

Vykon HVAC

Installation guide

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Contents:

Contents:	3
Introduction	5
<i>Scope</i>	5
Introduction	6
Vykon HVAC controller and I/O modules	7
<i>Controller</i>	7
<i>I/O Modules</i>	8
<i>I/O Module calculator</i>	10
Common module features	11
<i>Addressing</i>	11
<i>Line termination</i>	12
<i>Network arrangements</i>	14
<i>LED Status</i>	16
Detailed module features	17
<i>IO-CON</i>	17
<i>IO-10DI</i>	17
<i>IO-10DI</i>	18
<i>IO-6DOH-12DI</i>	19
<i>IO-8AI</i>	21
<i>IO-4AOH-3DO</i>	22
<i>IO-4DO</i>	23
<i>IO-MULTIIO</i>	24
<i>IO-2HILO</i>	25
Module Version Control	26
Regulations and approvals	27
<i>WEEE (Waste of Electrical and Electronic Equipment)</i>	27
<i>CE marking</i>	27
Related documents	28

Document Control 28

This is a 28 page document at A4

Introduction

Vykon HVAC provides a new approach to creating heating, ventilating and air-conditioning control applications within a standard Tridium JACE® controller. Powered by the industry-leading NiagaraAX Framework®, it dramatically speeds up control system engineering whilst ensuring consistency and accuracy of set-up.

For the installer, to the engineer and end-user, Vykon HVAC has been designed to provide productivity, reliability and efficiency from a simple to use, intuitive software based solution. With a web browser interface for remote maintenance and a future-proof ability to adapt along with a building's lifespan the benefits of Vykon HVAC set the benchmark for HVAC applications.

The use of standardised applications provides the framework to control any location. Although each Vykon HVAC installation will be different in option choices and settings, as each is derived from a standard application source, it offers instant familiarity and versatility for the engineer.

Thanks to the power of the NiagaraAX® framework you won't get bogged down with detailed programming. Configuring of Vykon HVAC is a truly automated experience. Applications come with default settings to ensure your system works first time, every time and modifications can be made instantly offering total flexibility and future-proof expansion.

As a solution which is delivered in a standard JACE® controller, Vykon HVAC seamlessly connects to the controls automation network and operates alongside other application solutions. It is a scalable implementation which supports standard NiagaraAX® connectability to enterprise applications.

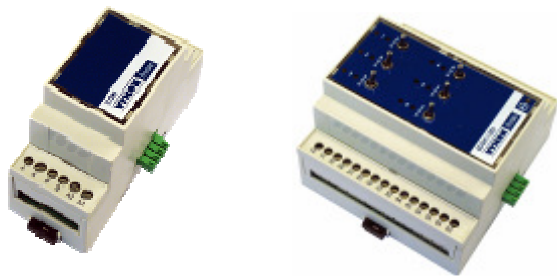
Scope

This document is an installation guide which serves two purposes. Firstly it is a guide to explain the concept of the Modules, I/O and JACE and how to estimate the I/O module varieties. Secondly the guide provides detailed wiring information regarding all the I/O which will enable the MCC designer or site electrician to wire and commission the installation ...

- Introduction
- Module and Jace selection criteria
- Module I/O wiring connections to field devices
- Regulations and Approvals

Introduction

The Vykon HVAC modules are designed to be used as local I/O (within a Motor Control Cabinet (MCC) or panel) as well as remote I/O (wired outside of the MCC).



When used as local I/O, the modules are interconnected by clicking them together on a DIN (DIN-TS35 35mm x 7.5mm) rail. Power and the serial bus are automatically connected to the modules via the 4 way connectors on the sides of each module.

When used in remote I/O configurations, a shielded twisted-pair cable is recommended for the communications wiring. Due to potential differences which may arise over longer distances, it is strongly recommended to use galvanic isolation for power and serial bus when using remote I/O.

Vykon HVAC controller and I/O modules**Controller**

There are several varieties of Vykon HVAC controller. Please refer to the price list for details of product references and I/O module capabilities. However the following notes apply to all the product varieties:

Notes on controller selection

- Only the JACE® 6 controller is used for Vykon HVAC
- All the JACE® 6 varieties have a maximum 'heap memory' (suitable for application station use) of 96 Mbyte
- The Vykon HVAC license device limit number on all the controllers is double the I/O module limit (each I/O module is equivalent to two devices)
- Any of the I/O module varieties may be used in association with any of the controllers

I/O Modules

There are 7 varieties of Vykon HVAC I/O module and their I/O capabilities are shown in Table 1:

Table 1 I/O type	DI	AI	DO	DOH	AOH	Comments
10DI	10					bi-colour LED per input
8AI		8				input configuration via hardware configuration block
4DO			4			4 x change over contacts
4AOH-3DO			3		4	3 x change over contacts
6DOH-12DI	12			6		3 x change over contacts + 3 x normally open contacts
2HILO	8		4			4 x change over contacts configured as 2 HI-LO switching pairs
MULTI I/O	4	6	4	2	2	mixture module

Table 1 key	
DI	24v ac/dc or volt-free contact (VFC)
AI	0-10v or 0-20mA or resistive temperature detector (RTD)
DO	relay – 250vac, 16A resistive, max power rating 4,000va
DOH	relay – 250vac, 8A resistive, max power rating 2,000va with hand-off-auto switch
AOH	0-10v with hand-auto switch and adjustable setting potentiometer output

The Vykon HVAC I/O modules have been designed to be compatible with a variety of different HVAC control devices. These are described here in Table 2:

Table 2		HVAC device	4DO	10DI	8AI	6DOH-12DI	4AO-3DO	MULTI-I/O	2HILO
Outputs	Motor control contactors		X			X	X	X	
	Motor control contactor with alarm and / or run contacts					X			
	Equipment		X			X	X	X	
	Equipment with fault alarm and / or run contacts					X			
	Open-close valve		X			X	X	X	
	Open-close valve with open and / or closed contacts					X			
	High/Low motor speed contactor or equipment					X			X
	Analogue output						X	X	
	Tri-state output		X					X	
	Inputs	Digital input			X		X		X
Meter pulse input				X				X	
Analogue input					X			X	

Notes on module selection

- Each digital output channel of the 6DOH-12DI module has a pair of digital input channels which are specifically designed to support a 'motor group'. A motor group has 'run' and 'fault/alarm' feedback signals which are normally present on many motor control contactors and on some equipment such as packaged boilers. The 'open' and 'closed' feedback contacts of a digital open-close control valve are similarly supported by each of the 6 output channels of the module.

A single LED on each output channel gives an off, green, red or orange indication for the state of the pair of motor group status of run and fault/alarm. If either of the digital input channels of an output channel are not required for use as a motor group, then those inputs can be 'released' and used for other digital input devices. Please be aware that the single LED indication on the module, representing the state of a pair of input devices may not then be appropriate for the status condition of those input devices.

- Hand-off-auto override switches for digital output channels are only available on the 6DOH-12DI and channels 5 and 6 of the MULTI-IO. Please note that channels 4, 5 and 6 of the MULTI-IO do not have change over contacts. They are only normally open contacts.
- When a tri-state output is required, a pair of digital output channels is used and they behave in a mutually exclusive manner where only one of the outputs can be on at any time. It is therefore not advisable to provide these outputs with hand-off-auto override switches. For this reason, tri-state I/O mapping in the Vykon HVAC applications will only allocate pairs of digital output channels from either the DO module or channels 1&2 and 3&4 of the MULTI-IO module because these do not have override switches
- For applications such as metering, where pulse counting is required, then the channels of the DI module and MULTI-IO module are used because these are designed to support a rapidly changing input signal. Where a Vykon HVAC application uses a pushbutton type device such as the 'alarm reset' pushbutton then the I/O mapping will also allocate these to the pulse counting type inputs
- The 2HILO module is specifically designed to support 2-speed motor devices which use a 'Dahlander' variable torque winding technique. A Dahlander wound motor comprises a single winding with two stator winding polarities which gives the ability to change motor speeds by varying the connections. Polarity speed ratios of 2:1 are obtained by bringing out centre tapped leads from the winding and double starring the high speed configuration. This means that to engage the low speed a simple three phase feed is required. However, when switching to high speed, control gear must put the low speed terminals into a star configuration. This is all achieved by a number of contactors but there are also strict timing and sequence precautions that must be taken when switching motor speed from off and between high and low speeds. These adjustable timers are available within the 2HILO module thereby negating the need for external timing control devices alongside the switching contactors

I/O Module calculator

To assist in the calculation of the most appropriate mixture of IO modules and selection of the JACE® controller, a simple to use calculator is available on line at <http://www.webeasyshop.nl/uk/>

Calculate IO configuration

Type	Description	Number
DI	Input Pulse input	<input type="text" value="10"/>
DO	Output	<input type="text"/>
	Output with hand/off/auto switches	<input type="text"/>
	Output without hand/off/auto switches	<input type="text"/>
	Output with feedback	<input type="text" value="6"/>
	Output without LED indication	<input type="text"/>
AI	Input	<input type="text" value="15"/>
AO	Output	<input type="text"/>
	Hi/Lo output	<input type="text"/>
	Tri-state output	<input type="text"/>
Is there remote IO ?		<input type="text" value="No"/>
The number of remote IO locations		<input type="text"/>

Simply enter your IO requirement into the relevant boxes...

...then Calculate

...and Result

Your server and IO module configuration has been calculated as follows:

Vykon HVAC Jace
6 module Jace 1

Modules

CON	1
4DO	0
10DI	1
6DOH-12DI	1
8AI	2
4AOH-3DO	0
2HILO	0
MULTIIO	0

The module selection above is based on the following IO points:

DI	Input	10
	Pulse Input	
DO	Output	
	Output with hand/off/auto switches	
	Output without hand/off/auto switches	
	Output with feedback	6
	Output without LED indication	
AI	Input	15
AO	Output	
	Hi/Lo output	
	Tri-state output	

Common module features

This section looks at the following things which are common to all the modules with relation to installation:

- Addressing
- Line termination
- Network arrangements
- LED status

Addressing

Each I/O module has a pair of rotary switches which must be set to a number between 1 and 99 to enable the module to be uniquely addressed on the modbus network. Access to the switches and setting them up is straightforward as follows:

Remove the cover from the module by means of inserting a small screwdriver blade into in the access slots at each side of the module

With a small screwdriver blade, turn the rotary switches to the required address

Note:
The switch labelled 'S2' is the 10's

Note:
The switch labelled 'S1' is the units

Note:
The switch labelled 'S2' is the 10's

Note:
You must set each module address to correspond with the appropriate module address for this modbus network in the Vykon HVAC station
For example this module address is set to 04

Note:
Any change made to the address is **only** initiated when power is restored. if you make a change then you must power cycle the module to make them take effect

Note:
Address 00 is **not** allowed
Each address must be **unique** on the same bus network

Note:
The IO-CON module **does not** require an address

```

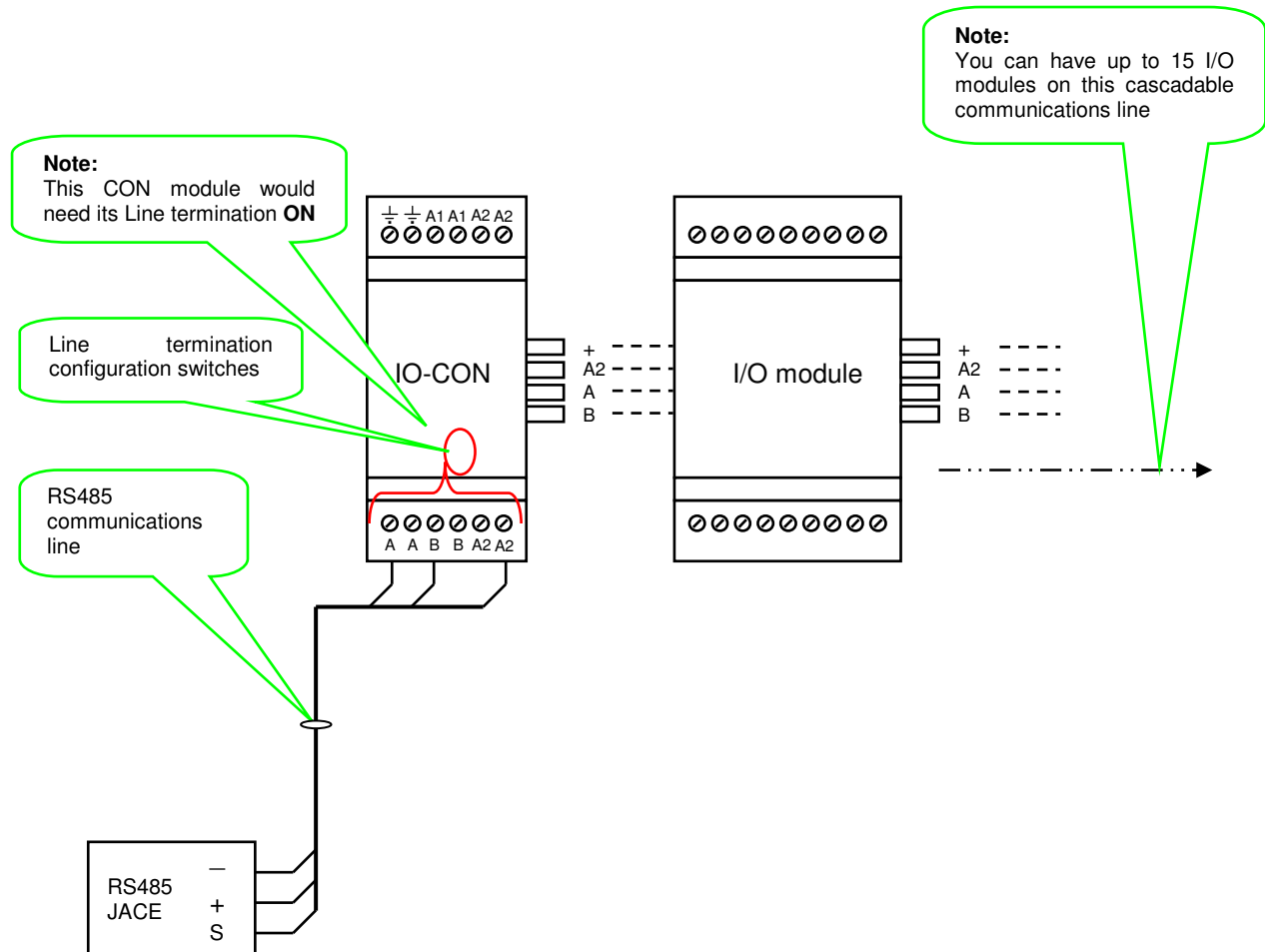
HvacModulesNetwork
├── Module_10DI_Station_01_COM2
├── Module_8AI_Station_02_COM2
├── Module_4AOH_3DO_Station_03_COM2
├── Module_8AI_Station_04_COM2
└── Module_6DOH_12DI_Station_05_COM2
    
```

Line termination

The end of every communications line should be terminated with impedance that is equal to the characteristic impedance of the line. This is done so that the power generated by the communications driver circuitry in each module is dissipated *through* the line but is not dissipated *in* the line itself. The line effectively appears to the driver, like an infinitely long transmission line and therefore any electrical noise generated from wave reflections is minimised.

Every Vykon HVAC I/O module, including the CON module, contains an 'end-of-line' termination impedance so that the communications line can be correctly terminated. All of these impedances can be optionally switched in or out of circuit so that only the end of line modules can be configured as 'terminated'. The default termination setting is 'OFF' or 'out of circuit' for all modules.

When the IO-CON module is utilised with its connected modules via the 4 way cascable plug then it performs the line termination function for all its connected I/O modules. There is no need to further terminate any of the I/O modules.

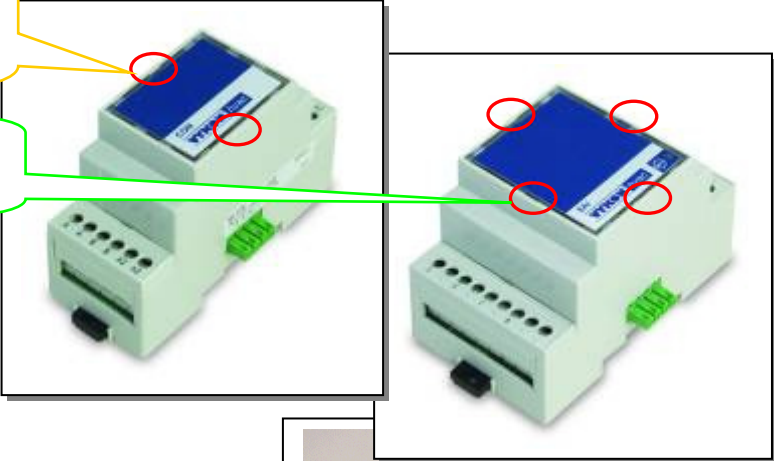


Access and setting the termination configuration is as follows:

Remove the cover from the module by means of inserting a small screwdriver blade into in the access slots at each side of the module.

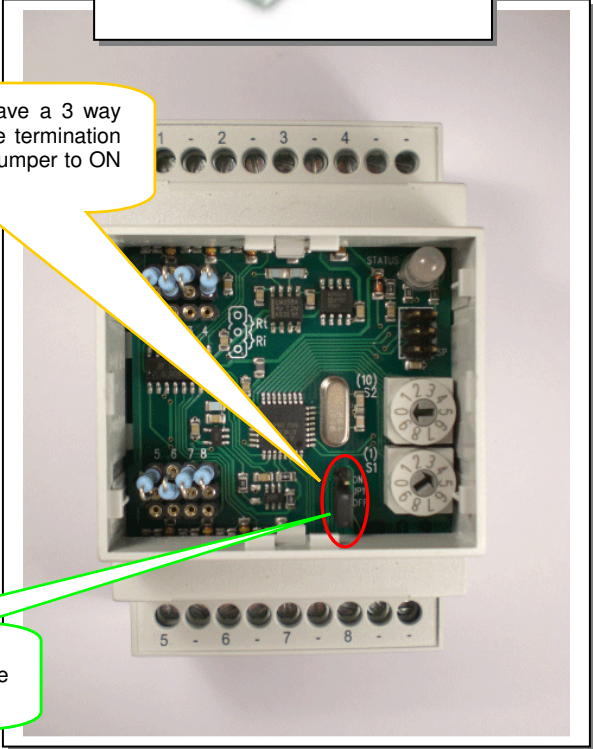
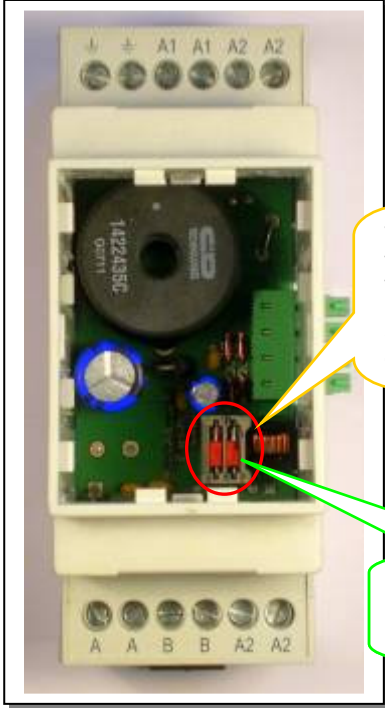
Note:
Some of the larger modules have slots on all sides

Note:
The 'default' setting that **all** modules are delivered in is termination **OFF**



All the I/O modules have a 3 way jumper to configure the termination impedance. Move the jumper to ON or OFF to configure

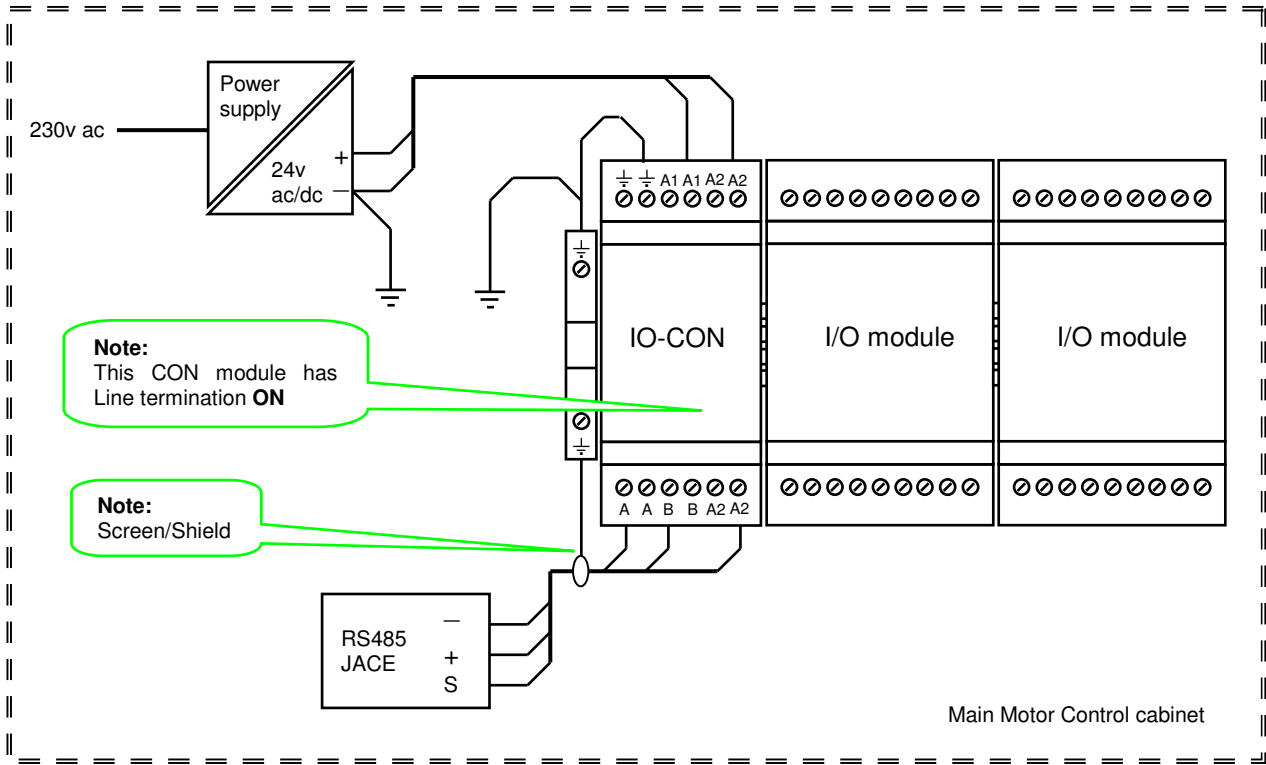
The I/O CON module has two switches to configure the termination impedance. Move both switches to either ON and OFF to configure

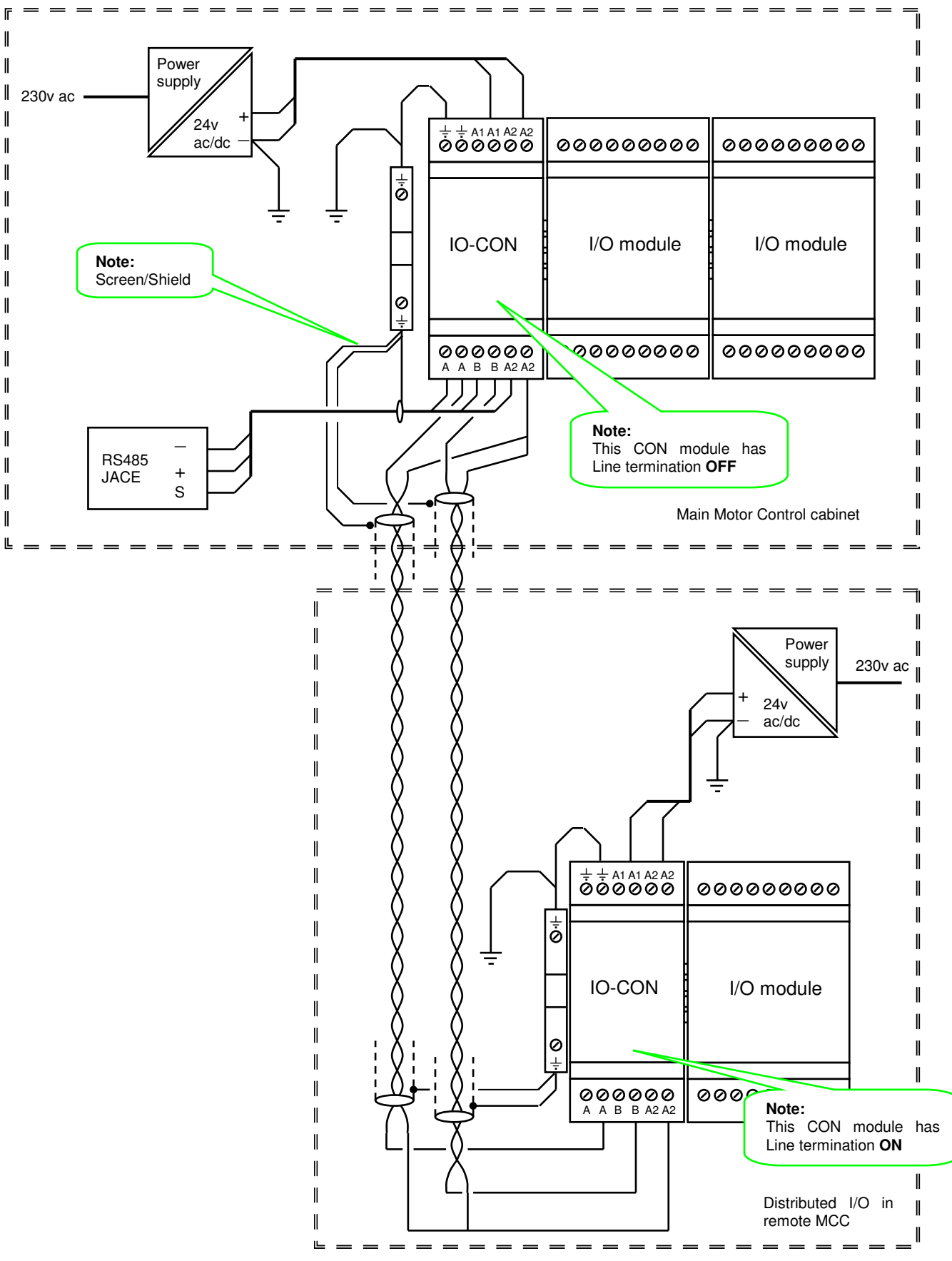


Note:
These are all shown in the 'OFF' condition

Network arrangements

The I/O modules may be situated local to the JACE® controller such as when a single motor control cabinet (MCC) is used to control main plant, or the modules may be situated remotely from the controller in separate MCC panels or a mixture of the two. 24v ac/dc power may be common or separate and the diagrams following show some typical arrangements:










LED Status

Each Vykon HVAC I/O module is provided with a status LED which indicates the current status of the module. The status LED can be found at the right hand top corner of every I/O module. The LED indicates the following status:



Note:
The IO-CON module does not have a communications address nor does it have a status LED



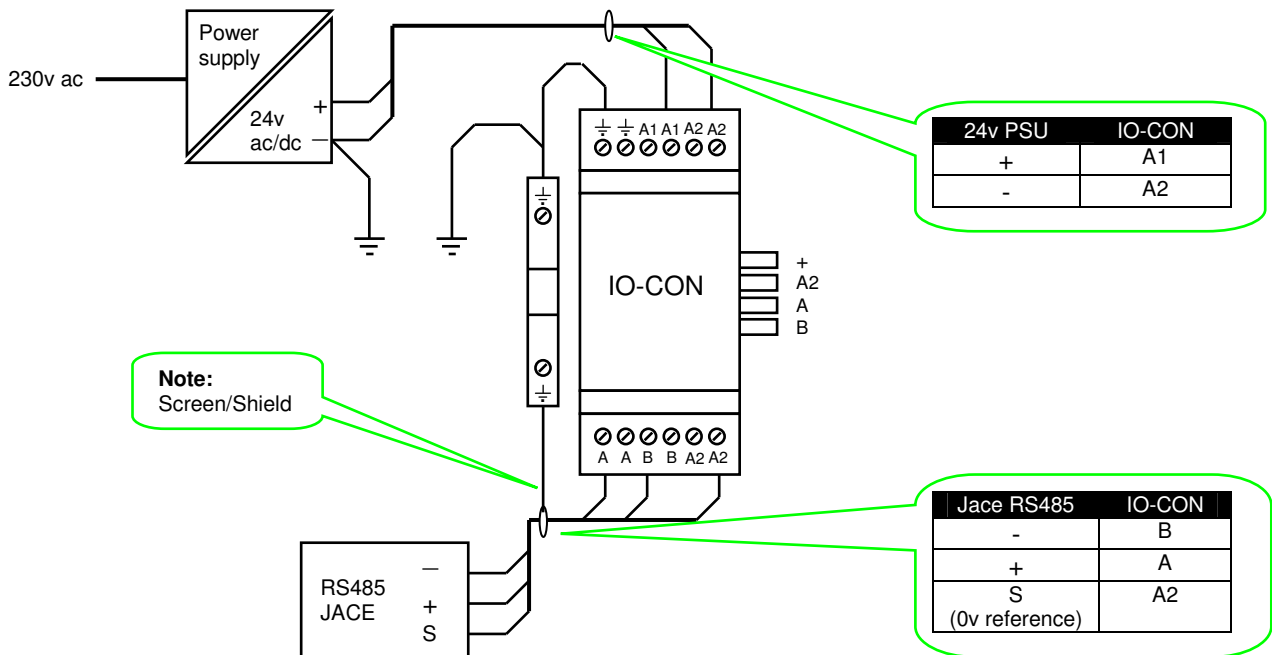
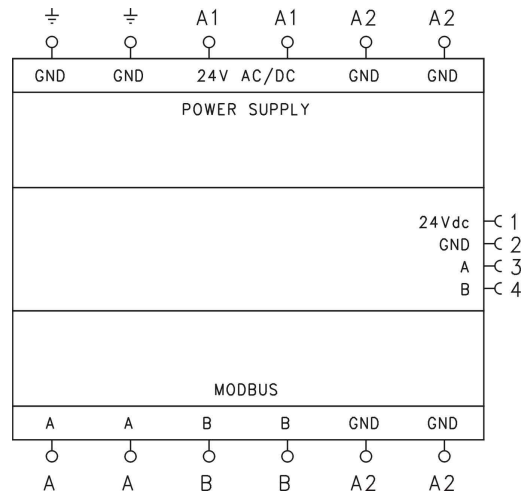
LED condition	Function	Cause	Check ...
Green 	Normal operation OK	-	-
Blinking Green 	Hand/off/auto switch active or sensor wire break detected	If it is an I/O-8AI, a sensor wire is broken, If not an I/O-8AI, a hand/off/auto switch is not in an 'Auto' position	...if it is an I/O-8AI, check the analogue sensor wiring, If it is not an I/O-8AI, check the hand/off/auto switches
Blinking Red 	No communications	Communications line fault	...the interconnection wiring, check line termination jumpers, check module address settings
Red 	Overload detection	Analogue output channels are overloaded (Applies to IO-4AOH-3DO and IO-MULTIIO)	...AO wiring and the analogue output devices. Each channel has a maximum load of 10mA
Blinking Amber 	Sensor wire break detected	A sensor wire is broken on the IO-MULTIIO	... the analogue sensor wiring on the IO-MULTIIO

Detailed module features

This section looks at each of the modules with relation to installation...

- IO-CON
- IO-10DI
- IO-6DOH-12DI
- IO-8AI
- IO-4AOH-3DO
- IO-4DO
- IO-MULTIO
- IO-2HILO

IO-CON



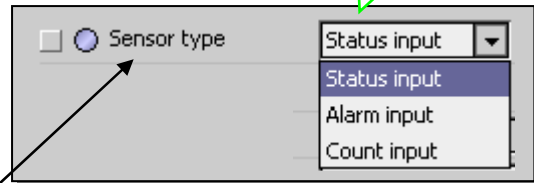
IO-10DI

Input status – Status input	
State	LED
Open contact = False	Off
Closed contact = True	Green

Input status – Alarm input	
State	LED
Open contact = False	Green
Closed contact = True	Red

Input status – Count input	
State	LED
Open contact = False	Off
Closed contact = True	Off

Note:
The LED condition is determined by the sensor type that is configured for the channel



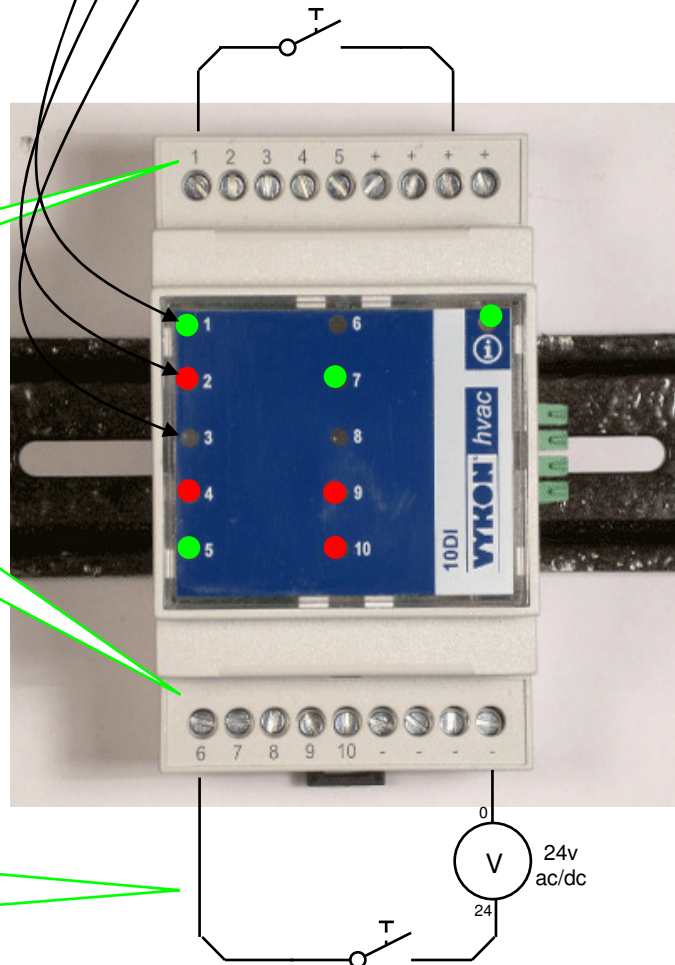
DI1	5-1 Floor pressure switch	Status input	true	1 +/24VAC
DI2	5-2 Fire alarm contact	Alarm input	true	2 +/24VAC
DI3	5-3 Digital pulse input	Count input	false	3 +/24VAC

Note:
The default input sense configuration of the digital input is illustrated on these input examples. The input sense may alternatively be inverted on individual channels

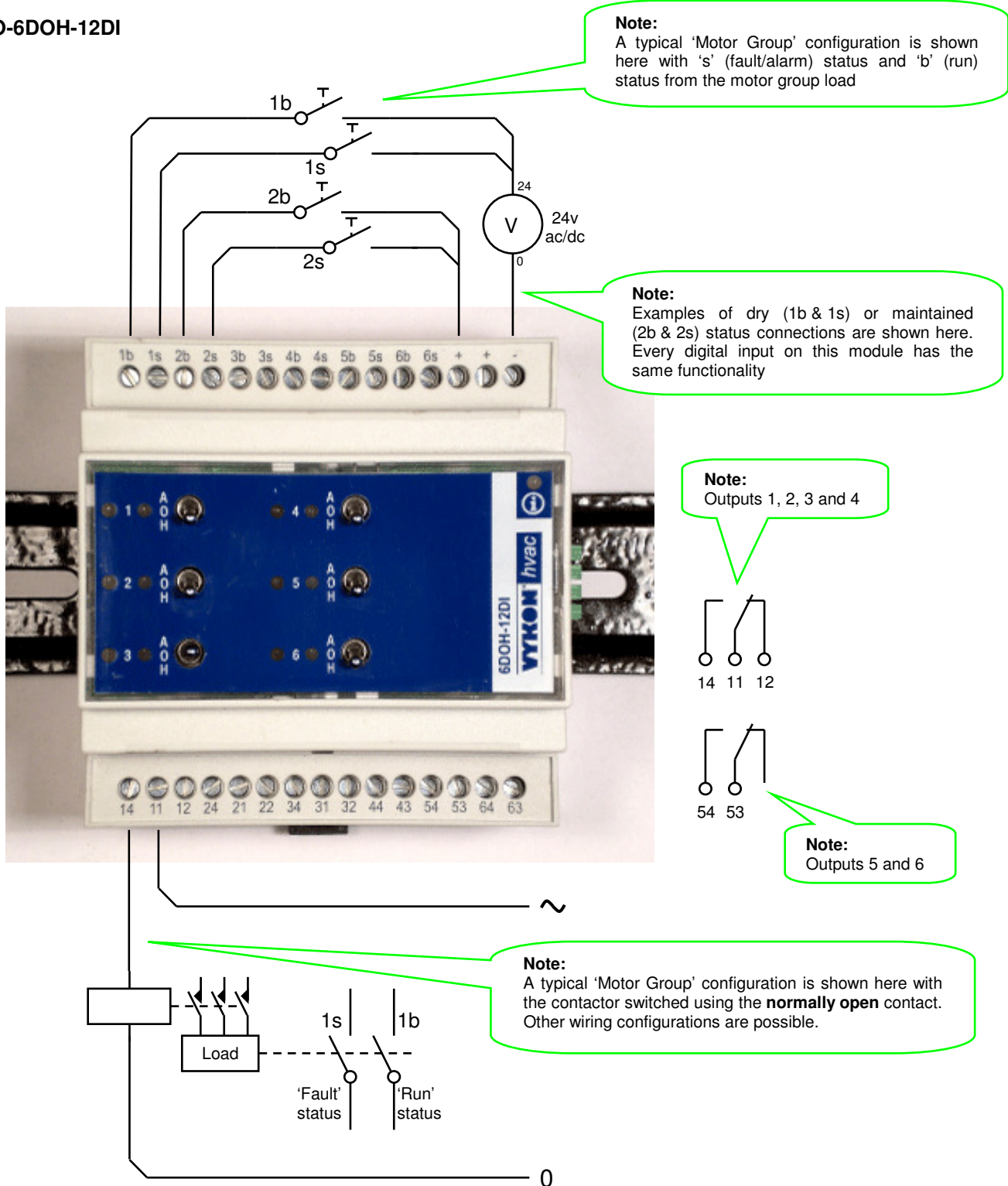
Note:
DI channels 1, 2, 3, 4 & 5

Note:
DI channels 6, 7, 8, 9 & 10

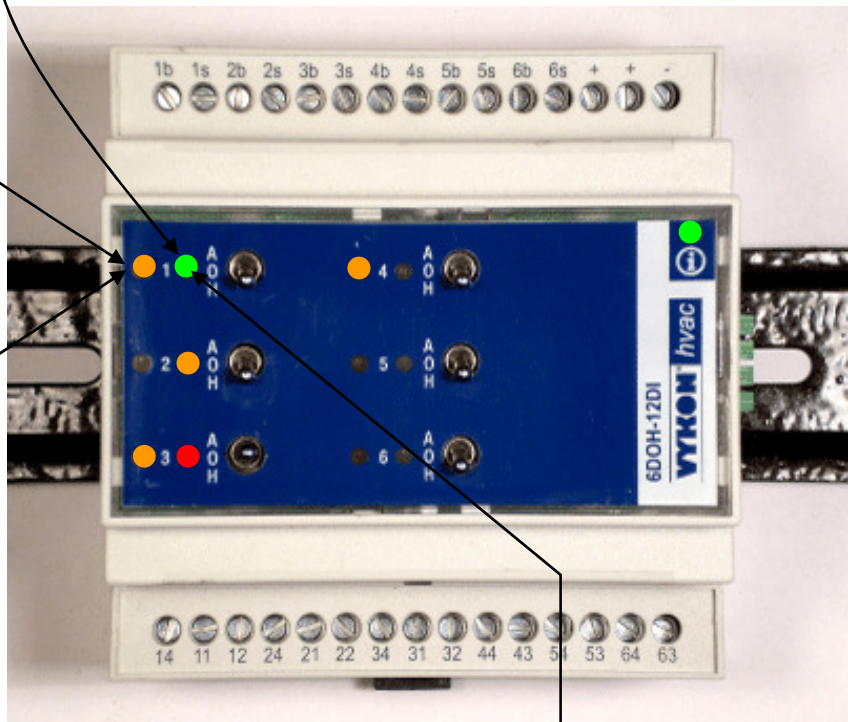
Note:
Examples of dry (DI1) or maintained (DI6) status connections are shown here. Every digital input on this module has the same functionality



IO-6DOH-12DI



DO1	20BL01 Boiler 1	Run+Alarm Used	● true	NO-14 P-11 NC-12
DI1 Running	Used by DO	Used by DO	● true	1b +/24VAC
DI1 Alarm	Used by DO	Used by DO	●	1s +/24VAC

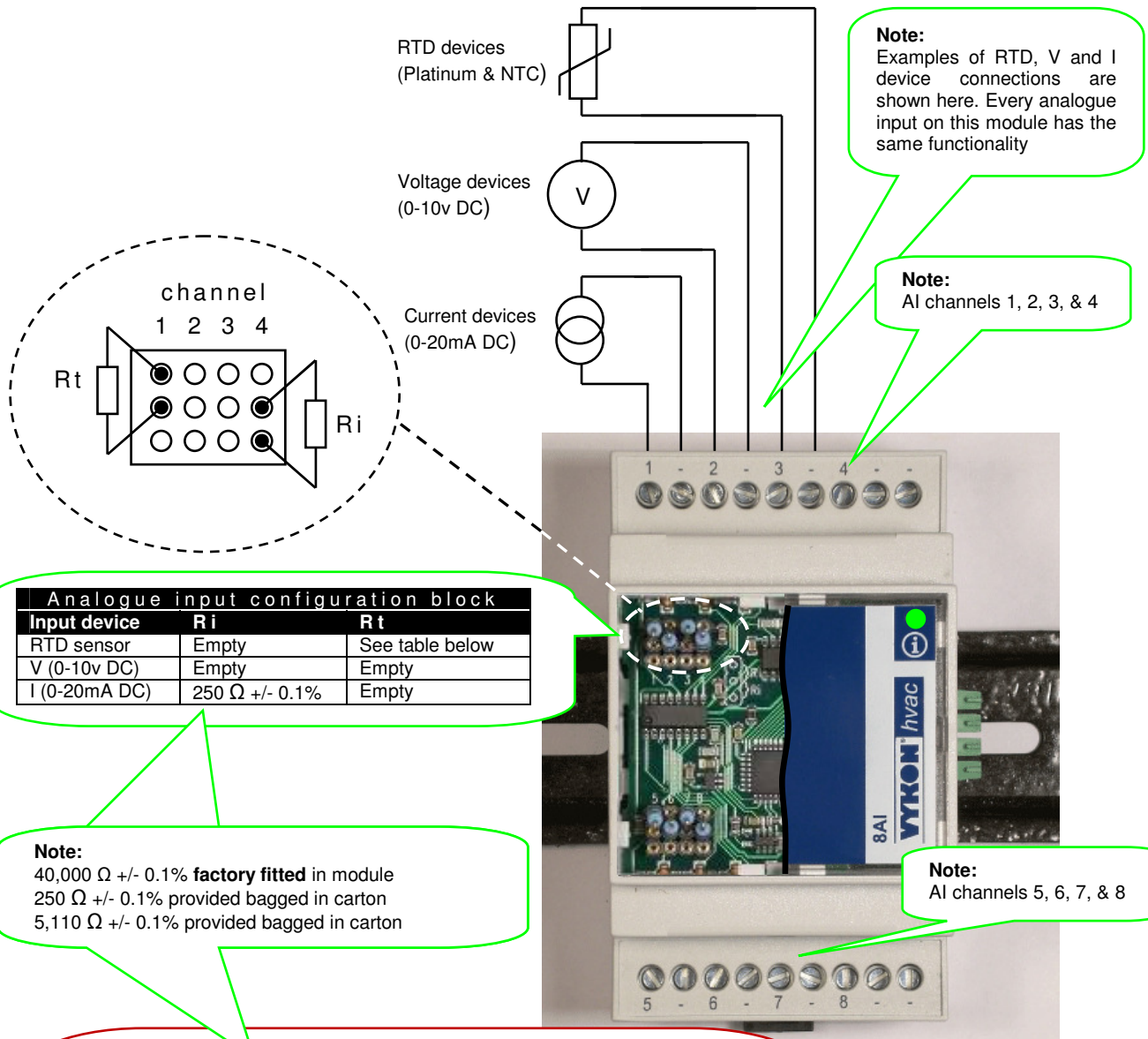


Output status	
State	LED
True	Orange
False	Off

Run and Fault/alarm status		
b (run)	s (fault)	LED
Closed contact = True	Open contact = (blank) no fault	Green
Open contact = False	Open contact = (blank) no fault	Off
Closed contact = True	Closed contact = Fault	Orange
Open contact = False	Closed contact = Fault	Red

Warning:
The single status LED provides an indication of the condition of both the run and fault/alarm inputs. Beware that if you use the inputs on this module as independent digital inputs, the LED status may not provide the expected independent digital input state indication

IO-8AI



Analogue input configuration block		
Input device	R_i	R_t
RTD sensor	Empty	See table below
V (0-10v DC)	Empty	Empty
I (0-20mA DC)	250 Ω +/- 0.1%	Empty

Note:
40,000 Ω +/- 0.1% **factory fitted** in module
250 Ω +/- 0.1% provided bagged in carton
5,110 Ω +/- 0.1% provided bagged in carton

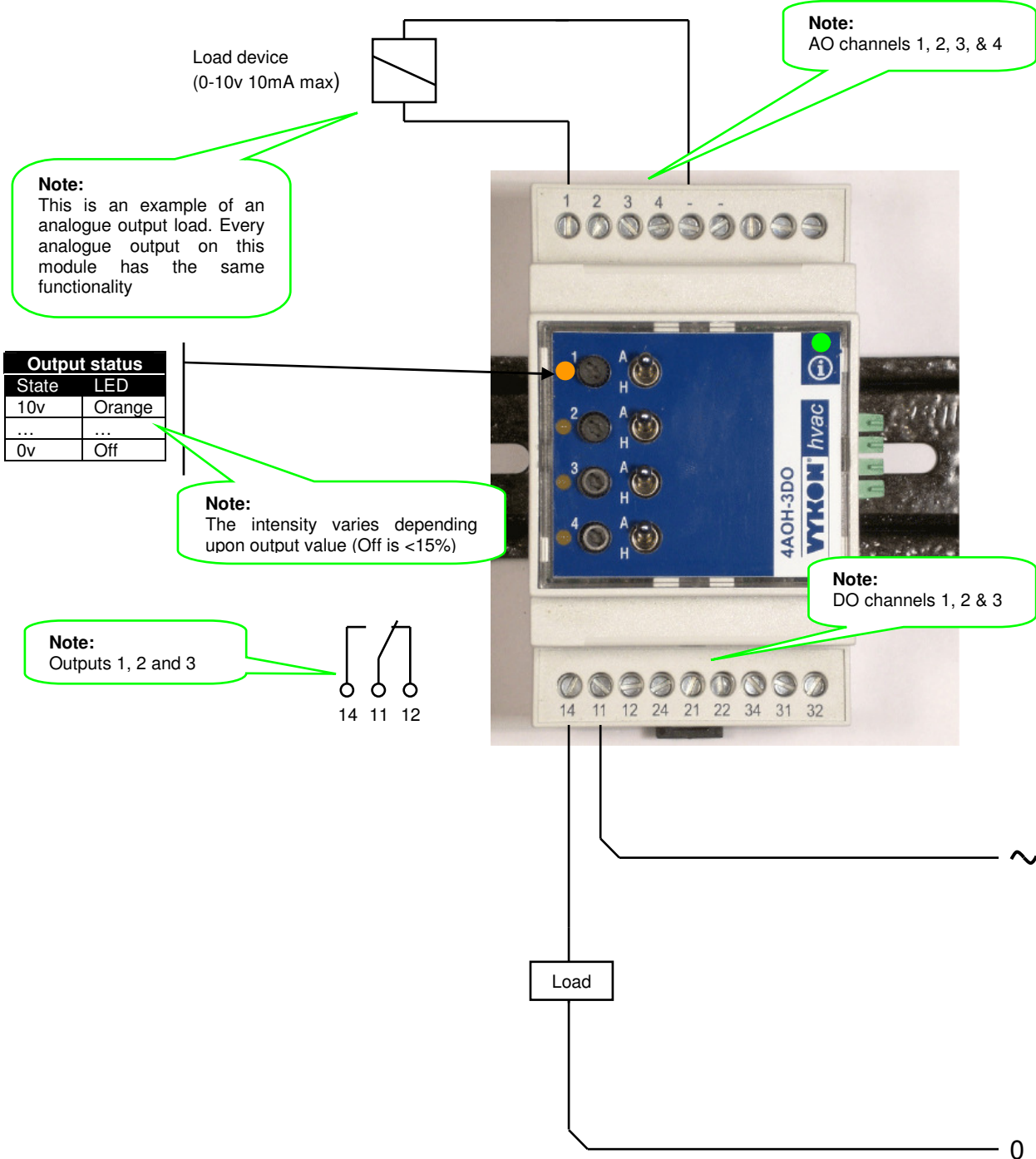
Sensor type	R_t	Sontay ref	Used by
Pt1000	5,110 Ω +/- 0.1%	E-PT1000A	Johnson Controls, Saia, Honeywell
Ni1000 (Landis & Gyr)	5,110 Ω +/- 0.1%	G-LAN1	Landis, Staefa, Siemens
Ni1000 (Standard)	5,110 Ω +/- 0.1%	F-NI1000	Various
NTC 1 (Lin)	40,000 Ω +/- 0.1%	H-SAT1	Satchwell, Invensys, TAC
NTC 1	40,000 Ω +/- 0.1%	10K3A1	Johnson Controls, Saia, Trend
NTC 3	40,000 Ω +/- 0.1%	10K4A1	Robertshaw, Siebe, Niagara "Type3 curve"
T1 (Staefa)	5,110 Ω +/- 0.1%	STA1	Staefa
NTC5K	40,000 Ω +/- 0.1%	----	Various

Sensor type
Voltage
Current
Pt1000
Ni1000 (Landis&Gyr)
Ni1000 (Standard)
User defined
NTC1(Lin)
NTC1
NTC3
T1 (Staefa)
NTC5K

Notes:

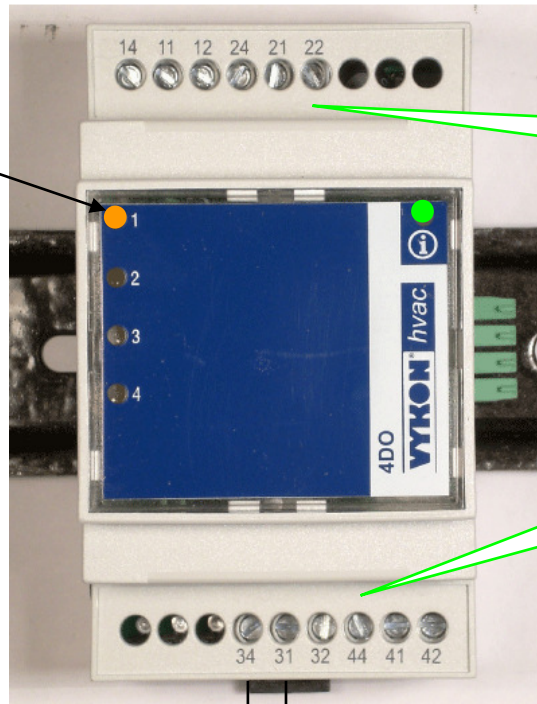
- It is **important** to use the correct R_t resistor for the appropriate sensor type
- Modules at software version less than v9.00 use a **factory fitted** 5,110 Ω for **all** sensor types

IO-4AOH-3DO



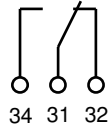
IO-4DO

Output status	
State	LED
True	Orange
False	Off



Note:
DO channels 1 & 2

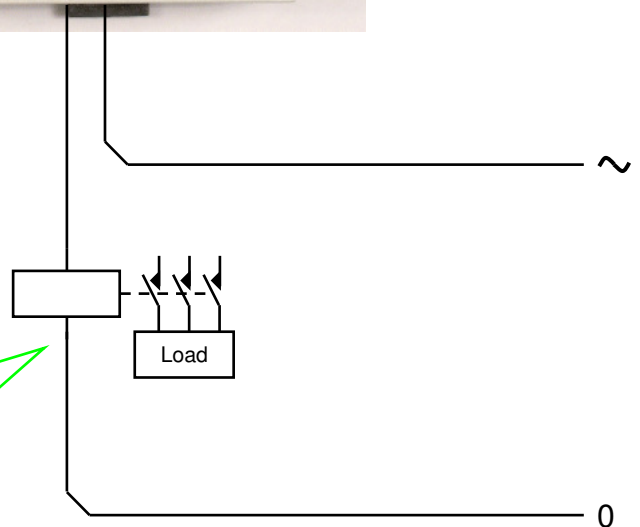
Note:
Outputs 1, 2, 3 and 4



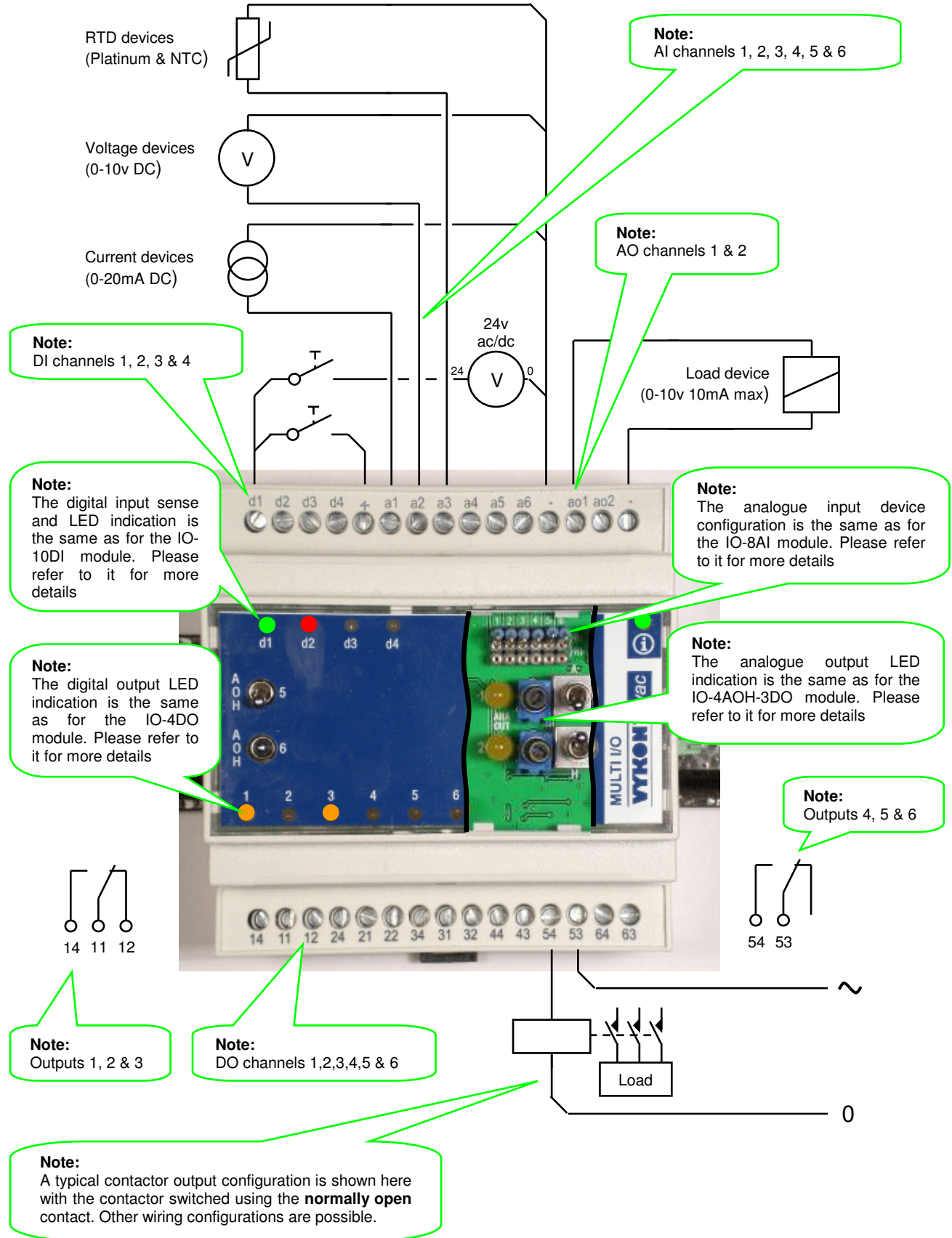
Note:
DO channels 3 & 4

Note:
This is an example of a digital output load. Every digital output on this module has the same functionality

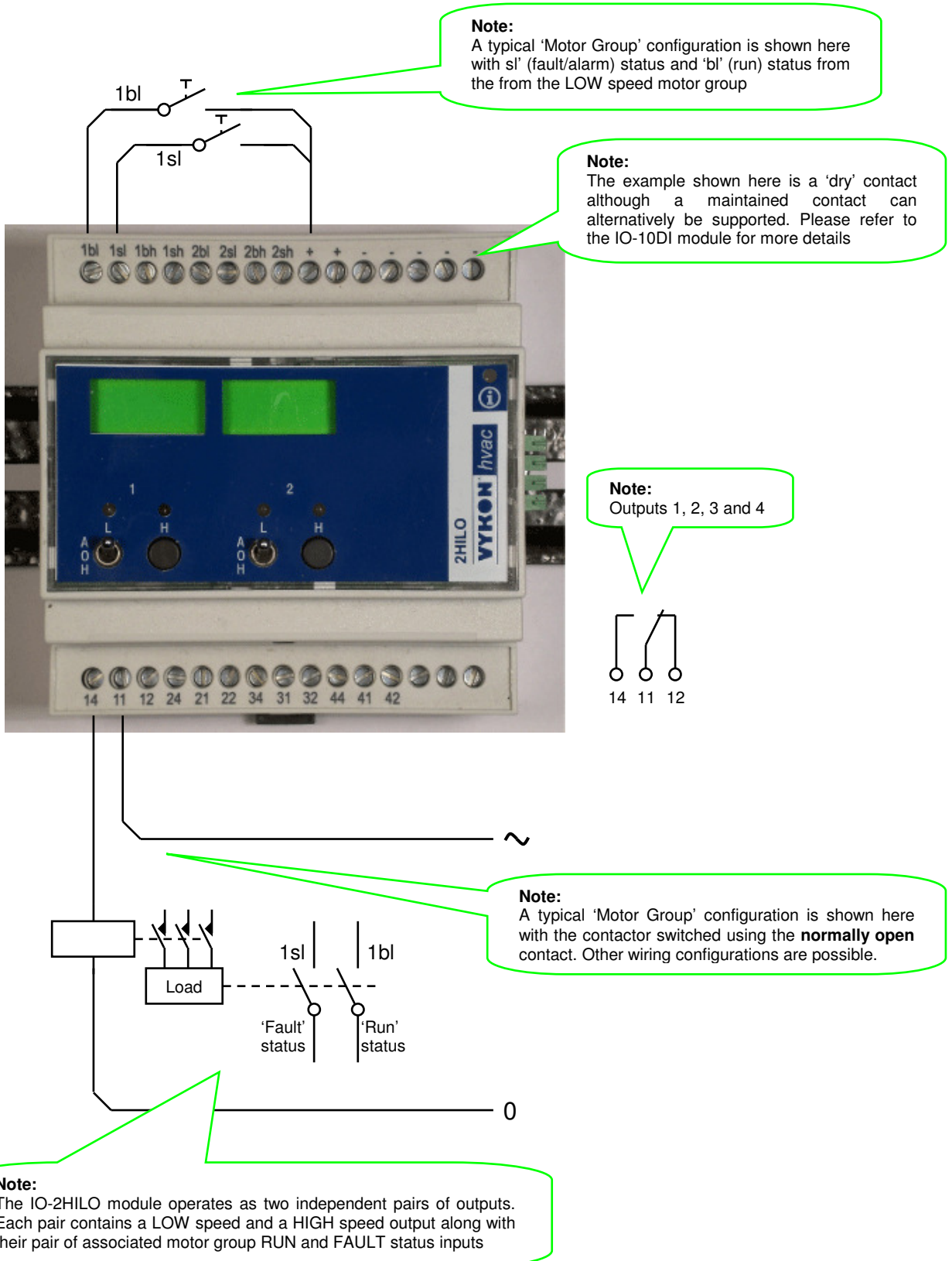
Note:
A typical contactor output configuration is shown here with the contactor switched using the **normally open** contact. Other wiring configurations are possible.



IO-MULTIIO



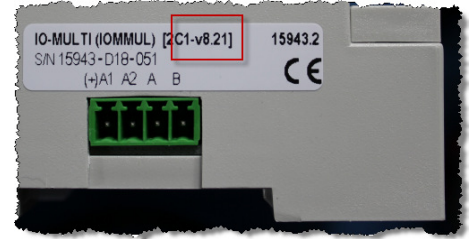
IO-2HILO



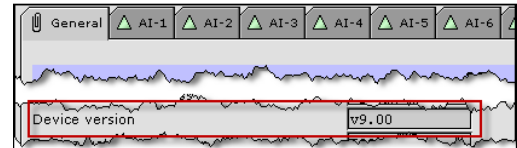
Module Version Control

There are two ways to identify a module's software version:

1. Visually on the label adjacent to the 4 way connector on the module side.
2. Modbus address 40001 (In Vykon HVAC, this is displayed in the General tab of the Module in the 'HVACModulesNetwork')



Register	M	D	Name	Notes
40001	0		Software version	x 0.01 = version number (e.g. 133 =v1.33)



Module Type	Hardware Generation	Software Version	Date	Details
10DI	1 st	v0.00 to v5.99		Original
	2 nd	v6.00		Clock speed increased
	2 nd	v7.00	Dec '06	
	2 nd	v7.10	Feb '09	Increased pulse count frequency, Factory defaults added
4DO	1 st	v0.00 to v6.99		Original
	1 st	v7.00	Dec '06	
	1 st	v7.10	Feb '09	Factory defaults added
8AI	1 st	v0.00 to v6.99		Original
	1 st	v7.00	Dec '06	Cable resistance added (+/- 20)
	2 nd	v8.00	Feb '08	More memory, Added NTC(1),(3),(1-Lin) sensors
	2 nd	v8.10	Mar '09	Factory defaults added, Power cycle to defaults added
	2 nd	v8.20	May '09	Added NTC5K, T1 sensors
	2 nd	v8.21	Dec '09	Cable resistance range increased (+/- 200)
6DOH-12DI	1 st	v0.00 to v7.00		Original
	1 st	v7.10	Feb '09	Filter added, Factory defaults added
	1 st	v7.11	Aug '09	Bug fix lighting toggle pulse
4AOH-3DO	1 st	v0.00 to v6.99		Original
	1 st	v7.00	Dec '06	
	1 st	v7.10	Feb '09	Factory defaults added
2HILO	1 st	v0.00 to v5.99		Original
	2 nd	v6.00		Clock speed increased
	2 nd	v7.10	Jan '07	Direct control of motor groups, low/high speed control
	2 nd	v7.11	Feb '09	Factory defaults added
MULTI IO	1 st	v0.00 to v5.99		Original
	2 nd	v6.00		Clock speed increased
	2 nd	v7.00	Dec '06	Cable resistance added (+/- 20)
	2 nd	v7.10	Feb '08	AI channel output out of range -50°C
MULTI IO	3 rd	v8.00	Feb '08	Ruggedised, More memory, Added NTC(1),(3),(1-Lin) sensors
	3 rd	v8.10	Mar '09	Factory defaults added, Power cycle to defaults added
	3 rd	v8.20	May '09	Added NTC5K, T1 sensors
	3 rd	v8.21	Dec '09	Cable resistance range increased (+/- 200)
	3 rd	v9.00	July '11	RT resistor and tables changed to reduce self heating effect

Regulations and approvals

WEEE (Waste of Electrical and Electronic Equipment)

Recycling of Electronic Products: (International Installations)

In 2006 the European Union adopted regulations (WEEE) for the collection and recycling of all waste electrical and electronic equipment. It is no longer allowable to simply throw away such equipment. Instead, these products must enter the recycling process. To properly dispose of this product, please take it to a local recycling centre. If a local recycling centre cannot be found, please return it to this office:

Tridium Europe Ltd.
1, The Grainstore
Brooks Green Road
Coolham, West Sussex
RH13 8GR United Kingdom

CE marking

The **CE marking** is a mandatory conformance mark on many products placed on the single market in the European Economic Area (EEA). The **CE marking** certifies that a product has met EU consumer safety, health or environmental requirements.



Application of Council Directive: 89/336/EEC, 92/31/EEC, 73/23/EEC, 93/68/EEC
Product Model Number: 4DO, 10DI, 8AI, 6DOH-12DI, 4AO-3DO, MULTI-IO, 2HILO
Type of Equipment: Information Technology Equipment

EMC standards applied:

Standard	Description	Criteria Met
EN 61000-6-4 EN 61000-6-2 and EN 61000-6-1, as defined below EN 50081-2	Electro-Magnetic Compatibility Emissions Electro-Magnetic Compatibility Generic Emission Standard for residential, commercial and light industrial environment	Generic Immunity Complies Complies, as documented below
CISPR 11	Limits of Radio Disturbance – Radiated Emissions Limits of Radio Disturbance – Conducted Emissions E.S.D.	Pass Class A Pass Class A Pass Criteria A Pass Criteria A
IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4	Radiated Field Immunity Electrical Fast Transient Immunity (signal Ports) Electrical Fast Transient Immunity (AC-Power)	Pass Criteria A Pass Criteria A Pass Criteria A
IEC 61000-4-5 IEC 61000-4-6 EN 61000-3-2 EN 61000-3-3	Surge Immunity Conducted Immunity Harmonic Current Quasi-Stationary Harmonics Test, Voltage Fluctuation and Flicker	Pass Pass Criteria A Pass Pass
IEC 61000-4-11 IEC 61010-10-1: 90 + A1:92 + A2:95	Voltage Dips, Voltage Interrupts Safety requirement for electrical equipment for Measurement, control and laboratory use	Pass Pass Criteria A Pass

Notes:

CISPR 11 was a standard originally from the Comite International Special des Perturbations Radioelectriques (CISPR). The International Electrotechnical Committee (IEC) now supports this, which is a radio-frequency EMC standard for industrial, scientific and medical equipment operating in the frequency range 0 Hz to 400 GHz and to domestic and similar appliances designed to generate and/or use locally radio-frequency energy.

IEC 61000 covers Electromagnetic compatibility (EMC)

EN 61326, “Electrical equipment for measurement, control and laboratory use” embracing equipment intended for professional, industrial process and educational usage

Related documents

No	Reference	Title

Document Control

Document release	Date	Comments
1	7 th May '08	First issue (JB)
2	15 th May '08	Added sensor type references (JB)
3	30 th Sep '08	Rewritten (JB)
4	8 th Jan '10	Removed JACE [®] product references and I/O module order codes. Changed header note to Partner Information (JB)
5	14 th Apr '11	Added Regulations and Approvals, WEEE and CE, Removed references to Jace2, Updated Calculator images (JB)
6	19 th Apr '11	Add external 24v dc/ac DI contact wiring and cautionary DI compatibility note to 6DOH-12DI. Updated AI sensor types table. (JB)
7	27 th Jul '11	Updated IO-8AI to include Rt changes for v9.00. Added Module Version Control. Removed blank pages (JB)

Prepared by	John Brown e-mail: jbrown@tridium.com	Authorised by	AJ
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