BlackBox Nexus
Installation Manual

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This Install Guide documents the BlackBox Series Nexus

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Sourcing
Proudly designed and manufactured in Australia by Innovative Air Systems Pty Ltd, an independent Australian-owned company.

Product support
Freecall: 1800 354 434 (Australia-wide)

Contents

1 INSTALLATION

1.1 Wiring

All electrical installation is to be carried out by a licensed trades person in accordance with AS3000 and manufacturers connection diagrams.

1.1.1 Device I/O Cabling Requirements

All touchpad and sensor cables should be shielded, and kept the maximum practical distance from any power cables ≥ 240 volts (minimum recommended distance = 300 mm).
Shielded 4 core data cable is acceptable provided the drain is firmly connected by a mechanical means to the SH terminal. The mechanical connection of the earth terminal on the Relay Module to a suitable point enables this shielded cable to function as intended.

1.2 Component Positioning

The Nexus Module can be positioned in the mechanical services switchboard or, on or near the systems air handling unit. Maintain a minimum distance of 300 mm from the indoor fan motor or similar inductive fields.

The External Touchpad (optional) should be mounted in a central position within the air conditioned space. It has been designed to be flush mounted to a cavity wall, or surface mounted through the use of a 15 mm mounting block.

The Return Air Sensor should be mounted either, inside the return air duct as close to the return air grille as possible, or wall mounted 1.5 meters from floor level close to the return air grille. Most importantly, the return air/room sensor should always be protected from direct sources of heat such as direct sunlight and office equipment.

The Outside Air Sensor (131E touchpad required) should be protected from direct sunlight, mounted inside the outside air duct as close to the outside air grille as possible.

1.3 Controller Configuration

The Nexus is capable of controlling many different A/C configurations of up to 5 relay outputs.

As a stand alone controller, the Nexus supports three different control configurations (personalities).

A control configuration is selected by turning on one of DIP switches 6, 7 or 8 on the face of the Nexus. define the relay outputs.
Relay outputs are assigned from 1 to 5 in the following order:

- fan outputs
- cooling outputs
- heating outputs
- pump output

Select the appropriate configuration for your A/C unit from the table below and switch the corresponding DIP switch to the ON position.

Only one DIP switch may be ON at any time.

If no DIP switch is turned on a control configuration may be passed to the controller by a compatible external touchpad.

Table 1.3a

Configuration DIP Switches						
DIP #	**Config**	**Relay 1**	**Relay 2**	**Relay 3**	**Relay 4**	**Relay 5**
1	Test1[1]	ON	OFF	OFF	OFF	OFF
2	Test2[1]	OFF	ON	OFF	OFF	OFF
3	Test3[1]	OFF	OFF	ON	OFF	OFF
4	Test4[1]	OFF	OFF	OFF	ON	OFF
5	Test5[1]	OFF	OFF	OFF	OFF	ON
6	311	Fan Low	Fan Med	Fan High	Cool	Heat
7	122	Fan	Cool	Cool	Heat	Heat
8	103	Fan	Heat	Heat	Heat	Pump

1. DIP switch 6, 7 and 8 must be OFF

1.4 Nexus technical specifications

Power input to Controller ..... 240 volt ± 10%
Line frequency ..... 50 Hz
Power Consumption ..... 6 VA (max)
Operating temperature ..... 0 °C to 65 °C
Altitude ..... 0 to 2000 meters
Operating Relative Humidity..... 10% to 80%
Unit Dimensions (mm)..... 173 (L) x 116 (W) x 55 (H)
Weight ..... 590 g
Avoid static electricity hazards
Avoid electromagnetic radiation sources
Avoid dust contamination
Avoid highly corrosive environments

1.4.1 Inputs/Outputs

5 x relay outputs

- Max load through all relay terminals is 7Amps (inductive).

1 x digital input

- Flow input. Open circuit = lock out compressor relays.

2 x analogue outputs

- 1 x 0-10 VDC linked to cooling control band - V1
- 1 x 0-10 VDC linked to heating control band - V2

2 x analogue inputs

- 1 x NTC thermistor - 47 kΩ @ 25 °C
- 1 x Multi purpose

1.4.2 Special Inputs

Analogue inputs S1 and S2 provide additional digital inputs in the following manner (voltage free clean contacts required):

- **S2 Closed Circuit = System Fault**
  Close circuit analogue input 2 terminals (S2 and SC) to shutdown all conditioning relays (compressors and electric duct heaters). The fan relay will remain energised only if the system is On.
  For 3 speed fan models in auto fan mode the controller will default to low fan speed. Manual changes to fan speed will be accepted.
- **S1 Closed Circuit = Remote On/Off**
  Close circuit analogue input 1 terminals (S1 and SC) to shutdown all relays.
- **S1 Open Circuit = Forced Vent Mode**
  Open circuit analogue input 1 terminals (S1 and SC) to shutdown all conditioning relays (compressors and electric duct heaters), the fan and reversing valve relays will remain energised. If the system is Off, the relay for the currently selected fan speed will be energised.
  For 3 speed fan models in auto fan mode the controller will default to low fan speed. Manual changes to fan speed will be accepted.

Any connected LCD touchpad will display a message on the screen for each digital input trigger and the service timer trigger.
If multiple trigger events occur at the same time the message displayed is based on the following priority.

1. System Fault
2. Service Timer
3. Remote On/Off
4. Forced Vent

The factory default messages may be replaced by one from the message library via the Advanced Settings Menu.
The library contains one custom entry of 2x8 character lines.

1.4.3 Default Software Settings

Following is a list of settings adjustable from the onboard touchpad, and their factory default values. For details on altering these settings refer to Section 3.2.

- **Setpoint (Default = 22.5 °C)**
  Setpoint is the temperature the controller will try to maintain. Adjustable via onboard interface or external touchpad.
- **RunTimer (Default = Disabled)**
  Run Timer counts down run hours from a preset limit. At the end of the timer period the system switches off.
- **Heating Control Band (Default = 0.5 °C per stage)**
  Control Band is a common variable covering both Stage Separation and Switching Differential. There is a separate control band for Heating and Cooling working from the heating and cooling setpoints dictated by the DEADBAND.
- **Deadband (Default = 0°C)**
  Adjustable in 1 °C increments to 3 °C
- **Cooling Control Band (Default = 0.5 °C per stage)**
  Control Band is a common variable covering both Stage Separation and Switching Differential. There is a separate control band for Heating and Cooling working from the heating and cooling setpoints dictated by the DEADBAND.

1.4.4 Default Hardware Settings

The following table details the function of the main processor module DIP switches located next to the sensor inputs.

Table 1.4.4a

Main Processor Module DIP Switch Settings

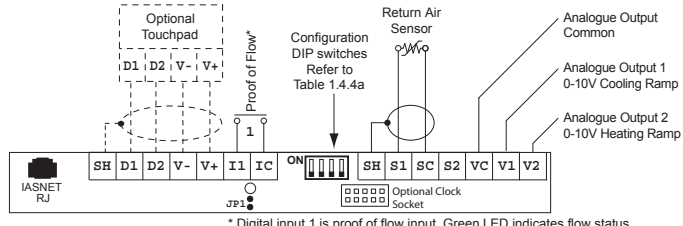
DIP #	Function	OFF (Factory Default)	ON
1	**Compressor Delay**	Software Selectable (4 minute default)	4 seconds max (overrides software)
2	**Memory Lock (Diagnostic Use Only)**	Disabled	Memory locked. Settings changes are discarded.
3	**Restore Factory Defaults**	Disabled	Restore factory defaults at next reboot.
4	**Heat Type**	Reverse Cycle	EDH or Cool Only

1.5 Connection Diagrams

Select the appropriate connection diagram from the following pages.

1.5.1 Configuration 311

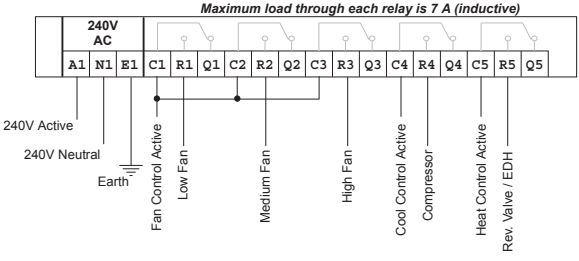
IASnet RJ and terminals, digital and analogue input / output terminals



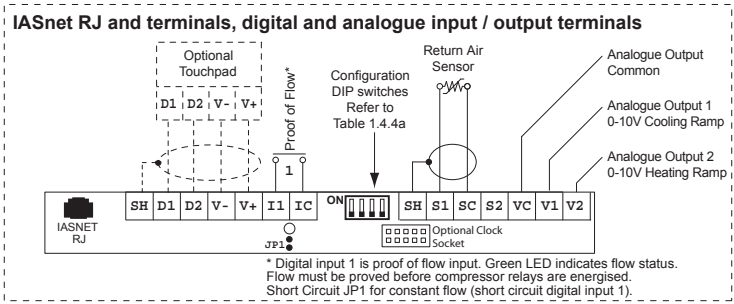
* Digital input 1 is proof of flow input. Green LED indicates flow status.
Flow must be proved before compressor relays are energised.
Short Circuit JP1 for constant flow (short circuit digital input 1).

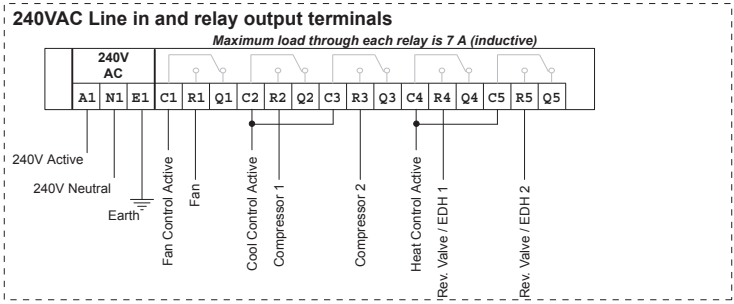
240VAC Line in and relay output terminals

Maximum load through each relay is 7 A (inductive)



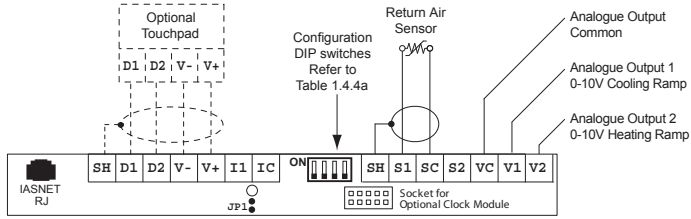
1.5.2 Configuration 122



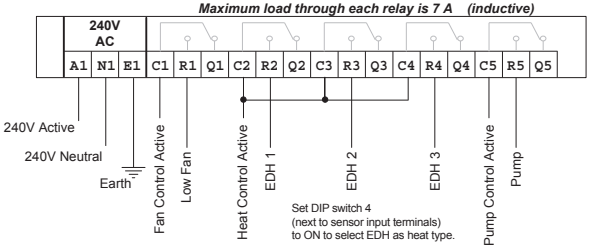


1.5.3 Configuration 103

IASnet RJ and terminals, digital and analogue input / output terminals



240VAC Line in and relay output terminals



2 COMMISSIONING

2.1 Before connecting 240 VAC power

Ensure all electrical connections are in accordance with the supplied connection diagrams and local bylaws.
Verify the correct configuration has been selected from the DIP switches on the face of the controller.
Verify the sensor has been connected as per the connection diagrams in section 1.5.

2.2 Before first run

Set all the system settings as detailed in Section 3.

2.3 Power on

If the Nexus display shows a message, then refer to section 3.1.1.
Operate the controller in heat, cool and try each fan speed setting.

2.4 Prior to departure

Ensure that the Delay software setting is restored to Safety and verify the hardware delay DIP switch # 1 is returned to the off position prior to finishing commissioning.

3 USER GUIDE

3.1 Controller Layout

This controller provides a simple user interface.

3.1.1 LED Display

The 3 x 7 segment LED display shows the current setpoint by default.
This display will show system status information when one of the special inputs is activated (see section 1.4.2).
S2c = Sensor 2 input closed circuit (or shorted)
S1c = Sensor 1 input closed circuit (or shorted)
S1o = Sensor 1 input open circuit (or not connected)

3.1.2 LED Indicators

The system's on/off status is indicated by the green LED below the **POWER** button. When the system is OFF, the colour LEDs R1... R5 show the Relay's function only (see colours below). When the system is ON, the colour indicates function and relay ON state. The colour of the LED indicates a Relay's function as follows:

Green = Fan
Blue = Cooling / Compressor
Orange = Reversing Valve
Red = Electric Duct Heat (EDH)
Purple = Pump
White = Unassigned

3.2 Controller Functions

3.2.1 Adjust the Setpoint

The current setpoint is shown on LED display and can be adjusted in 0.5 °C increments from 15.0 to 30.0 °C.

- To change the setpoint, press the **ARROW**s. Once the required temperature has been set the screen will revert to the default display after a short period.

3.2.2 To Set the Run Timer (After Hours Timer)

Operation: With the Run Timer enabled, and if the system is off (and outside any timer periods), pressing the On/Off button will start the system in Run Timer Mode. The system will run for the duration of time set in the Run Timer, after which the system will turn itself off.

- Press **TIMER**.
- The display shows '--.-'.
- Use the **ARROW**s to alter the hours shown (in ten minute increments) to the required period (up to 24 hours).
  NOTE: '12.5" = 12 hours and 50 minutes
- Press and hold the **ARROW**s to scroll numbers quickly.
- Press **TIMER** to save the new value and return to the default display screen.

To disable the Run Timer, select the minimum value of "---" and press **TIMER**.

3.2.3 To Set the Heating Control Band

Operation: Control Band is a common variable covering both Stage Separation and Switching Differential. There is a separate control band for Heating and Cooling working from the heating and cooling setpoints dictated by the DEADBAND.

- Press **HDC** button once.
- Display will show ‘h0.5’
- Use the **ARROW**s to alter the value.
- Press **HDC** button to save.

SINGLE STAGE CONTROLLERS: The control band for single stage controllers is adjustable in 0.5 °C increments from 0.5 °C to 1.5 °C, resulting in a switching differential equal to the control band value and stage separation also equal to the control band value.

TWO STAGE CONTROLLERS: The control band for two stage controllers is adjustable in 1.0 °C increments from 1.0 °C to 3.0 °C, resulting in a switching differential for each stage equal to half the control band value and stage separation equal to half the control band value.

THREE STAGE CONTROLLERS: The control band for three stage controllers can either be 1.5 °C or 3.0 °C, resulting in a switching differential for each stage equal to 1/3 the control band value and stage separation equal to 1/3 the control band value.

3.2.4 To Set the Deadband

Operation: A deadband value other than 0 will create separate Heating and Cooling setpoints (half of the deadband value either side of the displayed setpoint).

- Press **HDC** button twice.
- Display will show ‘d0.0’
- Use the **ARROW**s to alter the value in 1.0 °C increments from 0 to 3.
- Press **HDC** button to save.

3.2.5 To Set the Cooling Control Band

Operation: Control Band is a common variable covering both Stage Separation and Switching Differential. There is a separate control band for Heating and Cooling working from the heating and cooling setpoints dictated by the DEADBAND.

- Press **HDC** button three times.
- Display will show ‘c0.5’
- Use the **ARROW**s to alter the value.
- Press **HDC** button to save.

SINGLE STAGE CONTROLLERS: The control band for single stage controllers is adjustable in 0.5 °C increments from 0.5 °C to 1.5 °C, resulting in a switching differential equal to the control band value and stage separation also equal to the control band value.

TWO STAGE CONTROLLERS: The control band for two stage controllers is adjustable in 1.0 °C increments from 1.0 °C to 3.0 °C, resulting in a switching differential for each stage equal to half the control band value and stage separation equal to half the control band value.

THREE STAGE CONTROLLERS: The control band for three stage controllers can either be 1.5 °C or 3.0 °C, resulting in a switching differential for each stage equal to 1/3 the control band value and stage separation equal to 1/3 the control band value.

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