Hood Internal chamber area)

- Set Min Air change rate ach/hr (Design Hood Min air changes)

- Set Min Volumetric flow rate m3/hr/cfm (Design Hood Min volume)



AFA Units	Get Extended Properties Enabled
AFA's in Network	<ul style="list-style-type: none">• Select number 1-64
AFA's Setup as	<ul style="list-style-type: none">• Select Metric or Imperial to match AFA1000 or AFA4000 units
Extended properties	<ul style="list-style-type: none">• Enabled
Filter	<ul style="list-style-type: none">• Set the filter time
Sash Control	<ul style="list-style-type: none">• Enabled• Threshold – 0.1 to 1000m2• Hysteresis – 1 to 50%
AFA IDs	<ul style="list-style-type: none">• Select from the list AFA01, AFA02 etc.• Set Name – maximum 15 Characters• Set Slave ID – 1 to 128• Set Internal Volume m3/ft3 (Hood Internal chamber area)• Set Min Air change rate ach/hr (Design Hood Min air changes)• Set Min Volumetric flow rate m3/hr/cfm (Design Hood Min volume)• Set Sash Width mm/ins• Set Sash Height Fully Open mm/ins• Set Sash Height Fully Closed mm/ins• Set Sash Gap mm/ins (Leakage gaps)• Set Econ Output 1 Voltage Range 0-10V/2-10V• Set Personnel sensor Personality – Normal or Inverted



Sash Control – is used to override the room Exhaust Air control when the total Fume Hood open sash area is above the set threshold value, and resets at the threshold plus the hysteresis value.

For Example, with a threshold value of 1.000m² and a hysteresis of 10%, the Sash control will activate when the total open sash area is >1.000m² and reset when the open sash area <0.900m².

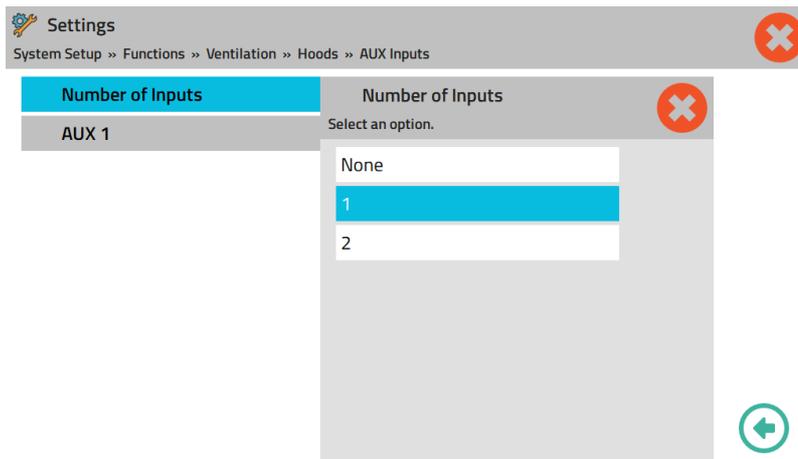
When the Sash control is activated, the Room Exhaust Air output will drive to zero over the set ramp time. When the Sash control is relinquished, the Exhaust Air output will operate back to the required Set point value with the PID control loop.

The Sash control function is useful when the room Exhaust is connected to the Fume Hood Exhaust manifold and a diversity factor is applied, the Sash control will give priority to the Fume Hoods if the Room Exhaust is open and the Sashes are opened, the Room Exhaust will close immediately ensuring enough volume is available for the Fume Hoods.

Get Extended Data values are used in the AFA5000 to calculate the following data that is provided to the BMS for monitoring the Fume Hood status and operation:

Additional BMS Data per Fume Hood	
Effective Setpoint	• Current AFA1000 or AFA4000 airflow Set Point m/sec or fpm
Econ OP 1 Percent	• Current AFA1000 or AFA4000 control output status
FH Internal Volume	• Fume Hood volume m ³ /ft ³
FH Air Changes	• Current Fume Hood ach/hr
Min Air Change Rate	• Design Minimum Fume Hood air change rate ach/hr
Min Volume	• Design Minimum Fume Hood volume m ³ /hr/cfm
Sash Position	• Current Fume Hood Sash position mm/ins open
Sash Open Area	• Current Fume Hood Sash open area m ² /ft ²
Additional BMS Data	
Total Sash Open Area	• Current Total Fume Hood Sash open area m ² /ft ²

AUX Inputs – enter the number of inputs



Select from the 3 input types and enter the relevant data for each input.

Flow Grid Settings

Analogue Input	<ul style="list-style-type: none"> Select Input 1-15
Enabled	<ul style="list-style-type: none"> Enable / Disable the input
Voltage Range	<ul style="list-style-type: none"> Select pressure sensor output voltage, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none"> Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none"> Set an offset to adjust the displayed value
Pressure Range	<ul style="list-style-type: none"> Select pressure sensor measuring range
Air Density	<ul style="list-style-type: none"> Set the Air Density value
Duct Area	<ul style="list-style-type: none"> Set the Duct Area
Low Alarm	<ul style="list-style-type: none"> Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none"> Set and enable the High volume alarm

Feedback Settings

Analogue Input	<ul style="list-style-type: none"> Select Input 1-15
Enabled	<ul style="list-style-type: none"> Enable / Disable the input
Voltage Range	<ul style="list-style-type: none"> Select input voltage range, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none"> Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none"> Set an offset to adjust the displayed value
Minimum Range	<ul style="list-style-type: none"> Select pressure sensor measuring range (Vmin)
Maximum Range	<ul style="list-style-type: none"> Select pressure sensor measuring range (Vnom)
Low Alarm	<ul style="list-style-type: none"> Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none"> Set and enable the High volume alarm

Static Pressure Settings

Analogue Input	<ul style="list-style-type: none"> Select Input 1-15
Enabled	<ul style="list-style-type: none"> Enable / Disable the input
Voltage Range	<ul style="list-style-type: none"> Select pressure sensor output voltage, 0-10/2-10/10-2/10-0V
Filter	<ul style="list-style-type: none"> Set the Input filter (time averaging)
Offset	<ul style="list-style-type: none"> Set an offset to adjust the displayed value
Pressure Range	<ul style="list-style-type: none"> Select pressure sensor measuring range
Air Density	<ul style="list-style-type: none"> Set the Air Density value
F Factor	<ul style="list-style-type: none"> Set the K factor and the Units (e.g. set CFM if K is relative to CFM)
Low Alarm	<ul style="list-style-type: none"> Set and enable the Low volume alarm
High Alarm	<ul style="list-style-type: none"> Set and enable the High volume alarm



AUX Input Switch – enter the number of inputs

Aux Input Switch

Enabled	<ul style="list-style-type: none">• Enable / Disable the input
Digital Input	<ul style="list-style-type: none">• Select the Input
Signal Polarity	<ul style="list-style-type: none">• Select Closed or Open contact
Volume	<ul style="list-style-type: none">• Set the volume that the switch represents

Alarms – enter the alarm settings

Alarms

Total Low Alarm	<ul style="list-style-type: none">• Enable / Disable and set the Eco Mode Alarm points
Total High Alarm	<ul style="list-style-type: none">• Enable / Disable and set the Eco Mode Alarm points
Diversity Alarm	<ul style="list-style-type: none">• Enable / Disable and set the Eco Mode Alarm points
Building Diversity Alarm	<ul style="list-style-type: none">• Enable / Disable and select Input and polarity

 **Settings** 

System Setup » Functions » Ventilation » Hoods » Alarms

 Total Low Alarm	>
 Total High Alarm	>
 Diversity Alarm	>
 Builing Diversity Alarm	>



4.15 Ventilation Functions, Air Changes.

The AFA5000 Dials can be set to display the Room Air Change rate per hour and provide low and high Ach/hr alarms. (Ach/hr = Air Change rate per Hour)

The Air changes can be calculated using either the Supply air volume or Exhaust air volume to give true values where the supply air may only be providing partial air replacement to maintain a negative room pressure.

To Access the Air Changes page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions -Ventilation -Air Changes"*

Select from the following options:

- *Enabled > enable or disable*
- *Volumetric Source > select Supply air or Exhaust Air*
- *Room Volume > enter the room volume m3 or ft3*
- *Room Clear > enter the free space percentage*
- *Low Alarm > enable and set the alarm*
- *High Alarm > enable and set the alarm*

 Settings 

System Setup » Functions » Ventilation » Air Changes

 Enabled	<input checked="" type="checkbox"/>
 Volumetric Source	Total Exhaust Air
 Room Volume	144 m ³
Room Clear	80.0 %
 Low Alarm	>
 High Alarm	>



Refer to the Dashboard section of the manual for information on how to set the Dial to display Air Changes.

4.16 *Functions, Pressure.*

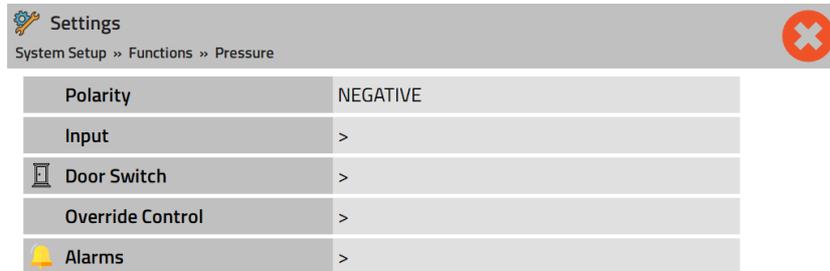
The Pressure function can be used to display, monitor, alarm and log Differential Room Pressure or can be used to override Volumetric control if the room pressure exceeds set limits.

The Pressure polarity can be set so that for example, a High pressure alarm is a High negative pressure in a typically negative room or is a High positive alarm in a normally positive pressure room.

The polarity is also used for Pressure Override control, where a negative polarity will keep the room negative to the set point and a positive polarity will keep the room positive to the set point.

The Pressure Override function will make continuous steady adjustments set as time / step values to the Supply Air set point. An addition alarm can be set if the amount of adjustment made to the set point exceeds a set limit.

A door switch can be assigned as a digital input to hold the Pressure Override control loop at its current state whilst the door is open and give a Door open alarm.



To Access the Pressure page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions - Pressure"*

Select from the following options:

- *Enabled* > enable or disable
- *Volumetric Source* > select Supply air or Exhaust Air
- *Room Volume* > enter the room volume m3 or ft3
- *Room Clear* > enter the free space percentage
- *Low Alarm* > enable and set the alarm
- *High Alarm* > enable and set the alarm

Pressure Settings

Polarity • Set to Negative or Positive

Inputs • Enable or Disable
• Select the Analogue Input
• Select the Pressure sensor output voltage range
• Set the Input filter (Time average)
• Calibration (Pressure sensor)
• Set the Minimum Range of the Pressure sensor
• Set the Maximum Range of the Pressure sensor

Door switch • Enable or Disable
• Select the Digital Input
• Set the Input polarity
• Set the Door Alarm delay time
• Assign an Alarm group 1-4

Override Control • Enable or Disable
• Set the Set Point
• Set the Adjustment Rate
• Enable the Limit Alarm:
• Set the Alarm points for all 3 Eco Modes
• Assign an Alarm group 1-4
• Set the Override Limit Alarm delay time

Alarms • Set the Low and High pressure Alarms

Settings ✕
 System Setup » Functions » Pressure » Override Control

Enabled	<input type="checkbox"/>
Set Point	-0.0120 Ins/Wg
Adjustment Rate	177 cfm per Minute
Limit Alarm	>



Settings ✕
 System Setup » Functions » Pressure » Override Control » Limit Alarm

Enabled	<input checked="" type="checkbox"/>
Occupied Level	589 cfm
Unoccupied Level	589 cfm
Setback Level	589 cfm
Alarm Group	None
Delay Time	00:00:05



4.17 Functions, Humidity.

The AFA5000 can be used to monitor or control the Humidity level in the room. The control mode can be Exhaust Air, dedicated PID controlled output or 2 stage relay control.

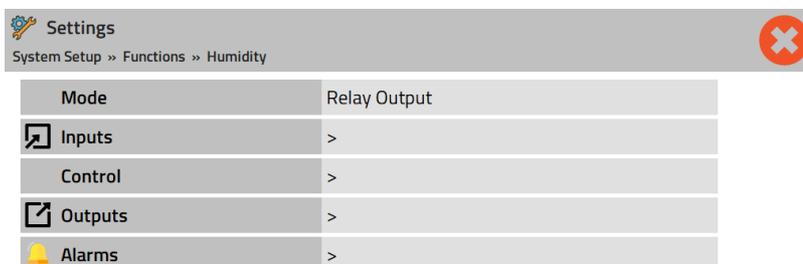
Multiple sensors can be used to provide an averaged reading, or the highest value can be selected.

To Access the Humidity page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions - Humidity"*

Select from the following options:

- *Mode > select the control mode*
- *Inputs > select the inputs*
- *Control > set the Setpoint and control settings*
- *Outputs > select the outputs*
- *Alarms > enable and set the alarms*





Changing the control mode will give different menu options.

Exhaust Air

Inputs

- Select the Number of Inputs
- Select the Analogue Input
- Select the RH sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the RH sensor
- Set the Maximum Range of the RH sensor

Control

- Enable or Disable
- Set the Set Points for all 3 Eco Modes
- Set the PID values

Alarms

- Set the Low and High Humidity Alarms
-

In Exhaust Air mode, the controller will use the Environmental Control algorithm to calculate a volumetric amount that should be added to or subtracted from the Room Exhaust air Set Point to increase or decrease the room air changes to maintain the RH level in the room.

The Exhaust air control is interlocked with the Supply air and Fume Hood Exhaust so the Exhaust air output may be limited if the Fume Hoods are open or if the Supply air is operating at maximum capacity.

The Environmental Control may also include CO₂, VOC and Cooling and will calculate the required demand for all assigned functions based on error, demand and PID settings.

The diagnostics menu screen "Control Function Summary" page shows the current status of each function in the control loop.

Relay Output

Inputs	<ul style="list-style-type: none">• Select the Number of Inputs• Select the Analogue Input• Select the RH sensor output voltage range• Set the Input filter (Time average)• Set the Offset if required• Set the Minimum Range of the RH sensor• Set the Maximum Range of the RH sensor
Control	<ul style="list-style-type: none">• Enable or Disable• Set the Set Points for all 3 Eco Modes• Set the PID values
Outputs	<ul style="list-style-type: none">• Select Stage 1 Relay output Relay 1-4• Select Stage 2 Relay output Relay 1-4
Alarms	<ul style="list-style-type: none">• Set the Low and High Humidity Alarms

The Relay Output mode gives 2 stage control for dehumidification. The relay output switching points and dead bands are fixed, the PID settings can be used increase or reduce the control response.

Stage 1 - Relay a – On 2V, Off 1V

Stage 2 - Relay b – On 6V, Off 5V

Analogue Output

Inputs

- Select the Number of Inputs
- Select the Analogue Input
- Select the RH sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the RH sensor
- Set the Maximum Range of the RH sensor

Control

- Enable or Disable
- Set the Set Points for all 3 Eco Modes
- Set the PID values

Outputs

- Set the Analogue Output
- Select Manual or Auto control
- Set the Output voltage range, 0-10/2-10/10-2/10-0V
- Set the Output filter
- Set the Minimum Output Voltage
- Set the Maximum Output Voltage

Alarms

- Set the Low and High Humidity Alarms
-

The Analogue Output mode provides a 0-10V PID controlled output independent of other functions.

4.18 Functions, Room Temperature.

The Room Temperature function is used for Reheat and Cooling operation.

Both Reheat and Cooling use the same set point with Dead Band operation. For example, with a Set Point of 68 Deg F and a Dead Band of 3 Deg F the controller will Heat to 65 Deg F and Cool to 71 Deg F.

A sensible Dead Band should be considered so that the Heating and Cooling are not both operating at the same time.

The Cooling control mode can be Exhaust Air, dedicated PID controlled output or 2 stage relay control.

Multiple sensors can be used to provide an average Temperature reading, or the highest value can be used.

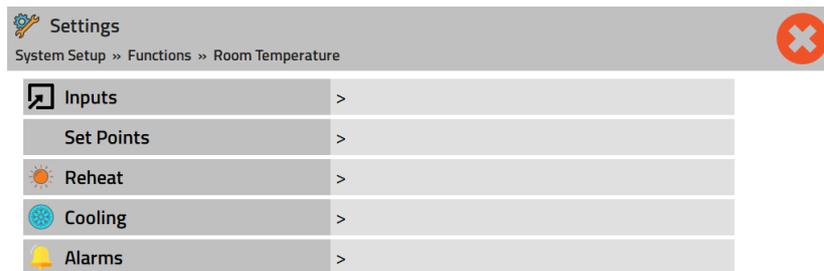
A user Set Point adjustment function can be configured in the Dashboard to allow limited adjustment of the current Set Point on the Run screen.

To Access the Room Temperature page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions – Room Temperature"*

Select from the following options:

- *Inputs > select the type and number of Temperature Sensors*
- *Set Points > select the Set Points and Dead Bands for all 3 Eco Modes*
- *Reheat > set the Control settings*
- *Cooling > select the Control mode and settings*
- *Alarms > enable and set the alarms*



Room Temperature

Inputs

- Select the Number of Thermistor sensor Inputs
- Select the Number of Analogue sensor Inputs
- Select the Analogue Input
- Select the Analogue sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the Analogue sensor
- Set the Maximum Range of the Analogue sensor

Set Point

- Set the Set Points for all 3 Eco Modes
- Set the Dead Bands for all 3 Eco Modes

Reheat

- Set the Analogue Output
- Set the PID Settings
- Select Manual or Auto control
- Set the Output voltage range, 0-10/2-10/10-2/10-0V
- Set the Output filter
- Set the Minimum Output Voltage
- Set the Maximum Output Voltage

Alarms

- Set the Low and High Temperature Alarms
-



Changing the control mode will give different menu options for cooling.

Cooling Analogue Mode

Analogue Mode

- Set the Analogue Output
- Set the PID Settings
- Select Manual or Auto control
- Set the Output voltage range, 0-10/2-10/10-2/10-0V
- Set the Output filter
- Set the Minimum Output Voltage
- Set the Maximum Output Voltage

Exhaust Mode

- Set the PID Settings

Relay Output Mode

- Select Stage 1 Relay output Relay 1-4
 - Select Stage 2 Relay output Relay 1-4
-

In Exhaust Air mode, the controller will use the Environmental Control algorithm to calculate a volumetric amount that should be added to or subtracted from the Room Exhaust air Set Point to increase or decrease the room air changes to maintain the cooling level in the room.

The Exhaust air control is interlocked with the Supply air and Fume Hood Exhaust so the Exhaust air output may be limited if the Fume Hoods are open or if the Supply air is operating at maximum capacity.

The Environmental Control may also include CO₂, VOC and Humidity and will calculate the required demand for all assigned functions based on error, demand and PID settings.

The diagnostics menu screen "Control Function Summary" page shows the current status of each function in the control loop.

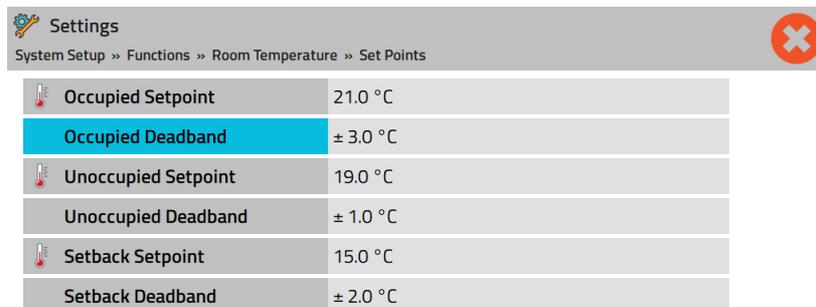
The Relay Output mode gives 2 stage control for Cooling. The relay output switching points and dead bands are fixed, the PID settings can be used increase or reduce the control response.

Stage 1 - Relay a – On 2V, Off 1V

Stage 2 - Relay b – On 6V, Off 5V

The Analogue Output mode provides a 0-10V PID controlled output independent of other functions.

Set Point Menu.



The screenshot shows a settings menu for 'Set Points'. The menu is titled 'Settings' and has a breadcrumb trail: 'System Setup » Functions » Room Temperature » Set Points'. A red 'X' icon is in the top right corner. The menu contains six items, each with a thermometer icon and a value:

Occupied Setpoint	21.0 °C
Occupied Deadband	± 3.0 °C
Unoccupied Setpoint	19.0 °C
Unoccupied Deadband	± 1.0 °C
Setback Setpoint	15.0 °C
Setback Deadband	± 2.0 °C



Note, The Reheat output and Temperature Set Points are BAS writeable values, as the BAS may override the controller settings it is recommended that the Room Temperature control is commissioned initially without BAS connection to ensure the controller settings maintain priority.

4.19 Functions, Supply Temperature.

The Supply Air Temperature is only an alarm function within the controller operation, the Temperature value and alarm status are provided on the BAS coms.

Multiple sensors can be used to provide an average Temperature reading, or the highest value can be used.

To Access the Supply Temperature page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions – Supply Temperature"*

Select from the following options:

- *Inputs >* select the type and number of Temperature Sensors
- *Alarms >* enable and set the alarms

Supply Temperature

Inputs

- Select the Number of Thermistor sensor Inputs
- Select the Number of Analogue sensor Inputs
- Select the Analogue Input
- Select the Analogue sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the Analogue sensor
- Set the Maximum Range of the Analogue sensor

Alarms

- Set the Low and High Temperature Alarms
-

4.20 Functions, Return Temperature.

The Return Air Temperature is only an alarm function within the controller operation, the Temperature value and alarm status are provided on the BAS coms.

Multiple sensors can be used to provide an average Temperature reading, or the highest value can be used.

To Access the Return Temperature page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions – Return Temperature"*

Select from the following options:

- *Inputs >* select the type and number of Temperature Sensors
- *Alarms >* enable and set the alarms

Return Temperature

Inputs

- Select the Number of Thermistor sensor Inputs
- Select the Number of Analogue sensor Inputs
- Select the Analogue Input
- Select the Analogue sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the Analogue sensor
- Set the Maximum Range of the Analogue sensor

Alarms

- Set the Low and High Temperature Alarms
-

4.21 Functions, CO2.

The AFA5000 can be used to monitor or control the CO2 level in the room. The control mode is Exhaust Air only.

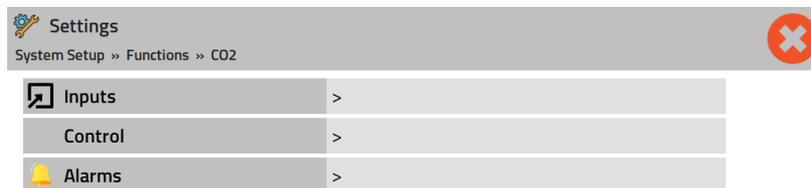
Multiple sensors can be used to provide an average Temperature reading, or the highest value can be used.

To Access the CO2 page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions – CO2"*

Select from the following options:

- *Inputs >* select the inputs
- *Control >* set the Setpoint and control settings
- *Alarms >* enable and set the alarms



CO2

Inputs

- Select the Number of sensor Inputs
- Select the Inputs
- Select the sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the Analogue sensor
- Set the Maximum Range of the Analogue sensor

Set Point

- Set the Set Points for all 3 Eco Modes
- Set the PID Settings

Alarms

- Set the Low and High CO2 Alarms
-

The controller will use the Environmental Control algorithm to calculate a volumetric amount that should be added to or subtracted from the Room Exhaust air Set Point to increase or decrease the room air changes to maintain the CO2 level in the room.

The Exhaust air control is interlocked with the Supply air and Fume Hood Exhaust so the Exhaust air output may be limited if the Fume Hoods are open or if the Supply air is operating at maximum capacity.

The Environmental Control may also include Humidity, VOC and Cooling and will calculate the required demand for all assigned functions based on error, demand and PID settings.

The diagnostics menu screen "Control Function Summary" page shows the current status of each function in the control loop.

4.22 Functions, VOC.

The AFA5000 can be used to monitor or control the VOC level in the room. The control mode is Exhaust Air only.

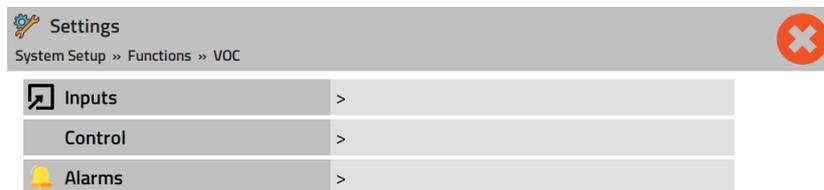
Multiple sensors can be used to provide an average Temperature reading, or the highest value can be used.

To Access the VOC page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Functions – VOC"*

Select from the following options:

- *Inputs >* select the inputs
- *Control >* set the Setpoint and control settings
- *Alarms >* enable and set the alarms



VOC

Inputs

- Select the Number of sensor Inputs
- Select the Inputs
- Select the sensor output voltage range
- Set the Input filter (Time average)
- Set the Offset if required
- Set the Minimum Range of the Analogue sensor
- Set the Maximum Range of the Analogue sensor

Set Point

- Set the Set Points for all 3 Eco Modes
- Set the PID Settings

Alarms

- Set the Low and High VOC Alarms
-

The controller will use the Environmental Control algorithm to calculate a volumetric amount that should be added to or subtracted from the Room Exhaust air Set Point to increase or decrease the room air changes to maintain the VOC level in the room.

The Exhaust air control is interlocked with the Supply air and Fume Hood Exhaust so the Exhaust air output may be limited if the Fume Hoods are open or if the Supply air is operating at maximum capacity.

The Environmental Control may also include Humidity, CO₂ and Cooling and will calculate the required demand for all assigned functions based on error, demand and PID settings.

The diagnostics menu screen "Control Function Summary" page shows the current status of each function in the control loop.

4.23 *ECO Settings.*

The AFA5000 has 2 configurable modes of operation giving multiple states of control and operation, Occupancy and Setback. The Eco mode is displayed on the top left-hand side of the Screen and will indicate the current status.

Occupied Mode is typically operated using PIR sensors in the room, in Occupied mode the ventilation and air quality controls will operate at normal design parameters.

When the room is no longer Occupied, the controller can be set to switch to **Unoccupied** mode, the ventilation may operate at normal or reduced design levels, and the air quality, heating and cooling levels may also reduce. Timers can be set so that the room must be Unoccupied for a period before the controller switches state and must be Occupied again for a period before the controller switches back to Occupied mode.

The controller can also be set to operate in **Setback** mode, this is typically out of hours operation. In Setback mode the ventilation, air quality control and heating and cooling will operate at minimum settings.

The controller can be set to Manually or Automatically Override Setback mode when out of hours working is required. Manual Override is operated by pressing the Override button on the screen, this will give a time extended period with a displayed countdown of time remaining, pressing the button again will reset the timer to start again.

Automatic Override is operated by room Occupancy, where if the room is occupied for a set time the controller will reset to Occupied mode. Once the room is unoccupied the controller will revert to Setback mode operation.

Setback can be operated by a remote input, BAS command or by an on-board Time Scheduler. The Scheduler is set for working hours for each day of the week. Up to 5 holiday periods can be set where the controller will remain in Setback mode during the daily working hours.



To Access the ECO page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "ECO"*

Select from the following options:

- *Occupancy > sets Occupancy settings*
- *Setback > sets Setback, Override and Scheduler settings*

Occupancy

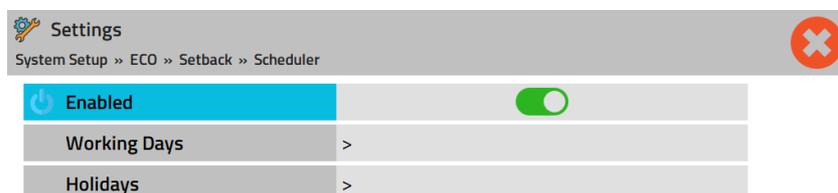
Enable	<ul style="list-style-type: none">• Enable or Disable Occupancy Mode
AFA Occupancy Operation	<ul style="list-style-type: none">• When connected to TEL VAV Fume Hood controllers, sets the Hood Face Velocity to Low Set Point value and Reduced alarm points
Relay Output	<ul style="list-style-type: none">• Select a Relay Output 1-4
PIR	<ul style="list-style-type: none">• Select the Digital Input• Set the input Polarity• Set a Run on Timer• Override Setback Enable and Time Delay (Auto Setback Override)

Setback

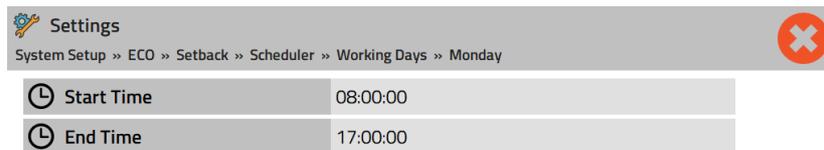
Enable	<ul style="list-style-type: none"> • Enable or Disable Setback Mode
AFA Occupancy Operation	<ul style="list-style-type: none"> • When connected to TEL VAV Fume Hood controllers, sets the Hood Face Velocity to Night Setback mode
Relay Output	<ul style="list-style-type: none"> • Select a Relay Output 1-4 (used to switch off plant etc).
Input	<ul style="list-style-type: none"> • Select the Digital Input • Set the input Polarity
Input	<ul style="list-style-type: none"> • Select the Digital Input • Set the input Polarity
Override Button	<ul style="list-style-type: none"> • Enable or Disable Override Button • Set Override Time extend period (Manual Setback Override)
Scheduler	<ul style="list-style-type: none"> • Enable or Disable the Scheduler • Set the working days • Set the Holiday period

Scheduler

Enable the Scheduler and select Working days to set the daytime working periods for each day.



Set the Start and End times for each day in HH/MM/SS format. If the day has no working hours, set both the Start and End times to 00:00:00.

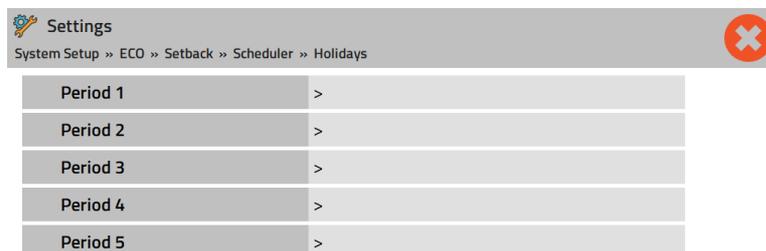


The screenshot shows a settings window titled 'Settings' with a gear icon and a red 'X' icon. The breadcrumb trail is 'System Setup » ECO » Setback » Scheduler » Working Days » Monday'. Below the breadcrumb, there are two rows of settings:

Start Time	08:00:00
End Time	17:00:00



Set the Start and Return Dates for the selected Holiday periods in DD/MM/YY format. If the holiday periods are not used set both dates to the 1st day of the year, 01/01/2019.



The screenshot shows a settings window titled 'Settings' with a gear icon and a red 'X' icon. The breadcrumb trail is 'System Setup » ECO » Setback » Scheduler » Holidays'. Below the breadcrumb, there are five rows of settings, each labeled 'Period 1' through 'Period 5' with a right-pointing arrow:

Period 1	>
Period 2	>
Period 3	>
Period 4	>
Period 5	>



4.24 Date / Time.

The AFA5000 has a built-in time clock for the Scheduler operation. The time clock can be set up manually, or when an Ethernet coms connection is made can be set Automatically using an NTP (Network Time Protocol) server IP address.

The BAS system may support NTP internally, if not a local reliable external NTP server IP address may be used, e.g. Google's public NTP Server address 216.239.35.0 can be used.

The NTP options should be discussed with the BAS engineer to discover the options available on an individual installation.

Note – The Ethernet connection can still be used for an NTP server connection when the BAS coms are set to RS485 BACnet MS/TP or Modbus RTU with the optional RS485 expansion board.

To Access the Date / Time page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Date / Time"*

Select from the following options:

- *Date Format > select DD/MM/YY or MM/DD/YY format*
- *Daylight Savings > select the local region*
- *NTP Enable > enable or disable NTP, enter Server IP address and Time Zone*
- *Set Date Manually > Set the Date*
- *Set Time Manually > Set the Time*

NTP enabled

Settings 

System Setup » Date / Time

Date Format	DD/MM/YYYY
Daylight Saving	UK/Western Europe
NTP Enable	<input checked="" type="checkbox"/>
Server IP Address	216.239.35.0
Time Zone	UTC±0 (GMT/WET)



Manually set the Time and Date

Settings 

System Setup » Date / Time

Date Format	DD/MM/YYYY
Daylight Saving	UK/Western Europe
NTP Enable	<input type="checkbox"/>
Set Date Manually	>
Set Time Manually	>





NTP Enabled

Dated Format	<ul style="list-style-type: none">• Select DD/MM/YY or MM/DD/YY
Daylight Saving	<ul style="list-style-type: none">• Select Region
NTP Enable	<ul style="list-style-type: none">• Enabled
Server IP Address	<ul style="list-style-type: none">• Obtain from BAS or use remote server address e.g. <i>216.239.35.0</i>
Time Zone	<ul style="list-style-type: none">• Select Local Time Zone (UTC +/- Hours)

NTP Disabled (Manual set up)

Dated Format	<ul style="list-style-type: none">• Select DD/MM/YY or MM/DD/YY
Daylight Saving	<ul style="list-style-type: none">• Select Region
NTP Enable	<ul style="list-style-type: none">• Disabled
Set Date Manually	<ul style="list-style-type: none">• Set the Time
Set Time Manually	<ul style="list-style-type: none">• Set the Date

The time and date are displayed on the top right of the touchscreen, with NTP enabled the date and time should synchronise with the server as soon as the controller goes to the run screen and will re-synchronise hourly.



4.25 Ethernet Port.

The AFA5000 controller has a RJ45 Ethernet port for BMS connection, the port is 10/100 Base – T. The controller has both Modbus and BACnet IP protocols on board and can be setup using the password protected BMS coms menus.

The MAC address of the controller is displayed in the Ethernet settings page.

The controller can be set to automatically obtain an IP address using DHCP if is supported on the network. Alternatively, the IP address can be entered manually.

If DHCP is enabled and the connection is successful the IPv4 address should appear in the menu, to refresh the page click on another setting or page and then return.

When connected, an Ethernet port icon will appear in the bottom left of the run screen.

To Access the Ethernet page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Ethernet"*

Manually set the IP Address

Settings	
System Setup » Ethernet	
MAC Address	80-1F-12-43-B9-EC
DHCP Enable	<input type="checkbox"/>
IPv4 Address	192.168.1.9
Subnet Mask	255.255.255.0
Default Gateway	0.0.0.0



The IP Address will appear automatically if DHCP is supported and enabled.

Settings	
System Setup » Ethernet	
MAC Address	80-1F-12-43-B9-EC
DHCP Enable	<input checked="" type="checkbox"/>
IPv4 Address	0.0.0.0
Subnet Mask	0.0.0.0
Default Gateway	0.0.0.0



Ethernet

MAC Address	<ul style="list-style-type: none"> The controller MAC address is displayed
DHCP Enable	<ul style="list-style-type: none"> Select if supported to obtain an IP address
IPv4 Address	<ul style="list-style-type: none"> Is displayed with DHCP enabled or enter Manually with DHCP disabled
Subnet Mask	<ul style="list-style-type: none"> Is displayed with DHCP enabled or enter Manually with DHCP disabled
Default Gateway	<ul style="list-style-type: none"> Is displayed with DHCP enabled or enter Manually with DHCP disabled





4.26 BMS Coms.

The AFA5000 can be set to provide Ethernet IP coms or RS485 coms with an optional plug in expansion board.

The standard protocol options are Modbus IP and BACnet IP, if the expansion board is detected Modbus RTU and BACnet MS/TP will also appear in the options.

To Access the BMS Coms page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "BMS Coms"*

The relevant options will appear once the Protocol is selected.

BACnet / Modbus IP

Network Protocol	<ul style="list-style-type: none">• Select BACnet or Modbus IP
BACnet or Modbus IP	<ul style="list-style-type: none">• UDP port is displayed
Settings	<ul style="list-style-type: none">• Device Name – enter Name, max 30 characters• Device Instance – enter Instance, 0-4194303



BACnet MS/TP

Network Protocol	<ul style="list-style-type: none">• Select BACnet MS/TP
BACnet MS/TP Settings	<ul style="list-style-type: none">• Device Name – enter Name, max 30 characters• Device Instance – enter Instance, 0-4194303• Station ID – enter ID, 1-127• Max Masters – enter Max Masters, 0-127• Baud Rate – select from 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200

Note, BACnet MS/TP is fixed 8-1-n:

Data Bits = 8

Stop Bits = 1

Parity = None

Modbus RTU

Network Protocol	<ul style="list-style-type: none">• Select Modbus RTU
Modbus RTU Settings	<ul style="list-style-type: none">• Device Name – enter Name, max 30 characters• Slave ID – enter ID, 1-255• Parity – set None / Even / Odd• Baud Rate – select from 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200

Refer to the separate Register documents for detailed information.

4.27 Alarms.

Most functions within the controller have Individual Low and High alarms and functions with more than one Input and Output may also have Total Low and High Alarms. All these Alarms are configured in the Individual function Alarm section.

The controller has an additional Fire alarm grouped in the Alarm section with the Alarm groups.

To Access the Alarms page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Alarms"*

Select from the following options:

- *Fire Alarm > enable or disable the alarm and set the functions*
- *Relays > select the relays for alarm groups*

Fire Alarm

Enable / Disable	<ul style="list-style-type: none">• Enable the Alarm
Digital Input	<ul style="list-style-type: none">• Select the Input
Signal Polarity	<ul style="list-style-type: none">• Select the Input Polarity
Supply Air Out	<ul style="list-style-type: none">• Set the Output % in Fire Alarm Mode
Exhaust Air Out	<ul style="list-style-type: none">• Set the Output % in Fire Alarm Mode

Fire Alarm – when activated, the Supply air and Room Exhaust will drive to the set Output percentage regardless of Eco Mode or other function status, the Fire Alarm has highest priority.

The Supply and Exhaust Air Control settings Slew Rates will be used for the speed of the output change.

The audible alarm will be active with a Fire Alarm tone (mutable) and “Fire Alarm” will be displayed in the Alarm status window, regardless of other alarm / mute status.

When the Fire alarm resets, the outputs will drive to zero and reset before going back to the current control settings and operation modes.

Settings	
System Setup >> Alarms >> Fire Alarm	
Enabled	<input checked="" type="checkbox"/>
Digital Input	DI05
Signal Polarity	Closed Contact
Supply Air Out	100.0 %
Exhaust Air Out	100.0 %





Relays

Group 1	• Select Relay Output 1-4
Group 2	• Select Relay Output 1-4
Group 3	• Select Relay Output 1-4
Group 4	• Select Relay Output 1-4

Relay Groups are used to group multiple alarms to a single relay output, the Alarm group is selected within the Individual function Alarm setting.

If any of the grouped alarms are active, the assigned relay will activate.



4.28 Engineers Screens.

The controller contains Diagnostic screens to aid commission and show current I/O and performance settings which are accessible using the Engineers screens.

Both the Settings and Engineering menu Passwords can be changed in the Engineering menu, the current passwords must be entered before a new password can be set.

There are also Debug and Factory Test settings for TEL engineers that are for Internal use only.

To Access the Engineers Screens page, press the **SETTINGS** button on the bottom of the screen and select the following:

- *System Setup > Enter Password > Select "Engineers Screens"*

Select from the following options:

- *Diagnostics > select for Diagnostic screens*
- *Passwords > select to change passwords*
- *Debug Options > select to show screen coms engineer data on the run screen*
- *Factory Calibration > for TEL Internal use only*



Diagnostics Screens are split into 6 pages:

Dagnostic Screens

Page 1	• I/O Summary
Page 2	• Control Function Summary
Page 3	• Hood Air Details (TEL AFA coms connection)
Page 4	• Supply Air Details
Page 5	• Exhaust Air Details
Page 6	• Ethernet Status

Page 1 – I/O Summary.

Diagnostics

1/7 I/O Summary

Analogue Inputs:				Analogue Outputs:			
Ai01	198 mV	EXHAUST AIR 1	0 m ³ /hr	Ao01	0 mV	SUPPLY AIR 1	0.0 %
Ai02	25 mV	SUPPLY AIR 1	113 m ³ /hr	Ao02	10000 mV	EXHAUST AIR 1	100.0 %
Ai03	0 mV			Ao03	0 mV		
Ai04	0 mV			Ao04	0 mV		
Ai05	3081 mV	CO2 1	616.2 ppm	Ao05	0 mV		
Ai06	5321 mV	HUMIDITY 1	53.2 %RH	Ao06	0 mV	REHEAT	0.0 %
Ai07	0 mV			Ao07	0 mV		
Ai08	2328 mV	CO2 2	465.3 ppm	Ao08	0 mV		
Ai09	0 mV			Ao09	0 mV		
Ai10	0 mV			Ao10	0 mV		
Ai11	558 mV	VOC 1	5.6 %	Ao11	0 mV		
Ai12	0 mV			Ao12	0 mV		
Ai13	6004 mV	PRESSURE	5.4 Pa	Ao13	0 mV		
Ai14	0 mV			Ao14	10000 mV	EXHAUST AIR 2	100.0 %
Ai15	3634 mV	ROOM TEMP 1	18.2 °C				
Thermistors:				Relays:			
TH1	FAULT	O/C		RLY1	OFF	AL1[] S/B[]	
TH2	21.1 °C	ROOM		» RLY2	OFF	AL2[] OCC[] DH1[]	
Digital Inputs:				» RLY3	OFF	AL3[] DH2[]	
Di1	HIGH	DOOR-SW[]		RLY4	OFF	ALARM GROUP 4[]	
Di2	LOW	SETBACK[]					
Di3	LOW	EA-AUXD[]					
Di4	HIGH	PIR[X]					
Di5	LOW	FIRE[]					
Di6	LOW	PURGE[]					

» There are 2 I/O conflicts !!!



The I/O Summary shows the Input and Output voltages, Functions and Status and is split into 4 Sections:

ANALOGUE INPUTS			
INPUT #	VOLTAGE	FUNCTION	VALUE / UNITS
(Inputs 1-15)	(Current Input V)	(Assigned Input Function)	(Current Value and Units)
e.g. Input 1	5670mV	Room Temperature	70.5 Deg F
e.g. Input 12	0mV	<i>Blank - Not Assigned</i>	<i>Blank - Not Assigned</i>
ANALOGUE OUTPUTS			
OUTPUT #	VOLTAGE	FUNCTION	OUTPUT STATUS 0-100%
(Outputs 1-14)	(Current Output V)	(Assigned Output Function)	(Current Value and Units)
e.g. Output 2	10000mV	Reheat	100%
e.g. Output 14	0mV	<i>Blank - Not Assigned</i>	<i>Blank - Not Assigned</i>
DIGITAL INPUTS			
INPUT #	POLARITY	FUNCTION	STATUS
(Inputs 1-6)	(Open Contact =High) (Closed Contact = Low)	(Assigned Input Function)	X = Contact Closed
e.g. Input 4	High	Purge	X
e.g. Input 5	Low	<i>Blank - Not Assigned</i>	
RELAY OUTPUTS			
OUTPUT #	STATUS	FUNCTION	OUTPUT STATUS 0-100%
(Outputs 1-4)		(Assigned Output Function)	X = Relay Energised
e.g. RLY 2	ON	PIR	X
e.g. RLY 3	OFF	<i>Blank - Not Assigned</i>	<i>Blank - Not Assigned</i>



If more than one function is accidentally assigned to the same input or output, a conflict (>>) will be displayed at the left-hand side of the input or output, and the conflicting items will be shown in the function list. E.g. Input 1 set to Supply Air 1 and Exhaust Air 1:

INPUT #	VOLTAGE	FUNCTION	VALUE / UNITS
>> Input 1	mV	SA1, EX1	

The total number of conflicts for all assigned I/O is shown at the bottom of the page, e.g. "There are 2 Conflicts!!!"



Page 2 – Control Function Summary.

Diagnostics														
1/7 I/O Summary														
HOOD AIR READING			EXHAUST AIR MAX S/P			EXHAUST AIR S/P			EXHAUST AIR READING			SUPPLY AIR S/P		
HA AFA's	378.4		SA RANGE	2400.0		EA MNU SP	1000.0		EA_IP	1528.7		SA MNU SP	-200.0	
HA AUXA	0.0 +		SA MNU SP	-200.0 -		HAR(*)	378.4 -		EA_AUXD	0.0 +		HAR(*)	378.4 +	
HA AUXD	0.0 +		HAR(*)	378.4 -		PURGE	0.0 +					EAR(#)	1528.7 +	
						ENV ADJ	927.1 +					P/OR	0.0 +	
HAR(*)	378.4		MAX EA SP	1600.0		EA S/P	1548.8		EAR(#)	1528.7		SA S/P	1707.1	
			CAPPED @ EA RANGE									PRESSURE: -2.00 Pa		
EXHAUST ENV FUNC	S/P	F/B	ERR	RANGE	E/R	P	I	D	OUT	ENV ADJ				
HUMIDITY	60.0	53.2	-6.8	100.0 %RH	-6.8 %	-0.7	-50.0	0.0	0.00 %					
COOLING	24.0	18.2	-5.8	50.0 degC	-11.5 %	-23.1	-50.0	-0.0	0.00 %					
CO2	700.0	722.8	22.8	2000.0 ppm	1.1 %	0.1	7.9	0.0	57.97 %	927.5 m3/hr				
VOC	40.0	5.5	-34.5	100.0 %	-34.5 %	-3.5	-50.0	-0.0	0.00 %					
CONTROL FUNCTION	S/P	F/B	ERR	RANGE	E/R	P	I	D	OUT					
SUPPLY AIR	1707.1	1664.2	42.9	2400.0 m3/hr	1.8 %	0.2	20.6	-0.0	70.77 %					
EXHAUST AIR	1548.8	1528.7	20.1	1600.0 m3/hr	1.3 %	0.1	47.0	0.0	97.14 %					
REHEAT	18.0	18.2	-0.2	50.0 degC	-0.5 %	-0.9	0.8	0.0	49.90 %					

The Control Function Summary page shows the Ventilation Set Points, PID Status, Function and Outputs values.

The controller Ventilation set points can be dynamic and limited or inhibited depending on the status of other functions, the top section shows the Hood, Exhaust and Supply air Total volumes and current calculated set points.



Hood Air Reading	Calculates the Total Fume Hood Volumes
HA AFA's	• Total Fume Hood AFA4000 volumes
HA AUXA	• Total Auxiliary Hood Air Analogue Input Volume
HA AUXD	• Total Auxiliary Hood Air Digital Input Volume
HAR	• Total of the Above
Exhaust Air Max S/P	Calculates the Maximum allowed Room Exhaust Set Point
SA RANGE	• Supply Air Range
SA MNU SP	• Supply Air menu Set Point
HAR	• Total Fume Hood Volume
MAX EA SP	• Maximum Exhaust Air Set Point allowed • Shows "Capped at EA Range" if no other limits are applied
Exhaust Air S/P	Calculates the Room Exhaust Set Point
EA MNU SP	• Menu Set Point Value
HAR	• Total Fume Hood Volume
PURGE	• Purge Volume
ENV ADJ	• Environmental Adjusted Volume (from air quality demand)
EA S/P	• Calculated Exhaust Air Set Point • Shows "Capped at Max EA SP" if no other limits are applied
Exhaust Air Reading	Calculates the Total Exhaust Air Volume
EA_IP	• Analogue Input Exhaust Air Total
EA_AUXD	• Digital Input Exhaust Air Total
EAR	• Current Exhaust Air Total
Supply Air S/P	Calculates the Supply Air Set Point
SA MNU SP	• Supply Air menu Set Point
HAR	• Total Fume Hood Volume
EAR	• Total Exhaust Air
P/OR	• Pressure Override Volume Adjustment
SA S/P	• Calculated Supply Air Set Point
PRESSURE	• Shows Room pressure if enabled



The centre section shows the Environmental Control status for all enabled and assigned functions set to Exhaust Air Output.

Control

Function	<ul style="list-style-type: none">• Control Loop Function e.g. CO₂, VOC
S/P	<ul style="list-style-type: none">• Current Menu Set Point
F/B	<ul style="list-style-type: none">• Current Value
ERR	<ul style="list-style-type: none">• Difference between the Set Point and Current Value
Range	<ul style="list-style-type: none">• The Functions Input Range
E/R, P, I, D	<ul style="list-style-type: none">• Calculated control values
Out	<ul style="list-style-type: none">• Calculated Output 0-100%
Env Adj	<ul style="list-style-type: none">• Calculated amount of Volume to be added or subtracted from Exhaust Air Set Point

The PID values will show "Limit" If the Environmental control loop is suspended or if the Exhaust Air has reached its maximum allowed Set Point value. When the loop is active the Highest demand will show a Volumetric value in the Env Adj column.

This value is then added into the Exhaust Air Set Point calculation shown on the top row.

The bottom section shows the current control status of the Supply Air, Exhaust Air and Reheat control loops.

The Exhaust Air PID loop will show "Sash Override" if the Sash Override function is enabled and active. the Sash Override function will be shown at the bottom of the screen, with the Total open area and Threshold values displayed.



Page 3 – Hood Air Details.

Diagnostics

3/7 Hood Air Details

SLAVE #	ID	NAME	ALIVE TIMER	VOLUME m3/hr	VELOCITY m/sec
1	1	Bench Hood #1	10	608.4	0.500
2	2	Walk In Hood #1	10	241.2	1.000
3	3	Walk In Hood #2	10	0.0	0.000
4	4	Walk In Hood #4	0	-,-	-,-,-
5	5	AFA 05	0	-,-	-,-,-
6	6	AFA 06	0	-,-	-,-,-
7	7	AFA 07	0	-,-	-,-,-
8	8	AFA 08	0	-,-	-,-,-
9	9	AFA 09	0	-,-	-,-,-
10	10	AFA 10	0	-,-	-,-,-
11	11	AFA 11	0	-,-	-,-,-
12	12	AFA 12	0	-,-	-,-,-
13	13	AFA 13	0	-,-	-,-,-
14	14	AFA 14	0	-,-	-,-,-
15	15	AFA 15	0	-,-	-,-,-

Total AFA Volume 854.77 m3/sec
Polling cycles since power on: 2997
12 of the 15 AFA's enabled are NOT responding.

The Hood Air page shows all the assigned TEL AFA Controller connections. As each Hood is assigned an Alive Timer is enabled, this is a countdown timer starting at 10, if the AFA does not respond to the AFA5000 poll within the expected time the timer reduces by 1, if the timer reaches zero the AFA5000 will report the AFA as not responding. If the AFA responds before the timer reaches zero, the timer will reset to 10.

The timer value will always be 10 on a healthy network but may occasionally drop to 9 if there is a lot of traffic. The total number of polling cycles is show in the summary at the bottom of the page.

This page can be used to monitor the network or Hood Volume and Velocity status.

Page 4 – Supply Air Details.

 Diagnostics





4/7 Supply Air Details

INPUT CH	ANIP	VOLTAGE	RANGE	PERCENT	SENSOR	FILTER	PRESSURE [Pa]	VOLUME [m3/hr]	CAPACITY [m3/hr]	ALARM LO	HI
SA-1	Ai02	0.044	0-10V ->	0.44	FLOWGRID	10 sec	0.44	154.87	2277.31	0	0
SA-2	Ai05	3.462	0-10V ->	34.62	STATIC	20 sec	34.62	1933.64	3286.34	0	0
TOTAL INPUT								2088.52	5563.65	0	0

SETPOINT: 1101.53 m3/hr
CONTROL ENABLED CONTROL (PID) [ERR: -986.98 P:-4.11 I:-50.00 D:0.01]
REQUEST: 0.00%

OUTPUT	MODE	REQUEST	MIN-LIMIT	MAX-LIMIT	FILTER	DELIVER	RANGE	VOLTAGE	ANOP
SA-1	CONTROL	0.00%	0.00%	100.00%	0 sec	->	0.00%	0-10V ->	0.00V Ao01
SA-2	CONTROL	0.00%	0.00%	100.00%	5 sec	->	0.00%	0-10V ->	0.00V Ao05

The Supply Air Details page shows a summary of all the assigned Supply Air Inputs and Outputs along with the control status.



Input

CH	<ul style="list-style-type: none">• Supply Air Input Number
ANIP	<ul style="list-style-type: none">• Assigned Analogue Input
Voltage	<ul style="list-style-type: none">• Current Input Voltage
Range	<ul style="list-style-type: none">• Menu set Range Feedback or Calculated Pressure Range
Percent	<ul style="list-style-type: none">• Current Input % of full range
Sensor	<ul style="list-style-type: none">• Input type
Filter	<ul style="list-style-type: none">• Input Filter Time
Pressure	<ul style="list-style-type: none">• Current Pressure sensor Pressure
Volume	<ul style="list-style-type: none">• Calculated Volume
Capacity	<ul style="list-style-type: none">• Calculated Capacity
Alarm	<ul style="list-style-type: none">• Low and High alarm status (1=Alarm, 0=Off)

Output

Output	<ul style="list-style-type: none">• Supply Air Output Number
Mode	<ul style="list-style-type: none">• PID Control or Demand Mode
Request	<ul style="list-style-type: none">• Current Output demand 0-100%
Min Limit	<ul style="list-style-type: none">• Current set Minimum Output Limit 0-100%
Max Limit	<ul style="list-style-type: none">• Current set Maximum Output Limit 0-100%
Filter	<ul style="list-style-type: none">• Output Filter Time
Deliver	<ul style="list-style-type: none">• Output Status 0-100%
Range	<ul style="list-style-type: none">• Output Voltage Range 0-10/2-10/10-2/10-0
Voltage	<ul style="list-style-type: none">• Current Output Voltage
ANOP	<ul style="list-style-type: none">• Assigned Analogue Output

Page 5 – Exhaust Air Details.

i Diagnostics
← →
✖

5/7 Exhaust Air Details

INPUT CH	I/P	VOLTAGE	RANGE	PERCENT	SENSOR	FILTER	PRESSURE [Pa]	VOLUME [m3/hr]	CAPACITY [m3/hr]	ALARM LO HI
EA-1	Ai01	0.011	0-10V ->	0.11	STATIC	5 sec	0.05	0.00	1714.65	0 0
EA-2	Ai06	5.320	0-10V ->	53.20	FEEDBACK	10 sec		425.60	800.00	0 0
EA_D1	--			0.00	N/O CONTACT			0.00		
TOTAL INPUT								425.60	2514.65	0 0
PID CONTROL [ENABLED] units:m3/hr										
S/P: 159.49 F/B: 425.60 ERR: -266.11 RANGE: 1600.00										
E/R: -16.63% P: -1.66% I: -50.00% D: 0.01% OUT: 0.00%										
OUTPUT	MODE	REQUEST	MIN-LIMIT	MAX-LIMIT	FILTER	DELIVER	RANGE	VOLTAGE	ANOP	
EA-1	CONTROL	0.00%	0.00%	100.00%	0 sec	->	0.00%	0-10V	->	0.00V Ao02
EA-2	CONTROL	0.00%	0.00%	100.00%	0 sec	->	0.00%	0-10V	->	0.00V Ao06

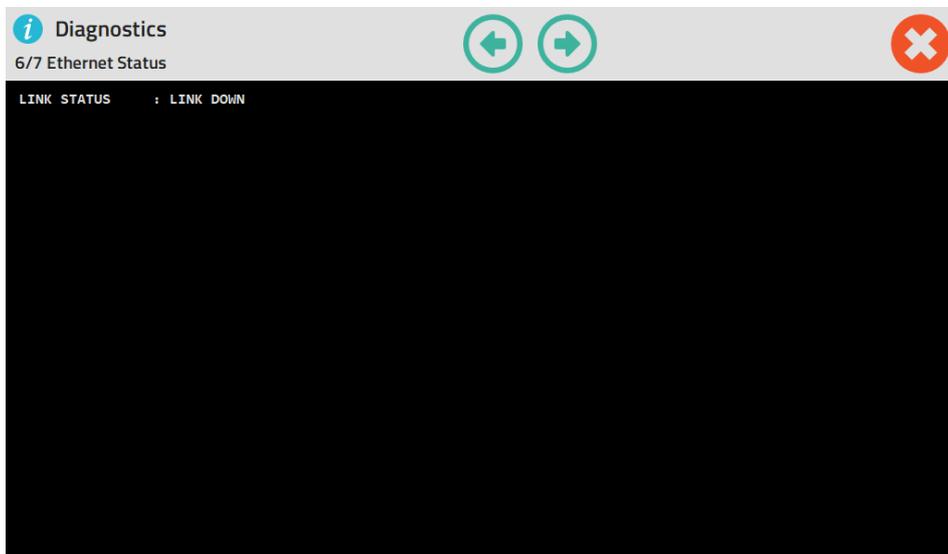
The Exhaust Air Details page shows a summary of all the assigned Exhaust Air Inputs and Outputs along with the control status.



Input	
CH	<ul style="list-style-type: none">• Exhaust Air Input Number
ANIP	<ul style="list-style-type: none">• Assigned Analogue Input
Voltage	<ul style="list-style-type: none">• Current Input Voltage
Range	<ul style="list-style-type: none">• Menu set Range Feedback or Calculated Pressure Range
Percent	<ul style="list-style-type: none">• Current Input % of full range
Sensor	<ul style="list-style-type: none">• Input type
Filter	<ul style="list-style-type: none">• Input Filter Time
Pressure	<ul style="list-style-type: none">• Current Pressure sensor Pressure
Volume	<ul style="list-style-type: none">• Calculated Volume
Capacity	<ul style="list-style-type: none">• Calculated Capacity
Alarm	<ul style="list-style-type: none">• Low and High alarm status (1=Alarm, 0=Off)
Output	
Output	<ul style="list-style-type: none">• Exhaust Air Output Number
Mode	<ul style="list-style-type: none">• PID Control or Demand Mode
Request	<ul style="list-style-type: none">• Current Output demand 0-100%
Min Limit	<ul style="list-style-type: none">• Current set Minimum Output Limit 0-100%
Max Limit	<ul style="list-style-type: none">• Current set Maximum Output Limit 0-100%
Filter	<ul style="list-style-type: none">• Output Filter Time
Deliver	<ul style="list-style-type: none">• Output Status 0-100%
Range	<ul style="list-style-type: none">• Output Voltage Range 0-10/2-10/10-2/10-0
Voltage	<ul style="list-style-type: none">• Current Output Voltage
ANOP	<ul style="list-style-type: none">• Assigned Analogue Output

Page 6 – Ethernet Status.

The Ethernet Status is displayed when a successful connection is made. If the Ethernet is not connected the page will show the Link is down.





When a successful connection is made, the information provided is:

Connection

Link Status	<ul style="list-style-type: none">• Link Up or Down
--------------------	---

Physical Status	<ul style="list-style-type: none">• Connection Details e.g. 100Mbps Full Duplex
------------------------	---

Network Interface

Status	<ul style="list-style-type: none">• Link Up or Down
---------------	---

MTU	<ul style="list-style-type: none">• Max permitted bytes
------------	---

DHCP	<ul style="list-style-type: none">• Enabled or Disabled
-------------	---

IP Address	<ul style="list-style-type: none">• DHCP acquired or Manually Configured IP Address
-------------------	---

Subnet Mask	<ul style="list-style-type: none">• Subnet Mask
--------------------	---

Gateway	<ul style="list-style-type: none">• Gateway
----------------	---

NTP Client	<ul style="list-style-type: none">• Enabled or Disabled• Server IP Address shown when Enabled• Time Zone Displayed
-------------------	--

5. Events and Alarms

The AFA5000 contains multiple function alarms, any enabled and active alarms are displayed in the Status Window at the top of the Screen. When multiple alarms are active, the alarms will scroll one after the other in the window.

If a Dial or Icon function is in alarm condition, the Dial LED Halo or Icon Background colour will change to Red.

All alarms are mutable and are stored in the Alarm Log.





5.1 Alarm Log.

Date	Time	EventID	Description
17/08/2019	02:23:32	101	Total Supply Air Low
17/08/2019	02:23:08	201	Total Exhaust Air Low
17/08/2019	00:53:56	AFACE00F	Comms Error AFA 15 » ID: 15 "AFA 15"
17/08/2019	00:53:56	AFACE00E	Comms Error AFA 14 » ID: 14 "AFA 14"
17/08/2019	00:53:56	AFACE00D	Comms Error AFA 13 » ID: 13 "AFA 13"
17/08/2019	00:53:55	AFACE00C	Comms Error AFA 12 » ID: 12 "AFA 12"
17/08/2019	00:53:55	AFACE00B	Comms Error AFA 11 » ID: 11 "AFA 11"
17/08/2019	00:53:55	AFACE00A	Comms Error AFA 10 » ID: 10 "AFA 10"
17/08/2019	00:53:55	AFACE009	Comms Error AFA 09 » ID: 9 "AFA 09"
17/08/2019	00:53:55	AFACE008	Comms Error AFA 08 » ID: 8 "AFA 08"
17/08/2019	00:53:55	AFACE007	Comms Error AFA 07 » ID: 7 "AFA 07"
17/08/2019	00:53:55	AFACE006	Comms Error AFA 06 » ID: 6 "AFA 06"
17/08/2019	00:53:55	AFACE005	Comms Error AFA 05 » ID: 5 "AFA 05"
17/08/2019	00:53:54	AFACE004	Comms Error AFA 04 » ID: 4 "Walk In Hood #4"
17/08/2019	00:52:22	AFACE004	Comms Error AFA 04 » ID: 4 "Walk In Hood #4"
17/08/2019	00:17:41	101	Total Supply Air Low
17/08/2019	00:17:41	201	Total Exhaust Air Low
17/08/2019	00:17:37	AFACE003	Comms Error AFA 03 » ID: 3 "Walk In Hood #2"
16/08/2019	23:17:30	0	POWER UP

Alarm events are shown in the log, the date, Time the alarm activated, Event ID and Description are shown. The Log can be cleared by pressing the Dustbin Icon in the Top right hand of the page. Multiple pages of alarms can be logged, Up and Down arrows will appear so that scroll multiple pages can be accessed.

The log will clear on a power cycle.



Alarm Event Codes

Event	Description
0	• Power Up
1	• Fire Alarm
2	• Building Diversity Alarm
3	• Purge Alarm
4	• Door Open
AFACE0-01 to 64	• Fume Hood AFA Coms Error (AFAs 01 to 64)
101	• Total Supply Air Low
102	• Total Supply Air High
103	• Supply Pressure Override High Alarm
104	• Supply Pressure Override Low Alarm
111	• Supply Air 1 Low
112	• Supply Air 1 High
121	• Supply Air 2 Low
122	• Supply Air 2 High
131	• Supply Air 3 Low
132	• Supply Air 3 High
141	• Supply Air 4 Low
142	• Supply Air 4 High
151	• Supply Air 5 Low
152	• Supply Air 5 High
161	• Supply Air 6 Low
162	• Supply Air 6 High
201	• Total Exhaust Air Low
202	• Total Exhaust Air High
211	• Exhaust Air 1 Low
212	• Exhaust Air 1 High



Event	Description
221	• Exhaust Air 2 Low
222	• Exhaust Air 2 High
231	• Exhaust Air 3 Low
232	• Exhaust Air 3 High
241	• Exhaust Air 4 Low
242	• Exhaust Air 4 High
251	• Exhaust Air 5 Low
252	• Exhaust Air 5 High
261	• Exhaust Air 6 Low
262	• Exhaust Air 6 High
301	• Total Fume Hood Air Low
302	• Total Fume Hood Air High
303	• Fume Hood Diversity High
311	• Fume Hood Aux Input 1 Low
312	• Fume Hood Aux Input 1 High
321	• Fume Hood Aux Input 2 Low
322	• Fume Hood Aux Input 2 High
401	• Air Changes Low
402	• Air Changes High
511	• Room Temperature Low
512	• Room Temperature High
521	• Supply Air Temperature Low
522	• Supply Air Temperature High
531	• Return Air Temperature Low
532	• Return Temperature High
601	• Humidity Level Low
602	• Humidity Level High



Event	Description
701	• Positive Room pressure Low
702	• Positive Room pressure High
703	• Negative Room pressure Low
704	• Negative Room pressure High
801	• CO2 Level Low
802	• CO2 Level High
901	• VOC Level Low
902	• VOC Level High

6. Troubleshooting

6.1 Fault finding

Problem	Check for
Screen blank - No Audible Alarm on Power Up	<ul style="list-style-type: none"> • Check the power supply terminal is plugged into the controller and wired correctly. • Check if the Power LED is illuminated on the top right of the I/O board. • If Main power is present on the Terminals, check Fuse F1 is healthy.
Screen blank - Audible Alarm Sounds on Power Up	<ul style="list-style-type: none"> • Check the screen cable is securely plugged into the control box and the screen, the cable should click into place. • Ensure the correct "Straight Through" type U/UTP RJ45 patch cable is used for the screen. • Check the Screen cable hasn't been connected into the Ethernet port by mistake.
Audible Alarm not working	<ul style="list-style-type: none"> • Check the Audible Alarm has been enabled in the Dashboard menu.
USB Not found	<ul style="list-style-type: none"> • Ensure the USB drive has been formatted and is not corrupted.
USB Files not found	<ul style="list-style-type: none"> • No valid files are stored on the drive, try Exporting Settings then Import back to prove the USB device is operating correctly. • Check the USB device on a PC

Problem	Check for
No Ethernet connection	<ul style="list-style-type: none"> • Check the Ethernet settings in the Ethernet page. • Ensure the Ethernet cable is plugged into the Ethernet Port.
RS485 Comms not connected	<ul style="list-style-type: none"> • Check the RS485 Expansion Board is connected and powered (LEDs will be illuminated). • Check the BACnet MS/TP or Modbus RTU settings are correct on the BMS Coms page. • Check the wiring is correct. • Ensure the AFA5000 has a unique address on the Network • If the protocol has changed, power cycle the controller if the coms do not connect.
Function Input values not reading correctly	<ul style="list-style-type: none"> • Check the Inputs are enabled, wired correctly and Set up correctly. • Refer to the Diagnostics Summary page of the Engineers screens to check the Input voltages and ranges. • Check there are no conflicts
Functions not controlling correctly	<ul style="list-style-type: none"> • Check the Inputs and Outputs are enabled, wired correctly and Set up correctly. • Set the Outputs Manually and check the operation, if correct ensure the output Voltage is set correctly. • Check the PID settings are correct.

6.2 Hints and Tips

When setting up and enabling a control function, there are 3 elements that can affect the operation and performance:

1. Inputs

The input is the measuring point of the function, this provides feedback to the control loop. If the input is inherently unstable, it will be difficult to set the control correctly.

Ensure that the sensor, e.g. flow grid or probe is mounted in a suitable straight length of duct away from any bends, ideally 5 x duct diameters away from bends. If this is not possible, an amount of input filtering can be added to time average the reading. The filter is settable as 0-60 seconds, a 30 second filter will mean the input value will take 30 seconds to read between the min and max range. A 5-10 second filter time should be adequate for most installations.

When a pressure transducer is used, ensure that the correct range is selected and is matched in the controller input settings. The pressure in the duct may be large but the pressure drop across a venturi or probe will be significantly lower, the pressure can be measured using a handheld micromanometer or viewed on the diagnostics screens. Select a suitable range for the maximum volume operation. Ensure the pressure tubes are fitted the correctly and are not crossed.

When using a VAV box or separate control device with feedback input into the controller, ensure the measurable feedback input range and output ranges are correct as they may be different, e.g. a VAV Box can measure fully closed to fully open but will be pre-set to a reduced control range to suit the application.

TERMINOLOGY	FUNCTION
Vnom	Measurable range of the VAV Box, set as Input range Max value
Vmin	Minimum controllable volume, set as Output Min Value
Vmax	Maximum controllable volume, set as Output Max Value

2. Outputs

The output can be set to operate as direct or reverse action by setting the output voltage as 0-10/2-10/10-2 or 10-0V. The output can also be limited by setting a minimum or maximum output voltage.

The output can be set in Auto or Manual modes. In manual mode, the output can be manually set 0-100%.

The limits do not apply to the manual mode output value.

OUTPUT RANGE				
MANUAL MODE	0-10V	2-10V	10-2V	10-0V
0%	0V	2V	10V	10V
100%	10V	10V	2V	0V

AUTOMATIC MODE	0-10V	2-10V	10-2V	10-0V
0% with 30% Min Limit	3V	3V	3V	3V
100% with 75% Max Limit	7.5V	7.5V	7.5V	7.5V

Ensure that the output type is correct, set the output manually to 0 or 100% and check the action is correct, e.g. damper or valve open or closed.

Use the Min limit if an output is required never to be off or below a certain value, or if the input is not capable of measuring a low value, this will mean the output will never go below the set value. For example, if an output device is only required to operate between 25 & 100%, setting a Min limit of 20% will stop the output from dropping too low under control and always allow the minimum set value when the control demand is zero.

Use the Max limit if only a small percentage of the available output range is used, this will give better PI control and stop under or overshooting. For example, if an output device is capable of 200% of the required value, a limit of 60% would stop the output from achieving more than 120% of the required value.

3. Control

The room controller used PID type closed loop control. This method provides a good range of control functions that when set correctly will give good, stable and repeatable control of any function.

When Fume Hoods are used in the room, fast control of the ventilation functions will be required to maintain pressure regimes, the response time and speed of the Fume Hood VAV controllers will be the governing factor in setting the Room supply and Exhaust loops.

When air quality is to be controlled in the room, slow control of the functions will be required as Room Temperature, CO₂, RH values will be very slow to change.

The controller has a graph of the current status of each function, setting the graph timescale to the lowest timescale value is a good way of monitoring the function performance where undershoot, overshoot and stability can be seen. Note, the graph shows current input status data, e.g. Supply Air volume from the input feedback signal and is not a graph of the output voltage, there will be a time lag on the feedback input from the output voltage change that should be considered.

a. P (Gain)

The P setting will change the output voltage to a value calculated from the error, or difference between the set point and measured value. The controller uses midpoint type control, which presumes that the output will be at 50% to achieve the correct output, this means that with no error (measured value is equal to the set point), the output will be 50%.

The error value is calculated with the P setting to change the output so a positive error will increase the output and a negative error will decrease the output.

b. I (Integral)

The Integral is a function that will change the output on a time basis. If the function has an error and the P value has changed the output but an error is still seen, the Integral will keep changing the output until the error is zero, the setting will change how much or how fast the output changes, the P value is considered so a high I setting with a low P setting will mean the output change is fast but changes in small steps.



c. D (Derivative)

The Derivative action is used to slow down the effect of the P & I settings to stop overshoot if the output action is too fast and is based on rate of change. In most applications the Derivative setting will be zero as the P & I control settings will be able to control the output efficiently without any Derivative action. If constant overshoot is evident and the P & I settings are achieving the good stable control, then a small amount of Derivative can be added.

The default settings in the controller should provide good control, if the control loop requires tuning it is advised to note the current settings before any changes are made and to make changes in small steps, one function at a time:

SUGGESTED TUNING	
OPERATION	SUGGESTED ACTION
To increase initial reaction to an Error / Change in measured value	Increase "P" in steps of 2
To increase overall control time to achieve Set Point value following an Error / Change in measured value	Increase "I" in steps of 10
To stop overshoot or undershoot when control response is good and stable	Increase "D" in steps of 5
To stop hunting or instability at Set Point	Decrease "P" in steps of 2, if "P" < 5, Decrease "I" in steps of 10

7. *Cleaning and maintenance*

7.1 *Cleaning*

The Room Controller is generally maintenance free.

Some parts fitted within the laboratory space may need occasional cleaning depending on the environmental conditions and usage. Include the following:

Part	Method	Notes
HMI Touchscreen	Use a dry cloth, optical lens or screen wipe to remove dust, dirt, grease or finger marks.	Apply light pressure only.
Room Sensors e.g. Temperature CO2 Humidity	Not required in room environment.	Sensor calibration should be checked with hand-held instrument on 2-year period
Duct sensors e.g. Flow Grids, Flow Probes	Refer to Manufacturers recommendations.	

7.2 Contamination

When any part of the Room Control system is contaminated it must be either removed and decontaminated or disposed of and replaced with a new part.

The local in-house Risk assessment, removal and disposal procedures (SOP) and COSHH requirements must be observed whilst de-contaminating or disposing of the contaminated part and should only be carried out by trained and competent parties.

Isolate the power to the controller before removing or replacing any contaminated parts to avoid the risk of electric shock.

7.3 Maintenance

7.3.1 Faulty / replacement parts

If a faulty part has been identified, the part should be isolated and marked as *Faulty – do not use /Out of service* until a replacement part has been fitted. The Room Controller function may be isolated to allow the controller to operate in Automatic mode unless a specific problem is caused by the faulty part and the controller has to be switched off and not used, where the controller should then be marked *do not use /Out of service* until a replacement part has been fitted.

No special tools or parts are required for maintenance.

7.3.2 Validation

Once a replacement part has been fitted the Room Control system operation should be fully tested to ensure safe operation.

A new tested label should be fitted, or a new date should be applied to an existing label to show that the system has been repaired and tested and is safe to use.



8. *Technical specifications*

8.1 *AFA5000 RSC-2 Room Controller*

8.1.1 *Physical*

Specification	AFA5000
Dimensions (Touchscreen)	130.5 mm (H) x 198.75 mm (W) x 28.7 mm (D) 5.138 ins (H) x 7.82 ins (W) x 1.13 ins (D)
Dimensions (Touchscreen c/w Mounting Plate)	134.9 mm (H) x 203.1 mm (W) x 33 mm (D) 5.311 ins (H) x 7.99 ins (W) x 1.299 ins (D)
Dimensions (I/O Control Box)	230 mm (H) x 310 mm (W) x 130 mm (D) 9.055 ins (H) x 12.20 ins (W) x 5.12 ins (D)
Touchscreen Mounting	Fully flush or Semi flush with Mounting Plate
I/O Control Box Connections	Hard wire to PCB terminals, with Cable Glands
Touchscreen Connections	RJ45 Cable (provided)
Ethernet Port	Modbus IP and BACnet IP protocols, 10/100 Base-T
RS485 Expansion Board	Modbus RTU and BACnet MS/TP protocols
USB Port	USB 1 – Used for firmware upgrades and configuration settings
Power Supply	100-240VAC 50-60Hz 3A 24VDC version on request

8.1.2 Operational information

Specification	AFA5000
Functions:	<p>Volumetric or Pressure control of:</p> <ul style="list-style-type: none"> Fume Hoods Supply Air Exhaust Air <p>Environmental control of:</p> <ul style="list-style-type: none"> Room Temperature – Heating and Cooling Supply Air Temperature monitoring Return Air Temperature monitoring Room Pressure CO2 Humidity VOC <p>Operation Modes:</p> <ul style="list-style-type: none"> Occupied Unoccupied Setback c/w on board scheduler
Field set up	<ul style="list-style-type: none"> Password protected menus USB drive - upload / download settings / Software updates

8.1.3 I/O

Specification	AFA5000
Analogue Inputs	15 configurable outputs
Analogue Outputs	14 configurable outputs

Specification	AFA5000
Digital Inputs	6 configurable inputs
Digital Outputs	4 configurable outputs
Thermistor Inputs	2 configurable inputs

8.1.4 *Regulatory*

Specification	AFA5000
Agency listings	CE RoHS

8.1.5 *Environmental conditions*

	Rating	Notes
Pollution Degree	Pollution degree 2	Laboratory Areas
Over-Voltage Category	300 V Cat II	
Operating Temperature Range	13 to 30 °C	
Operating Humidity Range	20 - 90% RH non-condensing	
Storage Temperature Range	-20 to 60 °C	

8.1.6 *Auxiliary equipment interconnections*

8.1.6.1 *TEL supplied equipment*

1. Isolate the mains supply to the controller **before** connecting any equipment.
2. Follow the installation instructions in the relevant sections of this manual.
3. Where possible check the physical condition of the equipment for damage before the mains power is switched on to the controller.

8.1.6.2 *3rd part equipment*

All 3rd party equipment must be within the electrical specification and the connection diagrams.

All 3rd party equipment performance must comply with the requirements of the Room controller. Parameter re-configuration may be required, when the equipment does not meet the required performance characteristics for the factory settings.

1. Isolate the mains supply to the controller **before** connecting any equipment.
2. Follow the installation instructions in the relevant sections of this manual.
3. Where possible check the physical condition of the equipment for damage before the mains power is switched on to the controller.



9. *Warranty*

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

1. Batteries and certain other components when indicated in specifications are warranted for a period of 90 days from the date of shipment to the customer.
1. With respect to any repair services rendered, Seller warrants that the parts repaired or replaced will be free from defects in workmanship and material, under normal use, for a period of 90 days from the date of shipment to the customer
2. Seller does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies
3. Unless specifically authorized in a separate writing by Seller, Seller makes no warranty with respect to, and shall have no liability in connection with, any goods which are incorporated into other products or equipment by the Buyer. All goods returned under warranty shall be at the Buyer's risk of loss, Seller's factory prepaid, and will be returned at Seller's risk of loss, Buyer's factory prepaid.

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