

**Vykon HVAC**

**I/O module communications**

**guide**

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## 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® connectivity to enterprise applications.

The Vykon HVAC range of I/O modules are designed for use as local I/O within motor control cabinets or as remote I/O connected via RS485 Modbus. The wide variety of modules enables cost-effective use in a range of applications, and LED's plus Hand/Off/Auto switches on some varieties help with commissioning. The IP20 rated modules may be plugged together on standard DIN rail or direct mounting; the cascable design allows power and 2-wire RS485 Modbus communications to connect through without any extra wiring.

## Scope

This document is a communications reference guide for Vykon HVAC and details the communications protocol for each of the I/O modules. Some use examples are also included.

- Digital input module – 10DI (IOMDIP)
- Digital output module – 4DO (IOMDOP)
- Analogue input module – 8AI (IOMAIP)
- Digital input and output module – 6DOH-12DI (IOMDIO)
- Analogue and digital output module – 4AOH-3DO (IOMADO)
- Digital output module – 2HILO (IOM2HL)
- Mixed I/O module – MULTI I/O (IOMMUL)

## Digital input module – 10DI (IOMDIP)

### Overview

The Vykon HVAC 10DI module supports 10 independent digital inputs with input voltages up to 24v ac or dc. The module also provides a voltage source that can be used for applications using volt-free contacts. Each digital input has a bi-colour LED which indicates the current status of the connected device.

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	Notes as to the use and operation of register and its value... <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Input channel profile: 0=Status (<b>Green LED</b> on when true); 1=Alarm (<b>Red LED</b> on when true); 2=Counter (No LED)</li> <li>▪ Bit 0...9; Bit 0=Input1; Bit 1=Input2;...Bit 9= Input10</li> <li>▪ Write count command: Each input count can be preset to a value by the Modbus master. The value is incremented from its preset value when the write count command is received</li> <li>▪ Input channel count value: Current count value or the preset count value if the write count command is received</li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A ✓ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of "Use Examples" which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module's modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40101	100	Input channel status	Bit 0...9;	R	W	0	0	1	
40111	110	LED colour	Bit 0...9; FALSE=Green; TRUE=Red	R	W	0	0	1	
40112	111	LED status	Bit 0...9; FALSE=Off; TRUE=On	R	W	0	0	1	
40341	340	Input channel 1 profile	0, 1 or 2	R/W	I	0	0	2	✓
40342	341	Input channel 2 profile	0, 1 or 2	R/W	I	0	0	2	✓
40343	342	Input channel 3 profile	0, 1 or 2	R/W	I	0	0	2	✓
40344	343	Input channel 4 profile	0, 1 or 2	R/W	I	0	0	2	✓
40345	344	Input channel 5 profile	0, 1 or 2	R/W	I	0	0	2	✓
40346	345	Input channel 6 profile	0, 1 or 2	R/W	I	0	0	2	✓
40347	346	Input channel 7 profile	0, 1 or 2	R/W	I	0	0	2	✓
40348	347	Input channel 8 profile	0, 1 or 2	R/W	I	0	0	2	✓
40349	348	Input channel 9 profile	0, 1 or 2	R/W	I	0	0	2	✓
40350	349	Input channel 10 profile	0, 1 or 2	R/W	I	0	0	2	✓
40359	358	Write count command	Bit 0...9; FALSE=NoOverwrite; TRUE=Overwrite	R/W	W	0	0		
40360	359	Input channel sense	Bit 0...9; FALSE=Normal; TRUE=Invert	R/W	W	0	0	65535	✓
40361	360	Input channel 1 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40362	361	Input channel 2 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40363	362	Input channel 3 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40364	363	Input channel 4 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40365	364	Input channel 5 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40366	365	Input channel 6 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40367	366	Input channel 7 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40368	367	Input channel 8 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40369	368	Input channel 9 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40370	369	Input channel 10 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓

## Digital output module – 4DO (IOMDOP)

### Overview

The Vykon HVAC 4DO module provides 4 independent 240vac/16A rated digital relay output channels each with change over contact configuration. Each digital output has a yellow LED which indicates the current status of the connected device.

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	Notes as to the use and operation of register and its value... <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Bit 0...3; Bit 0=Output1; Bit 1=Output2; Bit 2= Output3; Bit 3= Output4</li> <li>▪ Set output channel value: Bit 0...5; FALSE=Relay off; TRUE=Relay on</li> <li>▪ Output channel (comm fail): Output channel value in a communications failure condition: 0=off; 1=on; 2=(do nothing)</li> <li>▪ Write hours count command: Bit 0...5; FALSE=No overwrite; TRUE=Overwrite hours counter with preset value</li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A ✓ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of “Use Examples” which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module’s modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40101	109	Channel1 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40111	110	Channel1 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40112	111	Channel2 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40113	112	Channel2 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40114	113	Channel3 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40115	114	Channel3 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40116	115	Channel4 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40117	116	Channel4 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40301	300	Set output channel value	Bit 0...3; FALSE=Relay off; TRUE=Relay on	R/W	W				
40311	310	Output channel 1 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40312	311	Output channel 2 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40313	312	Output channel 3 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40314	313	Output channel 4 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40350	349	Write hours count command	Bit 0...5; FALSE=No overwrite TRUE=Overwrite	R/W	W				
40351	350	Channel1 on count preset	Preset value	R/W	I	0	0	65535	
40352	351	Channel1 off count preset	Preset value	R/W	I	0	0	65535	
40353	352	Channel2 on count preset	Preset value	R/W	I	0	0	65535	
40354	353	Channel2 off count preset	Preset value	R/W	I	0	0	65535	
40355	354	Channel3 on count preset	Preset value	R/W	I	0	0	65535	
40356	355	Channel3 off count preset	Preset value	R/W	I	0	0	65535	
40357	356	Channel4 on count preset	Preset value	R/W	I	0	0	65535	
40358	357	Channel4 off count preset	Preset value	R/W	I	0	0	65535	

## Analogue input module – 8AI (IOMAIP)

### Overview

The Vykon HVAC 8AI module supports 8 independent analogue inputs which can be used with a wide variety of voltage, current and resistive temperature detector (RTD) devices.

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	Notes as to the use and operation of register and its value... <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Bit 0...7; Bit 0=Input1; Bit 1=Input2; Bit 2= Input3; Bit 7= Input8</li> <li>▪ Sensor type: 0=0 to10v; 1=0ma to 20ma; 2=RTD (Pt1000); 3=RTD (Ni1000 Siemens); 4=RTD (Ni1000 standard); 5=Reserved; 6=NTC1(Lin); 7=NTC1; 8=NTC3; 9=T1(Staefa); 10=NTC5K</li> <li>▪ Scaled value of sensor:               <ul style="list-style-type: none"> <li>○ Value <math>\times 10^{-1}</math> (234 = 23.4°C) (only applies when sensor type&gt;1)</li> <li>○ Value <math>\times 1</math> (0 = 0v, 1000 = 10v ) (only applies when sensor type&lt;2)</li> </ul> </li> <li>▪ Channel cable offset resistance: Resistance <math>\text{value} \times 10^{-1} \Omega</math> (e.g. 567 = 56.7 <math>\Omega</math> )(only applies when sensor type&gt;1)</li> <li>▪ Channel maximum real value: Scaled value corresponding to100% input value (only applies when sensor type&lt;2)</li> <li>▪ Channel minimum real value: Scaled value corresponding to 0% input value (only applies when sensor type&lt;2)</li> <li>▪ Channel offset: Scaled offset value. (only applies when sensor type&lt;2)</li> <li>▪ Celsius/Fahrenheit real value: Passive sensors only</li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A ✓ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of “Use Examples” which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module’s modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40101	100	Channel1 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40102	101	Channel2 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40103	102	Channel3 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40104	103	Channel4 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40105	104	Channel5 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40106	105	Channel6 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40107	106	Channel7 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40108	107	Channel8 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40121	120	Wire break detection	Bit 0...7; FALSE=wire OK, TRUE=wire broken	R	W	0	0	1	
40341	340	Channel 1 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40342	341	Channel 2 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40343	342	Channel 3 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40344	343	Channel 4 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40345	344	Channel 5 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40346	345	Channel 6 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40347	346	Channel 7 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40348	347	Channel 8 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40351	350	Channel1 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40352	351	Channel2 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40353	352	Channel3 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40354	353	Channel4 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40355	354	Channel5 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40356	355	Channel6 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40357	356	Channel7 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40358	357	Channel8 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40360	359	Wire break detection on/off	Bit 0...7; FALSE=inactive, TRUE=active	R	W	0	0	1	
40361	360	Channel1 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40362	361	Channel2 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40363	362	Channel3 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40364	363	Channel4 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40365	364	Channel5 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40366	365	Channel6 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40367	366	Channel7 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40368	367	Channel8 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40371	370	Channel1 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40372	371	Channel2 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40373	372	Channel3 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40374	373	Channel4 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40375	374	Channel5 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40376	375	Channel6 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40377	376	Channel7 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40378	377	Channel8 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40381	380	Channel1 offset	Scaled offset value	R/W	I	0	0	1000	✓
40382	381	Channel2 offset	Scaled offset value	R/W	I	0	0	1000	✓
40383	382	Channel3 offset	Scaled offset value	R/W	I	0	0	1000	✓
40384	383	Channel4 offset	Scaled offset value	R/W	I	0	0	1000	✓
40385	384	Channel5 offset	Scaled offset value	R/W	I	0	0	1000	✓
40386	385	Channel6 offset	Scaled offset value	R/W	I	0	0	1000	✓
40387	386	Channel7 offset	Scaled offset value	R/W	I	0	0	1000	✓
40388	387	Channel8 offset	Scaled offset value	R/W	I	0	0	1000	✓

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40407	406	Celsius/Fahrenheit real value	Bit 0...7; FALSE= °C , TRUE= °F	R/W	W	0	0	1	✓
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## Digital input and output module – 6DOH-12DI (IOMDIO)

### Overview

The Vykon HVAC 6DOH-12DI module provides 6 independent 240vac/8A rated digital relay output channels with hand-off-auto override switches. Each output channel has a pair of digital input channels for contactor run and alarm status. Each output has a yellow LED and each input has a bi-colour LED to indicate the current status of the connected devices.

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	Notes as to the use and operation of register and its value... <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Bit 0...5; Bit 0=Output1; Bit 1=Output2; Bit 2= Output3; Bit 3= Output4; Bit 4= Output5; Bit 5= Output6</li> <li>▪ Set output channel value: Bit 0...5; FALSE=Relay off; TRUE=Relay on</li> <li>▪ Output channel (comm fail): Output channel value in a communications failure condition: 0=off; 1=on; 2=(do nothing)</li> <li>▪ Output channel profile: 0=normal operation; 1=lighting control; 2=pulse control; 3=off delay</li> <li>▪ Write hours count command: Bit 0...5; FALSE=No overwrite; TRUE=Overwrite hours counter with preset value</li> <li>▪ Prohibit local override: Prevent the hand-off-auto switch overriding output. (only applies when output channel profile&gt;0)</li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A ✓ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of “Use Examples” which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module’s modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40101	100	Override switch position	Bit 0...5; FALSE=hand, TRUE=auto	R	W				
40102	101	Fault contact (S) status	Bit 0...5; FALSE=normal, TRUE=fault	R	W				
40103	102	Run contact (B) status	Bit 0...5; FALSE=not running, TRUE=running	R	W				
40104	103	Relay status	Bit 0...5; FALSE=open, TRUE=closed	R	W				
40110	109	Output channel1 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40111	110	Output channel1 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40112	111	Output channel2 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40113	112	Output channel2 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40114	113	Output channel3 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40115	114	Output channel3 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40116	115	Output channel4 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40117	116	Output channel4 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40118	117	Output channel5 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40119	118	Output channel5 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40120	119	Output channel6 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40121	120	Output channel6 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40301	300	Set output channel value	Bit 0...5; FALSE=Relay off; TRUE=Relay on	R/W	W				
40311	310	Output channel 1 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40312	311	Output channel 2 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40313	312	Output channel 3 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40314	313	Output channel 4 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40315	314	Output channel 5 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40316	315	Output channel 6 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40341	340	Output channel 1 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40342	341	Output channel 2 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40343	342	Output channel 3 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40344	343	Output channel 4 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40345	344	Output channel 5 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40346	345	Output channel 6 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40350	349	Write hours count command	Bit 0...5; FALSE=No overwrite TRUE=Overwrite						
40351	350	Channel1 on count preset	Preset value	R/W	I	0	0	65535	
40352	351	Channel1 off count preset	Preset value	R/W	I	0	0	65535	
40353	352	Channel2 on count preset	Preset value	R/W	I	0	0	65535	
40354	353	Channel2 off count preset	Preset value	R/W	I	0	0	65535	
40355	354	Channel3 on count preset	Preset value	R/W	I	0	0	65535	
40356	355	Channel3 off count preset	Preset value	R/W	I	0	0	65535	
40357	356	Channel4 on count preset	Preset value	R/W	I	0	0	65535	
40358	357	Channel4 off count preset	Preset value	R/W	I	0	0	65535	
40359	358	Channel5 on count preset	Preset value	R/W	I	0	0	65535	
40360	359	Channel5 off count preset	Preset value	R/W	I	0	0	65535	
40361	360	Channel6 on count preset	Preset value	R/W	I	0	0	65535	
40362	361	Channel6 off count preset	Preset value	R/W	I	0	0	65535	
40363	362	Channel1 off delay preset	Preset value	R/W	I	120	0	65535	✓
40364	363	Channel2 off delay preset	Preset value	R/W	I	120	0	65535	✓
40365	364	Channel3 off delay preset	Preset value	R/W	I	120	0	65535	✓
40366	365	Channel4 off delay preset	Preset value	R/W	I	120	0	65535	✓
40367	366	Channel5 off delay preset	Preset value	R/W	I	120	0	65535	✓
40368	367	Channel6 off delay preset	Preset value	R/W	I	120	0	65535	✓
40369	368	Prohibit local override	Bit 0...5; FALSE=Enable; TRUE=Prohibit	R/W	W	0	0	1	

## Analogue and digital output module – 4AOH-3DO (IOMADO)

### Overview

The Vykon HVAC 4AOH-3DO module provides 4 independent analogue output channels with hand-auto override switches and setting potentiometers. Each output has a yellow LED. The module also provides 3 independent 240vac/8A rated digital relay output channels each with change over contact configuration.

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	Notes as to the use and operation of register and its value... <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Bit 0...3; Bit 0=Output1; Bit 1=Output2; Bit 2= Output3; Bit 3= Output4</li> <li>▪ Set digital o/p channel value: Bit 0...2; FALSE=Relay off; TRUE=Relay on</li> <li>▪ Digital o/p ch 1 (comm fail): Output channel value in a communications failure condition: 0=off; 1=on; 2=(do nothing)</li> <li>▪ Analogue o/p ch 1 (comm fail): Output channel value in a communications failure condition: Value (x 10<sup>-3</sup>)</li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A ✓ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of “Use Examples” which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module’s modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40101	100	Override switch position	Bit 0...3; FALSE=hand, TRUE=auto	R	I				
40102	101	Analogue channel1 feedback	Value (x 10 <sup>-3</sup> )	R	I	0	0	1000	
40103	102	Analogue channel2 feedback	Value (x 10 <sup>-3</sup> )	R	I	0	0	1000	
40104	103	Analogue channel3 feedback	Value (x 10 <sup>-3</sup> )	R	I	0	0	1000	
40105	104	Analogue channel4 feedback	Value (x 10 <sup>-3</sup> )	R	I	0	0	1000	
40106	105	Analogue outputs in overload	Bit 0...3; FALSE=normal, TRUE=overload	R	W	0	0	1	
40301	300	Analogue channel1 set value	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	
40302	301	Analogue channel2 set value	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	
40303	302	Analogue channel3 set value	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	
40304	303	Analogue channel4 set value	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	
40309	308	Set digital o/p channel value	Bit 0...2; FALSE=Relay off; TRUE=Relay on	R/W	W				
40311	310	Analogue o/p ch 1 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40312	311	Analogue o/p ch 2 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40313	312	Analogue o/p ch 3 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40314	313	Analogue o/p ch 4 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40318	317	Digital o/p ch 1 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40319	318	Digital o/p ch 2 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40320	319	Digital o/p ch 3 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓

### Digital output module – 2HILO (IOM2HL)

#### Overview

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

#### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	<p>Notes as to the use and operation of register and its value...</p> <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Language selection: Used for presenting status information on LCD display; 0 = Dutch; 1 = English</li> <li>▪ Override switch position:... <ul style="list-style-type: none"> <li>○ Bit 0 = not auto/auto motor group 1</li> <li>○ Bit 1 = Manual Off/On motorgroup 1</li> <li>○ Bit 4 = not auto/auto motor group 2</li> <li>○ Bit 5 = Manual Off/On motorgroup 2</li> </ul> </li> <li>▪ Fault contact (S) status: Corresponds to terminals 1SL, 1SH, 2SL and 2SH</li> <li>▪ Run contact (B) status: Corresponds to terminals 1BL, 1BH, 2BL and 2BH</li> <li>▪ Motor group (comm fail): Output value in a communications failure condition: 0=off; 1=low; 2=high; 3=(do nothing)</li> <li>▪ Motor group profile : Details how the motor group will be controlled. Either with or without the 'low' output controlled... <ul style="list-style-type: none"> <li>○ 0= 'high' without 'low' output activated</li> <li>○ 1= 'high' with 'low' output activated</li> <li>○ 2 = direct switching of corresponding outputs , with 'low' output activated (feedback guarding is not active)]</li> </ul> </li> <li>▪ Input channel sense: Bit 0...7; Bit0=1BL, Bit1=1SL, Bit2=1BH, Bit3=1SH, Bit4=2BL Bit5=2SL, Bit6=2BH, Bit7=2SH</li> <li>▪ Motor group 'idle' timer: Time in OFF position in 0.1 sec. - 'Low' can be switched on after this timer has expired.</li> <li>▪ Write hours count command: Bit 0...3; FALSE=No overwrite; TRUE=Overwrite hours counter with preset value... <ul style="list-style-type: none"> <li>○ Bit 0 = reg 40104 - Motor group 1 low count</li> <li>○ Bit 1 = reg 40105 - Motor group 2 low count</li> <li>○ Bit 2 = reg 40106 - Motor group 1 high count</li> <li>○ Bit 3 = reg 40107 - Motor group 2 high count</li> </ul> </li> <li>▪ Use feedback from Run status: Bit 0 ..3 Corresponds to terminals 1BL, 1BH, 2BL &amp; 2BH; FALSE=don't use, TRUE=use</li> <li>▪ Motor gp 'low/(high)' alarm timer: Timer-on-delay is used to guard feedback from 'low/(high)'. (in 0.1 sec). It is only used when 40317 has selected the relevant low/(high) motor group - as 'use'</li> <li>▪ Reset alarm(s): Bit 0 and 1 correspond with feedback alarms 'FA-1x and FA-2x; reset performed on a rising edge</li> <li>▪ Maintain active during fault: Bit 0 ..3 correspond with 1SL, 1SH, 2SL and 2SH... <ul style="list-style-type: none"> <li>○ FALSE=switch off relay when corresponding fail contact is activated</li> <li>○ TRUE=maintain relay condition while fail contact is activated</li> </ul> </li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A ✓ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of "Use Examples" which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module's modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40054	53	LCD language type	0=Dutch, 1=English	R/W	I	0	0	65535	✓
40101	100	Override switch position	Bit 0,1 motorgroup1 & Bit 4,5 motorgroup2	R	W				
40102	101	Status motor group 1	0 = off; 1 = low; 2 = high	R	I				
40103	102	Status motor group 2	0 = off; 1 = low; 2 = high	R	I				
40104	103	Motor group 1 low count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40105	104	Motor group 2 low count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40106	105	Motor group 1 high count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40107	106	Motor group 2 high count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40108	107	Fault contact (S) status	Bit 0...3; FALSE=normal, TRUE=fault	R	W				
40109	108	Run contact (B) status	Bit 0...3; FALSE=not running, TRUE=running	R	W				
40301	300	Control motor group 1	0 = off; 1 = low; 2 = high	R/W	I	0	0	2	
40302	301	Control motor group 2	0 = off; 1 = low; 2 = high	R/W	I	0	0	2	
40303	302	Motor group 1 (comm fail)	0, 1, 2 or 3	R/W	I	0	0	3	
40304	303	Motor group 2 (comm fail)	0, 1, 2 or 3	R/W	I	0	0	3	
40305	304	Motor group 1 profile	0, 1 or 2	R/W	I	0	0	2	✓
40306	305	Motor group 2 profile	0, 1 or 2	R/W	I	0	0	2	✓
40307	306	Input channel sense	Bit 0...7; FALSE=Normal; TRUE=Invert	R/W	W	0	0	65535	✓
40308	307	Motor group 1 'low' timer	Delay switching from low to high in 0.1 sec	R/W	I	70	0	36000	✓
40309	308	Motor group 2 'low' timer	Delay switching from low to high in 0.1 sec	R/W	I	70	0	36000	✓
40310	309	Motor group 1 'idle' timer	Time in OFF position in 0.1 sec	R/W	I	150	0	36000	✓
40311	310	Motor group 2 'idle' timer	Time in OFF position in 0.1 sec	R/W	I	150	0	36000	✓
40312	311	Write hours count command	Bit 0...3; FALSE=No overwrite TRUE=Overwrite						
40313	312	Motor gp 1 'low' count preset	Preset value	R/W	I	0	0	65535	
40314	313	Motor gp 2 'low' count preset	Preset value	R/W	I	0	0	65535	
40315	314	Motor gp 1 'hi' count preset	Preset value	R/W	I	0	0	65535	
40316	315	Motor gp 2 'hi' count preset	Preset value	R/W	I	0	0	65535	
40317	316	Use feedback from Run status	Bit 0... 3 FALSE=don't use TRUE=use]	R/W	W	1	0	1	✓
40318	317	Motor gp 1 'low' alarm timer	Timer value in 0.1 sec	R/W	I	30	0	36000	✓
40319	318	Motor gp 2 'low' alarm timer	Timer value in 0.1 sec	R/W	I	30	0	36000	✓
40320	319	Motor gp 1 'hi' alarm timer	Timer value in 0.1 sec	R/W	I	30	0	36000	✓
40321	320	Motor gp 2 'hi' alarm timer	Timer value in 0.1 sec	R/W	I	30	0	36000	✓
40322	321	Reset alarm(s)	Bit 0, 1	R/W	W				
40323	322	Maintain active during fault	Bit 0..3	R/W	W	0	0	1	✓

## Mixed I/O module – MULTI I/O (IOMMUL)

### Overview

The Vykon HVAC MULTI I/O module provides a mixture of 4 digital inputs, 6 digital outputs, 6 analogue inputs and 2 analogue outputs. The analogue outputs and 2 digital output channels have appropriate hand-auto override switches and setting potentiometers. Each output has a yellow LED and each digital input has a bi-colour LED which indicates the current status of the connected device.

Modbus address setting is by rotary switches which are easily accessible underneath the top cover. A bi-colour LED indicates the communications status.

### Notes

Name	Meaning and options
Register M	Modbus register - <b>Modicon register number</b>
Register D	Modbus register - <b>Decimal register number</b>
Name	Register <b>name</b>
R/W	As seen by the master device: R= <b>Read only</b> R/W= <b>Read and Write</b>
D	Data <b>Type</b> : I= <b>Integer</b> ; W= <b>Word</b> ; S= <b>Signed Integer</b> ;
Notes	<p>Notes as to the use and operation of register and its value...</p> <ul style="list-style-type: none"> <li>▪ Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O</li> <li>▪ Digital Input channel status: Bit 0...9: Bit0=D/I 1; Bit1=D/I 2; Bit2=D/I 3; Bit3=D/I 4; Bit4=A/I 1; Bit5=A/I 2; Bit6=A/I 3; Bit7=A/I 4; Bit8=A/I 5; Bit9=A/I 6; (Bits 4..9 only applies when digital input is chosen as sensor type)</li> <li>▪ Override switch position: Bit 0...3; Bit0=D/O 1; Bit1=D/O 2; Bit2=A/O 1; Bit3=A/O 2;</li> <li>▪ Relay status : Bit 0...5; Bit 0=Output1; Bit 1=Output2; Bit 2= Output3; Bit 3= Output4; Bit 4= Output5; Bit 5= Output6</li> <li>▪ Wire break detection: Bit 0...5: Bit0=A/I 1; Bit1=A/I 2; Bit2=A/I 3; Bit3=A/I 4; Bit4=A/I 5; Bit5=A/I 6;</li> <li>▪ A/I real (scaled) value: Scaled value of sensor: Value <math>\times 10^{-1}</math> (234 = 23.4 °C) (only applies when sensor type&gt;1)</li> <li>▪ Analogue outputs in overload: Bit 0...1; Bit 0=Output1; Bit 1=Output2;</li> <li>▪ Digital input channel profile: 0=Status (<b>Green</b> LED on when true); 1=Alarm (<b>Red</b> LED on when true); 2=Counter (No LED)</li> <li>▪ Digital Input channel count value: Current count value or the preset count value if the write count command is received</li> <li>▪ Digital Output ch (comm fail): Output channel value in a communications failure condition: 0=off; 1=on; 2=(do nothing)</li> <li>▪ A/I Sensor type: 0=0 to10v; 1=0ma to 20ma; 2=RTD (Pt1000); 3=RTD (Ni1000 Siemens); 4=RTD (Ni1000 standard); 5 =Digital input 24VDC; 6=NTC1(Lin); 7=NTC1; 8=NTC3; 9=T1(Staeafa); 10=NTC5K</li> <li>▪ A/I channel cable offset resistance: Resistance <math>\text{valuex}10^{-1} \Omega</math> (e.g. 567 = 56.7 <math>\Omega</math>) (only applies when sensor type&gt;1)</li> <li>▪ A/I channel maximum real value: Scaled value corresponding to100% input value (only applies when sensor type&lt;2)</li> <li>▪ A/I channel minimum real value: Scaled value corresponding to 0% input value (only applies when sensor type&lt;2)</li> <li>▪ A/I channel offset: Scaled offset value. (only applies when sensor type&lt;2)</li> <li>▪ Analogue o/p ch (comm fail): Output channel value in a communications failure condition: Value (<math>\times 10^{-3}</math>)</li> <li>▪ D/I write count command: Each input count can be preset to a value by the Modbus master. The value is incremented from its preset value when the write count command is received</li> <li>▪ D/O write hours count command: Bit 0...11; FALSE=No overwrite; TRUE=Overwrite hours counter with preset value</li> <li>▪ Set D/O output channel value: Bit 0...5; FALSE=Relay off; TRUE=Relay on</li> <li>▪ D/O channel profile: 0=normal operation; 1=lighting control; 2=pulse control; 3=off delay</li> <li>▪ Prohibit local override: Prevent the hand-off-auto switch overriding output. (only applies when output channel profile&gt;0)</li> <li>▪ Sensor valid: Voltage when sensor becomes valid. Value <math>\times 10^{-1}</math> (674 = 67.4v) (only applies when A/I sensor type=0)</li> <li>▪ Sensor invalid: Voltage when sensor becomes invalid. Value <math>\times 10^{-1}</math> (674 = 67.4v) (only applies when A/I sensor type=0)</li> <li>▪ Bit 0...5; Bit 0=Input1; Bit 1=Input2; Bit 2= Input3; Bit 5= Input6</li> <li>▪ Celsius/Fahrenheit real value: Passive sensors only</li> </ul>
Def	The <b>Default</b> value the register is set to after a full reset.
Min	The <b>Minimum</b> value of the register
Max	The <b>Maximum</b> value of the register
S	A $\checkmark$ indicates that this value is <b>saved</b> into EEPROM whenever it is changed. After a power restart the saved value is used

You will find property setting details of the Modbus Async Network driver towards the back of this guide. In addition, at the back of this guide, there are a number of “Use Examples” which give an illustration of how to configure the driver proxy points to use some of the features of the module and the module’s modbus registers.

**Modbus register data allocation**

Register		Name	Notes	R/W	D	Def	Min	Max	S
M	D								
40001	0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40002	1	Watchdog	Incrementing and rolling 1 second counter	R	I		0	65535	
40003	2	Device number	Read BCD switches (Read on power restart)	R	I		0	99	
40004	3	Spare		R	I		0	65535	
40005	4	Spare		R	I		0	65535	
40006	5	Module type number	Preset to 0,1,2,3,4,5,6,7 or 8	R	I		0	8	
40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓
40053	52	Power cycle start	Write '0' after power started	R/W	I	0	0	65535	
40101	100	Digital Input channel status	Bit 0...9;	R	W	0	0	1	
40102	101	Digital Input LED colour	Bit 0...3; FALSE=Green; TRUE=Red	R	W	0	0	1	
40103	102	Digital Input LED status	Bit 0...3; FALSE=Off; TRUE=On	R	W	0	0	1	
40104	103	Override switch position	Bit 0...3; FALSE=hand, TRUE=auto	R	W				
40105	104	Relay status	Bit 0...5; FALSE=open, TRUE=closed	R	W				
40106	105	Wire break detection	Bit 0...5; FALSE=wire OK, TRUE=wire broken	R	W	0	0	1	
40107	106	Digital o/p ch 1 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40108	107	Digital o/p ch 1 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40109	108	Digital o/p ch 2 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40101	109	Digital o/p ch 2 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40111	110	Digital o/p ch 3 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40112	111	Digital o/p ch 3 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40113	112	Digital o/p ch 4 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40114	113	Digital o/p ch 4 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40115	114	Digital o/p ch 5 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40116	115	Digital o/p ch 5 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40117	116	Digital o/p ch 6 on count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40118	117	Digital o/p ch 6 off count	Cumulative hours - updated every 4 hours	R	I	0	0	65535	✓
40119	118	A/I ch 1 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40120	119	A/I ch 2 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40121	120	A/I ch 3 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40122	121	A/I ch 4 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40123	122	A/I ch 5 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40124	123	A/I ch 6 real (scaled) value	Scaled value of sensor	R	S	0	0	1024	
40125	124	Analogue o/p ch 1 feedback	Value (x 10 <sup>-3</sup> )	R	I	0	0	1000	
40126	125	Analogue o/p ch 2 feedback	Value (x 10 <sup>-3</sup> )	R	I	0	0	1000	
40127	126	Analogue o/p in overload	Bit 0...1; FALSE=normal, TRUE=overload	R	W	0	0	1	
40301	300	Digital Input channel 1 profile	0, 1 or 2	R/W	I	0	0	2	✓
40302	301	Digital Input channel 2 profile	0, 1 or 2	R/W	I	0	0	2	✓
40303	302	Digital Input channel 3 profile	0, 1 or 2	R/W	I	0	0	2	✓
40304	303	Digital Input channel 4 profile	0, 1 or 2	R/W	I	0	0	2	✓
40305	304	Digital Input ch 1 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40306	305	Digital Input ch 2 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40307	306	Digital Input ch 3 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40308	307	Digital Input ch 4 count value	READ=Count value; WRITE=Preset value	R/W	I	0	0	65535	✓
40317	316	Digital Output ch 1 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40318	317	Digital Output ch 2 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40319	318	Digital Output ch 3 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40320	319	Digital Output ch 4 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40321	320	Digital Output ch 5 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40322	321	Digital Output ch 6 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40329	328	Digital o/p ch 1 oncount preset	Preset value	R/W	I	0	0	65535	
40330	329	Digital o/p ch 1 offcount preset	Preset value	R/W	I	0	0	65535	
40331	330	Digital o/p ch 2 oncount preset	Preset value	R/W	I	0	0	65535	
40332	331	Digital o/p ch 2 offcount preset	Preset value	R/W	I	0	0	65535	
40333	332	Digital o/p ch 3 oncount preset	Preset value	R/W	I	0	0	65535	
40334	333	Digital o/p ch 3 offcount preset	Preset value	R/W	I	0	0	65535	
40335	334	Digital o/p ch 4 oncount preset	Preset value	R/W	I	0	0	65535	
40336	335	Digital o/p ch 4 offcount preset	Preset value	R/W	I	0	0	65535	
40337	336	Digital o/p ch 5 oncount preset	Preset value	R/W	I	0	0	65535	

40338	337	Digital o/p ch 5 offcount preset	Preset value	R/W	I	0	0	65535	
40339	338	Digital o/p ch 6 oncount preset	Preset value	R/W	I	0	0	65535	
40340	339	Digital o/p ch 6 offcount preset	Preset value	R/W	I	0	0	65535	
40341	340	A/I channel 1 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40342	341	A/I channel 2 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40343	342	A/I channel 3 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40344	343	A/I channel 4 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40345	344	A/I channel 5 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40346	345	A/I channel 6 sensor type	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10	R/W	I	3	0	10	✓
40346	346	A/I channel 1 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40346	347	A/I channel 2 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40346	348	A/I channel 3 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40346	349	A/I channel 4 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40351	350	A/I channel 5 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40352	351	A/I channel 6 cable offset	Resistance value x 10 <sup>-1</sup> Ω	R/W	S	-2000	0	2000	✓
40354	353	A/I ch 1 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40355	354	A/I ch 2 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40356	355	A/I ch 3 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40357	356	A/I ch 4 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40358	357	A/I ch 5 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40359	358	A/I ch 6 maximum real value	Scaled value corresponding to100% input value	R/W	I	1000	0	1000	✓
40360	359	A/I ch 1 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40361	360	A/I ch 2 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40362	361	A/I ch 3 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40363	362	A/I ch 4 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40364	363	A/I ch 5 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40365	364	A/I ch 6 minimum real value	Scaled value corresponding to 0% input value	R/W	I	0	0	1000	✓
40366	365	A/I channel1 offset	Scaled offset value	R/W	I	0	0	1000	✓
40367	366	A/I channel2 offset	Scaled offset value	R/W	I	0	0	1000	✓
40368	367	A/I channel3 offset	Scaled offset value	R/W	I	0	0	1000	✓
40369	368	A/I channel4 offset	Scaled offset value	R/W	I	0	0	1000	✓
40370	369	A/I channel5 offset	Scaled offset value	R/W	I	0	0	1000	✓
40371	370	A/I channel6 offset	Scaled offset value	R/W	I	0	0	1000	✓
40372	371	Analogue o/p ch 1 set value	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	
40373	372	Analogue o/p ch 2 set value	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	
40374	373	Analogue o/p ch 1 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40375	374	Analogue o/p ch 2 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40376	375	D/I write count command	Bit 0...3; FALSE=NoOverwrite; TRUE=Overwrite	R/W	W	0	0		
40377	376	D/I channel sense	Bit 0...3; FALSE=Normal; TRUE=Invert	R/W	W	0	0	65535	✓
40378	377	Set D/O output channel value	Bit 0...5; FALSE=Relay off; TRUE=Relay on	R/W	W				
40379	378	Wire break detection on/off	Bit 0...5; FALSE=inactive, TRUE=active	R/W	W	0	0	1	✓
40381	380	D/O write hours count cmd	Bit 0..11; FALSE=NoOverwrite TRUE=Overwrite	R/W	W				
40382	381	D/O channel 1 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40383	382	D/O channel 2 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40384	383	D/O channel 3 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40385	384	D/O channel 4 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40386	385	D/O channel 5 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40387	386	D/O channel 6 profile	0, 1, 2 or 3	R/W	I	0	0	3	✓
40388	387	Channel1 off delay preset	Preset value	R/W	I	120	0	65535	✓
40389	388	Channel2 off delay preset	Preset value	R/W	I	120	0	65535	✓
40390	389	Channel3 off delay preset	Preset value	R/W	I	120	0	65535	✓
40391	390	Channel4 off delay preset	Preset value	R/W	I	120	0	65535	✓
40392	391	Channel5 off delay preset	Preset value	R/W	I	120	0	65535	✓
40393	392	Channel6 off delay preset	Preset value	R/W	I	120	0	65535	✓
40394	393	Prohibit local override	Bit 0...5; FALSE=Enable; TRUE=Prohibit	R/W	W	0	0	1	
40395	394	Sensor 1 valid	Value (x 10 <sup>-3</sup> )	R/W	I	670	0	999	✓
40396	395	Sensor 1 invalid	Value (x 10 <sup>-3</sup> )	R/W	I	600	0	999	✓
40397	396	Sensor 2 valid	Value (x 10 <sup>-3</sup> )	R/W	I	670	0	999	✓
40398	397	Sensor 2 invalid	Value (x 10 <sup>-3</sup> )	R/W	I	600	0	999	✓
40399	398	Sensor 3 valid	Value (x 10 <sup>-3</sup> )	R/W	I	670	0	999	✓

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40400	399	Sensor 3 invalid	Value (x 10 <sup>-3</sup> )	R/W	I	600	0	999	✓
40401	400	Sensor 4 valid	Value (x 10 <sup>-3</sup> )	R/W	I	670	0	999	✓
40402	401	Sensor 4 invalid	Value (x 10 <sup>-3</sup> )	R/W	I	600	0	999	✓
40403	402	Sensor 5 valid	Value (x 10 <sup>-3</sup> )	R/W	I	670	0	999	✓
40404	403	Sensor 5 invalid	Value (x 10 <sup>-3</sup> )	R/W	I	600	0	999	✓
40405	404	Sensor 6 valid	Value (x 10 <sup>-3</sup> )	R/W	I	670	0	999	✓
40406	405	Sensor 6 invalid	Value (x 10 <sup>-3</sup> )	R/W	I	600	0	999	✓
40407	406	Celsius/Fahrenheit real value	Bit 0...5; FALSE= °C , TRUE= °F	R/W	W	0	0	1	✓

### Module communications settings

The Vykon HVAC range of I/O modules are designed for use as local I/O within motor control cabinets or as remote I/O connected via RS485 Modbus. When connected to the JACE® controller a Modbus Async Network driver is installed. Here are the settings required for that driver:

**Note:**  
This Modbus driver network is on COM2

**Note:**  
These two settings are changed from what you are given by default in the Modbus Async Network

**Note:**  
This Modbus driver network is on COM2

**ModbusDriverCOM2 (Modbus Async Network) Settings:**

- Status: {ok}
- Enabled:  true
- Fault Cause: [Empty]
- Health: Ok [15-Sep-08 10:06 AM GMT]
- Alarm Source Info: Alarm Source Info
- Monitor: Ping Monitor
- Tuning Policies: Tuning Policy Map
- Poll Scheduler: Basic Poll Scheduler
- Retry Count: 1
- Response Timeout: +00000h 00m 00.499s
- Float Byte Order: Order3210
- Long Byte Order: Order3210
- Use Preset Multiple Register:  false
- Use Force Multiple Coil:  false
- Max Fails Until Device Down: 2 [0 - max]
- Inter Message Delay: 00000h 00m 00.050s [0ms - 1sec]
- Serial Port Config: Serial Helper
  - Modbus Data Mode: Rtu
  - Sniffer Mode:  false
  - Rtu Sniffer Mode Buffer Size: 8 [1 - max]

**Serial Port Config Settings:**

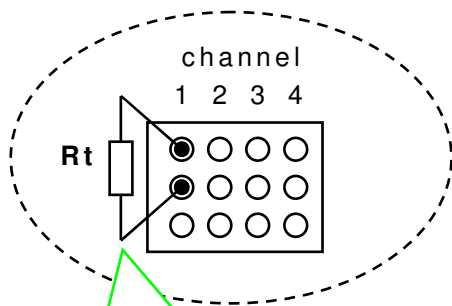
- Status: {ok}
- Port Name: COM2
- Baud Rate: Baud19200
- Data Bits: Data Bits8
- Stop Bits: Stop Bit1
- Parity: None
- Flow Control Mode:  RtsCtsOnInput  RtsCtsOnOutput  XonXoffOnInput  XonXoffOnOutput

## Use examples

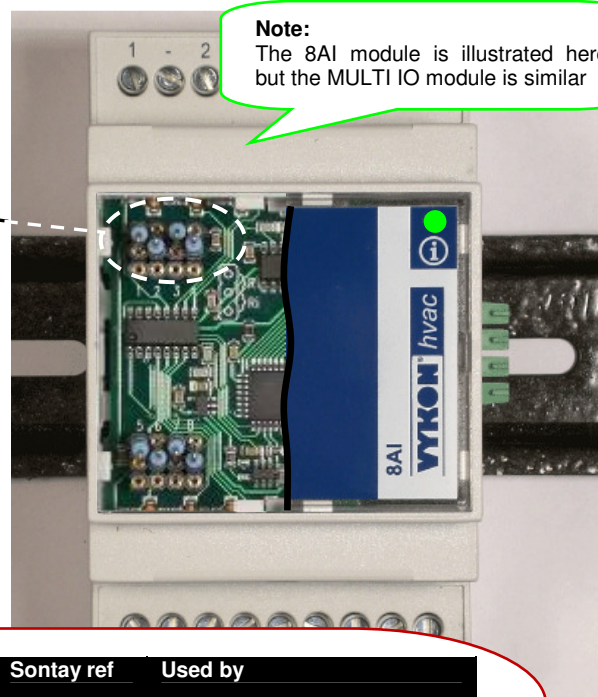
### Analogue Input RTD sensor

Each analogue input channel of a Vykon HVAC module can be configured to one of a number of analogue sensor types. This applies to both the 8AI and MULTI-I/O modules. The firmware of the module contains some pre-programmed lookup tables that represent popular sensors which are described in engineering note EN20. By using these sensor types the configuration process is simplified because the lookup table does not need entering in the proxy point and in operation, the I/O module returns a real value from the sensor thereby eliminating any conversion processing within the station runtime. It is further recommended to use one of the pre-programmed sensor types because the resolution on these internal tables is far higher than the 10bit resolution that is available on the 0-10v input.

Before describing an example here are some notes about the supported popular sensors and the configuration jumper in the module. Note that module wiring and configuration is described in the Vykon HVAC Installation Guide document.



**Note:**  
**Rt** = 40,000  $\Omega$  +/- 0.1% **factory fitted** in module  
**Rt** = 5,110  $\Omega$  +/- 0.1% provided bagged in carton



**Note:**  
 The 8AI module is illustrated here but the MULTI IO module is similar

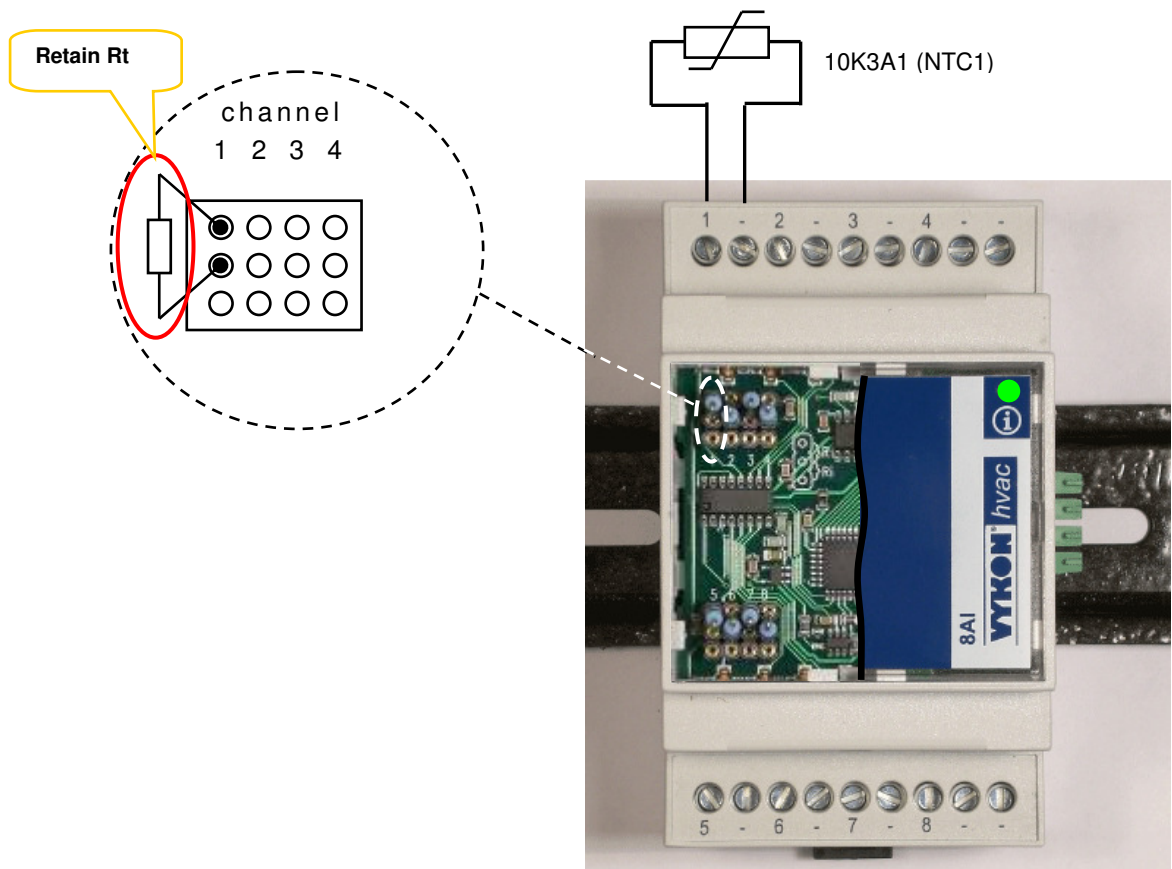
Sensor type	A/I Sensor type setting	Rt	Sontay ref	Used by
Pt1000	2	5,110 $\Omega$ +/- 0.1%	E-PT1000A	Johnson Controls, Saia, Honeywell
Ni1000 (Landis & Gyr)	3	5,110 $\Omega$ +/- 0.1%	G-LAN1	Landis, Staefa, Siemens
Ni1000 (Standard)	4	5,110 $\Omega$ +/- 0.1%	F-NI1000	Various
NTC 1 (Lin)	6	40,000 $\Omega$ +/- 0.1%	H-SAT1	Satchwell, Invensys, TAC
NTC 1	7	40,000 $\Omega$ +/- 0.1%	10K3A1	Johnson Controls, Saia, Trend
NTC 3	8	40,000 $\Omega$ +/- 0.1%	10K4A1	Robertshaw, Siebe, Niagara "Type3 curve"
T1 (Staefa)	9	5,110 $\Omega$ +/- 0.1%	STA1	Staefa
NTC5K	10	40,000 $\Omega$ +/- 0.1%	-----	Various

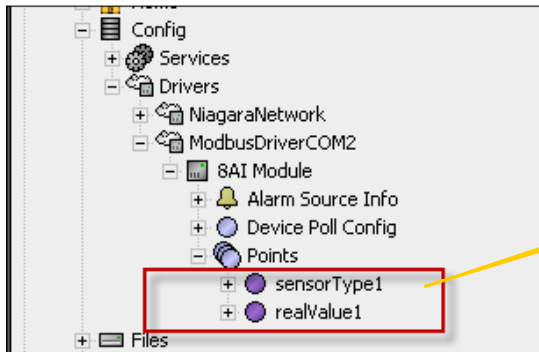
**Notes:**

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

In this example, an RTD (resistance temperature detector) sensor is being used which is supported by one of the module's internal lookup tables. The sensor is a Sontay 10K3A1, used by Johnson Controls, Saia and Trend and is known by the module as NTC1 or Sensor Type 7. The sensor is connected to the analogue input channel of channel 1 of the 8-AI module. All other channels of this module are similar as well as those on the MULTI-I/O module. The Rt resistor in the module must be configured correctly as described earlier.

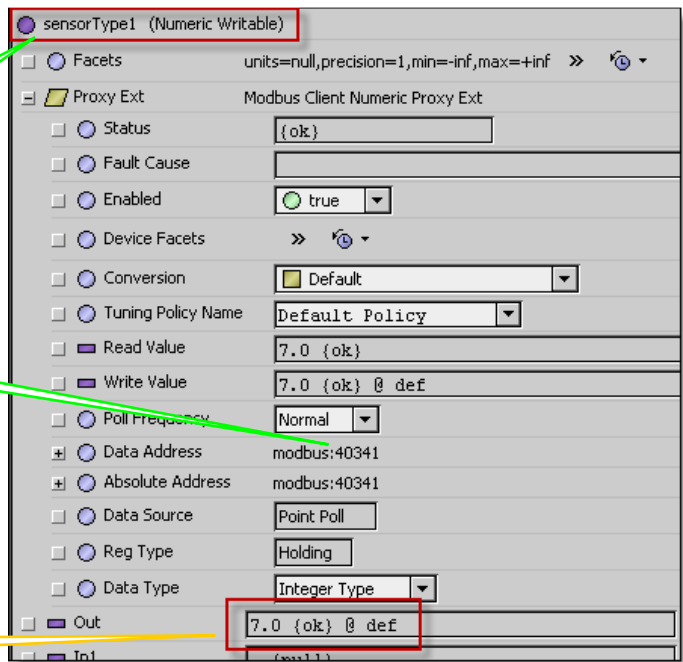
In this example, the default factory fitted Rt resistor (40,000  $\Omega$  +/- 0.1%) is retained because it satisfies the requirements for the 10K3A1 sensor.





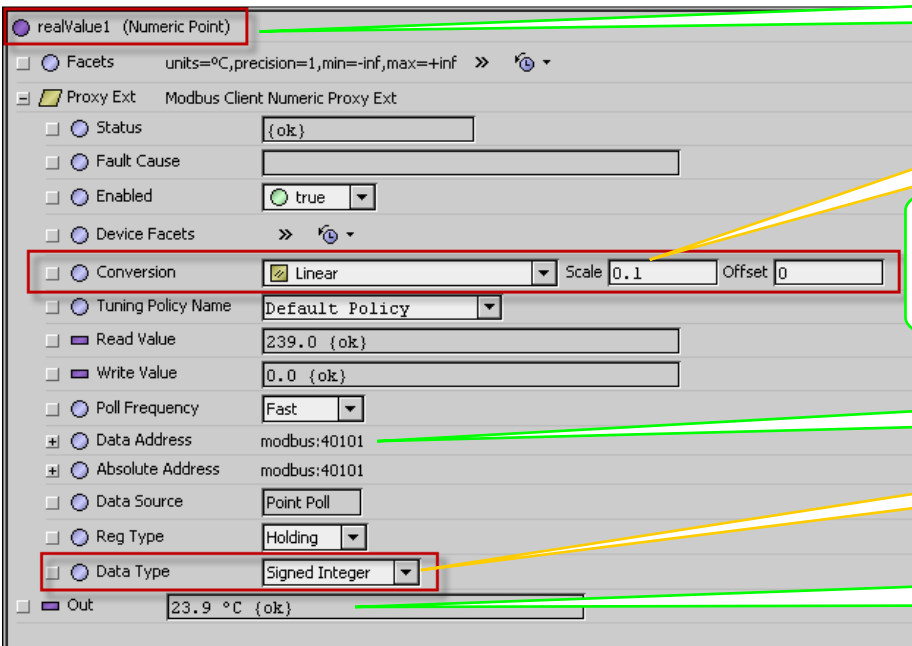
Add 2 Points

This sets the input sensor type on channel 1 to be NTC1



Set the output value to '7' (NTC1 Sensor)

This is the **measured** real value for channel 1



Set conversion scaling to '0.1'

**Note:**  
The Read value of the sensor which is returned from the module is:  
Value x 10 (239 = 23.9°C)  
(only applies when sensor type>1)

This is the **measured** real value for channel 1

Set Data Type as 'Signed Integer'

This is the **scaled output** for channel 1

### 0(4)-20mA current sensor

Each analogue input channel of a Vykon HVAC module can be configured as a 'current' input. This applies to both the 8AI and MULTI-I/O modules.

Before describing an example here are some notes about the configuration jumper in the module. Note that module wiring and configuration is described in the Vykon HVAC Installation Guide document

**Note:**  
For current operation **REMOVE Rt** and **ADD Ri**

channel  
1 2 3 4

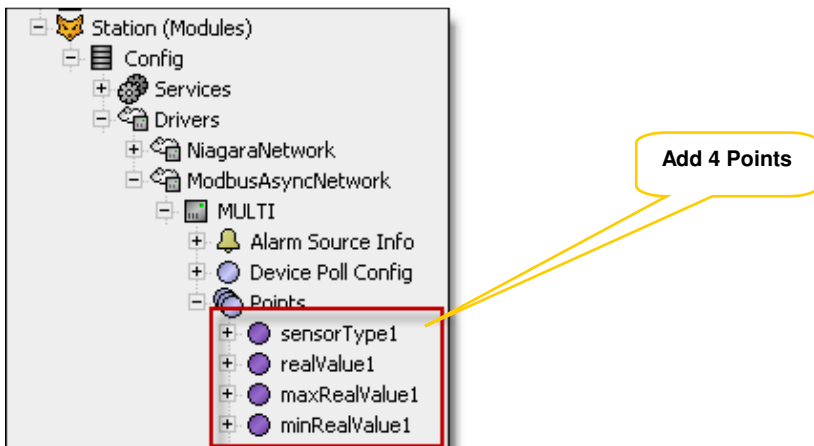
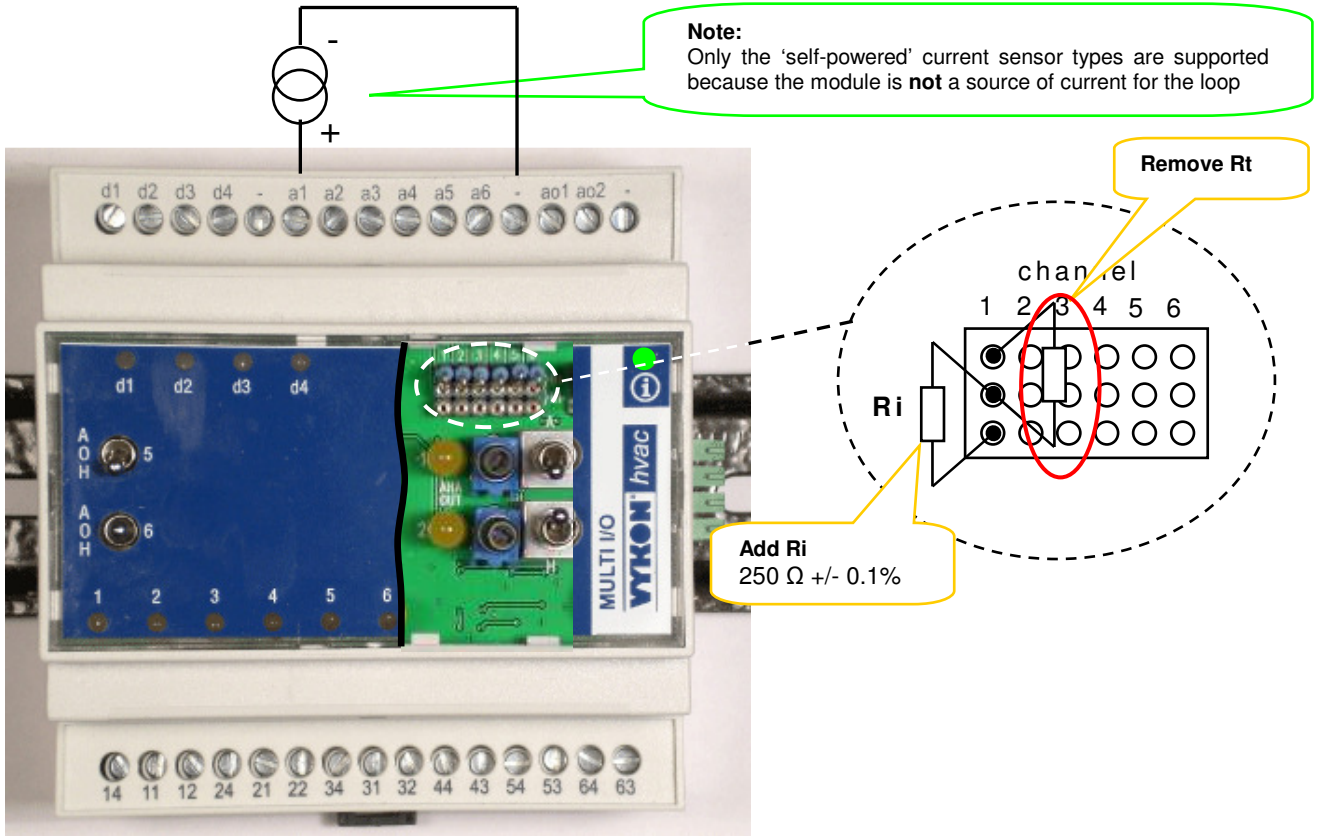
**Note:**  
The 8AI module is illustrated here but the MULTI IO module is similar

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

**Note:**  
Ri = 250 Ω +/- 0.1% provided bagged in carton

When configured for current operation, the analogue input channel will generate an output depending on the voltage generated across the **Ri** resistor which operates across the full input range of 0 to 20mA. It is important to note that both 0 to 20mA and 4 to 20mA devices can be connected to the input channel.

In this example a 4-20mA sensor is connected to channel 1 of the MULTI-I/O module. All other channels of this module are similar as well as those on the 8AI module.



This is the **measured** real value

realValue1 (Numeric Point)

Facets units=null,precision=2,min=-inf,max=+inf

Proxy Ext Modbus Client Numeric Proxy Ext

Status {ok}

Fault Cause

Enabled true

Device Facets units=null,precision=2,min=-inf,max=+inf

Conversion Default

Tuning Policy Name Default Policy

Read Value 599.00 {ok}

Write Value 0.00 {ok}

Poll Frequency Fast

Data Address modbus:40119

Absolute Address modbus:40119

Data Source Point Poll

Reg Type Holding

Data Type Signed Integer

Out 599.00 {ok}

This sets the input sensor type to be **current**

sensorType1 (Numeric Writable)

Facets units=null,precision=1,min=-inf,max=+inf

Proxy Ext Modbus Client Numeric Proxy Ext

Status {ok}

Fault Cause

Enabled true

Device Facets units=null,precision=1,min=-inf,max=+inf

Conversion Default

Tuning Policy Name Default Policy

Read Value 1.0 {ok}

Write Value 1.0 {ok} @ def

Poll Frequency Normal

Data Address modbus:40341

Absolute Address modbus:40341

Data Source Point Poll

Reg Type Holding

Data Type Integer Type

Out 1.0 {ok} @ def

These two set the **range** of the measured value

Set this to '1'  
(Current sensor)

minRealValue1 (Numeric Writable)

Facets units=null,precision=1,min=-inf,max=+inf

Proxy Ext Modbus Client Numeric Proxy Ext

Status {ok}

Fault Cause

Enabled true

Device Facets units=null,precision=1,min=-inf,max=+inf

Conversion Default

Tuning Policy Name Default Policy

Read Value 0.0 {ok}

Write Value 0.0 {ok} @ def

Poll Frequency Normal

Data Address modbus:40360

Absolute Address modbus:40360

Data Source Point Poll

Reg Type Holding

Data Type Integer Type

Out 0.0 {ok} @ def

Set this to the minimum value of the output range. (0 is the module default)

maxRealValue1 (Numeric Writable)

Facets units=null,precision=1,min=-inf,max=+inf

Proxy Ext Modbus Client Numeric Proxy Ext

Status {ok}

Fault Cause

Enabled true

Device Facets units=null,precision=1,min=-inf,max=+inf

Conversion Default

Tuning Policy Name Default Policy

Read Value 1000.0 {ok}

Write Value 1000.0 {ok} @ def

Poll Frequency Normal

Data Address modbus:40354

Absolute Address modbus:40354

Data Source Point Poll

Reg Type Holding

Data Type Integer Type

Out 1000.0 {ok} @ def

Set this to the maximum value of the output range. (1000 is the module default)

If you want to convert the measured real value into an engineering value, it can be achieved by adding a lookup table to the proxy point as follows:

units = %

Source	Result
200.0	0.0
1000.0	100.0

In this example, A linear table is creating an engineering output value where a 4mA input (which is a measured real value of 200) gives an engineering value of 0% and 20mA (maximum measured real value of 1000) gives 100%. In this example, 12mA gives an 'out' scaled value of 50% (49.9%)

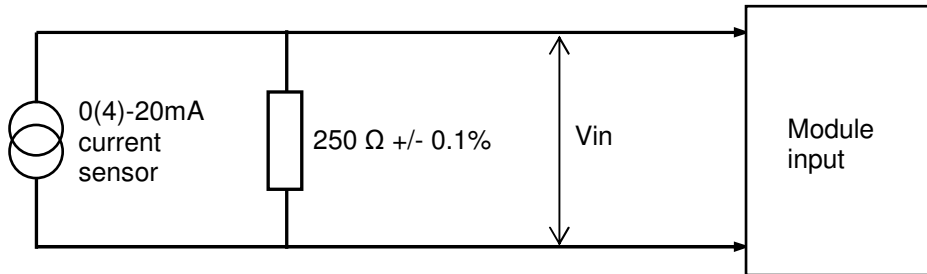
You can trim the output value to cater for measurement tolerance inaccuracy by adding more lookup entries and adjusting the lookup source values

Source	Result
201.0	0.0
599.0	50.0
996.0	100.0

Out: 50.0 % {ok}

**Note:**  
The ability to import a generic table was introduced into the NiagaraAX Framework® in 3.4.57. If your point does not display this option then you will need to upgrade and install a module called **kitlo.jar**

**Equivalent circuit**



Input current	Vin	Real value (register 40108)
0mA	0v	(0)
4mA	1v	200
12mA	3v	600
20mA	5v	1000

**Note:**  
The real value at very low current values can be indeterminate (under test conditions the real value at an input current of 0mA was 93)

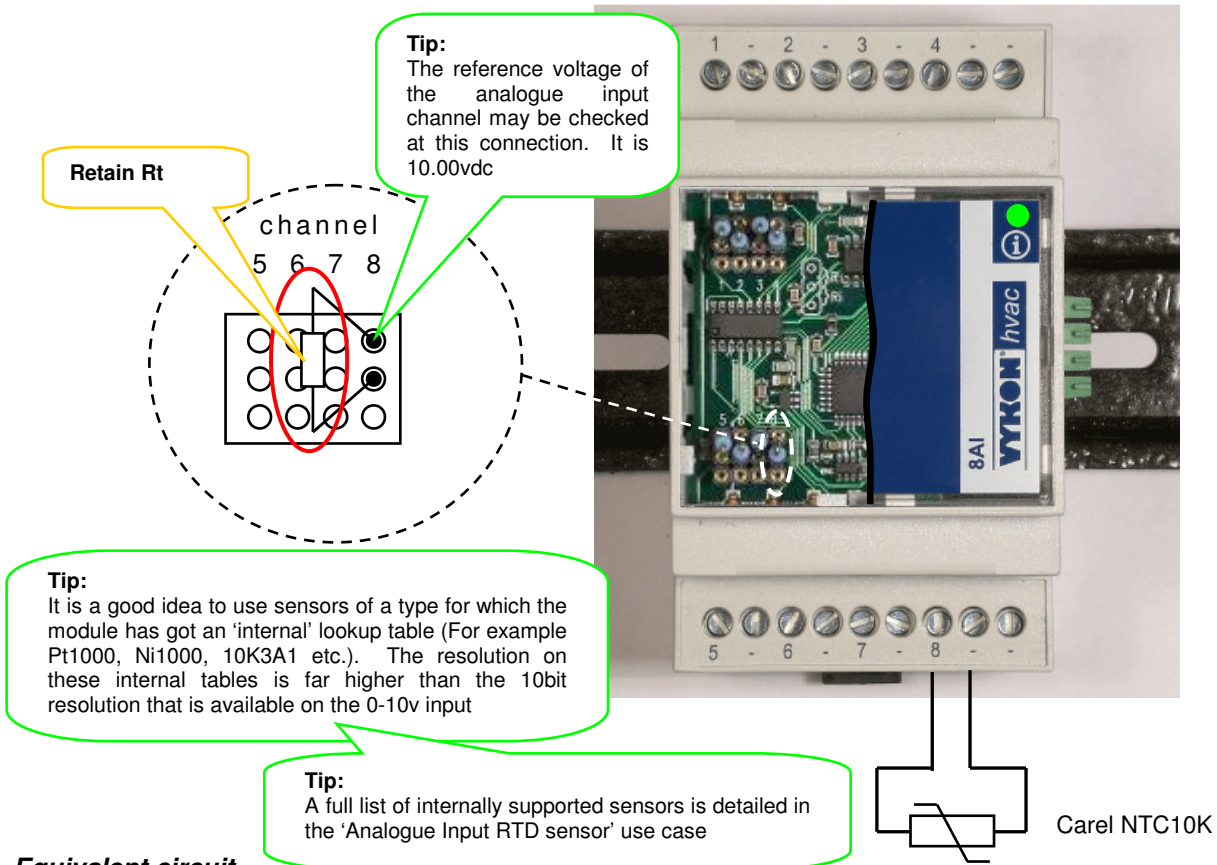
**Note:**  
With a 0-1000 range, a change of 1 mA is represented by a real count value change of 50, or 1 count is equivalent to 20µA

**Note:**  
The range of this real value may be adjusted by registers 40378 and 40368 between 0 and 1000

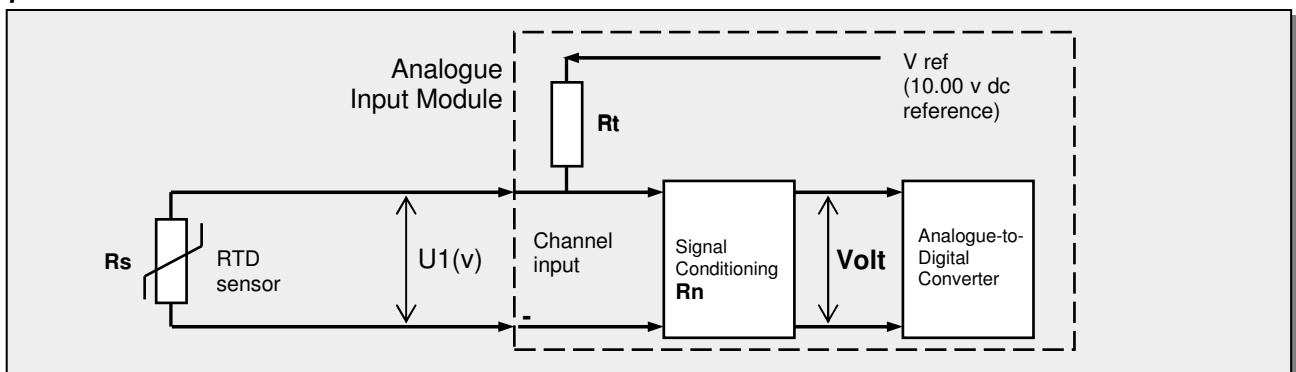
## Generic Tabular RTD sensor

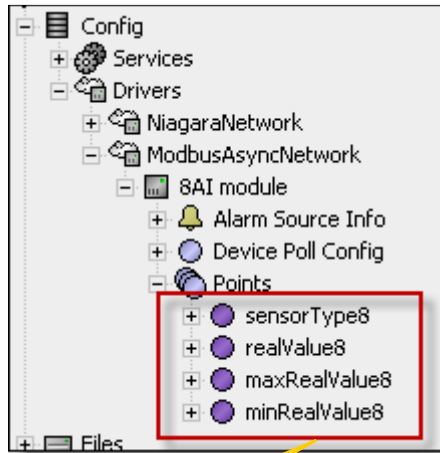
In this example an RTD (resistance temperature detector) sensor is being used which is not supported by any of the module's internal lookup tables. The sensor is a passive wire ended ('HP' package) temperature probe manufactured by Carel and uses their 'NTC10K' sensor. The sensor is connected to the analogue input channel of channel 8 of the 8-AI module. All other channels of this module are similar as well as those on the MULTI-I/O module.

As an overview to the operation, the channel must be set to a 0-10v input but the  $R_t$  pull up resistor remains in circuit. In this example, because the sensor is a 10k device, the factory fitted pull up resistor  $R_t$ , of  $40,000\Omega$  is retained in order to minimise the sensor's self-heating effect by reducing the power applied to the sensor. A  $5,110\Omega$  resistor (provided bagged in the carton) can alternatively be used for other, lower resistance RTD sensors. The subsequent voltage produced by the sensor, after signal conditioning, is read by the module's Analogue to Digital converter and the raw value is converted to a temperature by a generic lookup table within the proxy point. A 'generic' lookup table must be created which is based upon the RTD sensor's "temperature-to- resistance" characteristic.



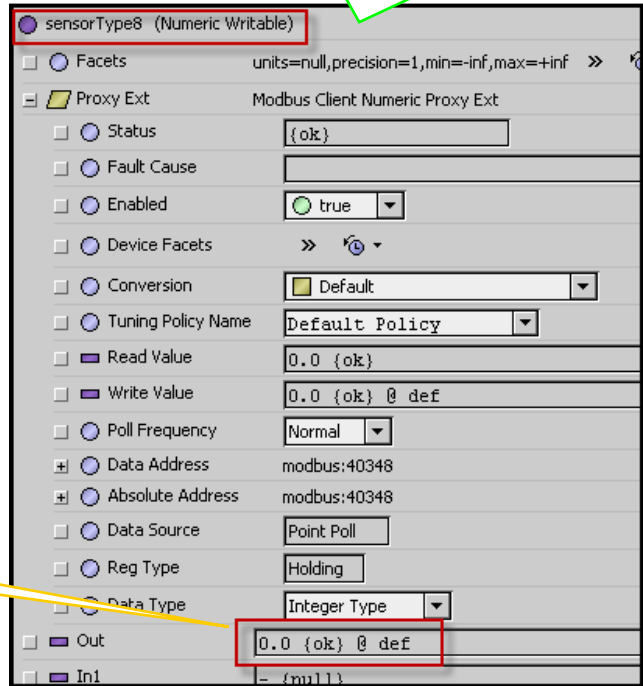
## Equivalent circuit



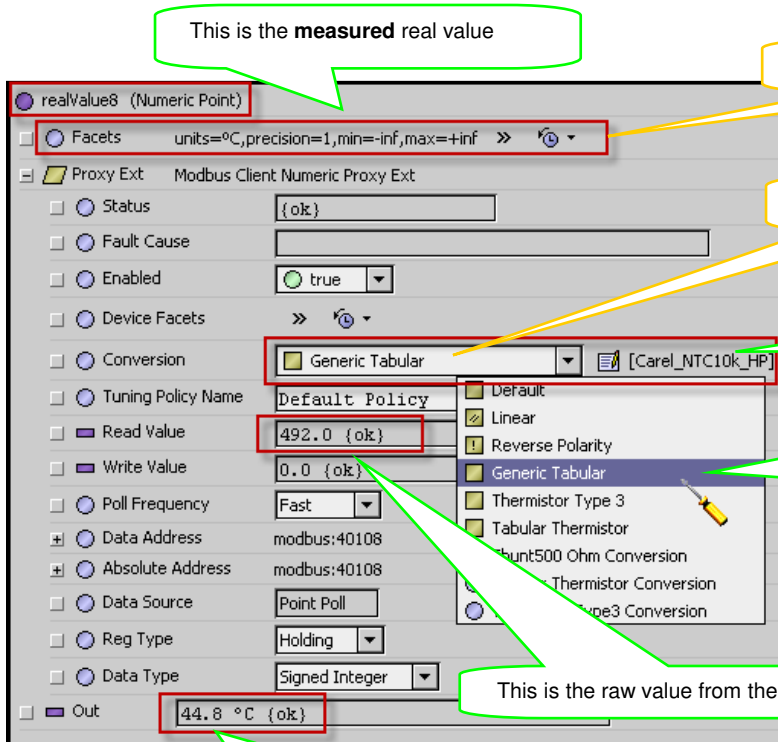


Add 4 Points

This sets the input sensor type to be **voltage**



Set this to '0' (0-10v sensor)



This is the **measured** real value

Set this to temperature °C

Select Generic Tabular

**Note:**  
The Table is described later in this example

**Note:**  
The ability to import a generic table was introduced into the NiagaraAX Framework® in 3.4.57. If your point does not display this option then you will need to upgrade and install a module called **kitlo.jar**

This is the output value via the table and with facets

This is the raw value from the module

These two set the **range** of the measured value

**minRealValue8 (Numeric Writable)**

Facets: units=null,precision=1,min=-inf,max=+inf

Proxy Ext: Modbus Client Numeric Proxy Ext

Status: {ok}

Fault Cause:

Enabled: true

Device Facets: >> [lock]

Conversion: Default

Tuning Policy Name: Default Policy

Read Value: 0.0 {ok}

Write Value: 0.0 {ok} @ def

Poll Frequency: Normal

Data Address: modbus:40378

Absolute Address: modbus:40378

Data Source: Point Poll

Reg Type: Holding

Data Type: Integer Type

Out: 0.0 {ok} @ def

In1: - {null}

**maxRealValue8 (Numeric Writable)**

Facets: units=null,precision=1,min=-inf,max=+inf

Proxy Ext: Modbus Client Numeric Proxy Ext

Status: {ok}

Fault Cause:

Enabled: true

Device Facets: >> [lock]

Conversion: Default

Tuning Policy Name: Default Policy

Read Value: 1000.0 {ok}

Write Value: 1000.0 {ok} @ def

Poll Frequency: Normal

Data Address: modbus:40368

Absolute Address: modbus:40368

Data Source: Point Poll

Reg Type: Holding

Data Type: Integer Type

Out: 1000.0 {ok} @ def

In1: - {null}

Set this to the minimum value of the output range. (0 is the module default)

Set this to the maximum value of the output range. (1000 is the module default)

**CAREL**

**5. TABLE OF T**

**Table of temperature-resistance values for NTC sensor 10K@25°C B 3435**

Temp. °C	Resistance value		
	Max. KΩ	Typical KΩ	Min. KΩ
-50	344.40	329.20	314.70
-49	324.70	310.70	297.20
-48	306.40	293.30	280.70
-47	289.20	277.00	265.30
-46	273.20	261.80	250.60
-45	258.10	247.50	237.30

From the published 'temperature/resistance table, create a workbook to calculate the voltage of A-D input at the various temperatures

Formula:  $=((C12*\$B\$6)/((C12*\$B\$6)+((C12+\$B\$6)*\$B\$5)))*\$B\$4$

	A	B	C	D	E	F	G
1	<b>Carel NTC10K - HP</b>						
2	Type:	Thermistor					
3	Used by:	Carel					
4	Vref (volt)	<b>10</b>					
5	Rt (ohm)	<b>40,000</b>					
6	Rn (ohm)	<b>204,800</b>					
7	<b>Carel NTC10K - HP</b>						
8	<b>Tabular Conversion</b>						
9	Source	Result					
10	Volt	Value °C	Rs Ω				
11	<b>Sensor Characteristic</b>						
12	7.59	-50	329200				
13	7.55	-49	310700				
	7.51	-48	293300				

**Tip:**  
Calculate the voltage 'Volt' using the formulae:  
 $Volt = ((Rs * Rn) / ((Rs * Rn) + ((Rs+Rn)*Rt)))*Vref$

Go back into the realValue proxy point and add the **Source (Volt)** and **Result (Temperature Value)** entries into the generic table

**Tip:** You can export the table and then import it into other similar points

Carel NTC10K - HP			
Tabular Conversion			
Source	Result		
Volt	Value °C	Rs Ω	
Sensor Characteristic			
7.59	-50	329200	
7.55	-49	310700	
7.51	-48	293300	
7.46	-47	277000	
7.22	-42	209800	
7.16	-41	198700	
7.10	-40	188400	
7.04	-39	178300	

You can also trim the value by setting an offset which will reduce the raw real value

This is the realValue which is now offset

Set this to an offset (a positive number)

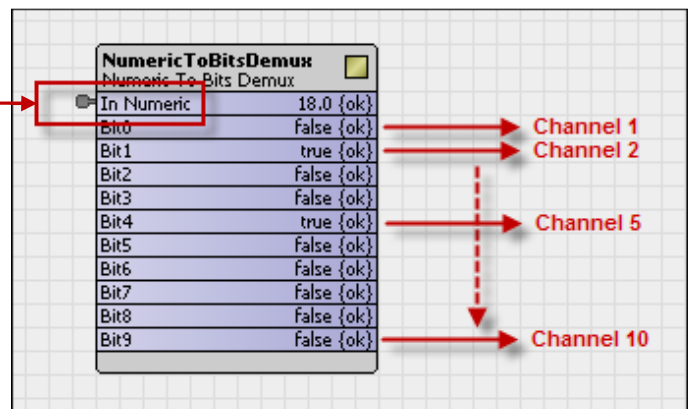
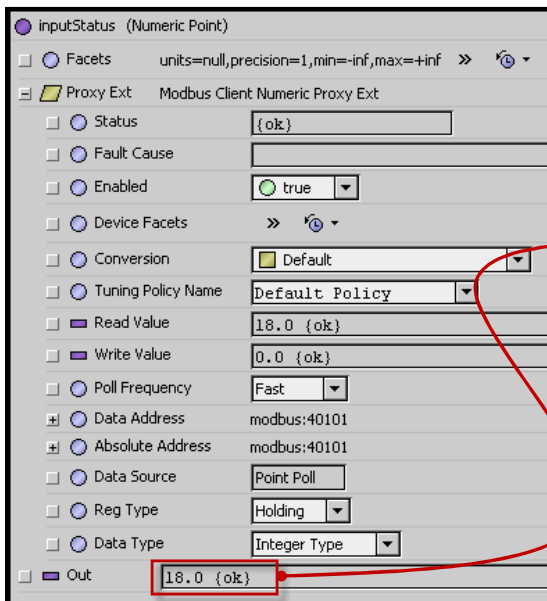
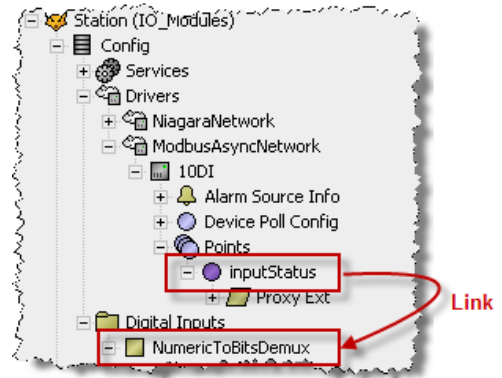
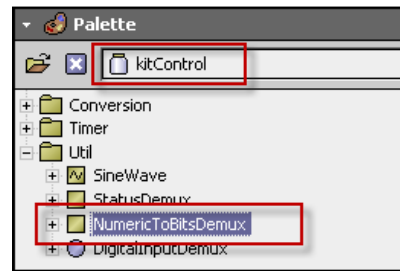
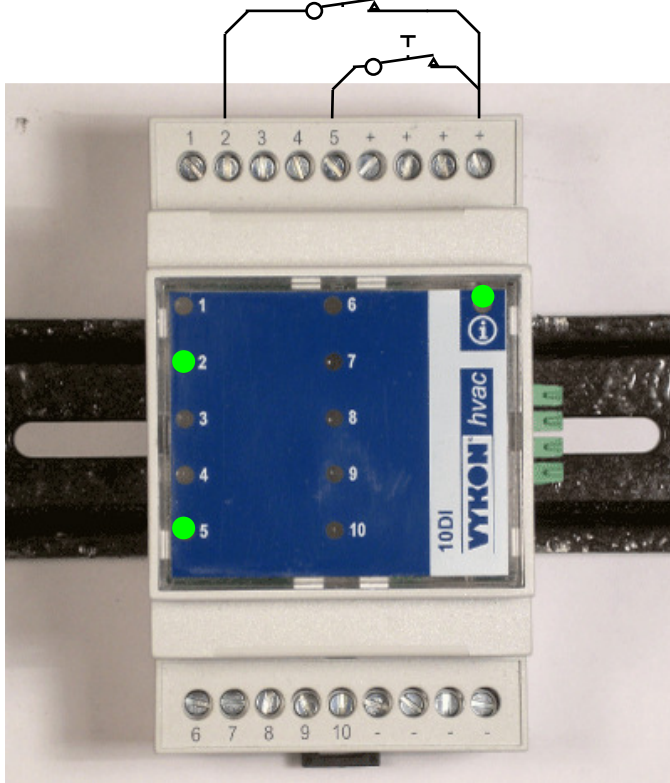
**Note:** The offset is on the raw value

## Reading the digital input channel status

As an economy for module register addressing, some registers are multiplexed and contain the boolean data from more than one channel. The 'Digital input channel status' on the 10-DI and MULTI-I/O modules and the 'Fault contact (S) status' and 'Run contact (B) status' on the 6DOH-12DI module are typical examples. Here are two methods you can use to demultiplex the single register into its constituent digital channels.

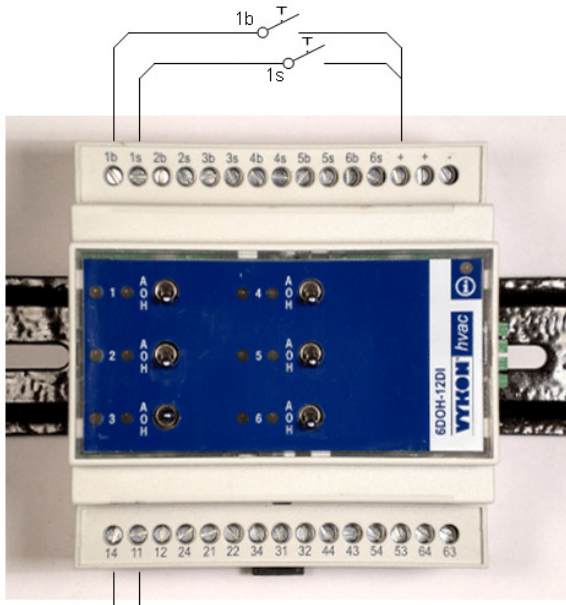
### Method 1: "NumericToBitsDemux"

This method demultiplexes all 10 channels in one go and uses the 'NumericToBitsDemux' component which can be found in 'KitControl...Util':



### Method 2: "Register Bit Point"

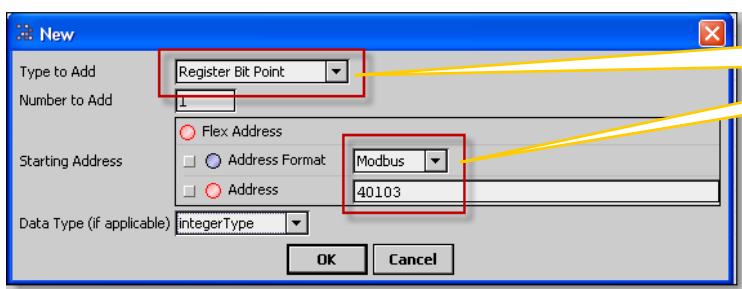
This method demultiplexes each channel individually and uses the 'Register Bit Point' proxy point type in the 'points' folder of the Modbus device. Note that in this example, the 'Fault contact (S) status' and 'Run contact (B) status' on the 6DOH-12DI are illustrated but both these methods of demultiplexing can apply to any of the 'bit' related input registers on any of the IO modules.



The bit related Modbus points typically have:  
 Bit 0= channel 1  
 Bit 1= channel 2  
 Bit 2= channel 3  
 ... etc

40102	101	Fault contact (S) status	Bit 0... 5; FALSE=normal, TRUE=fault	R	W
40103	102	Run contact (B) status	Bit 0... 5; FALSE=not running, TRUE=running	R	W
40104	103	Relay status	Bit 0... 5; FALSE=open, TRUE=closed	R	W

~~Bit 0... 5; Bit 0=Output1; Bit 1=Output2; Bit 2= Output3; Bit 3= Output4; Bit 4= Output5; Bit 5= Output6  
 Set output channel value: Bit 0... 5; FALSE=Relay off; TRUE=Relay on~~



Add a new **register bit point** and give it the Modbus address

Name	Type	Enabled	Tuning Policy Name	Poll Frequency	Data Address
Channel 2 run B status	Register Bit Point	true	defaultPolicy	Normal	modbus:40103

Name: Channel 2 run B status

Type: Cannot edit

Enabled:  true

Tuning Policy Name: Default Policy

Poll Frequency: Normal

Data Address:  Flex Address

Address Format: Modbus

Address: 40103

Reg Type: Holding

Data Type: Cannot edit

Status Type: Cannot edit

Bit Number: 1 [0 - 15]

Number Registers: Cannot edit

Device Facets: trueText=true,falseText=false

Facets: trueText=true,falseText=false

Conversion: Default

Give it a Name

Set the 'Bit Number' that you want to read

And finally you can 'link' your logic directly to the boolean 'out' slot

Database						
Name	Type	Out	Absolute Address	Reg Type	Bit Number	
versionNumberSoftware	Numeric Point	700.0 {ok}	modbus:40001	Holding		
watchdogCounter	Numeric Point	18566.0 {ok}	modbus:40002	Holding		
Channel 1 run B status	modbusCore:RegisterBitPoint	true {ok}	modbus:40103	Holding	0	
Channel 1 fault S status	modbusCore:RegisterBitPoint	false {ok}	modbus:40102	Holding	0	
Channel 2 run B status	modbusCore:RegisterBitPoint	false {ok}	modbus:40103	Holding	1	
Channel 2 fault S status	modbusCore:RegisterBitPoint	true {ok}	modbus:40102	Holding	1	
Channel 6 run B status	modbusCore:RegisterBitPoint	true {ok}	modbus:40103	Holding	5	
Channel 6 fault S status	modbusCore:RegisterBitPoint	false {ok}	modbus:40102	Holding	5	

## Communications monitoring by the module

Every Vykon HVAC module has two registers which are used to set delay timers in the module's communications monitoring. They are always the same two register numbers (40051 and 40052) in every module type. Each module monitors the Modbus traffic for its specific device number and every time it receives a message, it resets a timer. If the timer expires then the module asserts a "Comms failure" which initiates the following actions:

- The Status LED (visible on the module top right corner) will 'blink' red
- The Module will override selected "Output" registers to a determined condition.



If the module is in a "Comms failure" condition and it successfully receives messages for its device number then it will release a timer and after its time has expired then a "Normal operation" condition is established reverting the failure actions back to normal.

**Note:**  
You can adjust the default settings by writing new values into these registers

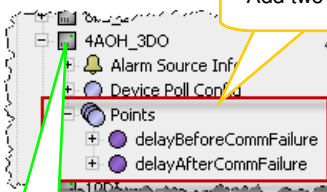
By default the module waits 300 seconds before asserting "comms failure"

40051	50	Comms failure assert delay	Time to assert comms failure (sec)	R/W	I	300	0	3600	✓
40052	51	Normal operation assert delay	Time to assert comms OK (sec)	R/W	I	30	0	3600	✓

By default the module waits 30 seconds before asserting "normal operation"

## Notes

- It is possible that if the communications network is busy servicing other modules, unless there is a specific control change to a module's output, then the module may not receive any message for some time. Therefore, if you are experiencing problems of Digital Outputs and/or Analogue Outputs changing condition after a period of time, then it is likely that the module is asserting a "Comms failure" and the outputs are being set to their 'comm fail' condition. You can overcome this by increasing the "Comms failure assert delay" period or by adding a new 'Tuning Policy' for the outputs, or both. (please see another 'Use example')
- When the modules are used with the Vykon HVAC software, Vykon HVAC sets these registers to 660 (40051) and 30 (40052)



Add two points

**Note:**  
Other module types are similar

Set the delay times

## Output channel 'comm fail'

Each output (Digital o/p and Analogue o/p) on the Vykon HVAC modules will be forced to a determined state should the module go into a "Communications failure". The state that the output goes to is determined by a register value which, although it has a default value, it can be set to your own requirements:

- Digital outputs may be set such that the output goes to an 'Off', 'On' or 'do nothing' (remain as-is) condition. (Default is 'Off')
- Analogue outputs will go to a fixed value. (Default is '0v')

Register	M	D	Name	Notes	R/W	D	Def	Min	Max	S
40001		0	Software version	x 0.01 = version number (e.g. 133 =v1.33)	R	I		0	65535	
40313		312	Analogue o/p ch 3 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40314		313	Analogue o/p ch 4 (comm fail)	Value (x 10 <sup>-3</sup> )	R/W	I	0	0	1000	✓
40318		317	Digital o/p ch 1 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓
40319		318	Digital o/p ch 2 (comm fail)	0, 1 or 2	R/W	I	0	0	2	✓

These are the comm. fail registers

These are the settings

Notes as to the use and operation of register and its value...

- Module type numbers: 0=Unknown; 1=4DO; 2=10DI; 3=8AI; 4=4AOH-3DO; 5=6DOH-12DI; 6=2HILO; 7=XX; 8=MULTI I/O
- Bit 0...3; Bit 0=Output1; Bit 1=Output2; Bit 2= Output3; Bit 3= Output4
- Set digital o/p channel value: Bit 0...2: FALSE=Relay off; TRUE=Relay on
- Digital o/p ch 1 (comm fail): Output channel value in a communications failure condition: 0=off; 1=on; 2=(do nothing)
- Analogue o/p ch 1 (comm fail): Output channel value in a communications failure condition: Value (x 10<sup>-3</sup>)

Def The Default value the register is set to after a full reset.

Add points for each output

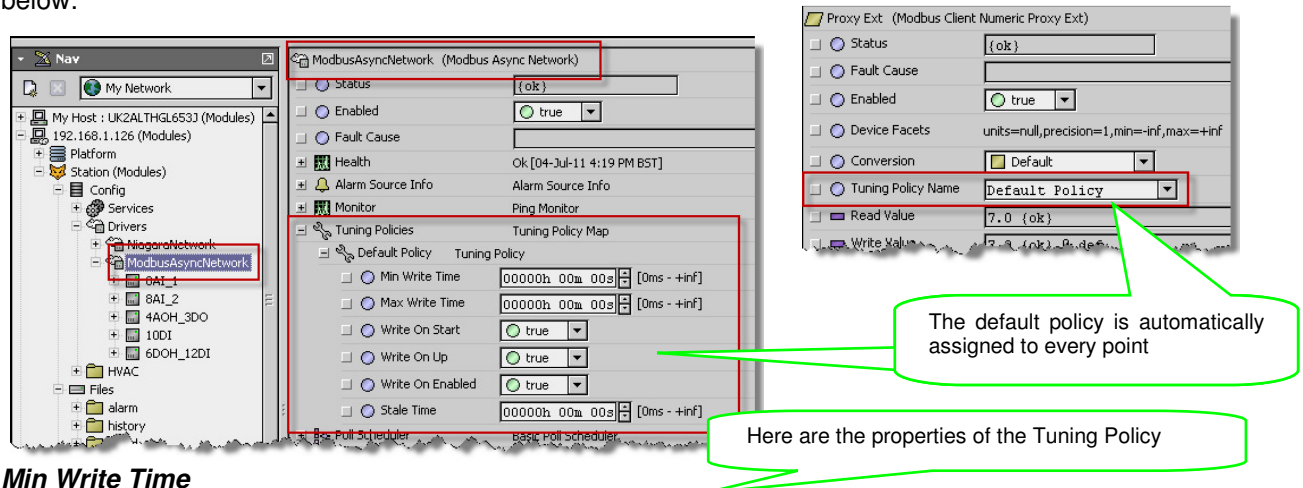
**Note:**  
Other module types are similar

**Note:**  
In this example the Analogue Output value is set to mid range (5v) output if communications fail

**Note:**  
In this example the Digital Output channel is set to remain at the condition it is currently at if communications fail

## Tuning Policies in the Modbus Async Network Driver

The NiagaraAX Modbus Async Network Driver has the ability to set a Tuning Policy for each proxy point. The driver network provides a 'Default Policy' and assigns this to every proxy point. This is illustrated below:



### Min Write Time

Applies to writable proxy points and specifies the minimum amount of time allowed between 'writes'. It provides a method to throttle a rapidly changing value so that only the last value is written. If this property value is 0 (default), this rule is disabled (all value changes cause an attempt to write).

### Max Write Time

Applies to writable proxy points and specifies the maximum "wait time" before *rewriting* the value, in case nothing else has triggered a write. Any write action resets this timer. If property value is 0 (default), this rule is disabled (no timed rewrites).

**Note:** In some cases setting this to some value, for example 10 minutes, may be useful. Often, a network may have devices that upon a power cycle (or even a power "bump"), have writable points that reset to some preset "default" value or state. Note that often in a "site-wide" power bump of a few seconds, such field controllers (devices on the network) typically reset, but a JACE continues normal operation on backup battery. Since the network's default monitor ping is usually 5 minutes, the station (network) may never mark these devices as "down," such that a "Write On Up" does not occur. Assigning the point to a tuning policy that does have a configured Max Write Time can correct issues like this.

### Write On Start

Applies to writable proxy points and determines the behaviour at *station startup*.

- If true, (default) a write occurs when the station first reaches "steady state."
- If set to false, a write does not occur when the station reaches "steady state."

### Write On Up

Applies to writable proxy points and determines the behaviour when a proxy point (and parent device) transitions from "down" to "up."

- If true, (default) a write occurs when the parent device transitions from down to up.
- If set to false, a write does not occur when the parent device transitions from down to up.

### Write On Enabled

Applies to writable proxy points and determines the behaviour when a proxy point's status transitions from "disabled" to normal (enabled).

- If true, (default) a write occurs when writable point transitions from disabled.
- If set to false, a write does not occur when writable point transitions from disabled.

### Stale Time

Applies to writable proxy points and determines the behaviour when a proxy point's status transitions from "disabled" to normal (enabled).

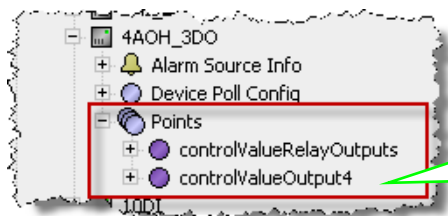
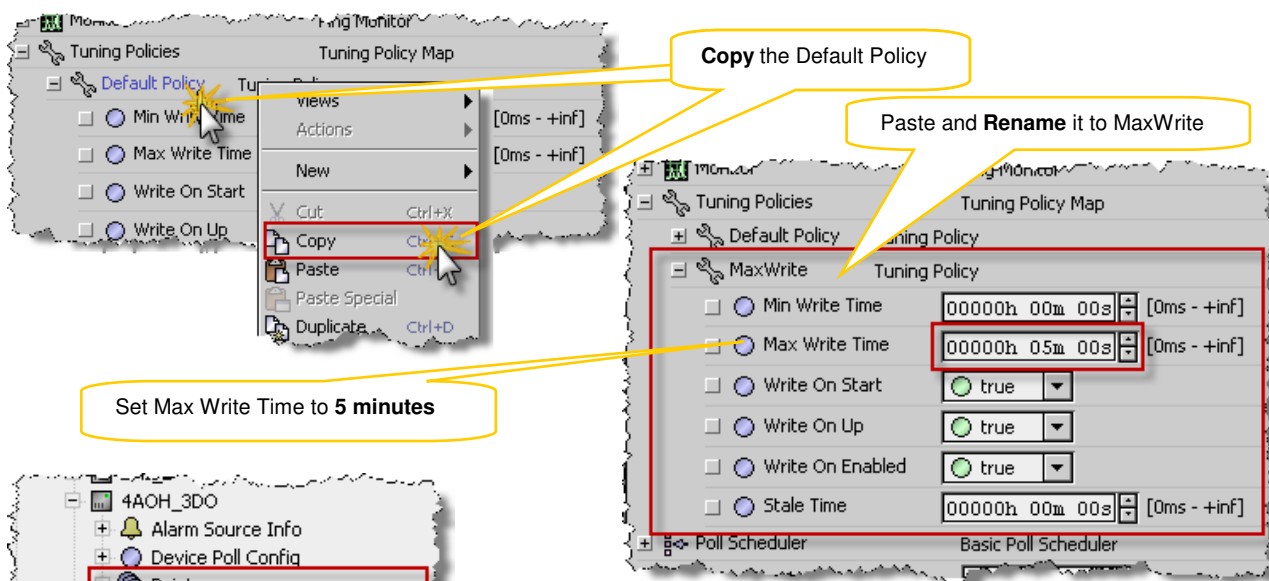
- If true, (default) a write occurs when writable point transitions from disabled.
- If set to false, a write does not occur when writable point transitions from disabled.

## Assigning a 'MaxWrite' Tuning Policy to Outputs

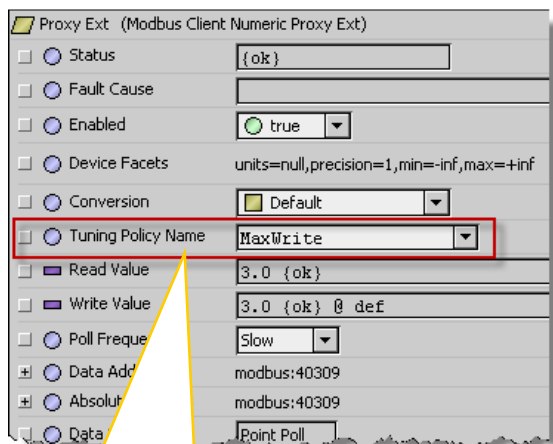
We know from the 'Output channel comm. fail use example' that "Each output (Digital o/p and Analogue o/p) on the Vykon HVAC modules will be forced to a determined state should the module go into a "Communications failure". If this happens then when the module comes out from a comm. failure condition, the output proxy points in the Async Network Driver will be unaware of the change.

We also know from the 'Tuning Policies in the Modbus Async Network Driver use example' that the 'Default Tuning Policy "Max Write Time" is set by default to '0' ensuring that there are no timed rewrites of writeable proxy points. Therefore, unless the Module device itself transitions from a 'down' to 'up' condition or the JACE restarts, the output will not be rewritten until the output proxy point changes state due to its operational control strategy.

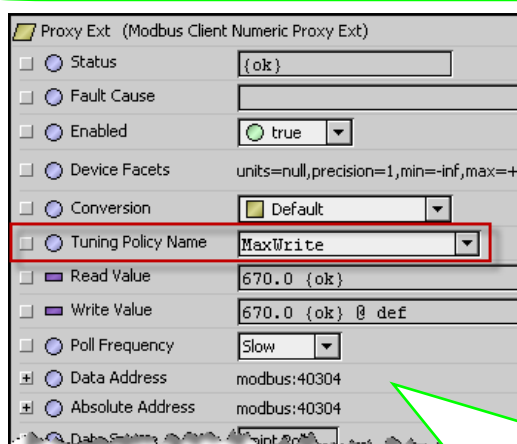
To overcome such an eventuality a 'MaxWrite' tuning policy should be created and assigned to each of the output writeable proxy points:



**Note:**  
This example illustrates two points in the 4AOH-3DO module but other modules and output points are similar



Set the Tuning policy in each output proxy point to the MaxWrite policy

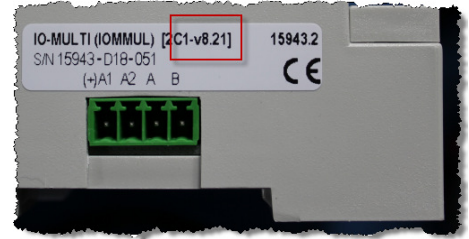


**Tip:**  
By setting every output to this new policy their output values will be rewritten at least every 5 minutes

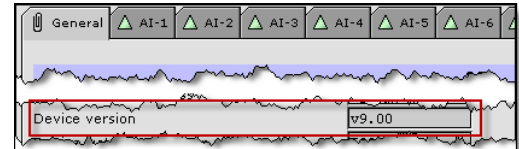
### Module Version Control

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



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

**Related documents**

No	Reference	Title

**Document Control**

Document release	Date	Comments
1	3 <sup>rd</sup> Nov '07	First issue (JB)
2	18 <sup>th</sup> Dec '07	AI module more detail (JB)
3	13 <sup>th</sup> May '08	Scope updated (JB)
4	20 <sup>th</sup> May '08	Added new sensor types to 8AI & MULTI I/O), Changed Vykon HVAC (JB)
5	15 <sup>th</sup> Sep '08	Corrected AI sensor type register notes range 0...8. U/I changed to A/I on MULTI I/O in line with data sheet (JB)
6	15 <sup>th</sup> Dec '09	Corrected AI sensor type=5 24VDC (not AC) in line with newer MULTI I/O modules (JB)
7	8 <sup>th</sup> Jan '10	Changed header note to 'Partner Information' (JB)
8	12 <sup>th</sup> Apr '10	Added Use examples – 4-20mA sensor (JB)
9	13 <sup>th</sup> Apr '10	Added Module communications settings (JB)
10	21 <sup>st</sup> Apr '10	Added T1(Staefa) & NTC5K sensors to 8AI & MULTI I/O (JB)
11	5 <sup>th</sup> May '10	Added Use example – Generic tabular RTD sensor (JB)
12	19 <sup>th</sup> May '10	Added Use example – Reading the digital input channel status (JB)
13	7 <sup>th</sup> Apr '11	Added Use example – Method 2 Reading the DI channel status: Added note regarding two changed settings in Modbus Async Network: Typos corrected 301, 302, 303 in 4AOH-3DO (JB)
14	23 <sup>rd</sup> Jun '11	Added Analogue Input RTD sensor use example. Correction to Generic Tabular Voltage calculation formulae– (JB)
15	30 <sup>th</sup> Jun '11	Added "Communications monitoring", "Output channel comm fail", "Tuning policies" and "MaxWrite" tuning policy use examples. Add "refer to back of guide" note. Added order code references to each module (JB)
16	27 <sup>th</sup> Jul '11	Added "Module Version control". Updated Analogue Input RTD sensor, 0(4)-20mA current sensor, Generic Tabular RTD sensor, for v9.00 Rt and table changes. Removed blank pages (JB)

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