The Intelligent Air Control System

Installation and Operation Manual

Contents

1 Introduction

The Inteliair™ intelligent air control system is a highly developed control system designed to optimise the operation of any air distribution network installed in commercial and industrial premises. The system is applicable to any system which involves the movement of air though ducts to either extract fumes or dust or distribute air. The control system is microprocessor controlled and configuration of the installation is carried out via a software based user interface.

As opposed to a traditional system which is either “on” or “off”, the Inteliair™ control system is capable of reacting to changing circumstances and tailor the system operation to conditions prevailing at any particular time. This ranges from full operation at peak demand to standby mode where no demand is present and anywhere between these two states including the ability to maintain minimum airflow through the system if required. To set the most efficient operating mode, the system central processor analyses data obtained from various sensing devices deployed throughout the air distribution system.

The principle benefit of the system is the ability to maximise the efficiency of the system in terms of operation and energy consumption. It could also yield benefits by increasing the life cycle of mechanical components.

The air distribution network can be sub-grouped into logical areas controlled individually to ensure that only operational areas are serviced.

The benefits can be summarised as follows:

- Totally flexible operation from standby state to full power subject to conditions;
- Potential increased life cycle of mechanical and motorised components;
- Reduced energy consumption;
- Environmental benefits, noise, etc.;
- Real time monitoring of system performance and fault alarms;
- Downloadable data logs to record system performance and efficiency;
- Flexible control system allowing extensions and additions to the system.

Installation and Operating Manual

This manual provides the system installer and the end user operator with instructions to install the devices specific to the Inteliair™ control system. Wiring instructions are also covered and where appropriate, information relating to the setting of dip switches on control boards and detection units.

Detailed instructions only cover items manufactured and or supplied by Inteliair™. Where third party devices are utilised within the system, the installer should refer to the device manufacturer’s instructions for detailed installation information.

Configuration and commissioning of the system using the user interface software is covered using graphic representations of typical screenshots supplemented by tables listing the data entry fields and appropriate explanations for data entry by the installer.

The latter sections of this manual cover operational and reporting features of the system.

2 System Description

The complete system consists of an air circulation system including damper controls, fans, and control devices such as air pressure gauges and drive units for dampers interconnected with ducts.

At its core the Inteliair™ control system has a central processor unit which is wall mounted and to which all the peripheral devices are connected. This is also the interface unit for the software control system.

Further sensor and detection devices are located in strategic positions in the area of the plant serviced by the air distribution system. These will detect the presence of an operator or that a specific workstation is operational.

The system is configured by entering data pertinent to the various system control devices and it is this data that enables the central processor to set the operating modes in accordance with the desired performance levels and in line with prevailing conditions within the areas serviced by the air movement system.

2.1 Component Descriptions

This section provides a brief description of all the devices deployed within on a typical installation.

Inteliair™ Components

The components described below are manufactured and supplied by Inteliair™.

The Central Control Unit

This is the central processor and all installations will include this device. Its function is to process the data received from the various system control and sensing devices to manage the system operation and performance.

It encloses the central processing board, the power supplies for the system and the connection points for the various devices.

Further connectors are provided for the main 240V AC power input, an Ethernet connection for the input device utilised to set the system configuration parameters at the commissioning stage, typically a laptop PC.

It is also equipped with a wireless antenna to transmit and receive wireless signals from the configuration input device (Laptop PC, Tablet, etc.) and/or the wireless controlled system devices if this type of control was selected by the installer.

Please also note the Ethernet connection allows the Central Control Unit to be connected to a Local Area Network.

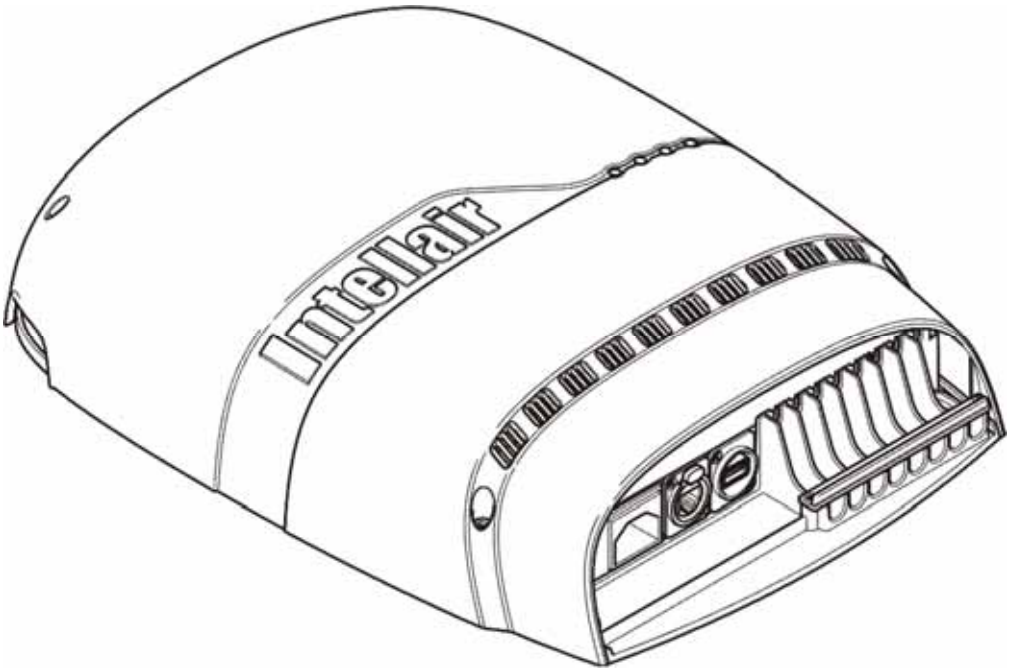


Figure 1 – Central Control Unit

The Control Unit is fitted with LED indicators to show the operational status of the unit. The significance of indications is listed in Table 1.

Table 1 – Control Unit LED indications

LED No	Function	Description
D200	System LED	Blinks every second while control board is active (Toggles at 500ms).
D201	Communication LED	Whenever communication happens it flashes.
D202	Override LED	ON whenever Inteliair™ system is in override state or any individual damper is in override state.
D203	Error Status LED	If a control board over current/overvoltage fault occurs, it toggles at 1 second. If a pressure sensor fault occurs, it toggles at 200 milliseconds.
D301	Zigbee	It toggles at 500 milliseconds if wireless mode is enabled.
D103	Power LED (5.0)	Indicates 5V supply.
D106	Power LED (3.3)	Indicates 3.3V supply.
D105	Power LED (12.0)	Indicates 12V supply.

Note: See Appendix A for a quick reference to LED indications

The Damper Control Unit

The Damper Control Unit consists of an enclosure capable of housing a drive motor (Inteliair™) to operate the damper and a circuit board to control the drive motor and generate the damper status signals.

The circuit board will also operate as an interface between the Inteliair™ control system and a third party damper drive motor.

Figure 2 – Damper Control Unit

The Damper Control Unit is fitted with LED indicators to show the operational status of the unit. The significance of indications is listed in Table 2.

Table 2 – Damper Control Unit LED indications

LED No	Function	Description
D101	Power LED	It is ON when the damper board is powered.
D400	Damper status bi-colour LED	If the damper is opening LED will toggle in GREEN at 1 second. If the damper is opened, it will glow in GREEN colour. If the damper is closing LED will toggle in RED colour at 1 second. If the damper is closed, it will glow in RED colour. For damper faults, over current, overvoltage, under voltage, motor terminals short, damper maximum operation timeout, damper not connected, limit switch, the LED will glow in ORANGE colour. If communication timeout happens, LED will toggle in ORANGE colour at 1 second. If Zigbee module error occurs, LED will toggle in RED at 200 milliseconds. If damper is unsynchronized, LED will toggle in ORANGE colour at 200 milliseconds. If control board tries to open a non-overridden damper, LED will glow in ORANGE colour.
D301	Zigbee LED	It toggles at 500 milliseconds if wireless mode is enabled.

Note: See Appendix A for a quick reference to LED indications

The Inteliair™ Current Sensing Switch

The Current Sensing Switch is enclosed in a small casing designed to be secured to an electrical mains supply cable feeding a machine located at a workstation that is to be monitored by the central processor.

The switch detects the presence of a current in the power supply cable and sends a signal back to the central processing unit indicating the workstation is operational.

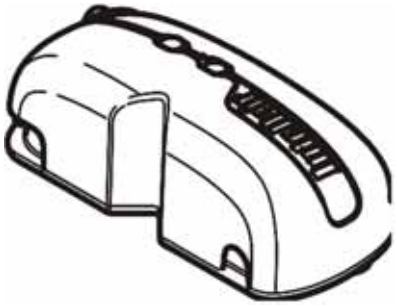


Figure 3 – Current Sensing Switch

Third Party Devices

The versatility of the Inteliair™ system allows it to be used with a number of air movement applications. Depending on the type of application, a number of peripheral components for sensing and detection may be used. Some of the more common items are described in the following sections.

It is necessary when selecting such components to ensure they are compatible with the functionality of the Inteliair™ system and they are equipped with the appropriate electronic outputs to send and receive data to and from the central processor.

Variable Speed Drives

Used to control the fan motors used within the system. These are capable of setting motor speeds at various levels of frequency depending on the parameters set by the central processing unit.

The configuration software comes preloaded with a number of common drives types. It is possible however to load parameters for a drive not listed by creating a new drive in the configuration software.

Other Sensing or Detection Devices

The installation may incorporate additional controls or sensing devices such as pressure switches, proximity detectors, thermostats etc.

Indicator Beacon

A 24v indicator beacon can be connected to the main control unit to provide visual indication when the system is in a manual override or 'fault' state.

2.2 Functional Description

Once the system is installed and configured, operation is fully automatic and does not require day to day manual intervention by the end user.

The system operates in effective mode depending on the sensing devices present and the performance data entered at the configuration stage of the installation. The processor will change the state of the system as and when necessary on demand.

It is possible for an engineer to set the system into manual override to perform maintenance. In this mode, devices can be controlled manually by running the software and viewing the Home Page which shows a graphic representation of the installation. Individual devices can be controlled using the buttons on the device icons.

Monitoring of the system performance is possible periodically by running the configuration software and viewing the reporting and system status pages. This will also display the messages appertaining to the system performance. More information about system monitoring is covered in section 5.

3 Installation

No specialist skills are required to install and configure the Inteliair™ control system. However, this publication assumes the work will be carried out by contractors fully conversant with the installation and operation of industrial and commercial air extraction or distribution systems and contemporary industrial electronic control systems.

It is recommended the installer reads all the sections of the manual before beginning the physical installation.

The instructions provided in the following sections cover devices and components specific to the Inteliair™ control system but do not cover third party components. Where such items are fitted, the installer is referred to the manufacturer's instructions for connection schedules and terminal functions.

3.1 Installation Phases

A complete installation is carried out in two principle phases:

- Physical installation of the hardware;
- System configuration (see section 4).

The present section considers the fitting and wiring of the control devices. It does not include instructions relating to the erection of ducting or the fitting of dampers, fans or other third party hardware.

The hardware installation has to be complete before the system can be fully configured. The minimum requirements are as follows:

- All hardware (ducting, dampers, fans, etc.) installed;
- All sensing and control devices fitted;
- All devices wired and connected to the Inteliair™ Central Control Unit;
- All dip switches appropriately configured;
- All devices identified;
- All devices to be under power.

3.2 Installation Options

The Inteliair™ control system has built in wireless capability and can communicate with other Inteliair™ devices. Where wireless is favoured, it is necessary to provide a separate 24V power supply to the remote devices. This can be derived from the Inteliair™ Central Control Unit.

Alternatively, all devices on the system can be hard wired.

3.3 Installation of Devices and Components

Central Control Unit

The Central Control Unit should be installed in a suitable location. This unit can be wall mounted and to do this, the protective cover needs to be removed using the four socket screws (see Figure 4 and Figure 5).

Mount the unit on to a suitable flat surface using the four elongated fixing holes in the control unit base. Please note the enclosure is rated at IP25 and is suitable for installation in a large number of industrial or commercial premises.

The unit is not suitable for external installation without being enclosed in to a suitably rated enclosure to protect the control unit from the elements.

Allow space below the unit to accommodate cables from the various devices. Cable entry is from beneath the unit.

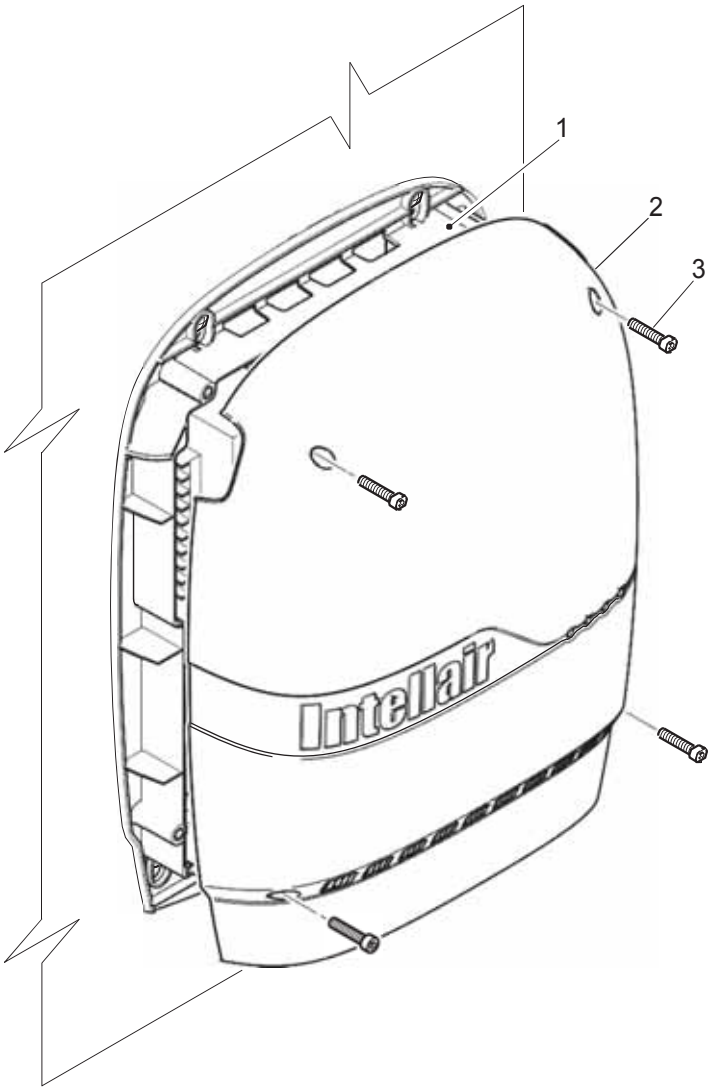


Figure 4 – Central Control Unit Front Cover Removal

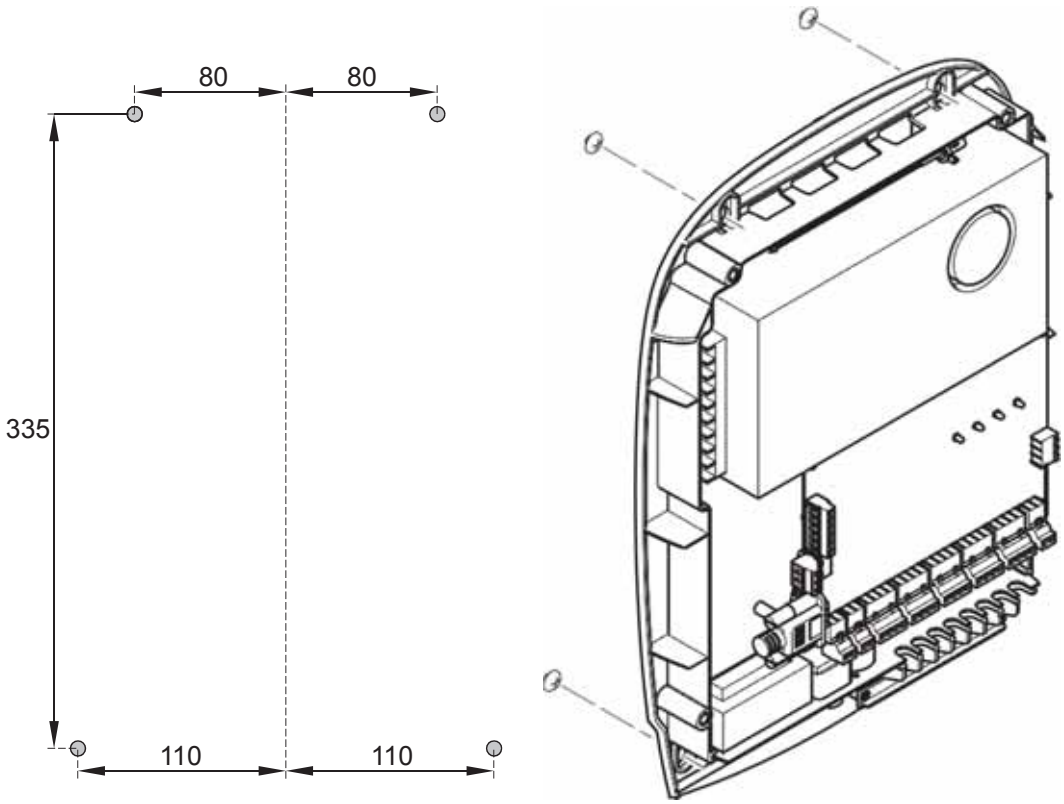


Figure 5 – Central Control Unit Fixing Points

Power to the unit is provided by an IEC lead which can be plugged directly into standard 13A power outlet located nearby or wired directly into a fused spur.

Damper Control Unit

If the system dampers are supplied by Inteliair™, the Damper Control Unit enclosure will be fitted with a drive motor. The enclosure will be fitted to the damper drive shaft and secured to the ducting using two fixings in the casing.

In the cases where a third party damper motor is fitted, the enclosure will need to be mounted close to the damper on the ducting or on a suitable bracket located nearby. Inteliair™ the two fixing holes pre drilled into the enclosure.

Once the Damper Control Unit is fitted, the dip switches must to be set according to the chart provided in Table 3.

Current Switch

Current switches are fixed to the power supply cables of machines located at the various work-stations located around the plant.

The casing has two slots to take a standard cable tie which is threaded through the Switch casing and then secured to the machine power supply cable.

The installer must ensure this device is fitted downhill from the main machine Isolating Switch to ensure detection is activated only when the machine is operating.

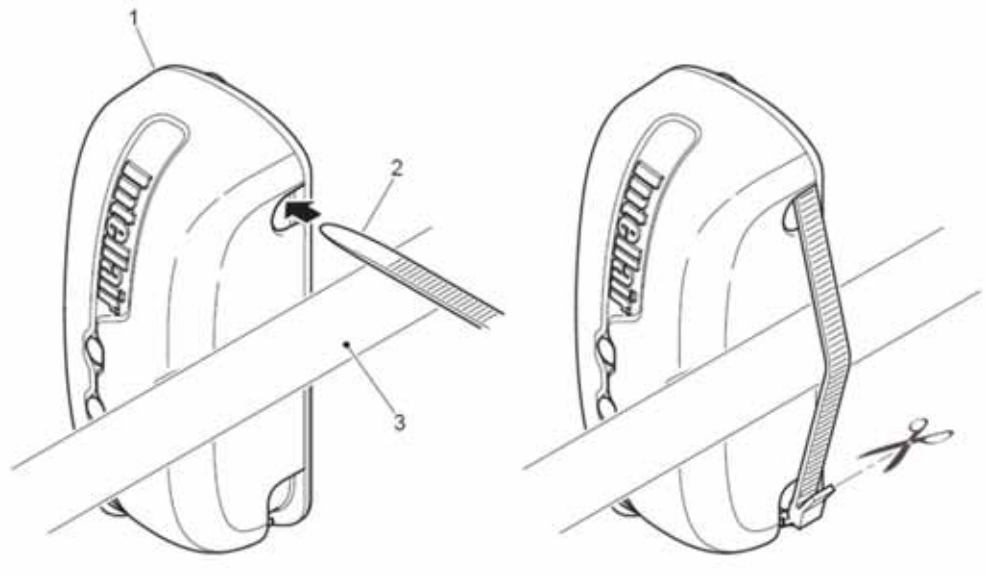


Figure 6 – Current Sensor Switch Fixing

Other devices

Other devices not specifically supplied by Inteliair™ (fans, filters, third party mechanical damper units and associated actuator units) will require fitting within the ducting network as per the manufacturer's instructions.

3.3.1 Setting the Device ID

To enable the Central Control Unit to identify the various devices connected to the system, the device control boards are fitted with dip switches which require setting to correctly identify each item in sequence.

The control system will accommodate up to 60 Damper Control Units and 20 Variable Speed Drives.

As the devices are fitted in their respective locations, the installer should identify each device by a sequential number. The dip switches on the device board will need setting in accordance with the sequential number allocated to the device. A written record of these identification numbers should be retained for later use.

Two tables are provided: lists IDs or DMX channels 1 to 60 and associated settings for the Damper Control Units. Table 4 lists the IDs or DMX Channel and settings for the Variable Speed Drives.

Note: *Device IDs and CDMX channels have the same number, i.e. device 1 is allocated to DMX Channel 1*

Table 3 – Damper Control Unit Dip Switch Settings

Sequential Number	Dip Switch Setting	Sequential Number	Dip Switch Setting
1	1	31	1, 2, 3, 4, 5
2	2	32	6
3	1, 2	33	1, 6
4	3	34	2, 6
5	1, 3	35	1, 2, 6
6	2, 3	36	3, 6
7	1, 2, 3	37	1, 3, 6
8	4	38	2, 3, 6
9	1, 4	39	1, 2, 3, 6
10	2, 4	40	4, 6
11	1, 2, 4	41	1, 4, 6
12	3, 4	42	2, 4, 6
13	1, 3, 4	43	1, 2, 4, 6
14	2, 3, 4	44	3, 4, 6
15	1, 2, 3, 4	45	1, 3, 4, 6
16	5	46	2, 3, 4, 6
17	1, 5	47	1, 2, 3, 4, 6
18	2, 5	48	5, 6
19	1, 2, 5	49	1, 5, 6
20	3, 5	50	2, 5, 6
21	1, 3, 5	51	1, 2, 5, 6
22	2, 3, 5	52	3, 5, 6
23	1, 2, 3, 5	53	1, 3, 5, 6
24	4, 5	54	2, 3, 5, 6
25	1, 4, 5	55	1, 2, 3, 5, 6
26	2, 4, 5	56	4, 5, 6
27	1, 2, 4, 5	57	1, 4, 5, 6
28	3, 4, 5	58	2, 4, 5, 6
29	1, 3, 4, 5	59	1, 2, 4, 5, 6
30	2, 3, 4, 5	60	3, 4, 5, 6

Table 4 – Variable Speed Drive Dip Switch Settings

Sequential Number	Dip Switch Setting	Sequential Number	Dip Switch Setting
61	1, 3, 4, 5, 6	71	1, 2, 3, 7
62	2, 3, 4, 5, 6	72	4, 7
63	1, 2, 3, 4, 5, 6	73	1, 4, 7
64	7	74	2, 4, 7
65	1, 7	75	1, 2, 4, 7
66	2, 7	76	3, 4, 7
67	1, 2, 7	77	1, 3, 4, 7
68	3, 7	78	2, 3, 4, 7
69	1, 3, 7	79	1, 2, 3, 4, 7
70	2, 3, 7	80	5, 7

3.4 System Wiring

Once the hardware installation is complete, the interconnecting wiring can be laid out between the Central Control Unit and the peripheral devices deployed across the system. Table 5 lists the recommended cable types for inter connection of the various devices, it is important that shielded cable is used and grounded in accordance with EMI best practice.

Table 5 – Recommended Cable Types

Application	Cable Type
Damper Control Board to current Sensing Switch	3 core 3 x 22AWG **shielded** cable Alpha wire 2403C or equivalent
Central Control Unit to Damper and Damper to Damper Less than 20 Dampers and under 200 metres total cable run	4 core, 24 x 18AWG **shielded** cable Alpha Wire 2424C or equivalent
Central Control Unit to Damper and Damper to Damper Installation of more than 20 Dampers and/or cable runs of over 200 metres	4 core 2 x 18AWG and 2 x 15AWG **shielded** Cable; Alpha Wire 6451 SL001 or equivalent
Central Control Unit to Filter Unit (potential free)	2 core, 2x 22AWG **shielded** cable Alpha Wire 2403C or equivalent
Control Board to Filter Unit (24V)	5 core, 5 x 19AWG **shielded** cable Lapp 0015105 or equivalent
Central Control Unit to Fixed Fan	2 core, 2 x 24AWG **shielded** cable Alpha Wire 2403C or equivalent (assume fixed fan is switched on by a contactor)
Central Control Unit to Pressure Sensor	2 core, 2 x 24AWG **shielded** cable Alpha Wire 5112C SL005 or equivalent
Central Control Unit to Variable Speed Drive	**Shielded** cable in accordance with Variable Speed Drive MOBUS Specification

If the installer has opted for wireless communication, all devices will need to be provided with a 24V power supply to enable their operation.

Cable Runs

Cable runs will be required to interlink all the system devices and the Central Control Unit control board. Cables can be tie wrapped or fixed using a standard cable management system to ducts, cable trays etc.

The general layout of the cabling is as follows:

- Dampers and Variable Speed Drives can be daisy chained in radial circuits. See note.–
- Fixed Fans, Pressure Sensors and Filter Units require individual circuits;
- Current Sensor Switches (or alternative) are connected to their related Damper Control Boards.

Note: *It is recommended the installer runs separate radial circuits for the Variable Speed Drives and the Damper Control Devices. If this is not practicable, then Dampers Control Devices and Variable Speed Drives may be daisy chained as part of a single radial circuit without compromising functionality. It will be necessary to ensure the 24V supply is continued to the last Damper Control Board on the circuit. Variable speed drives do not need a 24V supply.*

Termination of Circuits

Figure 7 shows the physical layout of the terminals located on the Central Control Unit board. These connectors are fitted with a plug to which the cable cores are terminated. The assembly plugs into the board mounted receptacle.

The Central Control Unit main circuit board connectors have different applications and care must be taken to connect the correct devices to the appropriate terminals to ensure functionality is not compromised.

The function of the terminals is explained in Table 6. See Figure 7 for the physical layout on the Central Processor Unit control board. The terminals are listed left to right as they are fitted to the board.

Table 6 – Main Control Board Terminals

Terminal Block Reference	Application
SK201	Used to connect the filter unit
SK200	Used to connect the fixed fan
SK300, SK301, SK302, SK304, SK305	Use to connect Damper Control Board and Variable Speed Drive units. See note 1
SK400	Used to connect the pressure sensor

Note: *These connectors are connected in parallel internally. They allow for several radial circuits to be installed.*

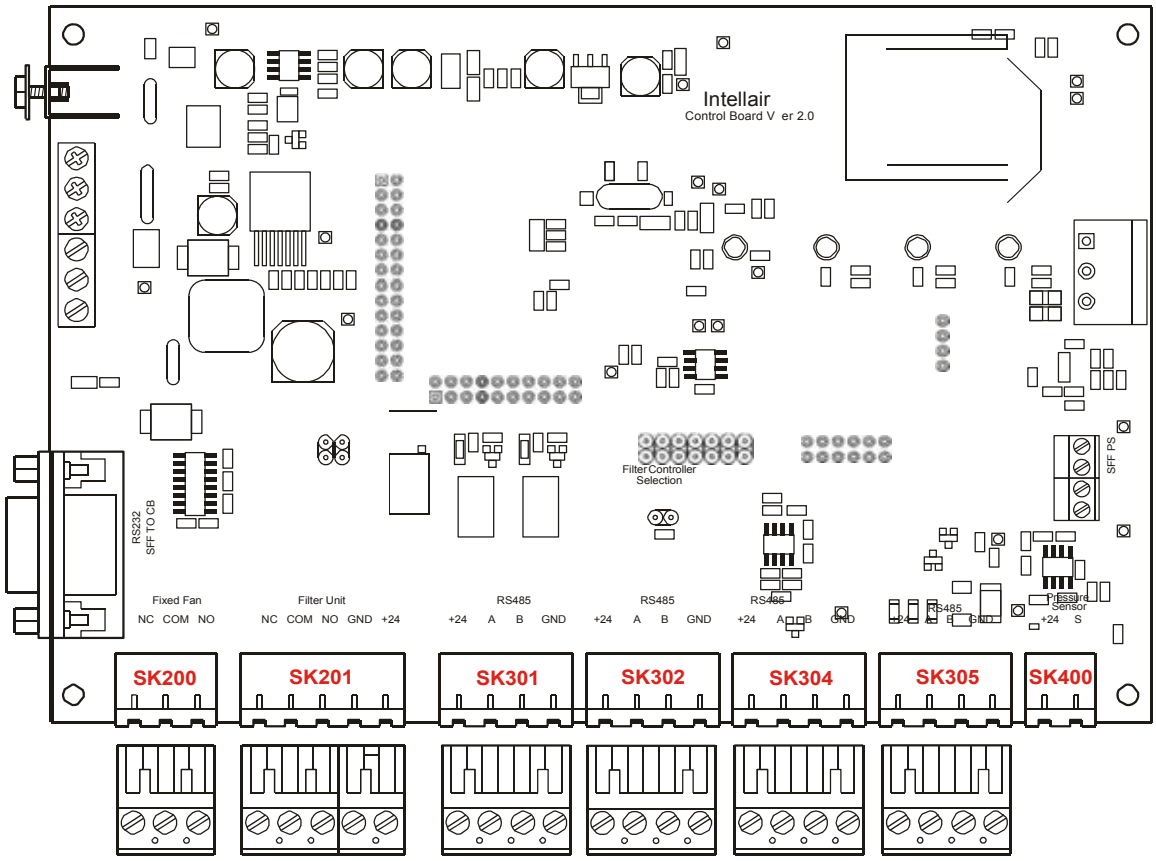


Figure 7 – Layout of Terminals on the Main Processor Board

The Damper Enclosure also has a control board and the terminal applications are explained in Table 7. Their position on the control board is shown in Figure 8.

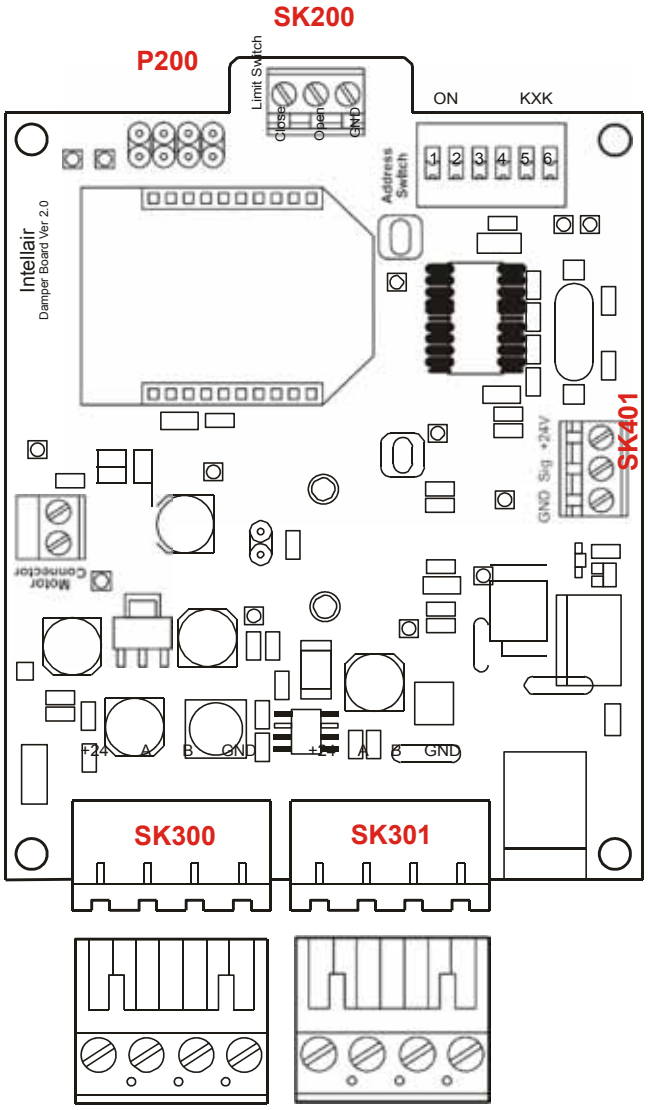


Figure 8 – Layout of terminals on the Damper Control Board

Table 7 – Damper Control Board Terminals

Terminal Block Reference	Application
SK300	Use to connect **to** Damper Control Board from previous Damper Control Board or main control board.
SK301	Use to connect **from** Damper Control Board to next Damper Control Board or Variable Speed Drive unit. See note 1
SK400	Used to connect the Inteliair™ Damper drive motor or 3rd party damper.
SK401	Used to connect the Inteliair™ current sensing switch or 3rd Party 24V switch.

Note 1 These connectors are connected in parallel internally.

3.4.1 Electrical Signal Connections

The connection instructions for each type of device are described in the following sections.

Central Control Unit

Connections to the Central Control Unit are as follows:

Fixed Fan

The fixed fan is connected to terminal block SK200. These terminals are internally wired to N/O N/C no-volt relay contacts.

If 24V is required, the installer will need to short pins 1 and 2 and pins 3 and 4 on connector P200. This will have the effect of supplying 24Volts to the NC terminal of SK200. Connect the contactor coil to the NC terminal and the COM terminal of SK200.

Filter Unit

The filter is connected to board mounted connector SK 201. This terminal block provides connections for a 24V supply, a common terminal, N/C and N/O volt free relay contacts.

If the filter unit requires a 24V supply, link terminals +24V to the COM terminal.

Damper Control Unit and Variable Speed Drives

These are connected to the Central Processor Unit via the RS485 Connectors SK300, SK301, SK304 and SK305.

All connectors provide four terminals, 24V, a ground connection and RS485 A and RS485 B terminations. Integrity will must be maintained at the remote end by matching the RS485 ”A” (+) and “B” (-) connections.

Note: Variable Speed Drives do not require a 24V supply.

Damper Control Unit

The Damper Control board has two RS485 connectors designated SK300 and SK301. SK300 is designated for input and SK301 for output.

The four core cable is connected to the plug which is then plugged into the board mounted receptacle.

Note: Please note the connections are made correctly to the appropriate terminal and that they correlate with the connection at the Central Processor Unit.

The Current Sensing Switch local to the Damper is also connected to the Damper Control board and a separate board mounted screw terminal block SK401 is provided for this purpose. Alternatively, a latching push button can be connected to this terminal enabling manual operation.

Note: Where a third party sensor is fitted, the device will need to be carefully selected to ensure its output voltage does not exceed 28V.

Where the Damper Control Unit is equipped with a motor, the motor will be pre-wired and connected. For information, the motor control is connected via a terminal block SK400.

In the case where a third party damper actuator is fitted and the Damper Control Unit is mounted locally, the actuator will need wiring back to the Damper Control Unit and connecting to terminal block SK400.

The damper limit switch to detect the status of the damper shutter (Open/Closed) is connected to terminal block SK200.

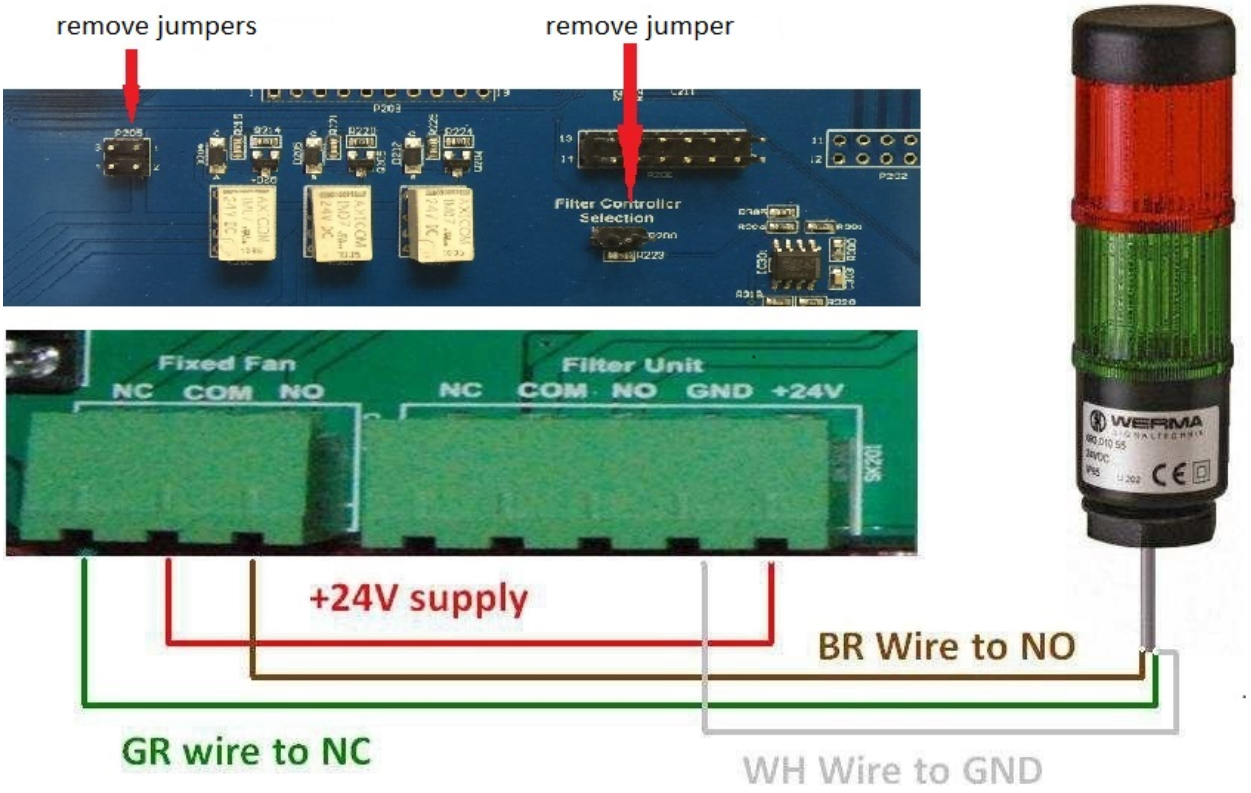
Variable Speed Drive

Only the RS485 “A” (+) and “B” (-) connections are required at the Variable Speed Drives as these have a separate integral power supply.

Integrity between the RS485 “A” (+) and “B” (-) connections between the Central Processor Unit and the Variable Speed Drives will need to be maintained throughout the installation.

Indicator Beacon

Figure 9 – 24v Indicator Beacon



The above figure is for a 3-wire 24v DC Beacon, the connection for the above beacon should be made as per the below instructions,

- Connect WH wire to power supply ground.
- Connect a cable from 24V to COM pin in fixed fan connector (SK200). The 24V power can be drawn from the filter unit connector.
- Connect GN wire to NC pin in the fixed fan connector (SK200).
- Connect BR wire to NO pin in the fixed fan connector (SK200).

NOTE: P205 and JP200 Filter Controller Section) Jumpers must be removed when a beacon is connected.

So when the fault indicator lamp (as selected on the Configuration page) is OFF the Green Beacon will glow and when the fault indicator lamp is ON the Red beacon will glow.

4 Configuration and Commissioning

The second phase of the installation covers the system commissioning and configuration which is carried out using an input device (laptop PC, tablet, etc.). The configuration software operates on the Central Processor Unit and runs on the Linux platform.

Communication between the central processor and the input device can be made using the following:

- Connect using a CAT 5 crossover cable;
- Connect via the LAN (Central Control Unit needs to be part of the LAN);
- Connection via Wi-Fi.

Introduction to the Configuration Software

The configuration software offers a series of screens to enable the installer to enter detailed parameters appertaining to the system devices and other conditional factors affecting the air movement system. The more accurate and pertinent the data entered at the configuration stage, the more the operating process can be 'fine-tuned'.

The software is also future proof allowing further devices to be added as and when the air extraction system is extended or contracted. Furthermore, these parameters can be updated and adjusted according to experience gained over a period of time or according to changing circumstances. This can be done in real time without powering down the system.

The system provides for complete monitoring of the operation and the end user can download statistical reports which can be used to make adjustments as experience is gained. System operation can be monitored on a continuous basis or periodically by accessing the user interface in a web browser over Wi-Fi, local area network or cross over CAT 5 cable. It will generate warnings and generate operational reports which can be viewed in real time (in your web browser), subscribed to via RSS feed, or downloaded periodically as and when a system check is schedule by the end user's maintenance planning teams.

With its networking capability, remote access is possible and where necessary, a service engineer can intervene on the system configuration or operating parameters from a remote location.

User Management

The software has three levels of user account. To perform a full system configuration, the installer will need to be logged on as a system administrator.

The other user accounts are "Engineer" and "User" and these do not allow the same level of access to system controls and configuration options.

Full details of user management are covered in Section 4.1.1.

Configuration Tasks and Guidance

The following sections guide the installer though the configuration process using the software interface.

It covers the detection of devices, manual set up of non-detectable devices, entering their parameters and setting the overall system parameters.

It shows the installer how to create logical groups of devices according to the physical layout of the system within the premises it is designed to serve.

Instructions on creating a graphical representation of the system layout using preloaded icons give the installer and end user a clear representation of the system and its functionality.

As data is entered into the fields in each dialogue box, a small green icon appears next to the field. This signifies that the changes have now been applied and after a short delay (max 1 min) the data is actually written to the hard disk and will thus be preserved if the system is restarted. Once the data is written to the hard drive the messaging system will confirm the changes.

Pre-configuration Set Up

Prior to beginning the configuration stage of the installation, all the physical elements will need to have been installed, connected up to the Central Processor Unit, powered up and fully operational. All the devices identified as requiring an ID should have been set by configuring the dip switches to their required settings.

Configuring and Commissioning the System

Connect your input device (Laptop computer, tablet) to the Ethernet connection on the Inteliair™ Central Processor Until of your input device – using a CAT 5 crossover cable. Alternatively, the data connection between the input device and the Control unit can be made by wireless connection.

If connecting wirelessly first log-in to the 'Inteliair' WiFi network using network security key **1nt3lla1r**.

Start the configuration software by opening your browser and typing in the following link into the browser bar:

- http://10.0.0.1:8080/Inteliair;
- if over cross over cable: http://169.254.19.19:8080/Inteliair;
- If over LAN you will need to set the IP address required.

If the software is initiated for the first time, it will load a preliminary screen with four fields which the user must fill in or confirm before proceeding to the next step.

- Confirm the system language;
- Confirm the currency symbol;
- Choose an administrator password and carefully make a note of this;
- Enter a name for the installation. See note below.

Note: *The system will ask you for an installation name. In the case of complex or multiple installations, the naming strategy should be carefully considered. This will assist the user identify separate elements or parts of the system at a later stage when modifications become necessary. Separate installations will appear at the very top of the screen as tabs allowing the user to select each one as required.*

Note: *If you choose to change the login credentials, the system will ask you to login again to confirm the changes. If you lose your login information, please contact Inteliair™ for assistance. Contact details are in the help file.*

Figure 10 shows the login screen.

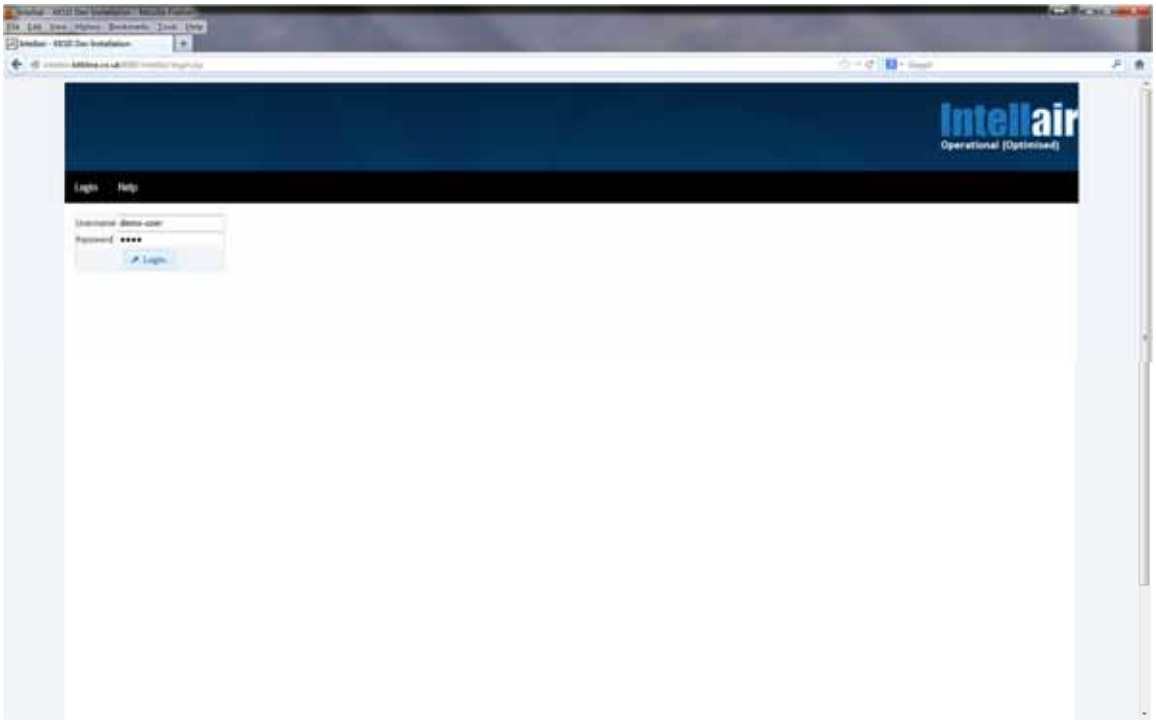


Figure 10 – Login screen

Warnings and Alarms

As soon as the application is launched, the messaging system will go into operation recording a variety of information about the system status as it is configured.

The top of the list is displayed in the top left header bar of the page and all critical messages are moved to the top of the list and remain there until appropriate action has been taken by the installer. The warning system shows general status messages as well as alarms related to critical malfunctions or faults on the system. Critical messages are appended with a red icon to indicate their level of seriousness.

Routine messages will appear appended with a green icon as these are shown to monitor system status. Where there is frequent re-occurrence of status messages, the number of occurrences will be displayed in brackets at the end of the message line.

To see a full list of messages, click on the “messages” tab and the full list will appear in the main window.

The system will display a maximum of 500 messages and will store up to 50 Mb of archived messages which can be downloaded using the button on the message screen.

Configuration First Step

Click on the “home” tab; the following page appears as shown in Figure 91.

Figure 91 – Home page

Click the “configuration” tab in the top menu to display the screen shown in Figure 102. A sub set of menu options will appear. Some of the tabs, though visible, will have no functionality until the installer begins to enter data into the configuration fields for the devices.

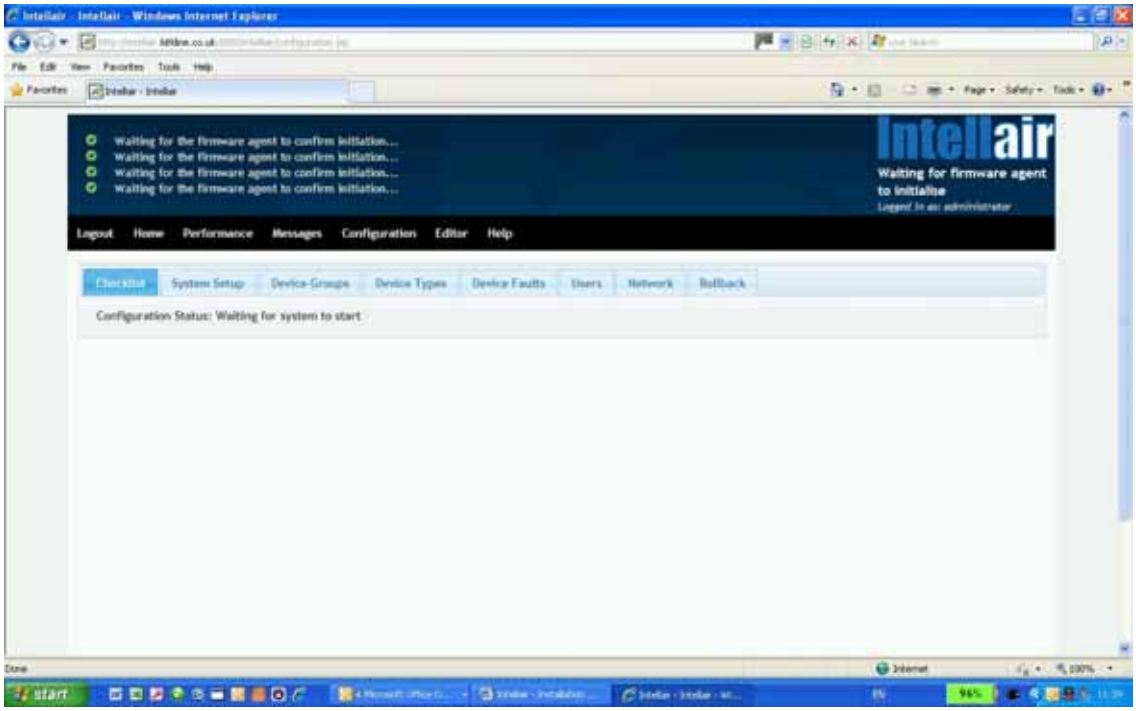


Figure 102 – Configuration main page

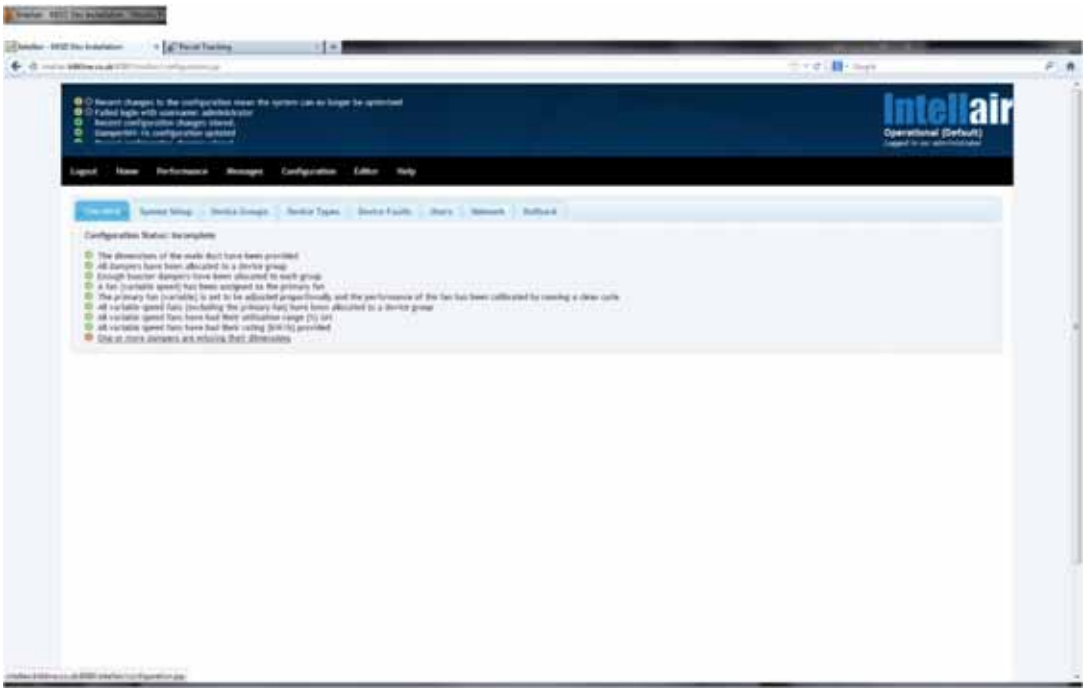


Figure 113 – Checklist screen

Figure 113 shows the “Checklist” page and this shows a list of completed or outstanding tasks. It is possible to click on a task to go directly to the configuration item requiring additional data or attention. Regular viewing of the checklist is recommended.

To begin the actual configuration of the system, click on the “System Setup” tab to display the dialogue box illustrated in Figure 124.

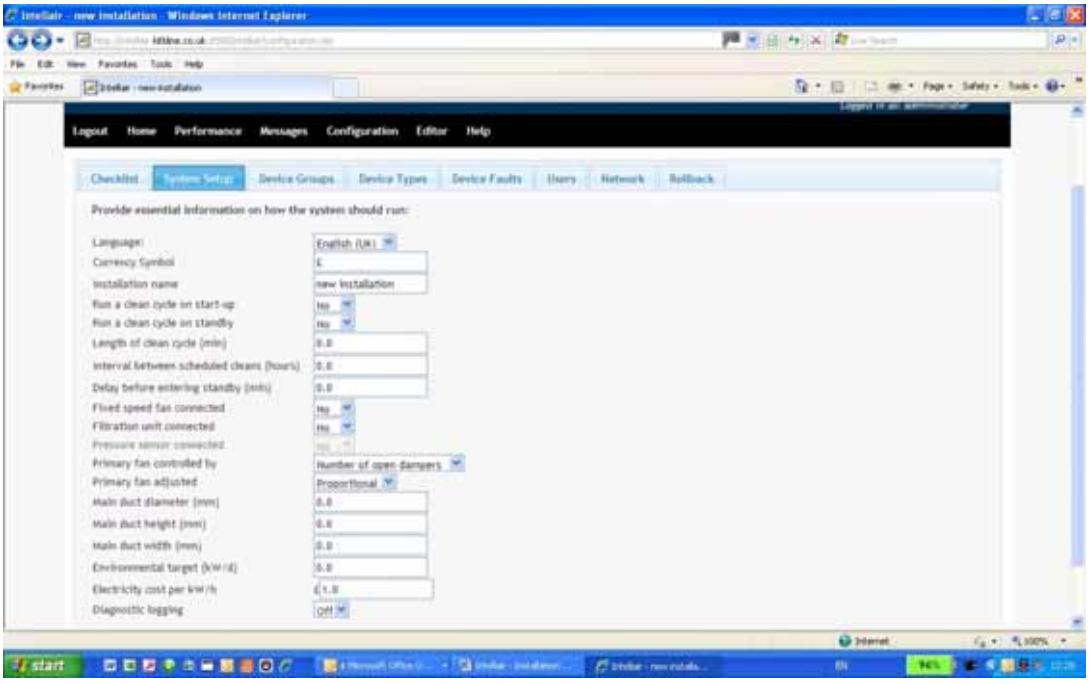


Figure 124 – System setup dialogue box

The system does not auto-detect the presence of a fixed speed fan or filtration unit. The installer will need to indicate their presence by entering the appropriate data into the dialogue box. Operational status for these devices is “on” or “off” as and when the complete system is powered up or down.

One of the variable speed fans will be designated as the primary fan. The installer will need to enter appropriate data into the “Primary fan controlled by” and “”Primary fan adjusted by” fields.

The primary fan can be controlled by the number of open dampers or by a pressure sensor reading where such a device is fitted to the installation. Finer results will be obtained with a pressure differential switch installed. The pressure differential switch provides for increased precision in control over fan speed. It takes a pressure reading once every second and constantly updates the system operating software which will then adjust the fan performance accordingly.

Note: If fitted, the pressure differential switch is auto-detected

There are two options for setting the fan speed by selecting the appropriate option in the “Fan adjusted by” field.

- Stepwise;
- Proportional.

The first method will change the fan speed by preset incremental percentage bands specified by the installer and verify its performance according to the prevailing conditions present in the system. If it does not reach the required speed, it will then jump to next incremental step value, this until the fan speed is optimised.

Note: This type of operation will cause the drive to work harder and result in frequent changes of speed. This has an impact on the life cycle of the drive and motor.

Table 8 – Summary of System Setup Data entry fields

Field	Data Required
Language	This is preset from the initial login page
Currency symbol	This is preset from the initial login page
Installation name	This is preset from the initial login page
Run a clean cycle on start up	Set as required
Run a clean cycle on stand-by	Set as required
Length of clean cycle (min)	Set as required in minutes
Interval between scheduled cleans (hours)	Set as required in hours
Delay before entering stand-by mode	Set as required in minutes
Fixed Fan connected	Yes/No – Set as required – The system does not auto detect the fixed fan (note: a fixed fan or a fault indicator lamp can be connected to the system (not both))
Fault Indicator Lamp connected	Yes/No – Set as required – The system does not auto-detect the fault indicator lamp (note: the fault indicator lamp or a fixed fan can be connected to the system (not both))
Filtration Unit connected	Yes/No – Set as required – The system does not auto-detect the filtration unit
Pressure sensor connected	Yes/No - No action required. If fitted, this item is auto-detected
Primary fan controlled by	Number of open dampers/Pressure Sensor Reading – Select the appropriate option (see text)

Field	Data Required
Primary fan adjusted	Stepwise/Proportional – Select the appropriate option (see text)
Main duct diameters	Enter diameter in millimetres if the duct cross section is circular
Main duct height	Enter duct height in millimetres if rectilinear ducting is installed
Main duct width	Enter duct width in millimetres if rectilinear ducting is installed
Environmental target	Enter a value in kW – See text
Electricity cost per kW/h	Enter unit cost of electricity in chosen currency – as per the currency (so in GBP not pence if the currency was £), i.e. 0.01 not 1 (pence)
Diagnostic logging	Off/On - For normal operation this option should be set to off

The proportional option is much less demanding on the hardware because the fan will attempt to find the most appropriate speed band to match the system conditions in one single step.

It is necessary to enter a duct size. This is possible by entering diameter or width and height dimensions. The system will calculate the cross sectional area of the ducting to optimise the data or system use.

Enter a target performance value in Kilowatts to be used as a bench mark for the system statistics. It will compare this value to the actual system performance and show this as comparative data in the downloadable performance graphs.

A price per electricity unit (kW/h) can be entered to generate financial reports based on electricity consumption. For more information on system performance monitoring and statistics, please refer to section 5.

Once the system setup dialogue box has been completed, the installer should click on the “Device Types” tab to begin specifying the parameters for the various devices fitted to the system.

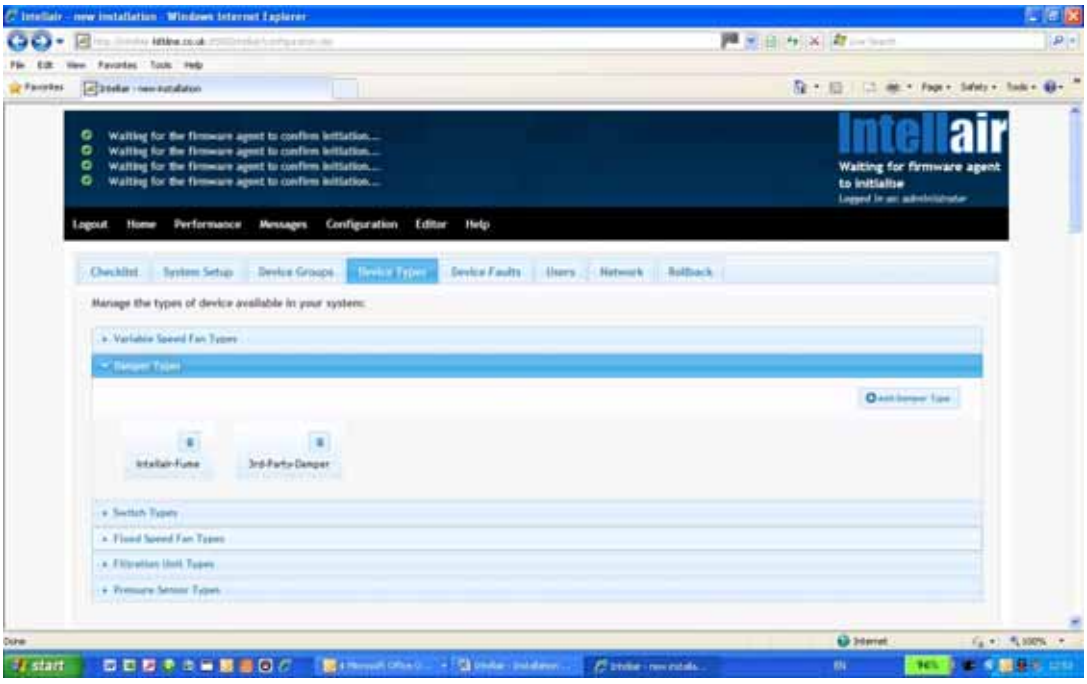


Figure 135 – Device types screen

Figure 15 shows the screen with the Device types tab expanded. There are tabs for the following devices:

- Variable Speed Fan types;
- Damper types;
- Switch types;
- Fixed Speed Fan types;
- Filtration Unit types;
- Pressure Sensor types.

The installer will need to click on the "Discover Devices" button at the top right of the devices types screen to auto detect the following devices:

- Damper Controllers;
- Pressure Switches;
- Variable Speed Drives (the installer will need to have specified the variable speed Drive type. See section "Variable Speed Drives" below).

The following devices will need to be added manually to the system using the appropriate device configuration pages.

- Variable Speed Fan Drives;
- Fixed Speed Fans;
- Filtration Units;

To begin the device configuration process, click on the "Variable Speed Drives" tab.

Variable Speed Drives (Fans)

There are a number of variable speed drives pre-loaded into the system and the installer will select the installed units from the list. Most of the parameters are pre-loaded and cannot be changed by the installer.

Enter the ID for the drive in the field at the bottom right of the dialogue box. Click anywhere in the screen to confirm the change. Repeat this until all drives of that particular type have been added.

Note: *The drive ID ("61", "62", "63", etc.) is the number obtained by the correct setting of the relevant Parameter within the VSD set-up configuration (please refer to your VSD manual). These ID numbers should have been recorded by the installer.*

As drives are added, they will appear as a list at the bottom of the dialogue box.

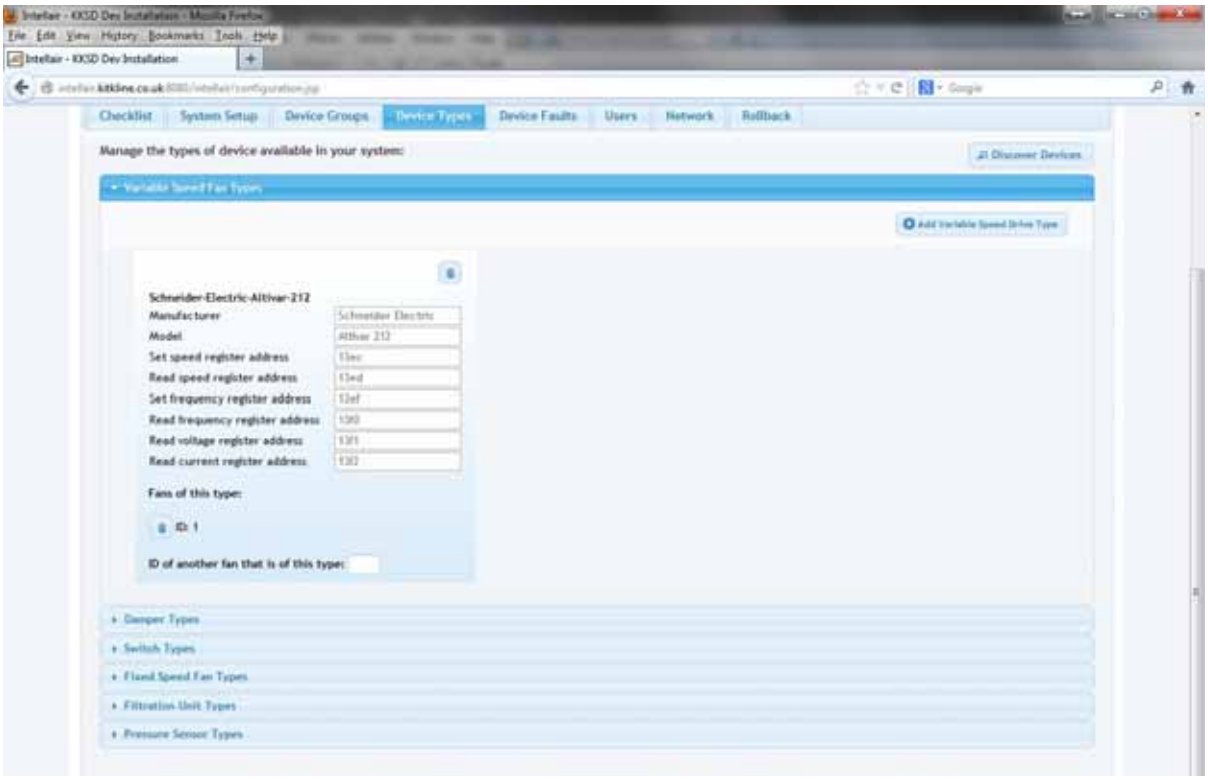


Figure 146 – Variable Speed Drive parameter screen

Should the user install a drive not already preloaded into the configuration software, it is possible to create a new drive type by clicking the “Add variable speed fan type” tab at the top right of the screen. In this instance, the installer will have to obtain the necessary data from the drive manufacturer to programme the parameters into the configuration software.

The next step is to ask the system to connect and set up communication with all the devices either manually set up or auto-detected by the software.

At this stage, the installer should view the checklist page to verify what tasks still need completing to optimise the system. Though the system is now functional it is not fully optimised to obtain maximum performance as there are missing parameters. The installer will complete this process by following the next steps of the configuration.

All remaining tasks listed in the check list will appear appended with a red icon until the appropriate action has been taken by the commissioning engineer. Click on the task and the system will take you directly to the appropriate screen.

Detecting Devices

Click the “Discover Devices” button at the top right hand side of the Device Types screen and the system will seek the devices installed on the system. Progress and warning messages will be displayed as devices are discovered and registered to the system.

Click the “Editor” button on the configuration top menu to display the following screen

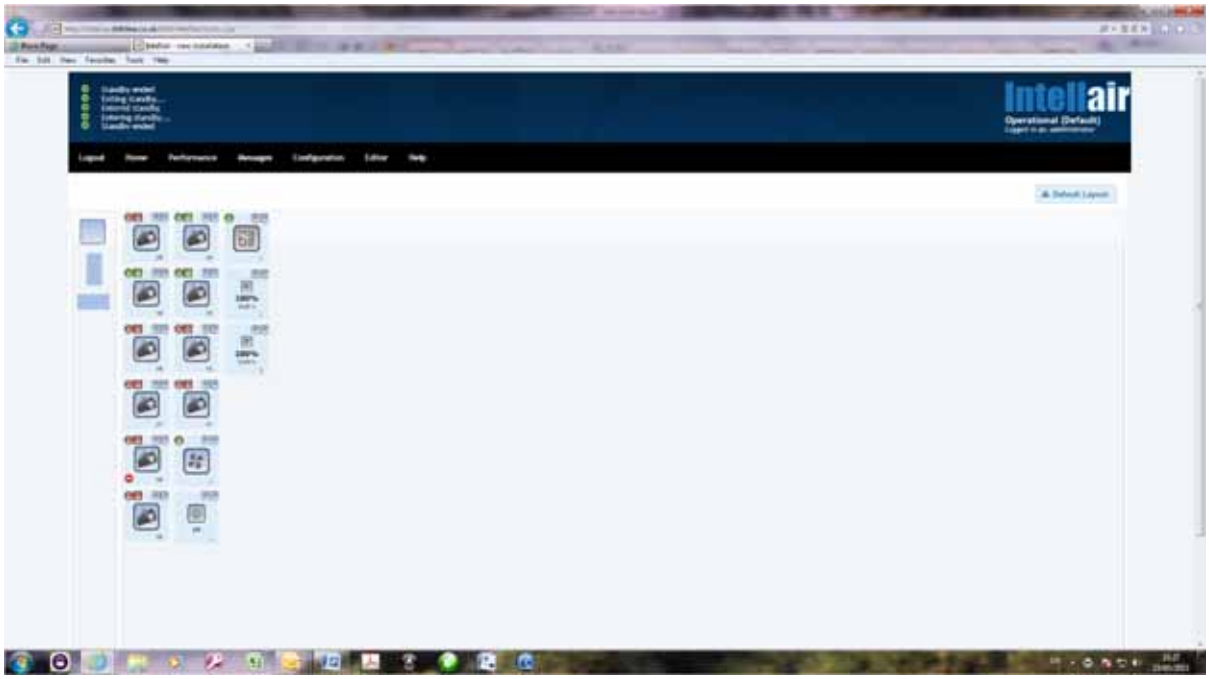


Figure 157 – Graphic display of discovered and specified system devices

The screen shows all the devices discovered by the software and those specified manually by the installer. These are shown in their default layout as a block of devices.

It is possible in “edit” mode to drag the icons and lay them out to create a more logical layout reminiscent of the actual physical installation. This is not necessary from an operational point of view, but will help the user to identify devices on the system. An example layout is shown in Figure 168.

Figure 168 – Representative system layout

This layout is achieved by dragging the symbols at the top left of the screen representing the following ducting elements respectively (from top to bottom):

- Junction/right angle;
- Vertical duct element;
- Horizontal duct element.

The duct elements can be extended using the mouse pointer and, when they are connected to device symbols, the extremities will snap to the icon.

To disconnect a device from its associated duct symbol, click on the “scissors” button. Now the device icon can be repositioned.

The device icon has system functionality and it can be used to control devices when the system is in override mode.

Figure 179 – Enlarged view of a typical device icon

Each of the Device Icons have indicators that will change aspect to show the device status and two control buttons. See Figure 179. The button at the top far right marked with a “spanner symbol” is the device configuration button.

The indicator and buttons have the following functions (Left to right, top to bottom):

- Round indicator: This is the status pilot light:
  - Red = off/closed (off for fan/filter or closed for damper);
  - Green = on/open (on for fan/filter, open for damper);
  - Amber = changing state;
- Square indicator: - This shows the switch setting for a damper;
- Scissors button: - this detaches the icon from an element on the graphic;
- Spanner button: click to open the device configuration screen;
- Number at bottom right of the icon: device ID No set by the dip switches.

Click the “spanner” button to open the device configuration screen. See Figure 20

The installer will need to repeat this operation for all the devices.

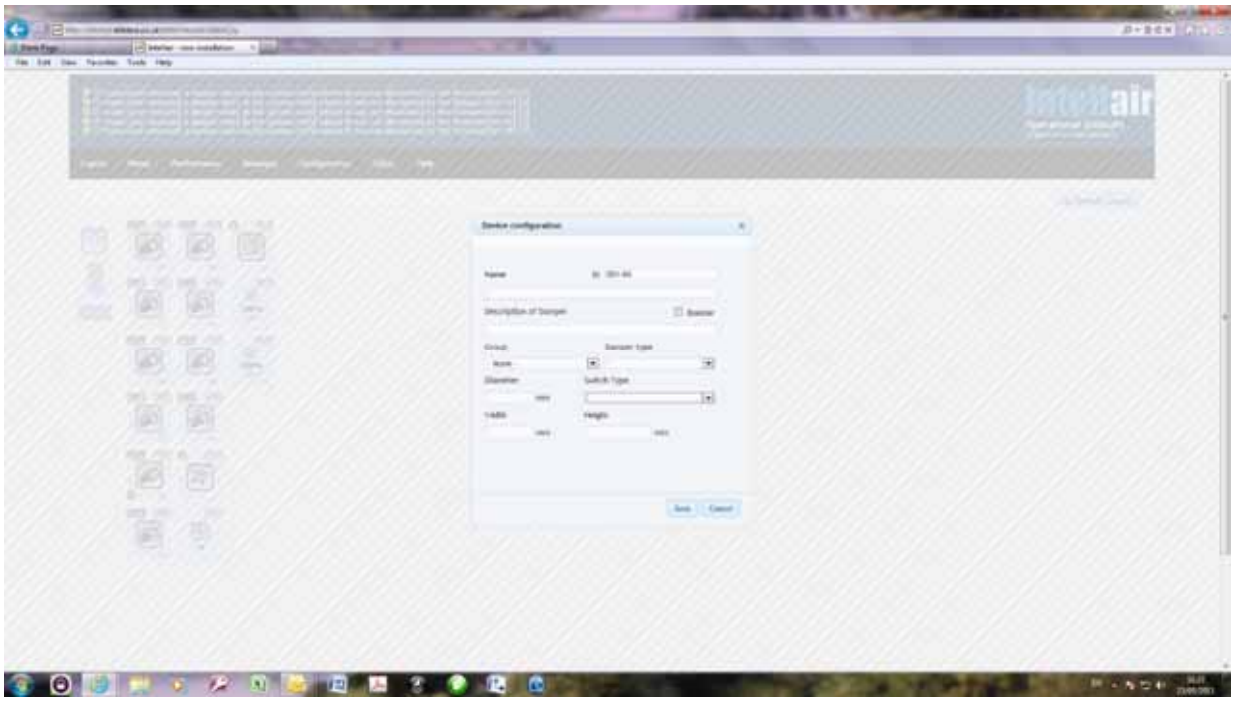


Figure 20 – Device configuration screen (Damper)

Device Groups

It is possible to set up groups of devices relating to specific areas of the plant covered by the system. This could be representative of different workshops or work areas.

Figure 181 – Representative system layout

The graphic representation shown in Figure 18 shows two distinct branches for a typical extraction system. The top and bottom branches could be subdivided into two operating groups.

Grouping devices further enhances the users' control over the total system performance. It allows the closing down of complete sections of the installation when no work is taking place in those areas.

First, create the logical groups by clicking on the "Device groups" tab and displaying the following screen.

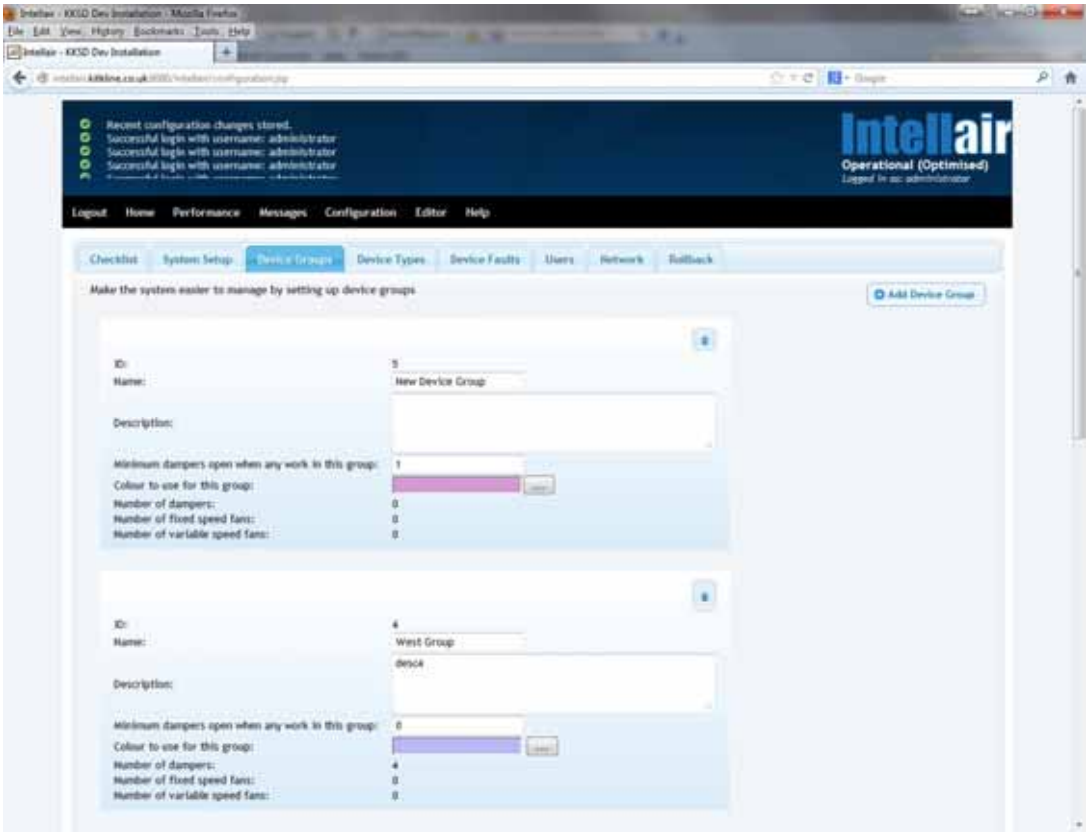


Figure 192 – Device Groups page

Create as many groups as necessary. The table below provides additional detail about the data fields

Table 9 – Summary of Group Setup Data entry fields

Field	Data Required
ID	This is automatically generated according to the number of groups set up
Name	Give the group a descriptive name
Description	Provide a description of the group
Minimum dampers open when any work in this group	Set as required See note.
Colour to use for this group.	Set a colour which will identify all the devices allocated to this group on the edit page which shows the graphic representation of the whole installation. The device icon background will take on the colour of the group to which it is allocated.

Note: The system may only require one damper to be open and the minimum value for this field is 1. But to ensure there is minimum air flow throughout that part of the system, it may be necessary to specify more than one unit in this box.

Go to the “edit” page to view the devices in their logical layout and click the “spanner” button for each device you wish to allocate to a specific group.

Device setup dialogue boxes are specific to the different devices and request differing information. The fields appertaining to specific devices have been listed in a series of tables and an explanation of the required data provided where appropriate.

Where necessary, comments have been added where options need further clarification.

Table 10 – Summary of the Fixed Speed Fan setup data entry fields

Field	Data Required
Name	Enter a descriptive device name
ID	Preset by the system
Description of fan	Describe the device
Primary	Tick this box if this fan is to designated as the primary fan
Type	Select the appropriate option from the drop down box (If required, you can change the types available on the device types tab)
Group	Select the group from the drop down box
KW when on max	Indicate the fan power consumption when running at maximum speed

There can only be one primary fan. If the installer overwrites a previously allocated primary fan, then the new allocation will take precedence.

Table 11 – Summary of the Variable Speed Fan setup data entry fields

Field	Data Required
Name	Enter a descriptive device name
ID	Enter the device ID
Description of fan	Describe the device
Primary	Tick this box if this fan is to designated as the primary fan
Type	This is already set according to the drive parameters entered at an earlier stage of the process.
Group	Select the group from the drop down box
KW when on max	Indicate the fan power consumption when running at maximum speed
Adjustment Step size (%)	Indicate in percentage terms the size of the fan speed state change size
Min Utilisation (%)	Indicate minimum utilisation as a percentage value
Max Utilisation (%)	Indicate maximum utilisation as a percentage value

Table 12 - Summary of the Filtration Unit setup data entry fields

Field	Data Required
Name	Enter a descriptive device name
ID	Already set at an earlier stage of the process
Description of filter	Describe the device
Type	Set by the device ID
KW when on max	Indicate the fan power consumption when running at maximum speed

Repeat the process above for pressure sensors, dampers and filters

4.1 Modifications to the Configuration

It is possible to make changes to the system configuration at any time. The following list details the different circumstances where a re-configuration may be necessary:

- Physical changes to the hardware installation, additional damper, etc.;
- Updates to the system or device parameters;
- Roll back to a previous configuration;
- General maintenance or recovery following breakdown or fault.

The update to the configuration process is similar to that followed for a new installation and will require the installer to use the interface software to make the changes to the system. This can be done whilst the system is operational and without the requirement for a shut down.

As soon as new data is entered, the system will revert to a default operating mode until all required parameters are entered into the configuration software. The installer should use the checklist page to monitor issues that need resolving in the same manner as is done on first installation.

Once all parameters have been updated, the message “system optimized” will appear in the top bar of the home screen.

Configuration Rollback

In some cases, the user will need to roll back to a previous configuration. This is achieved by clicking on the “Rollback” screen and selecting a previously saved configuration.

Click on the appropriate archived configuration and the system will restore the settings configured at that date.

The following screen (Figure 203) shows the rollback page

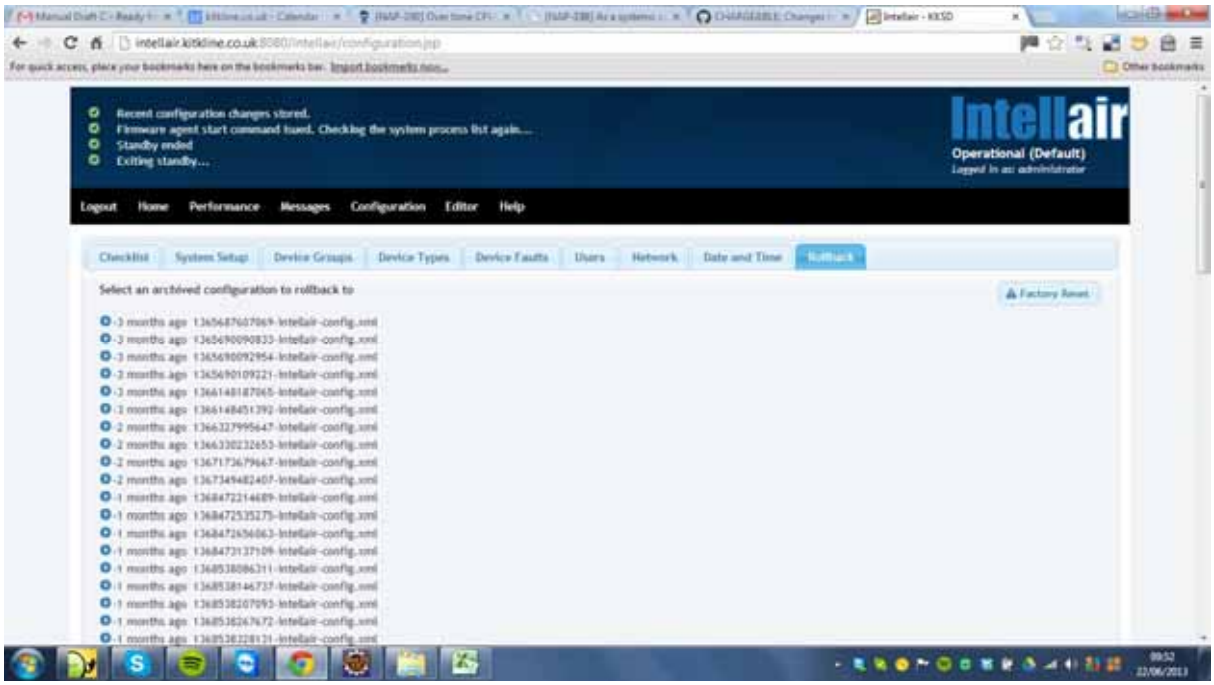


Figure 203 – Rollback Screen

4.1.1 User Management

Click the “user management” tab to display the list of users who have access to the system

The Inteliair™ Configuration system software provides for three types of user account. All three have different user privileges

- Administrator Account;
- Maintenance Account;
- Standard User.

Click on the “User Management “tab to access the various accounts that have been set up on the system.

The administrator can delete any account but the system will not allow the main administrator account to be deleted unless a second administrator account exists.

Administrator Account

The Administrator account allows full access to the system configuration and all functionality.

The administrator can set up new user accounts and reset passwords.

Engineer Account

The Engineer account allows maintenance personnel to manually control the system in manual override mode but does not allow access to the system configuration features.

User Account

The User account is the most restricted account. A user can only view system status, statistics and performance data. The user can also download performance data.

5 Monitoring and Reporting

5.1 System Operation Monitoring

The system is capable of running automatically and without supervision from an operator. However, to obtain the best performance from the control system, it is recommended the user monitors the system performance periodically.

Different levels of monitoring are possible depending on the end user maintenance and technical resources.

To monitor periodically, it is only necessary to connect the configuration device (laptop PC, tablet, etc.) via a CAT 5 crossover cable or over Wi-Fi and access in web browser as described earlier to view all the system data. Modification and fine tuning the system parameters can then be carried out in real time according to the experience gained from the system in service. It is recommended that system performance reviews are scheduled at regular intervals to ensure best performance.

Where the end user has a more developed maintenance department, the Inteliair™ System Central Processor can be connected to a local area network and continuous monitoring of the system is possible. Interventions can be instant and the system can be continuously fine-tuned to obtain optimum performance at all times.

It is also possible to set up an RSS feed to download system messages to a maintenance engineer's mail box to enable viewing of system error and fault messages as they happen. This mode of monitoring is recommended for small organisations where continuous monitoring is not practicable due to limited resources.

All the above require access at administrator level if configuration changes are to be made to the system.

5.2 System Reporting

The system will generate performance reports to enable the user to assess the system performance over time and make an assessment of the systems optimisation.

Click on the "Performance" tab to load the screen shown in Figure 214 and select the type of performance data you wish to view. The system will generate a graph, an example of which is shown in Figure 225.

It is also possible to download performance data in various numerical formats for further analysis using third party statistical tools (Spreadsheet, etc.).

These actions only require standard user access to the configuration software.

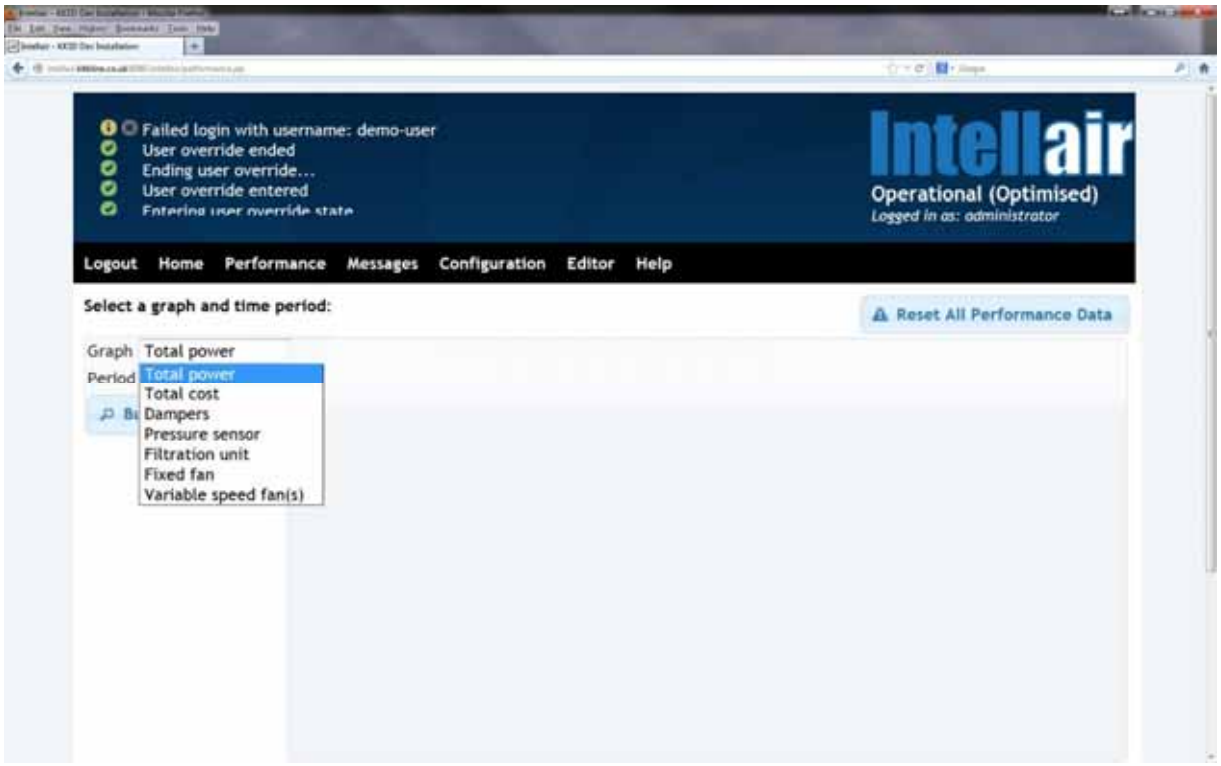


Figure 214 – Performance data graph selection screen

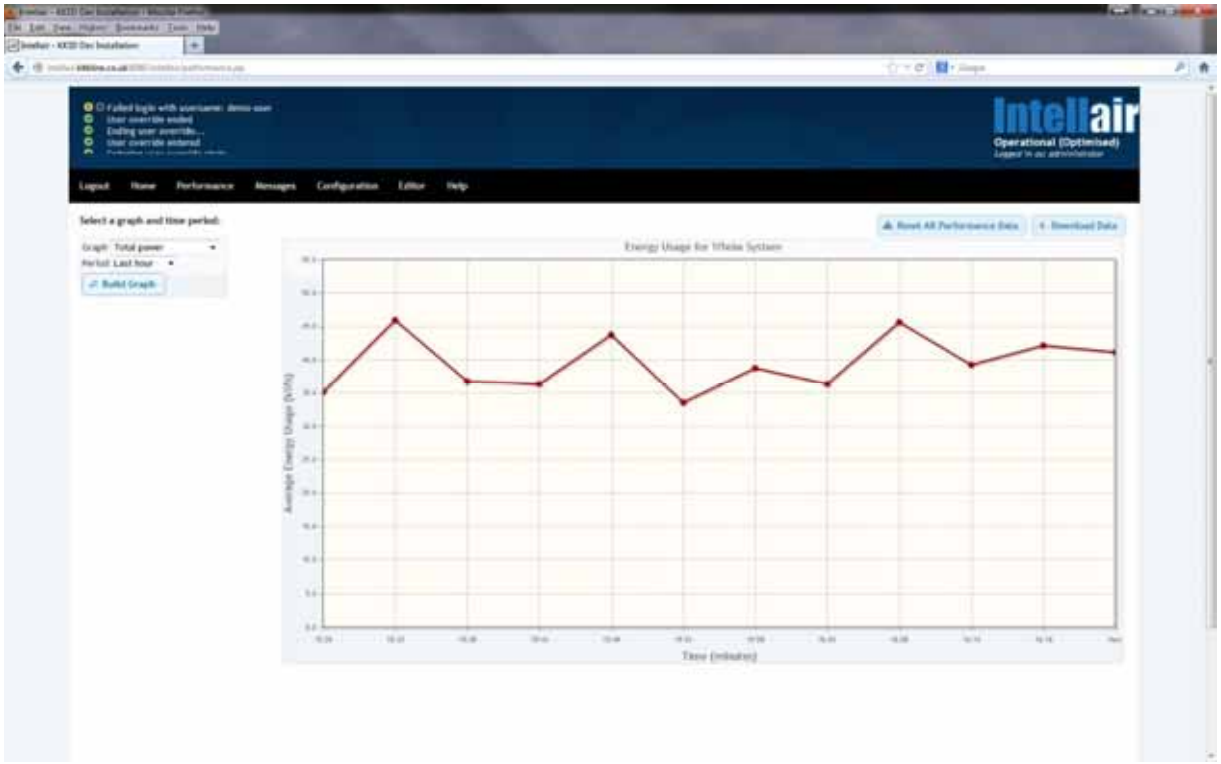


Figure 225 – Example performance graph

6 Troubleshooting

System faults are reported by the configuration system messaging system. Where a fault is critical, the warning message will rise to the top of the list and remain there until the grey X icon is clicked to remove it

Where the system warning and error messaging system is relayed by RSS Feed to an RSS feed reader, the warning will be seen by an operator monitoring the system operation.

If a device develops a fault, the system will post a message in the alarms list.

Until the fault has been rectified, the system will ignore the faulty device and treat it as “off line” for evaluating the system performance.

The operator will need to rectify the fault on the hardware and then inform the system that the fault has been rectified to bring the device back online.

7 Spares

There are no user-serviceable spares within the major components.

8 Support

Contact Information

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Patents

Patent Pending – Reg. GB 1220034.1

Appendix A LED Indications Quick Reference

The following tables provide a quick reference for the LED indications on the following Inteliair™ devices:

- The Central Control Unit;
- The Damper Control Unit;
- The Current Sensing Switch.

Table 13 –Central Control Unit LED Indications

Function	Description
LEDs listed from left to right on front panel	
Power LED	Blinks at 1 second intervals when the processor Unit is ON.
Communication LED	Blinks when communications are taking place.
Override LED	ON when the system is set to override mode
Error Status LED	• Blinks at 1 second intervals when there is an over/under current fault • Blinks at 200 millisecond intervals if there is a pressure sensor fault

Table 14 –Damper Control Unit LED Indications

Function	Description
LEDs listed from left to right on front panel	
Power LED	ON when the Damper Controller is under power.
Damper Status LED (multi-colour)	• Blinks (green) when the damper is opening • ON (green) when damper is open • Blinks (red) when damper is closing • ON (red) when damper is closed • ON (orange) to indicate damper fault • Blinks (orange) at 1 second intervals for damper communication timeout • Blinks (red) at 200 millisecond intervals to indicate Zigbee module error • Blinks (orange) at 200 millisecond intervals if there is a damper synchronisation error. • ON (orange) if Damper Controller attempts to open a non-overridden damper

Table 15 –Current Sensing Switch LED Indications

Function	Description
LEDs listed from left to right on front panel	
Power LED	ON when switch is powered
Switch Status LED	ON (green) when switch is on