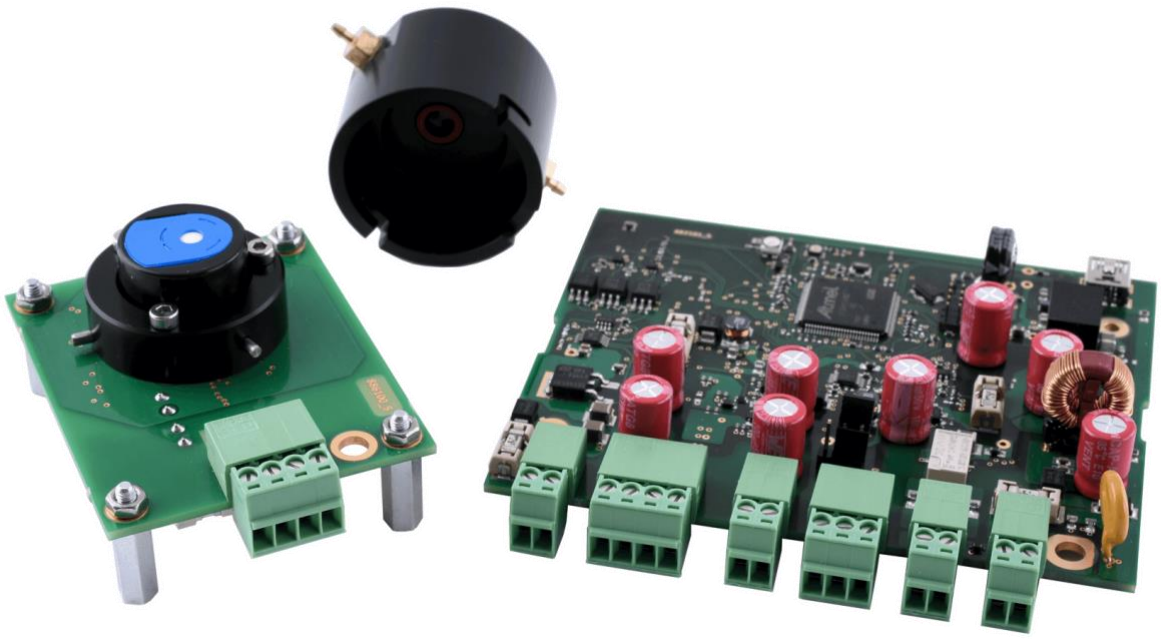
Sensor Development Kit (SDK)

Instrument User Manual V1.1



The standard warranty of your Sensor Development Kit is one year.

Contents

Symbols

WARNING!

USED TO INDICATE DANGER WARNINGS WHERE THERE IS A RISK OF INJURY OR DEATH.

WARNING! - DANGER OF ELECTRIC SHOCK

USED TO INDICATE DANGER WARNINGS WHERE THERE IS A RISK OF INJURY OR DEATH FROM ELECTRIC SHOCK.

CAUTION

USED TO INDICATE A CAUTION WHERE THERE IS A RISK OF DAMAGE TO EQUIPMENT.

PROHIBITED ACTION

USED TO INDICATE ACTIONS THAT ARE NOT PERMITTED; E.G. 'YOU MUST NEVER'.

INFORMATION

IMPORTANT INFORMATION OR USEFUL HINTS ABOUT USAGE.

Recycling and Disposal

RECYCLING

RECYCLE ALL PACKAGING.

WEEE REGULATIONS

ENSURE THAT WASTE ELECTRICAL EQUIPMENT IS DISPOSED OF CORRECTLY.

Statements

Validity of this Manual

This User Manual gives information and procedures for the firmware version shown on the back page of this manual.

If you have different versions of firmware, please obtain the correct User Manual.

Responsibility for Correct Use

Ion Science Ltd accepts no responsibility for incorrect adjustments, configurations or installations that cause harm or damage to persons or property.

Use the equipment in accordance with this manual, and in compliance with local safety standards.

Reduced performance of gas detection might not be obvious, so equipment must be inspected and maintained regularly. Ion Science recommends:

- you use a schedule of regular checks to ensure it performs within calibration limits, and that
- you keep a record of calibration check data.

ION Science Ltd SDK boards are not authorised for use in safety-critical applications where a failure of the ION Science Ltd product would reasonably be expected to cause severe personal injury or death. Safety-critical applications include, without limitation, life support devices and systems, equipment or systems for operation in Hazardous Areas or Zones. ION Science Ltd products are neither designed nor intended for use in military or aerospace applications or environments, nor for automotive applications or the automotive environment. The Customer acknowledges and agrees that any such use of ION Science Ltd products is solely at the Customer's risk, and that the Customer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

Warnings

1. Read and understand this Manual fully before you install or operate the SDK.
2. For safety, the SDK must only be installed by qualified personnel.
3. All electrical work must be only carried out by competent persons.
4. Substitution of components can result in unsafe conditions and will invalidate the warranty.
5. It is the responsibility of the user to ensure that PCB's are adequately protected from sources of EMI.
6. It is the responsibility of the user to ensure that PCB's are adequately protected from unsafe voltage conditions that could be transmitted into any connected equipment or systems.
7. It is the users responsibility to assess risk when working with toxic and flammable compounds. Relevant protective equipment must be used.

Quality Assurance

The SDK is manufactured using business systems complying to the ISO 9001 standard. That ensures that the equipment is:

- designed and assembled reproducibly, from traceable components,
- calibrated to the stated standards before it leaves our factory.

Disposal

Dispose of the SDK and its components in accordance with all local and national safety and environmental requirements. This includes the European WEEE (Waste Electrical and Electronic

Equipment) directive. Ion Science Ltd offers a take-back service. Please contact us for more information.

Legal Notice

Whilst every attempt is made to ensure the accuracy of the information contained in this manual, Ion Science accepts no liability for errors or omissions, or any consequences deriving from the use of information contained herein. It is provided "as is" and without any representation, term, condition or warranty of any kind, either expressed or implied. To the extent permitted by law, Ion Science shall not be liable to any person or entity for any loss or damage which may arise from the use of this manual. We reserve the right at any time and without any notice to remove, amend or vary any of the content which appears herein.

Warranty

ION Science Ltd warrants that its products will conform to the Specifications.

This warranty lasts for one (1) year from the date of the sale.

ION Science Ltd shall not be liable for any defects that are caused by neglect, misuse or mistreatment by the Customer, including improper installation or testing, or for any products that have been altered or modified in any way by the Customer. Moreover, ION Science Ltd shall not be liable for any defects that result from the Customer's design, specifications, installations or instructions or incorrect interfacing for such products. Testing and other quality control techniques are used to the extent ION Science Ltd deems necessary.

If any ION Science Ltd product fails to conform to the warranty set forth above, ION Science Ltd's sole liability shall be to replace such products. ION Science Ltd's liability shall be limited to products that are determined by ION Science Ltd not to conform to such warranty. If ION Science Ltd elects to replace such products, ION Science Ltd shall be given a reasonable time to provide replacements. Replaced products shall be warranted for a new full warranty period. ION Science Ltd shall not be liable for any freight costs incurred.

In no event shall ION Science Ltd be liable to the Customer or any third parties for any special, collateral, indirect, punitive, incidental, consequential or exemplary damages in connection with or arising out of the products provided hereunder, regardless of whether ION Science Ltd has been advised of the possibility of such damages. This indemnity will survive the termination of the warranty period.

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Introduction to the Sensor Development Kit (SDK)

The ION Science SDK consists of two PCBs designed to enable users to test and integrate MiniPID VOC sensors into their applications.

The sensor board holds an ION Science MiniPID 2 sensor and is fitted with a gas hood to allow easy introduction of gas to the sensor.

The integration board supplies power to the sensor board and can be configured to provide an analogue input, analogue output as well as a digital and serial output (Modbus). The integration board stores calibration values for the sensor and will also log and store data from all inputs.

Technical Specification

Sensor Board

Name	Sensor board
Dimensions	50mm x 62mm
Weight	40g (72g when fitted with hood & PID)
Nominal Voltage	5 VDC ± 500mV
Supply Cables	0.5 to 1.5mm^2
Flow Rate (max)	300 ml/min
Pressure (max)	<300mBar
Operating Humidity:	0 – 99 RH% (non-condensing)
OperatingTemperature	-20 °C to +60 °C

Compatible MiniPID 2 sensors	Lamp Energy	Voltage	Part number
MiniPID 2 hppm	10.6 eV	3.6V-10V	MP3SMLLCU2
MiniPID 2 hppm	10.6 eV	3.6-18V	MP3SMLLNU2
MiniPID 2 ppb	10.6 eV	3.6-10V	MP3SBLBCU2
MiniPID 2 ppb	10.6 eV	3.6-18V	MP3SBLBNU2

Integration Board

Name	Integration board
Dimensions	99mm x 82mm
Weight	70g
Nominal Voltage	12V to 30Vdc ± 500mV
Typical Power	< 200mA when connected to a PID via the sensor board
Supply Cables	0.5 to 1.5mm^2
Maximum Contact Load	100 Vac / 2A
Operating Humidity:	0 – 99 RH% (non-condensing)
OperatingTemperature	-20 °C to +60 °C

Gas Delivery Hood

Name	Gas delivery hood
Dimensions	Total height including PCB 40mm
Pipe Connection	1/16” OD barb push fit 1/16” ID/1/8” OD Viton pipe recommended
Seal material	Viton
Maximum gas pressure	<300 mBar

System Description

Outputs and Communications

The integration board has:

- 1 x 4-20mA current loop output.
- 1 x 4-20mA current loop input.
- 1 x RS485 Modbus® channel.
- 1 x programmable relay.

The 4-20mA output is an analogue representation of the calibrated sensor value.

You can program a normally open relay to operate at a chosen concentration of gas. This is setup in the companion software, available from www.ionscience.com. The relay can switch a maximum of 250VAC / 2A maximum load.

The integration board can be configured as a Modbus® RS485 slave. For further details of the available data registers please see below.

RS485 Modbus Interface

The SDK Modbus interface uses Modbus RTU

- 9600 or 19200 baud, 8 data bits, no parity, 1 stop bit.

Name	Address (hex)	Length (decimal)(bytes)	Notes
PIDGOOD	1200	2	Returns 1 if PID Power OK, 0 if not
POWERGOOD	1202	2	Returns 1 if Power OK, 0 if not
ADCMV	1260	24	Returns array of 6 x 32 bits values. [0] = RTD – raw ADC input in µV [1] = 10V – raw ADC input in µV [2] = PID – raw ADC input in µV [3] = LIGHT – raw ADC input in µV [4] = TEMPERATURE – raw ADC input in µV [5] = 4-20 – raw ADC input in ADC units
SIGNAL	12C0	24	Returns array of 6 x float values: [0] = RTD – Temperature in degC or degF [1] = 10V – Scaled Input [2] = PID – Signal in ppm [3] = LIGHT – 1.0 if lamp on, 0.0 if lamp off [4] = TEMPERATURE – Internal Temperature in degC [5] = 4-20 – Scaled Input The “Scaled Inputs” are scaled according to the configured user calibration.

Location Requirements

It is recommended that the integration board is housed in a metallic enclosure to protect against EMI from outside influences.

Power Requirements

The integration board must be powered from a stable 12-30VDC supply.

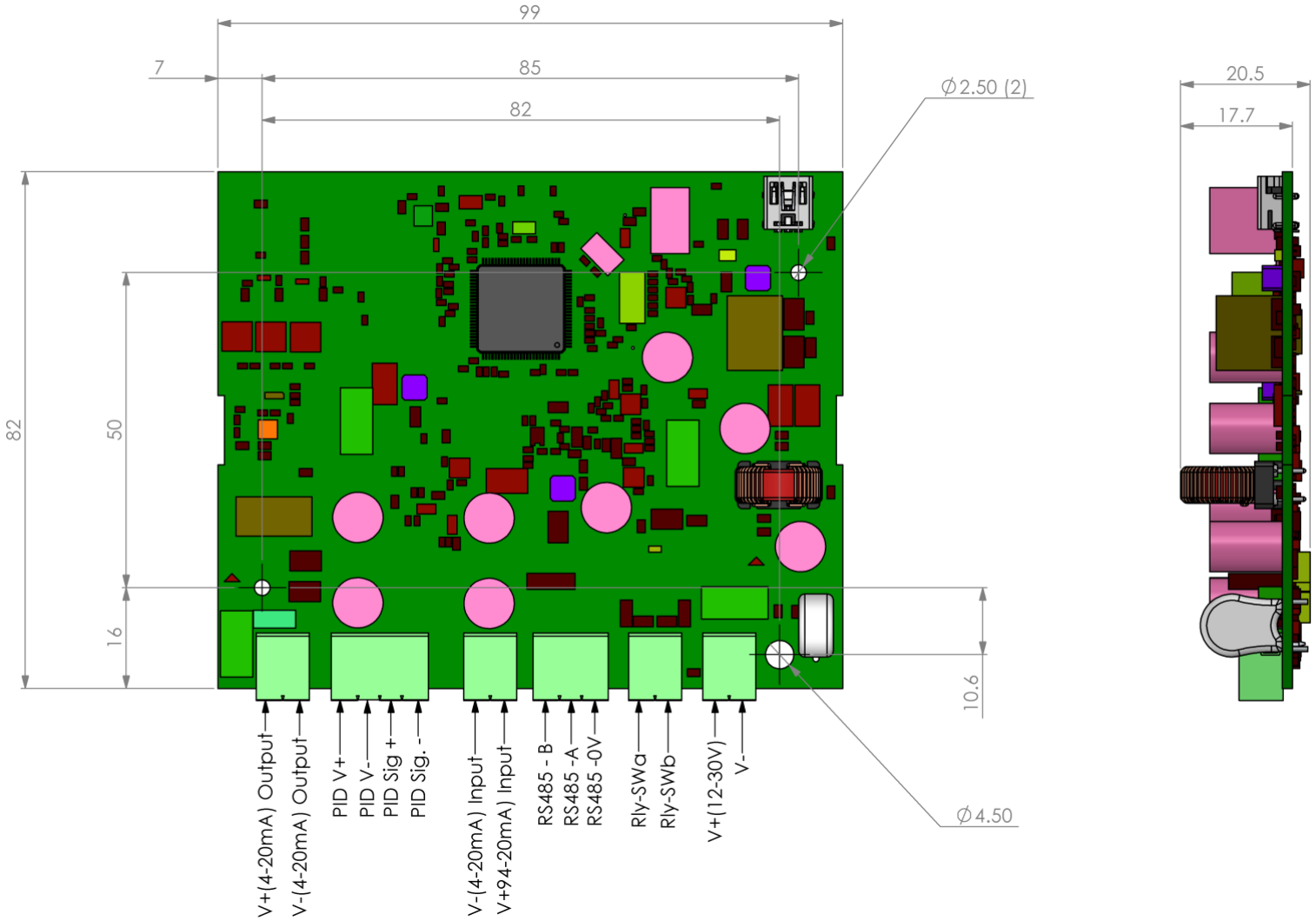
Cable Requirements

We recommend you use screened cables to protect against EMI.

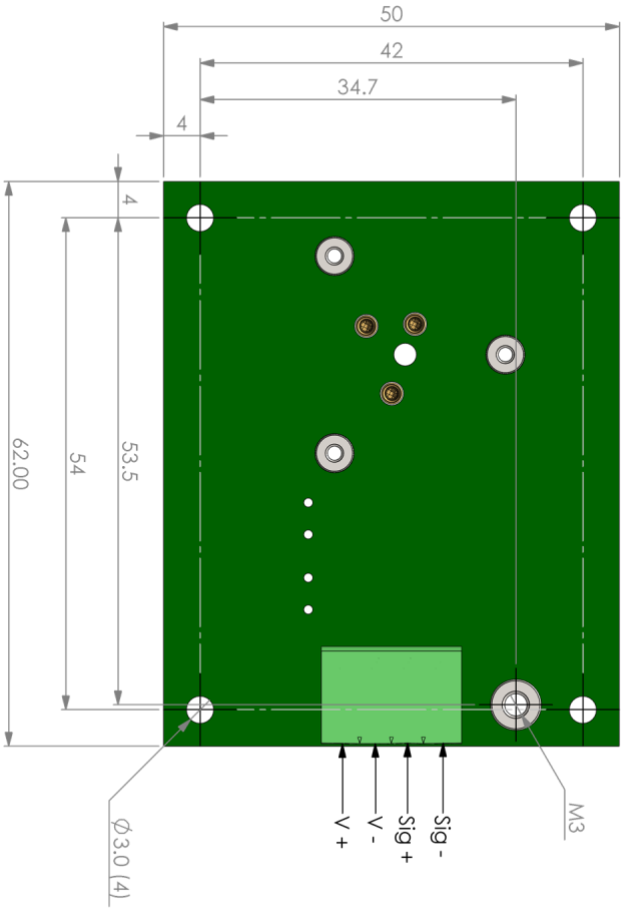
The manufacture and build of the cable glands is the responsibility of the installer/system designer.

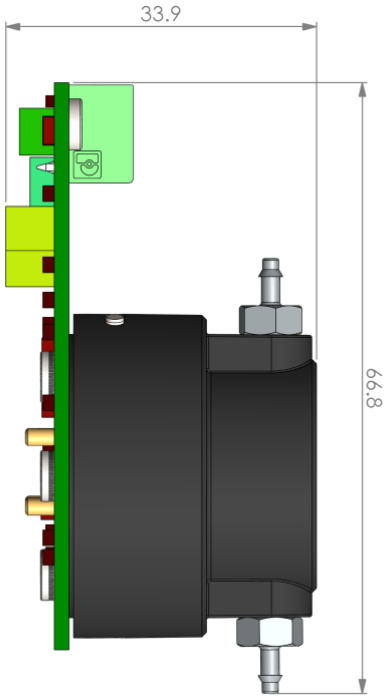
Dimensions for Installation

Integration Board



Sensor Board

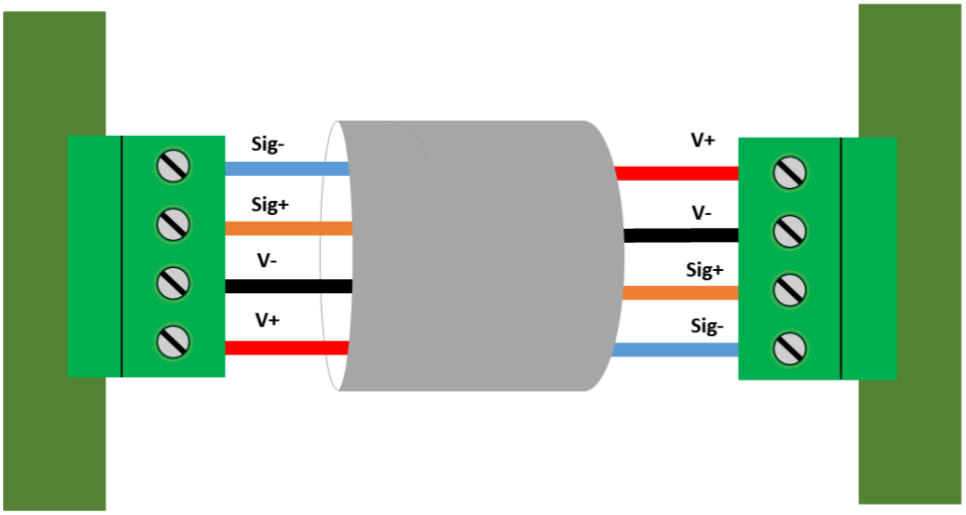




Note: maximum conductor size is 1.5mm²

Connections

The sensor board is connected to the integration board in the manner shown below. Cabling between the boards should be shielded.



Installing the configuration software

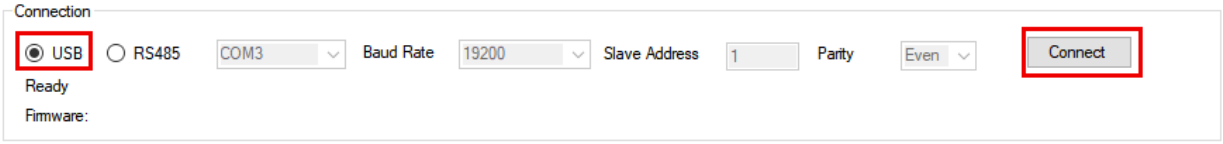
The integration board is configured using a Windows® based software tool. The software is available for download from www.ionscience.com. The software is compatible with Windows® 7,8 and 10.

1. Download the software.
2. Open the .zip file that contains the software.
3. Double click the setup.exe file.
4. The setup wizard will begin.
5. On the setup wizard dialogue, click “Next >”.
6. Use the “Browse” button to select a location for the wizard to install the integration board software or accept the default “C:\IonScience” folder and click “Next >”.
7. Choose a folder for the program shortcut and click “Next >”.
8. Select or deselect the tick box to create a desktop icon and click “Next >”.
9. Check the summary screen and if you are happy with the proposed structure, click “Install”.
10. Your software is now installed.

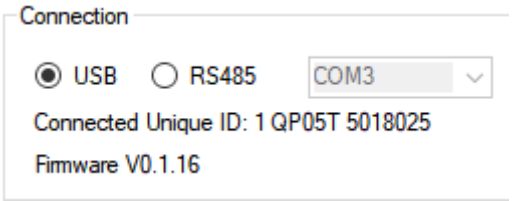
Configuring the Integration Board

Connection

1. Before connecting the integration board to your PC, please ensure you have connected the sensor PCB, fitted with a MiniPID 2 sensor.
2. Power up the integration board using a suitable DC power supply (12-30Vdc).
3. Connect the integration board to your computer with a USB A to USB mini B cable.
4. Open the configuration software and at the top of the page, select USB and click “Connect”.



5. When the integration board has connected successfully, you will see the Unique ID and firmware version of the board will appear. It is also possible to connect to the board via RS485 adaptor.

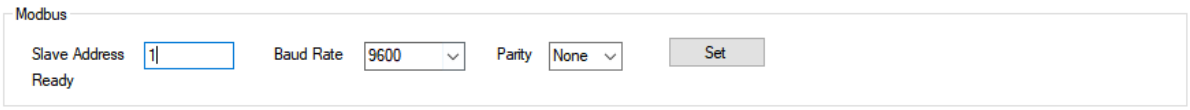


RTC

1. Set the realtime clock on the integration board (this is important for datalogging accurately). To do this, in the RTC section, click “Set to PC clock”. you will see a confirmation and the clock on the board will be synchronised with the clock on your PC.

Modbus

1. In the Modbus section of the software, you are able to configure the integration board as a Modbus® slave device. This allows you to collect data from the boards remotely.
2. Set the slave device address to a value between 1 – 254. Each integration board on a Modbus® network must have a unique slave address.
3. Set the baud rate and parity to suit your network. Please note that all devices on the same Modbus® network must have the same baud and parity settings.
4. When the Modbus® settings are correct click “Set” to save the settings to the integration board.



PID Setup and Calibration

To calibrate the PID sensor you will require the following:-

- 1 x cylinder of zero air fitted with a 300ml/min fixed flow regulator.
- 1 x cylinder of Isobutylene fitted with a 300ml/min fixed flow regulator for the first calibration span.
- 1 x cylinder of Isobutylene fitted with a 300ml/min fixed flow regulator for the 2nd calibration span (if doing 2 span calibration).
- Tubes to connect regulators to gas hood. The barb on the gas hood is suitable for 1/16” inner diameter tubing (Viton)
- A connected sensor board fitted with a PPM or PPB MiniPID2 sensor.

Procedure

In the PID section, the integration board can be setup to read data from a MiniPID 2 sensor. The integration board can also be calibrated. This calibration is stored on the integration board meaning the integration board will output a calibrated PPM (parts per million) value.

1. To begin configuring the sensor, first select the correct type of sensor you are using from the dropdown. Choose either PPM or PPB.

2. Now select the correct measurement range for your application either 1 – 100ppm or 1-1000ppm. **This is very important as this determines the scale of the 4-20mA output on i.e. on 100ppm range 0ppm = 4mA 100ppm = 20mA on 1000ppm range 0ppm = 4mA 1000ppm = 20mA.**

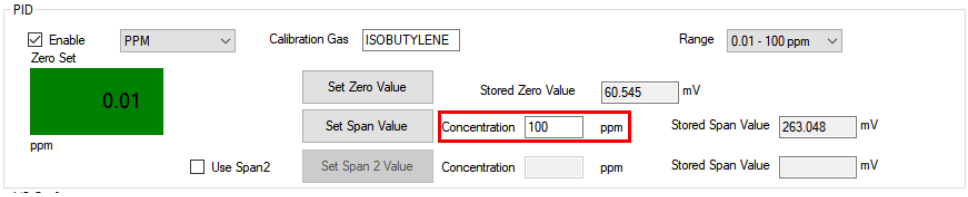
3. Enable the sensor by clicking the checkbox.

4. If the sensor is operational, the coloured indicator will be green. If there is an issue with the sensor, the fault will be displayed within the coloured indicator.

5. Connect the zero air to the gas hood and switch on the air supply. Leave the zero air connected to the PID for 2 minutes.

6. After 2 minutes have elapsed, press the “Set Zero Value” button. This will store the zero value in memory.

7. Enter the gas concentration for the first calibration span.



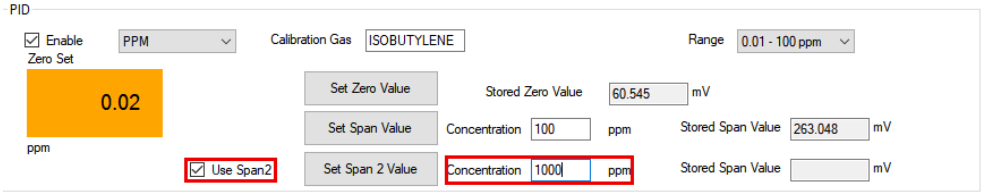
(Range refers to the 4-20mA range)

8. Now, connect your span 1 isobutylene cylinder to the gas hood and switch on the gas supply. Leave the gas connected for 2 minutes.

9. After 2 minutes have elapsed, press the “Set Span Value” button. This will store the span 1 value in memory. If you are not using a second span calibration, then calibration is complete.

10. If applicable, tick the “Use Span 2” box.

11. Enter the gas concentration for the second calibration span (maximum 1000 ppm).

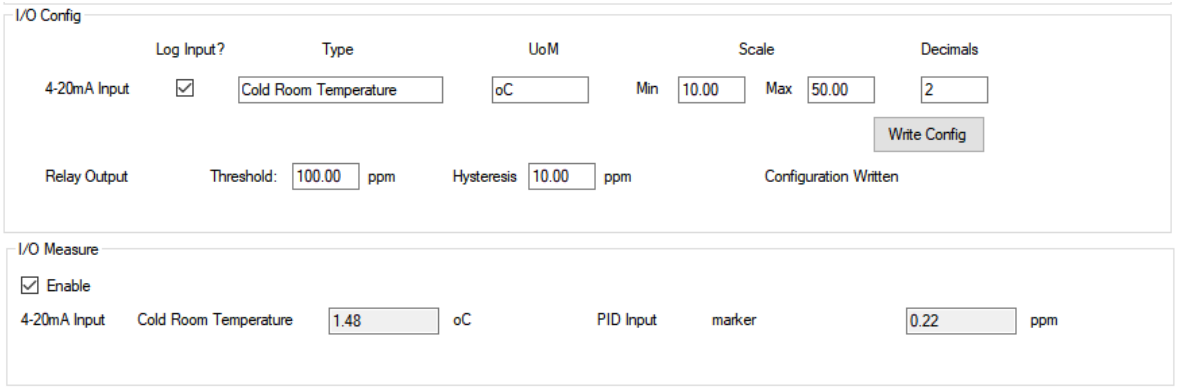


12. Now, connect your span 2 isobutylene cylinder to the gas hood and switch on the gas supply. Leave the gas connected for 2 minutes.

13. After 2 minutes have elapsed, press the “Set Span Value” button. This will store the span 2 value in memory. Calibration is now complete.

I/O Config

The integration board has a single 4-20mA input channel that can be used to log data from other sensors and instrumentation. This data can be logged along with data from the PID sensor.



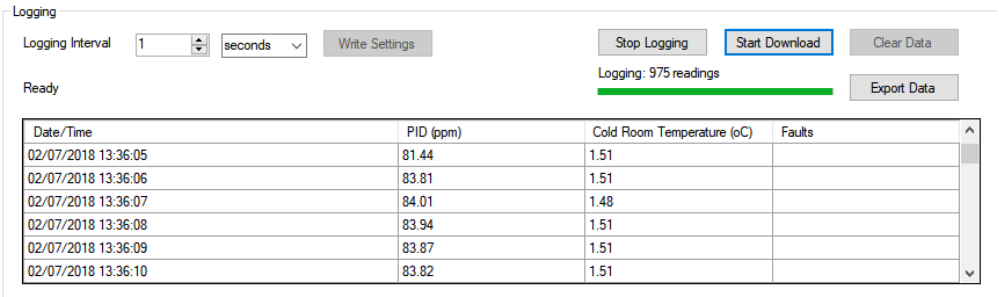
1. In the I/O config section, select “Log Input?”.
2. Move to the “Type” text field and enter the name of the device you are logging.
3. In the “UoM” text field, enter the unit of measure for the device you are logging.
4. In the scale text fields, enter the minimum and maximum value of the device you are logging. The Integration board will rescale the 4-20mA input based on this.
5. In the “Decimals” field you need to specify the number of decimal places you wish to record.
6. If you wish to use the onboard relay, it is enabled by specifying the PPM level at which you wish to the relay to activate. You also need to specify the level of hysteresis required.

   Please note the relay will not operate until the board is actively datalogging.
7. Once this is complete, click the “Write config” button. This will save all of these seettings to the Integration board.
8. To view live values from the PID and the 4-20mA input, navigate to the “I/O Measure” section and click “Enable”. You will now see live values being displayed.

Logging

The integration board has 256KB of memory. The first 768 Bytes are used to store calibration and configuration data leaving roughly 255KB for datalogs. The integration board memory runs on a circular buffer, meaning that when the memory becomes full, the oldest data will be overwritten first. Duration of data storage is dependent on the configured interval for datalogging. Each datalog entry is around 41 bytes.

1. Configure the logging interval by first selecting the units either minutes or seconds.
2. Now enter the number of minutes or seconds you require the logging interval to be.
3. Click “Write Settings” to save the datalogging settings to the integration board.
4. To start datalogging click the “Start Logging” button.
5. To stop datalogging click the “Stop Logging” button. If you wish to view the datalogs you can either view them in the software or you can export them to a CSV file.
6. To view datalogs within the software, click the “Start Download” button.
7. To export a CSV file with all logged data, click “Export Data”. A save file dialogue will open so you can choose the name and save location of the downloaded CSV file.



Spare Parts

Item No	Part
1	PID gas hood
2	PPM MiniPID2
3	PPB MiniPID2
4	HPPM Electrode Stack (Blue)
5	PPB Electrode Stack (White)
6	Mini PID Electrode Stack Removal Tool
7	MiniPID Lamp Spring
8	PID Lamp Cleaning Kit

Manual Log

Manual Version	Amendment	Issue Date	Instrument Firmware	PC Software
1.0	First Issue	27/11/18	V0.1.22	
1.1	Sensor information added (p8) Contact Details updated (p7)		V0.1.22	