

INSTALLATION AND OPERATING MANUAL

VE8206 6 Channel iVAS Controller Module



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REVISION HISTORY

Date	Revision	Updated by	Detail
02 June 2020	1.0	K.J.McWilliam	Created from MX6001 Controller IOM
16 October 2020	1.1	K.J.McWilliam	Amended RS485 Connector pinout

1 INTRODUCTION

The VE8206 6 Channel iVAS Controller Module has been designed to ease integration of iVAS VS8500 Air Sampler units into a system or to facilitate standalone operation using just hardware control.

VE8206 comprises an ABS plastic enclosure that houses an MX6001 six channel multifunction controller configured specifically to drive the iVAS units.

The controller provides:

- 1 Ethernet port to optionally connect to a host computer
- 6 RS485 communications ports, each with a switched, current limited 24V supply for connection to iVAS units. These ports are labelled 'A' thru 'F'.
- 8 digital inputs that can be freely assigned to start/stop one or more iVAS units
- 10 digital outputs that can be assigned to show status of specific iVAS units

VE8206 can drive six iVAS but is optimised for driving four iVAS units since it has a sufficient number of inputs and outputs to drive all four uniquely configured iVAS units with two inputs per iVAS and two outputs per iVAS. However, if inputs and/or outputs can be shared, then the full complement of six iVAS units can be accommodated using a single VE8206.

Internally the MX6001 offers six identical 4-way screw terminal blocks that provide connections out of the VE8206 enclosure via industry standard glands. The Ethernet connection to the host system exits the enclosure via an RJ45 port for added convenience.

2 SPECIFICATION

- ABS plastic enclosure:
 - 200mm Wide, 120mm High (excluding cable entry), 90mm Deep
 - Weight 2kg
- Power supply
 - 24Vdc $\pm 10\%$
 - 7.5A maximum for 6 iVAS @100lpm
- Ethernet port
 - 10/100Mbps Auto-negotiation
- 6 RS485 ports
 - $\frac{1}{4}$ load drivers with integral pull up and pull down 1K resistors
 - $\pm 80V$ Fault-Protected transceivers
 - Each port has a switchable 24V 0.5A supply to power iVAS
- Digital Inputs
 - 8 Opto-isolated as a group (200V isolation)
- Digital Outputs
 - 10 Switched 24V maximum current 500mA
- Environmental
 - Operating temperature -20 to 50°C
 - Storage temperature -20 to 60°C

3 **AN OVERVIEW OF THE VE8206**

3.1 **Power Supply**

A suitable 24Vdc (+/-10%) supply should be provided to the VE8206 enclosure via the rightmost gland.

The supply must be sufficient to provide power to all the connected iVAS units plus any loads associated with digital outputs.

24V Connector	Description
1 (nearest to MX6001 corner)	+24Vdc
2	0V

On power-up the communications activity LEDs next to RS485 Port A flash to indicate the firmware version. For example, four red flashes followed by eight green flashes indicates firmware version 4.8 (also known as 'DH').

3.2 **Ethernet Interface**

A standard RJ45 connector with integral LEDs is provided for the Ethernet port. This performs auto negotiation of the link speed (100/10Mbps) with duplex operation.

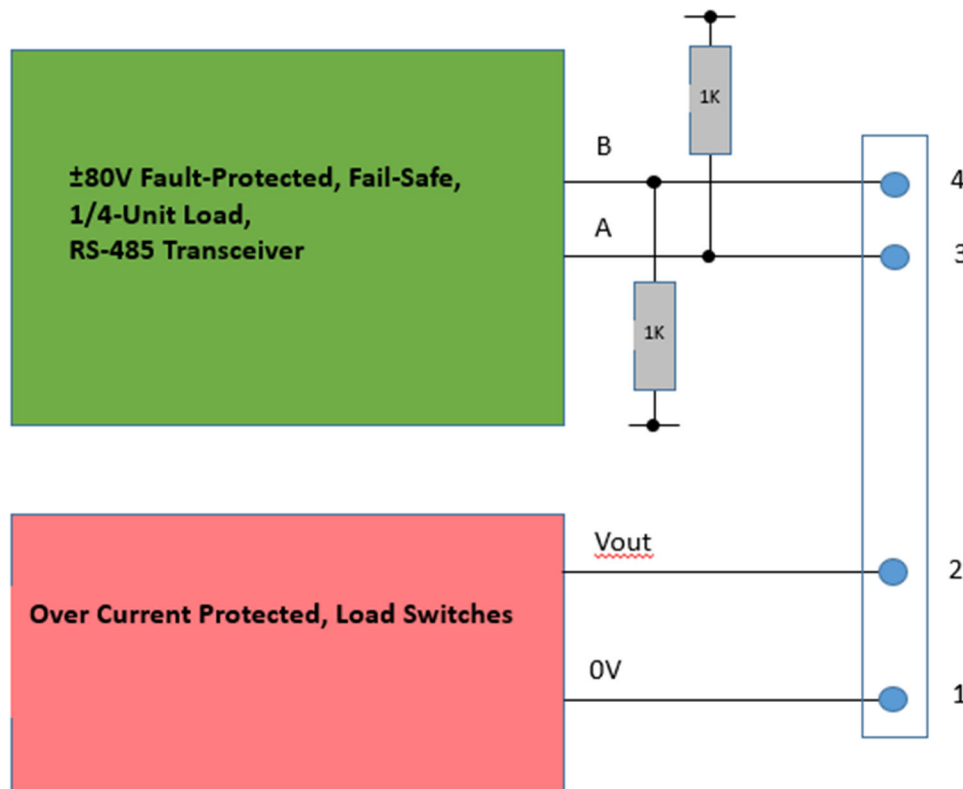
The amber LED is permanently illuminated when power is applied to the module. The Green LED can be interpreted as follows:

Off	No link
On	Link established
Blinking	Activity on link

The IP Address for the Ethernet port is set during module configuration.

3.4 MX6001 RS485 Communications Interfaces

4-way terminals are provided on the MX6001 for each of the six RS485 ports.



Each provides:

- A half-duplex, fault protected $\frac{1}{4}$ load RS485 transceiver.
- A 24V switched power supply output.
- Diagnostic LEDs

Screw Terminal Pin no.	Signal Description
1	0V (and RS485 screen)
2	Switched 24V
3	RS485 A
4	RS485 B

Each RS485 port has four diagnostic LEDs to assist in on-site fault finding, two providing diagnostics about communications adjacent to the edge of the MX6001 PCB and two inboard of the connector giving information about the status of the switched 24V supply.

The red communications LED pulses for each *received* character and the green LED pulses for each *transmitted* character on the RS485 port.

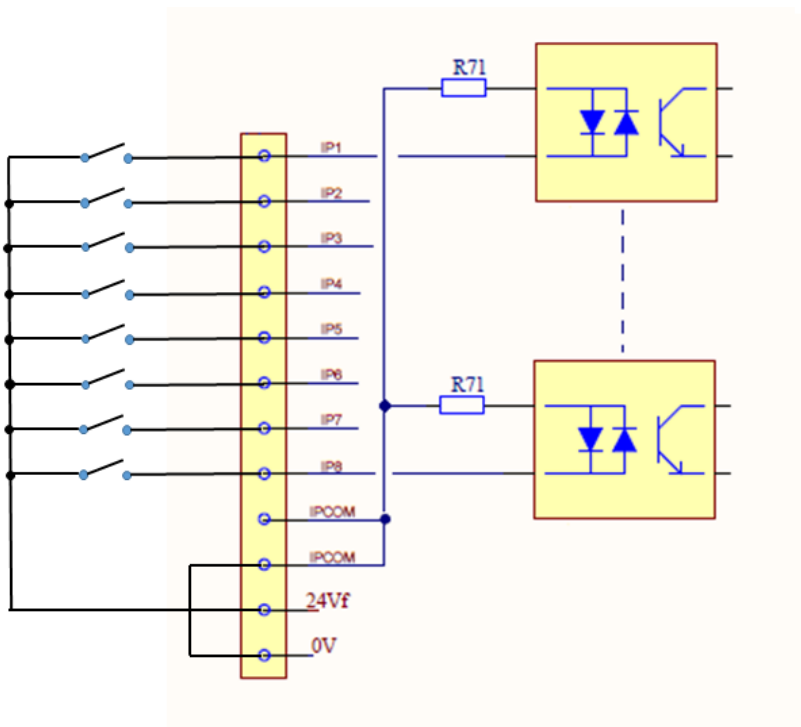
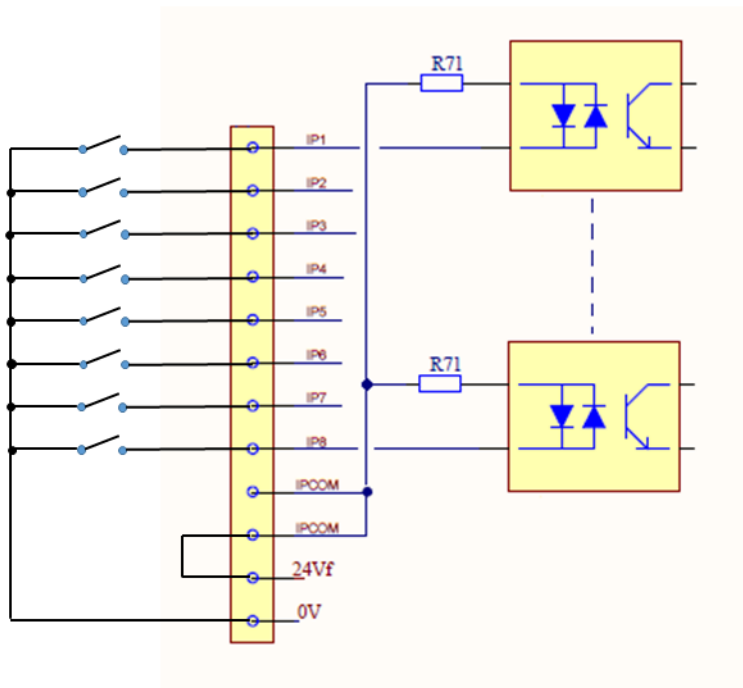
The amber power LED is on when the switched 24V is on. The red power LED only illuminates when a fault occurs in the 24V supply e.g. a short circuit condition.

3.5 Digital Inputs

The VE8206 has 8 digital outputs which are available on the 12 pin Digital Input header.

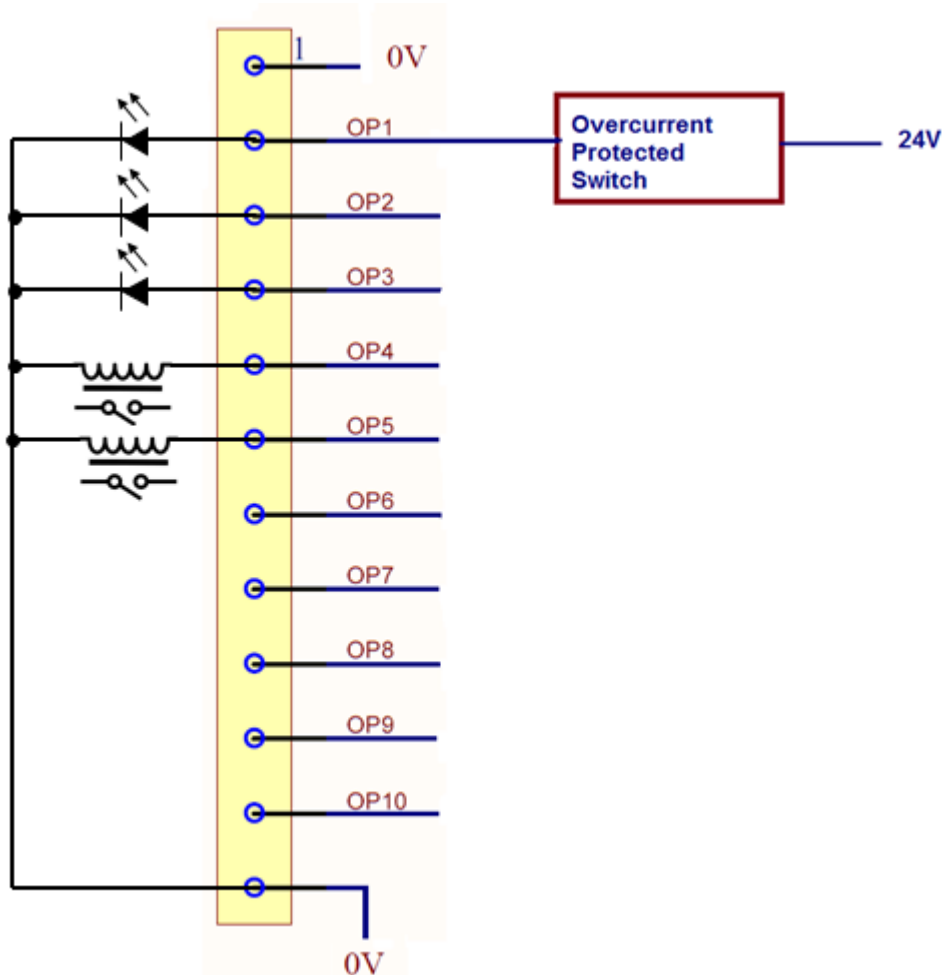
The inputs have been designed to be able to connect to systems with PNP or NPN transistor outputs as well as accommodating simple dry contacts.

The circuits are shown below:



3.7 Digital Outputs

The VE8206 has 10 digital outputs which are available on the 12 pin Digital Output header. Each output is a switched 24V source which can provide at least 0.5A and is protected from short circuits.



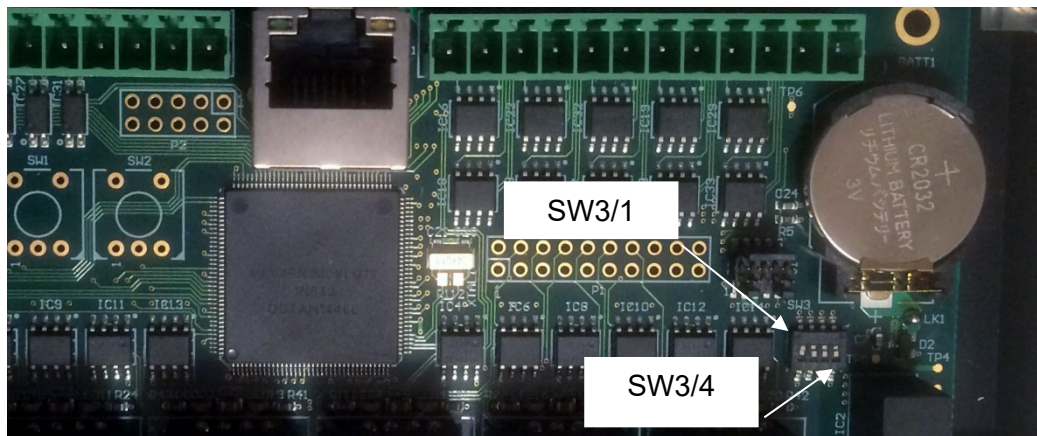
LEDs next to each output indicate the state of the output. An orange LED illuminates when the output is “On” i.e. providing 24V. A red LED illuminates when the output current is too high, usually indicating that there is a short circuit to 0V.

3.8 Option Switch Settings

The option switches are accessed by removing four retaining screws and the cover plate.

The switches (SW3) are positioned just above the power input connector and just below the battery.

SW3/1 is furthest from the edge of the module and Sw3/4 is closest to the PCB edge.



The VE8206 leaves the factory with a series of default settings:

IP Address: **192.168.0.100**

Gateway: **0.0.0.0**

iVAS	Run Input	Gas Input	Intermittent Run Input	Running Output	Fault Output	Flow Rate	Target Volume	Interval (secs)	Number of Runs
A	1	7	0	0	1	100	1100	0	0
B	2	7	0	0	2	100	1100	0	0
C	3	7	0	0	3	100	1100	0	0
D	4	7	0	0	4	100	1100	0	0
E	5	7	0	0	5	100	1100	0	0
F	6	7	0	0	6	100	1100	0	0

If the MX6001 is not in its factory default state, SW3 can be used to reset the module to defaults:

1	2	3	4	ACTION
Off	Off	Off	Off	Normal Operation
On	Off	Off	Off	IP Address forced to 192.168.0.100
Off	On	Off	Off	Reset MX6001 default state. Note that this 'blank' in readiness for the ConfVE8206 utility to be used to set it up for iVAS.
Off	Off	Off	On	Port A becomes a Modbus RTU server
Off	Off	On	On	Production Test Mode use only

The unit is most easily configured via ModbusTCP over Ethernet using a built-in ModbusTCP Server, however, if it is not possible to program the unit via Ethernet port, powering the MX6001 up with SW3/4 on will set the RS485A port to be a ModbusRTU server running at 19.2k baud. This can then be used to configure the unit. A suitable USB to RS485 serial programming cable is available from Pharmagraph.

4 Operation

In order to 'marshal' parameters within the attached iVAS units in a consistent manner, VE8206, or more accurately, the MX6001 within it, uses a structure called 'RtDb'.

4.1 Internal structure - RtDb

RtDb is an internal table of entries containing values gathered from the attached iVAS units. RtDb offers unified access to all iVAS units together with the control inputs and status outputs that may be user-configured to control iVAS.

Data is read automatically and continuously from any connected iVAS units and is written into fields within RtDb known as 'Points'. Data from the iVAS units is written into various points in the range 1 thru 1000 with some point numbers above 1000 used for the inputs and outputs. iVAS A uses Points 1 and subsequent above, iVAS B uses Points 101 and above, with iVAS F using Points 501 and above.

Points 1001 and above are used for control and status.

See the Modbus Register Map in section 5 for details.

NOTE: The Point map uses Base 1 numbering, but Modbus registers use Base 0 numbering. It is easy to retrieve a valid but incorrect parameter by overlooking this difference in numbering.

4.3 Modbus TCP Protocol

RtDb is accessed using Modbus TCP via the previously configured board IP address and fixed TCP port 502. The MX6001 within VE8206 processes Modbus TCP commands received on this port. Modbus protocol itself is outside the scope of this document but in summary, the Modbus Function Codes supported are:

Function Code	Description
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Force Single Coil
6	Preset Single Register
15	Force Multiple Coils
16	Preset Multiple Registers

For function codes 3, 4 and 16 the data is interpreted as signed integers.

Signed integer format uses a single register per point where data is scaled according to the 'Decimals' setting for that point. This permits floating point numbers to be reconstituted within the host computer by dividing the retrieved value dependent by a value determined by the associated number of decimals:

Decimals	Value
0	Current Value * 1
1	Current Value * 10
2	Current Value * 100
3	Current Value * 1000
4	Current Value * 10000
5	Current Value * 100000

Using the Volume Sampled as an example: This value is offered as a signed integer derived from the floating-point value by internally multiplying it by 1000 (i.e. 10^3), because the associated number of decimal places for Sampled Volume can be seen in the point table as '3'. When the host computer retrieves the signed integer, it can divide by 1000 to yield a floating-point number significant to three decimal places. A Sampled Volume of 0.345 m^3 would be internally scaled by MX6001 to yield $(0.345 \times 10^3 =) 345$ before offering it via Modbus. The host computer reads 345 as the value, but also reads the number of decimal places as '3', allowing it to divide the value by 10^3 to yield the Sampled Volume as 0.345 m^3 .

4.3.2 iVAS A Parameter layout within RtDb

Point	Read/ Write	Description	Units
1	R	Intermittent Mode State	
2	R	Gassing Mode Run State	
3	R	Continuous Mode Run State	
6	R	Motor Running	
7	R	Fault Detected	
8	R/W	Intermittent Mode Run Command	
9	R/W	Gassing Mode Run Command	
10	R/W	Continuous Mode Run Command	
12	R/W	Interval	sec
13	R/W	Number of runs	
14	R	Control Mode (0 = Speed, 1 = Volumetric Flow)	
17	R/W	Flow Rate (0 = 100 l/min, 1 = 50 l/min)	
18	R/W	Target Volume	m ³
19	R/W	Target Volume - Litres	l
21	R	Inlet Fan Failed to Start	
22	R	Outlet Fan Failed to Start	
23	R	Failed to Achieve Flow Rate	
25	R	Air Temperature Sensor Failed	
26	R	Barometric Pressure Sensor Failed	

iVAS A Fan/Motor Run Time Registers

Point	Read/ Write	Description	Units	Decimals
30	R	Percent of sample time complete	%	0
31	R	Percent of volume sampled	%	0
32	R	Time left to sample complete	sec	0
33	R	Total sample duration	sec	0
34	R	Total head run time	sec	0
35	R	Current run time	sec	0
36	R	Inlet Fan Frequency	Hz	0
37	R	Outlet Fan Frequency	Hz	0
38	R	Current Volumetric Flow Rate	lpm	0
39	R	Est. Total Volume Sampled	m ³	3
40	R	Est. Total Volume Sampled - litres	l	0
42	R	Speed Control Setpoint	Hz	0
43	R	Flow Rate Setpoint	lpm	0
51	R	Serial number		0
52	R	Calibration Date - day		0
53	R	Calibration Date - month		0
54	R	Calibration Date - year		0
55	R	Product Code		0
56	R	F/W Version		0
71	R	Inlet Fan Current	mA	0
72	R	Outlet Fan Current	mA	0
73	R	Total Fan Current	mA	0
75	R	Pressure across controlled orifice	Pa	0
76	R	Current Standard Volumetric Flow Rate	slpm	0
77	R	Barometric Pressure	mBar	0
78	R	Air Temperature	°C	1
79	R	Air Density	kg/m ³	3

The points associated for iVAS B thru F are similarly laid out by adding 100 to the point number for each iVAS.

See the Register Map below.

5 RtDb MODBUS REGISTER MAP

5.1 Signed Integer Register Access to iVAS A thru F

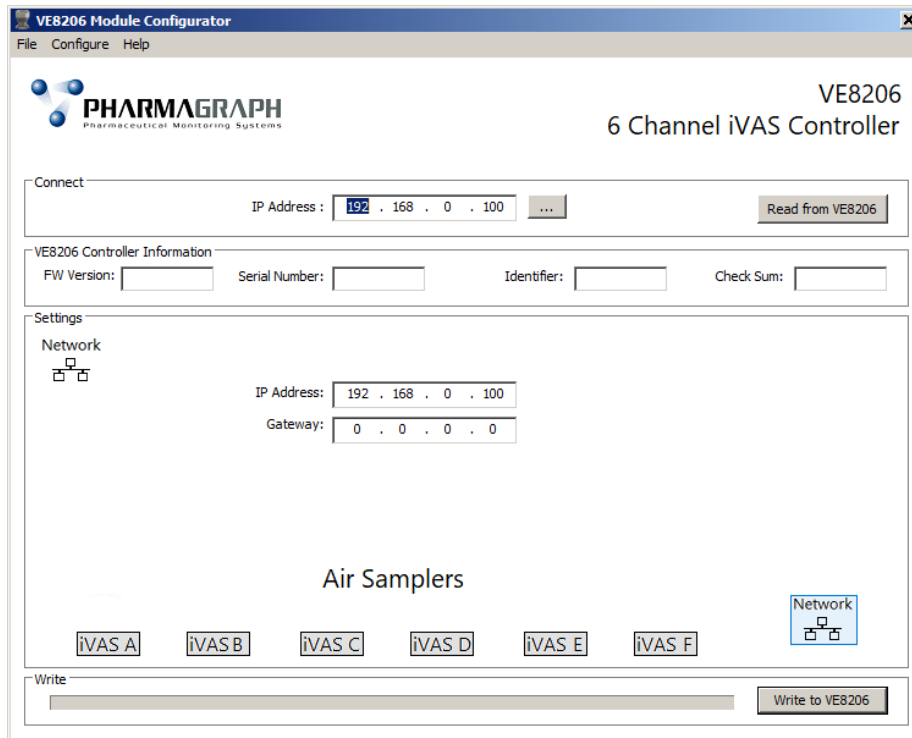
Protocol Address (Base 0)	RtDb Point (Base 1)	Read/Write	Description
0	1	R/W	Intermittent Run Command for iVAS A
1	2	R/W	Gassing Mode Command for iVAS A
.	.	.	.
100	101	R/W	Intermittent Run Command for iVAS B
101	102	R/W	Gassing Mode Command for iVAS B
.	.	.	.
500	501	R/W	Intermittent Run Command for iVAS F
501	502	R/W	Gassing Mode Command for iVAS F
578	579	R	Air Density in kg/m ³ for iVAS F

5.2 Signed Integer Register Access to MX6001 Control/Status

Protocol Address (Base 0)	RtDb Point (Base 1)	Read/Write	Description
1000	1001	R	Digital Input 1
.	.	.	.
1007	1008	R	Digital Input 8
1008	1009	R/W	Digital Output 1
.	.	.	.
1017	1018	R/W	Digital Output 10
1018	1019	R/W	24V Power output control for iVAS A
.	.	.	.
1023	1024	R/W	24V Power output control for iVAS F
1024	1025	R/W	Real-time clock seconds min, hr day, month, year
1025	1026	R/W	Real-time clock minutes
1026	1027	R/W	Real-time clock hours
1027	1028	R/W	Real-time clock days
1028	1029	R/W	Real-time clock month
1029	1030	R/W	Real-time clock year
.	.	.	.
1053	1054	R	Firmware version
1054	1055	R	Firmware revision

6 VE8206 Configuration utility

To configure the controller and its iVAS units, run the VE8206 Module Configurator program 'ConfVE8206'. This standalone application can be run from any location on your computer:

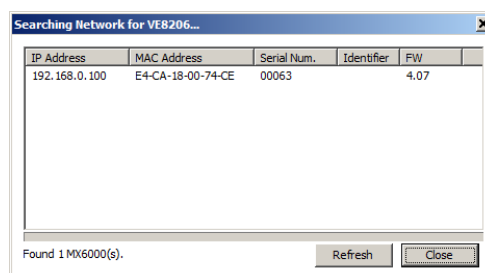


6.1 'Connect'

IP Address: Enter the IP Address of the VE8206 controller you wish to connect to.

Alternatively, pressing the adjacent button with three dots will search the network for any connected VE8206 units on the LAN segment. It uses the first 3 parts of the IP specified in the IP Address when searching. With the IP Address shown in the example above it will search from 192.168.0.0 to 192.168.0.255.

A dialog box will display all the VE8206 units that are found on that network segment:



Select the desired VE8206 and click Close. Click the 'Read from VE8206' will establish a connection with the controller at the chosen address and display its associated current configuration. A message will be displayed if unsuccessful.

6.2 'VE8206 Controller Information'

FW Version	Displays the firmware version of the integral MX6001 controller.
Serial Number	Displays the serial number of the MX6001. This can only be edited when the serial number is 65535.
Identifier:	Displays the VE8206 identifier. This can be used to describe the controller's location and is useful when multiple controllers are used.
Check Sum	This number is generated based on the configuration parameters. If this is recorded it can be used to easily identify if the configuration has changed.

6.3 'Settings'

This section contains all the settings for the VE8206 controller. You can change the IP Address, Gateway and up to 6 iVAS units. You can switch between individual iVAS units by clicking the associated grey button towards the bottom of this section.

6.3.1 'Network'

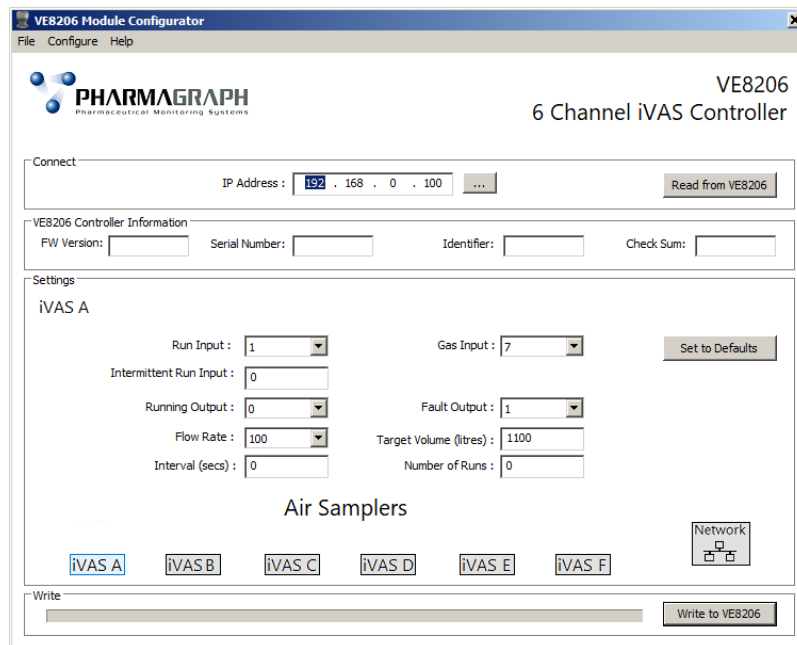
IP Address Defines the *desired* IP Address of the controller (may not be the current one).

Gateway Defines the desired Gateway of the controller.

Note: The controller is only updated when the 'Write to VE8206' button is clicked.

6.3.2 'iVAS A' through 'iVAS F'

Use the grey 'Air Samplers' buttons at the bottom to navigate between and configure up to six iVAS units as required.



Within each iVAS unit you can configure the following:

- Run Input** Defines which of the eight inputs will set the 'Continuous Mode Run Command' register of the iVAS unit (range: inputs 1 thru 8).
defaults:
 iVAS A driven by input 1
 iVAS B driven by input 2
 iVAS C driven by input 3 and so on...
- Gas Input** Defines which of the eight inputs will set the 'Gassing Mode Run Command' register of the iVAS unit (range: inputs 1 thru 8).
default:
 All - 7
- Intermittent Run** Defines which (if any) of the eight inputs will set the 'Intermittent Mode Run Command' register of the iVAS unit (range: 0 or inputs 1 thru 8).
default:
 All - 0 (not defined)
- Running Output** Defines which (if any) of the ten outputs will reflect the 'Motor Running' register of the iVAS unit (range: 0 or 1 thru 10).
default:
 All - 0 (not defined)

- Fault Output** Defines which (if any) of the ten outputs will reflect the 'Fault Detected' register of the iVAS unit (range: 0 or 1 thru 10).
defaults:
iVAS A drives output 1
iVAS B drives output 2
iVAS C drives output 3 and so on...
- Flow Rate** Defines the Flow Rate for each iVAS. You can select either 50 or 100 litres per minute (lpm).
default:
All: 100
- Target Volume** Defines the target volume you wish to achieve for each sample. The iVAS will use this value together with the Flow Rate to determine the sample duration.
default:
All: 1100
- Interval (secs)** Defines the interval in seconds between runs when running in intermittent run mode.
default:
All: 0 (not defined)
- Number of Runs** Defines the number of runs to perform during the intermittent run cycle.
default:
All: 0 (not defined)

You can press the Set to Defaults button to return the selected iVAS back to its default settings. Note that this will only set the iVAS you are currently configuring - the other iVAS units' settings will remain unchanged.

6.4 COMMITTING THE VE8206 CONTROLLER SETTINGS

Once you are satisfied with your configuration, you must click the 'Write to VE8206' button. This will update the controller with your configuration. A message box will inform you of successful update, otherwise it will display an error.

6.4.1 File Menu

The configuration program's File menu has the following items:

- | | |
|-------------------|---|
| New | This clears all configuration settings and reverts the controller default settings. Note: This will not reset the controller. |
| Open | This allows you to select an existing configuration file to edit. |
| Save | This saves the current configuration. If this configuration has not been saved before you will be prompted to choose the name and location of the new file. |
| Save As... | This allows you to save the current configuration to a new file. If the configuration file already exists, it will be overwritten. |
| Exit | Exits the configuration program. |

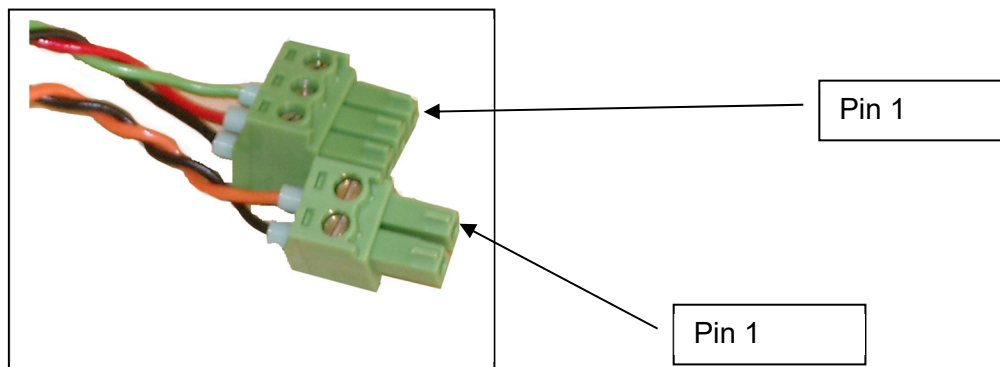
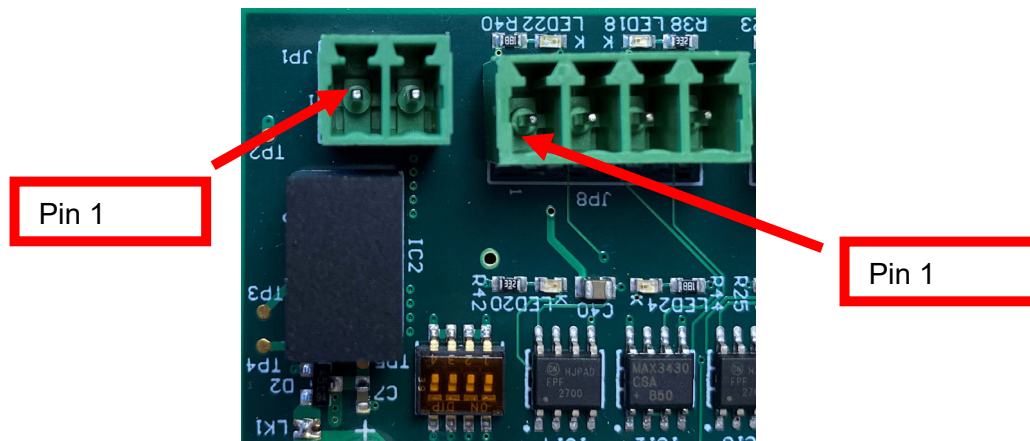
6.4.2 Configuration Menu

The configuration program's Configure menu has the following items:

- | | |
|--------------------------|--|
| Air Samplers | Selecting this option will display the list iVAS A - F. This is an alternative way to directly display the chosen iVAS settings. |
| VE8206 | Selecting this option will display a menu where you can read from VE8206, write to VE8206 or search for VE8206 connected to the network. These are simply alternative ways to directly access the Connect and Write sections of the main dialog. |
| Reset to Defaults | This will reset the connected VE8206 to its factory settings. It will set the IP address to 192.168.0.100, Gateway to 0.0.0.0 and all iVAS unit defaults mentioned in the Settings section of this manual. |

7 ORIENTATION OF HEADER CONNECTORS

To improve ease of installation, two part headers are used for all connections to the module. It is vital that the correct orientation of the two part connectors is observed. Pin 1 of the header on the PCB is always at the *left* when looking into the header with the PCB viewed from above when the keying detail is at the top. Failure to observe the correct orientation may result in damage to the system.



Orientation of pin 1 on two-part headers

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