User Manual

Pressure Sensor - Modbus or 4-20mA Output

Model: PRE11000x

Table of Contents

Notices

Please **read all of this manual** before you install, operate or maintain this product. Pay attention to notes, warnings and instructions. The manufacturer cannot be held liable for any damage which occurs as a result of noncompliance with this manual.

Do not tamper with product. Should the product be tampered with in any manner other than a procedure which is described and specified in this manual, the warranty is cancelled and the manufacturer is exempt from liability.

The product is designed exclusively for the application described in this manual. Use of this product in conditions not specified in this manual or, contrary to the instructions provided by the manufacturer, is considered improper handling of the product and will void your warranty. The manufacturer will not be held liable for any damages resulting from improper use of the product.

This manual should be read carefully by relevant personnel and the end user**.** This manual should be kept with the product and be made available as needed. **Once you install or use the product, you accept that you have read, understood and complied with this manual**.

Compressed Air Alliance endeavours to make the content of this manual correct, but is not responsible for omissions or errors and the consequences caused. In case of any doubts or questions regarding this manual or the product, please contact Compressed Air Alliance.

Warnings

Ignoring warnings can lead to serious injury and/or cause damage!

When handling, operating or carrying out maintenance on this product, personnel must employ safe working practices and observe all local health & safety requirements and regulations.

Improper operation or maintenance of this product could be dangerous and result in an accident causing damage to machinery or injury or death.

The manufacturer cannot anticipate every possible circumstance which may represent a potential hazard. The warnings in this manual cover the most common potential hazards and are therefore not all-inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by the manufacturer they must ensure that the product will not be damaged or made unsafe and that there is no risk to persons or property.

NEVER CHANGE ORIGINAL COMPONENTS WITH ALTERNATIVES.

Compressed Air Safety

Any contact with quickly escaping air or bursting parts of the compressed air system can lead to serious injuries or even death.

- Do not exceed the maximum permitted pressure.
- Only use pressure rated installation materials and parts.
- Avoid getting hit by escaping air or bursting parts.
- The system must be pressure-less during maintenance work.

Electrical Safety

Any contact with energised parts of the product, may lead to an electrical shock which can lead to serious injuries or even death. The user shall take all measures necessary to protect against electrical shock.

Consider all regulations for electrical installations.

The system must be disconnected from any power supply during maintenance work.

Any electrical work on the system is only allowed by authorised qualified personal.

Cleaning

If you need to clean the sensor it is recommended to use a clean, dry cloth. For stubborn marks, use distilled water or isopropyl alcohol only.

Please note: contamination on the sensor tip will affect calibration and accuracy of the sensor. Removal of the contamination may not fix the issue.

Disposal

Electronic devices are recyclable material and do not belong in the household waste. The product, accessories and its packing material must be disposed according to local statutory requirements.

About Pressure Sensors

Intended use

This Pressure Sensor is intended for use in manufacturing and industrial environments where the system gas pressure is under 16 bar and the ambient temperature is between -30°C to +80°C. This product has not been tested or rated for use in explosive areas.

About pressure sensors

Virtually every compressed air or gas system has some sort of low pressure warning on the machine. When the warning is triggered it's usually too late to react and the machine shuts down. If this happens often enough, system pressure is generally reset to a higher value to alleviate the problem. This increases the overall running cost of the system and the artificial demand.

There are a number of potential problems within compressed air or gas systems that can cause low pressure warnings to trigger, from compressor reaction time, high peak demands or simply restrictions in the filters and pipework. Continuously monitoring pressure can highlight the exact cause, helping you to resolve issues.

How many pressure sensors do I need?

You should have at least two pressure sensors:

- one (1) pressure sensor on the wet side of the system to monitor compressor output and
- one (1) pressure sensor on the dry side of the system to measure the system supply pressure.

You can also install pressure sensors (i) near high compressed air or gas consumers (ii) at the far ends of the system. This will assist you in identifying issues occurring downstream of your compressed air generation, (iii) on either side of filters, dryers, or other pressure loss systems to calculate pressure drops.

Benefits of monitoring pressure

- Monitor system pressure and fluctuations
- Improve system performance
- Avoid financial losses from down time
- Improve reliability and scheduled maintenance
- Protect key assets and critical equipment such as Compressors, Pumps, Conveyors, Motors, etc
- Plan maintenance in advance and prevent expensive failures

Pressure Sensor Pack

Each pressure sensor comes with:

- ✓ Pressure sensor
- ✓ 5 meter cable with M12 connector **or** M12 connector only (no cable).

Pressure Sensor	**PLUS**	5 meter cable with M12 connector	**OR**	M12 connector only (no cable)
	**PLUS**		**OR**	

Specifications

	Pressure Sensor	
Technology	Ceramic core, resistant to moisture	
Accuracy[1]	±1%	
	Measurement Ranges	
Pressure Range	0-16 bar	0-232 psi
	Outputs	
Output	Analogue: 4 to 20mA (2 wire) Modbus RS485 (4 wire)	
Output Signals	Pressure	
	Power	
Power Supply	≤10mA, 24V DC	
Electrical Connection	5 pin M12, female	
	Other Information	
Default Modbus Setting	Address: 1, Baud: 9600, Data/Parity/Stop: 8N1	
Process Connection	ISO G1/4" thread	
Ambient Temperature	-30°C to +80°C	-22°F to +176°F
Dimensions	100 mm L x 33 mm W	3.9" L x 1.3" W
Casing	Stainless Steel	
IP Rating	IP65	
Installation Type	Permanent, or Temporary installation	
Calibration Frequency[2]	Every 2 years	
Warranty Period	12 Months	

1 The accuracy of the sensor is affected by on-site conditions. Contaminants such as oil, high humidity or other impurities can affect the calibration and accuracy of the sensor.

2 Pressure sensors require calibration every 2 years. Compressed Air Alliance can arrange calibration for you.

Installation

Installation Overview

Mechanical Installation

Step 1 – Find a suitable location for sensor

- Check if you are measuring Dynamic or Static pressure

Step 2 – Install connection point in pipe, eg a ball valve, nozzle or nipple

Step 3 – Attach Pressure Sensor to connection point

Electrical Installation

Step 4 – Wire the sensor (see '*Installation – Electrical*')

Optional

Step 5 (optional) – Connect the sensor to your SCADA or energy management system

Tools and Equipment needed for installation

(not included with Pressure Sensor Pack)

Wrench / Spanner

Screw Driver

Thread Tape / Sealant

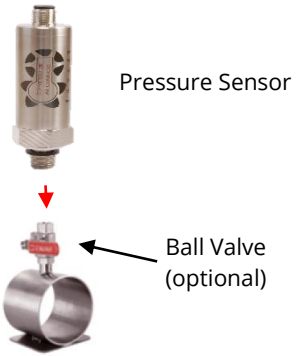
Ball Valve (optional)

Installation – Mechanical

WARNING! Incorrect installation can damage the sensor or cause it to work incorrectly.

Notes

- **Before installing the sensor, make sure it is rated for your system** (refer to the “Specifications” section).
  - Use of the product outside specified ranges or operating parameters can lead to malfunctions and may damage the product or system.
- Do not use this product in explosive areas.
- Always use a spanner / wrench to install the product.
- Only use pressure rated materials and parts when installing and maintaining the product.
- Do not disassemble the product.
- Please follow local and national regulations before/during installation and operation.
- The product must be installed properly and calibrated regularly, otherwise it may lead to inaccurate measurement values.



Step 1 – Find a suitable section of pipe

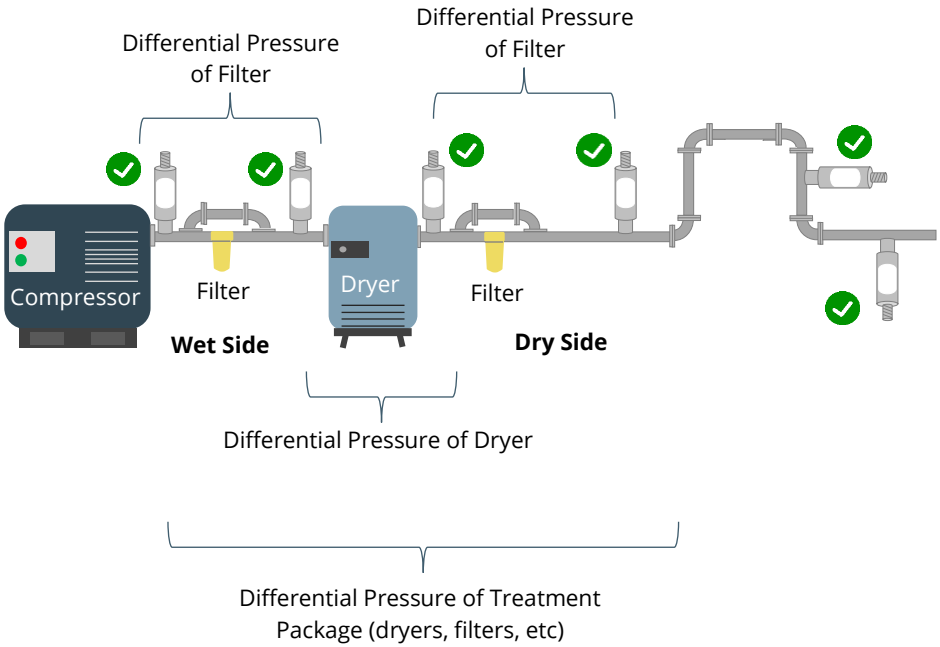
The sensor can be installed on pipes, wet and dry receivers, the compressor outlet or anywhere you want to record pressure.

The sensor **can be installed in any direction** (vertical, horizontal, upside down, at an angle) **in wet or dry gas.**

Make sure there is enough room around the installation point to fit the sensor.

If installing the sensor outdoor, protection from sun and rain is necessary.

Correct Installation



Compressed Air Alliance reccommends at least two pressure sensors are installed on the system:

- one (1) pressure sensor on the wet side of the system to monitor compressor output and
- one (1) on the dry side of the system to measure the system supply pressure.

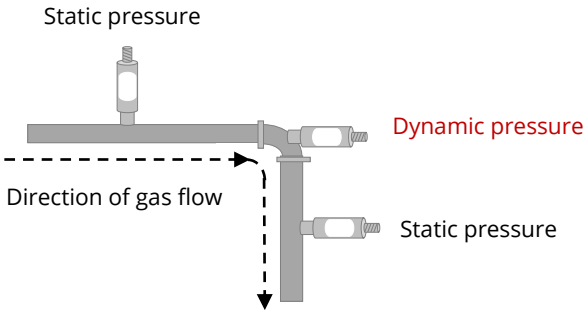
However more pressure sensors will give you a much clearer picture of what is going on in your system, eg near any high compressed air or gas consumers and at the far ends of the system. This will assist you in identifying issues occurring downstream of your compressed air or gas generation.

Dynamic v Static Pressure

Static and dynamic pressure will give different readings. It is important to know which pressure you want to measure as this will affect where you install the sensor. For most applications, you will measure static pressure.

To measure **Static** pressure – install the sensor adjacent / perpendicular to the gas flow

To measure **Dynamic** pressure - install the sensor inline with the direction of gas flow.



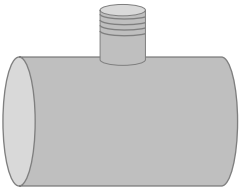
Step 2 – Install connection point in pipe

To install the sensor, you need a connection point to the pipe, eg a ball valve or a nozzle or nipple. The thread must be G 1/4".

Use of a ball valve is optional - You do not need to use a valve to install the sensor. However, using a valve will make removing the sensor easier (eg when you need to remove the sensor for calibration).

If installing a ball valve, you can use a hot tap drill and clamp to create a connection point on pressurised or unpressurised pipes. See the Compressed Air Alliance website for information on hot tap drills and clamps.

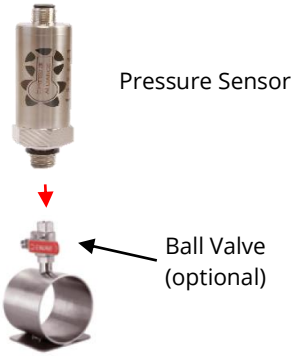
Ball Valve **OR** Welded nipple on pipe



If you need to remove the sensor, use a spanner. Do not pull the sensor out by the cable as this may snap the cable or damage the wiring.

Step 3 – Attach pressure sensor to connection point

- Screw the sensor into the connection point and tighten with a spanner
  - Fix sensor firmly to prevent loosing or shaking
  - A reducing bush may be needed if connecting the sensor to a large ball valve or nipple
  - Use thread tape or sealant, where required
- If using a ball valve, open the valve



Installation – Electrical

WARNING! Incorrect wiring can damage the sensor or cause it to work incorrectly.

Notes:

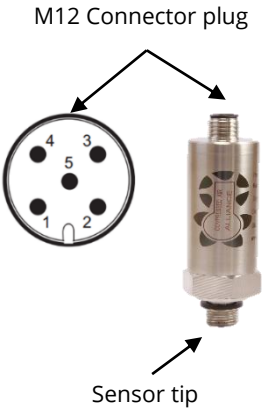
- **The pressure sensor is wired differently depending on whether you want 4-20mA output or Modbus output.** Please make sure you wire the sensor correctly.
- Do **not** screw the M12 connector using force, otherwise it may damage the connection pins.
- Always check the M12 connectors to make sure they are wired correctly.
- Consider all local and national safety requirements and regulations for electrical installations.
- The system must be disconnected from any power supply during installation and maintenance work.
- Any electrical work on the system is only allowed by authorised and qualified personal.

Wiring – 4-20mA Output

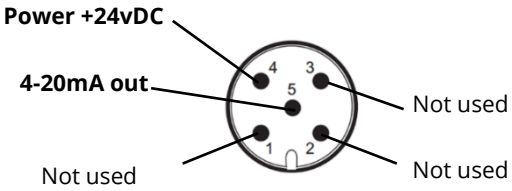
The Pressure Sensor has one 5 pin, M12 connector on top of the sensor.

Pin connections for 4-20mA output

Connector		Cable Colour
Pin 1	Not used	Brown
Pin 2	Not used	White
Pin 3	Not used	Blue
Pin 4	+24vDC	Black
Pin 5	4-20mA and 0vDC	Grey



4-20mA Wiring (2 wire)



4-20mA Scaling

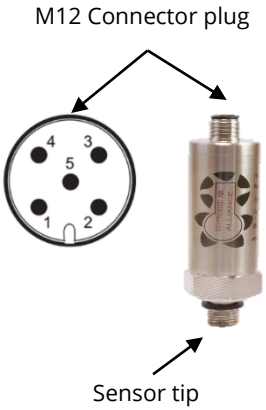
Pressure Range	4 mA	20mA
0-16 bar (232 psi)	0	16

Wiring - Modbus Output

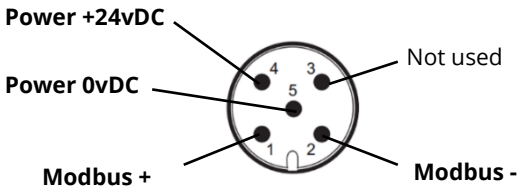
The Pressure Sensor has one 5 pin, M12 connector on top of the sensor.

Pin connections for Modbus Output

Connector		Cable Colour
Pin 1	A port of RS485 (Data +)	Brown
Pin 2	B port of RS485 (Data -)	White
Pin 3	Not used	Blue
Pin 4	+24vDC	Black
Pin 5	0vDC	Grey



Modbus Wiring (4 wire)



Default Modbus Settings

Refer to the Appendix on how to update modbus settings using Modbus Poll software. If you use another modbus program, please ignore the appendix

Address	Baud Rate	Data Bits	Parity	Stop Bits
1	9600	8	None (N)	1

Modbus Registers

Default Modbus Settings

Address	Baud Rate	Data Bits	Parity	Stop Bits
1	9600	8	None (N)	1

MODBUS-RTU Address Register

Note: when modifying settings, changes are automatically saved two seconds after the command is sent. Please ensure power and the modbus connection are not disconnected until at least two seconds after the last command has been sent.

Register Address	Register Name	Data Type	Number of Registers	Supported Modbus-RTU function codes	Description and Options
3	Theoretical current value integer	Signed Integers	1	03H 04H	Range: -32768 to 32767 to 3 decimal places. Example: if the register value is 4000, then the theoretical current value is 4.00mA
4	Host Variable floating point. Type is 16 bits lower	32 bit Float	2	03H 04H	**Output Value = Pressure** 32 bit Float Little Endian-Byte Swap Format: CDAB
5	Main Variable floating point. Type is 16 bits high			03H 04H	

Register Address	Register Name	Data Type	Number of Registers	Supported Modbus-RTU function codes	Description and Options
8	Board Temperature floating point. Type is 16 bits lower	32 bit Float	2	03H 04H	Output Value = Circuit Board Temperature 32 bit Float Little Endian-Byte Swap Format: CDAB Note: this is the temperature of the circuit board. It can be used to give an indication of ambient temperature.
9	Board Temperature floating point. Type is 16 bits high			03H 04H	
10	Theoretical current floating point. Type is 16 bits lower	32 bit Float	2	03H 04H	Output value= mA 32 bit Float Little Endian-Byte Swap Format: CDAB
11	Theoretical current floating point. Type is 16 bits high			03H 04H	
12	Variable range zero floating point. Type is 16 bits lower	32 bit Float	2	03H 04H 06H 10H	Output Value = Lower Scale Range 32 bit Float Litte Endian-Byte Swap Format: CDAB
13	Variable range zero floating point. Type is 16 bits high			03H 04H 06H 10H	
14	Variable range full scale floating point. Type is 16 bits lower	32 bit Float	2	03H 04H 06H 10H	Output Value – Upper Scale Range 32 bit Float

Register Address	Register Name	Data Type	Number of Registers	Supported Modbus-RTU function codes	Description and Options
15	Variable range full scale floating point. Type is 16 bits high				Little Endian-Byte Swap Format: CDAB
24	Modbus Address	Unsigned Integer	1	03H 04H 06H 10H	Range: 1 to 247
25	Modbus Baud Rate	Unsigned Integer	1	03H 04H 06H 10H	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200
26	Modbus Check Digit	Unsigned Integer	1	03H 04H 06H 10H	0: None 1: Odd 2: Even
27	Units of Measure	Unsigned Integer		03H 04H 06H 10H	0: kPa 1: Mpa 2: mH2O @ 20°C 3: Bar 4: PSI 5: mBar 8: atm 9: Pa
28	Number of decimal places for pressure reading	Unsigned Integer		03H 04H 06H 10H	Range: 0 to 4

Trouble Shooting

Trouble Shooting

Problem	Possible Causes	Suggested Action
Readings are different than expected	Sensor installed incorrectly	Check installation
	Sensor wired incorrectly	Check Wiring • 4-20mA wiring uses 2-wires • Modbus uses 4 wires
	4-20mA settings are incorrect	Check / update 4-20mA settings
	Modbus settings are incorrect	Check / update Modbus settings (see Appendix 1 and 2)
	Reading the wrong pressure (ie Dynamic v Static Pressure)	Check installation to see if you are reading "*Dynamic or Static Pressure*". Reinstall sensor.
	Your equipment is not compatible with the pressure sensor output	Check that the sensor's specifications are suitable for your system.
	M12 connection pins damaged	
	Sensor due for calibration	Calibrate sensor. Compressed Air Alliance can help with calibration
Readings don't change or readings stuck on a certain number	Sensor damaged	Contact Compressed Air Alliance
	Incorrect sensor for you compressed air system	Check that the sensor's specifications are suitable for your system.

Need help?

Contact your local dealer. Alternatively, contact Compressed Air Alliance via:

- Phone / Whatsapp:
  - Australia: 1300 558 526
  - International or Whatsapp: +61 494 095 632
- E-mail: sales@compressedairalliance.com

Warranty

Compressed Air Alliance provides a 12-month warranty for all sensors. The warranty covers materials and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time.

If faults occur during the warranty period Compressed Air Alliance will repair or replace the defective unit, without charge for repair labour and material costs but there is a charge for other services such as labour to remove or reinstall the instrument, transport and packing. Warranty repairs do not extend the period of warranty.

The following damage is excluded from this warranty:

- Improper use and non-adherence to the user manual.
- Use of unsuitable accessories.
- External influences (e.g. damage caused by vibration, damage during transportation, excess heat or moisture).

The warranty is cancelled when one of the following situations occurs:

- The user opens the measurement instrument without a direct request written in this manual.
- Repairs or modifications are undertaken by third parties or unauthorised persons.
- The serial number has been changed, damaged or removed.

Other claims, especially damage occurring on the outside of the instrument (eg dents, marks), are not included unless responsibility is legally binding.

Calibration

The sensor is calibrated before delivery. The calibration date is printed on the certificate which is shipped with the sensor.

Pressure Sensors require calibration to remain accurate. The frequency of calibration depends greatly on the level of contamination within your system.

We recommend you calibrate the sensor every 2 years. Calibration is excluded from the product warranty. For more information, contact Compressed Air Alliance.

Appendix

Setting Up Modbus using Modbus Poll

Setting up Modbus using Modbus Poll

This appendix describes how to use **Modbus Poll** to update modbus settings. If you use another modbus program, please ignore this appendix. Refer to Appendix 1 for Modbus Registers.

Warnings

- Make sure you connect the Pressure Sensor to **24vDC** otherwise permanent damage can be done.
- When using Modbus Poll, the Modbus Integrator communicates in HEX format, **not** binary.
- Make sure you are sending the right commands otherwise permanent damage can be done to the Pressure Sensor and/or Modbus Integrator.

Tools and Equipment needed

(not included in pressure sensor pack)

- 24vDC Power Supply
- USB/RS485 Converter
- Modbus Poll software

Modbus Poll is a Modbus master simulator that allows you to update Modbus settings of your product. You can download Modbus Poll software from https://www.modbustools.com/download.html

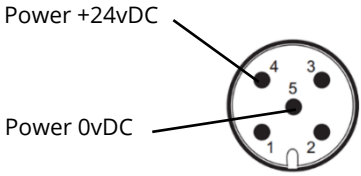
Note: the free version of Modbus Poll only allows you to connect to a sensor for limited periods, however this is generally enough time to program the Modbus integrator. If you intend to use Modbus Poll for more than 30 days, you will need to buy a license or find an alternative Modbus master simulator. Refer to the Modbus Poll website for more information.

Instructions

Step 1 - Connect Pressure Sensor to 24vDC Power Supply

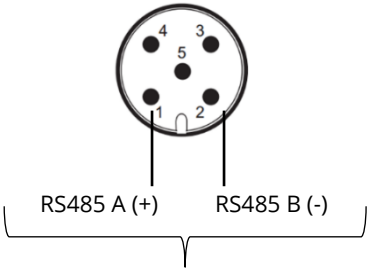
Make sure you connect the Pressure Sensor to **24 vDC** otherwise permanent damage can be done to the sensor.

- Pin 4: +24vDC
- Pin 5: 0vDC

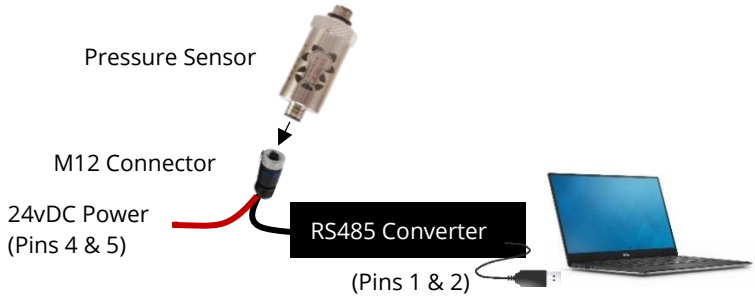


Step 2 - Connect Pressure Sensor to USB/RS485 Converter

- Pin 1: RS485 Data + (A)
- Pin 2: RS485 Data – (B)



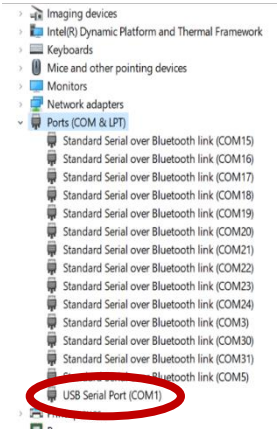
Step 3 - Connect USB/RS485 converter to computer



- Plug the USB/RS485 converter into one of your computer's USB ports. The preference is to connect the converter to the COM1, COM2 or COM3 port.

- On your computer, go to "Device Manager" > "Ports (COM & LPT)" and check which port the RS485 converter is assigned to.
  - The RS485 converter should be assigned to:
    - "USB Serial Port (COM1)", OR
      "USB Serial Port (COM2)" OR
      "USB Serial Port (COM3)".

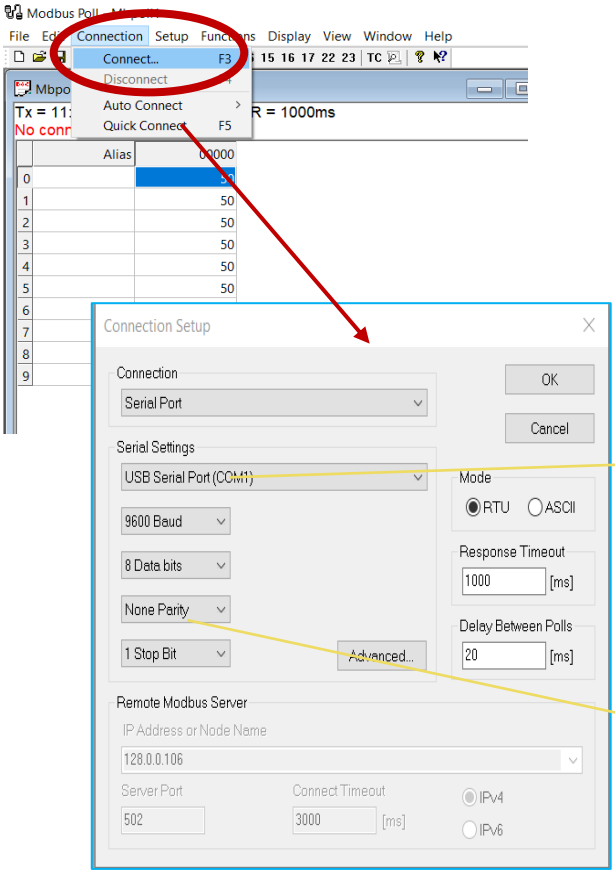
      In the diagram (right), the RS485 converter is assigned to "USB Serial Port (COM1)".



  - If the RS485 converter is assigned to another COM Port (eg COM4, COM5, etc), you will need to reassign the converter to COM1, COM2 or COM3. To do this:
    - right click on device and select "Properties"
    - select "Port Settings" tab > "Advanced" settings
    - change the COM port accordingly.
    - **DO NOT CHANGE ANY OTHER SETTINGS IN THESE TABS**.

Step 4 - Open Modbus Poll and connect to Pressure Sensor

- On your computer, open “Modbus Poll” software
- In Modbus Poll, select the “Connection” Tab > “Connect”
- Select connection settings are correct:
  - Ensure ‘Serial Settings’ is set to the correct COM port for your device. Eg, if you connected the RS485 converter to COM2, then select ‘USB Serial Port (COM2)’ from the drop down list
  - Enter the default Modbus settings: 9600 Baud, 8 Data Bits, None Parity, 1 Stop Bit
- Click ‘OK’.



Ensure ‘Serial Settings’ is set to the correct COM port for your device

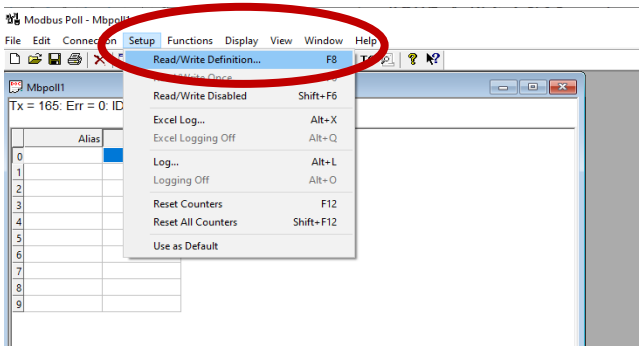
Default settings are:
9600 Baud
8 Data Bits
None Parity
1 Stop Bit

Step 5 – View Modbus settings

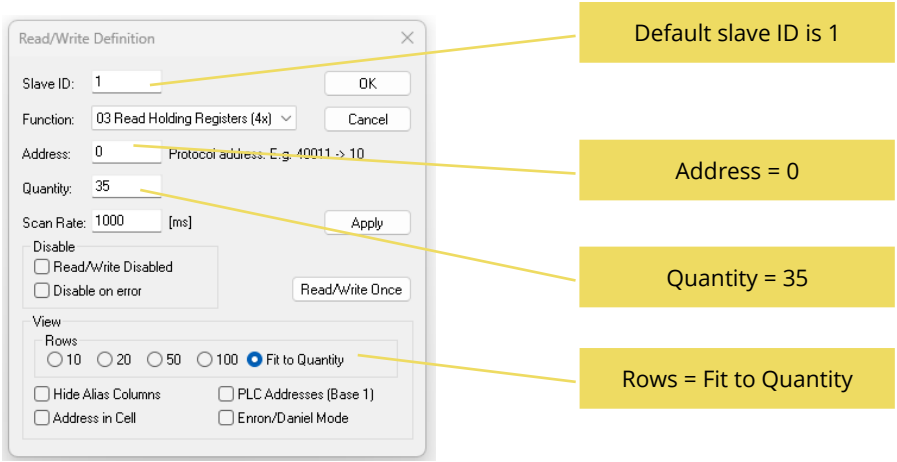
Step 5 lets you view your current Modbus Registers and their data. If you want to change the Modbus settings, go to Step 6.

To view the Modbus settings:

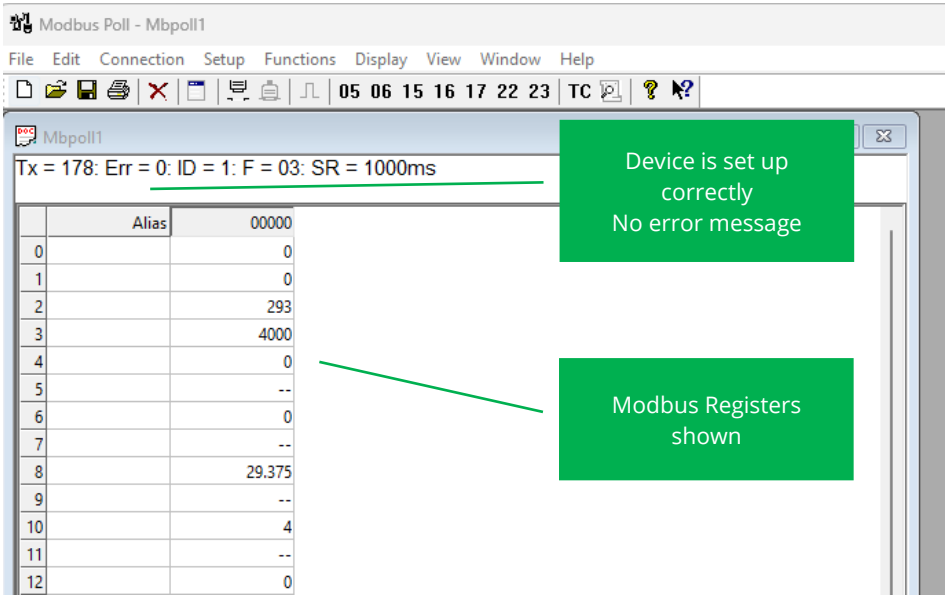
- Go to the “Setup” Tab > “Read/Write Definition”



- Make sure the Slave ID is correct. (Default salve ID = 1)
- Change:
  - Quantity to 35
  - View > Rows = ‘Fit to Quantity’
- Click “OK”

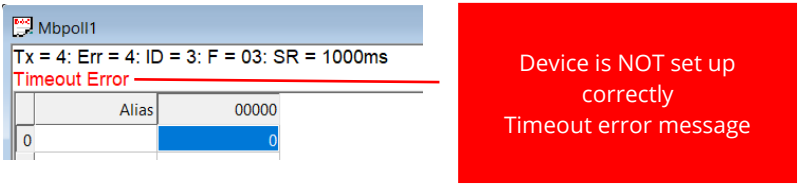


This will show you all the Modbus Registers. If setup is correct, Modbus Poll should display the following information in the open window.



Note: "Tx" will continue to count upwards.

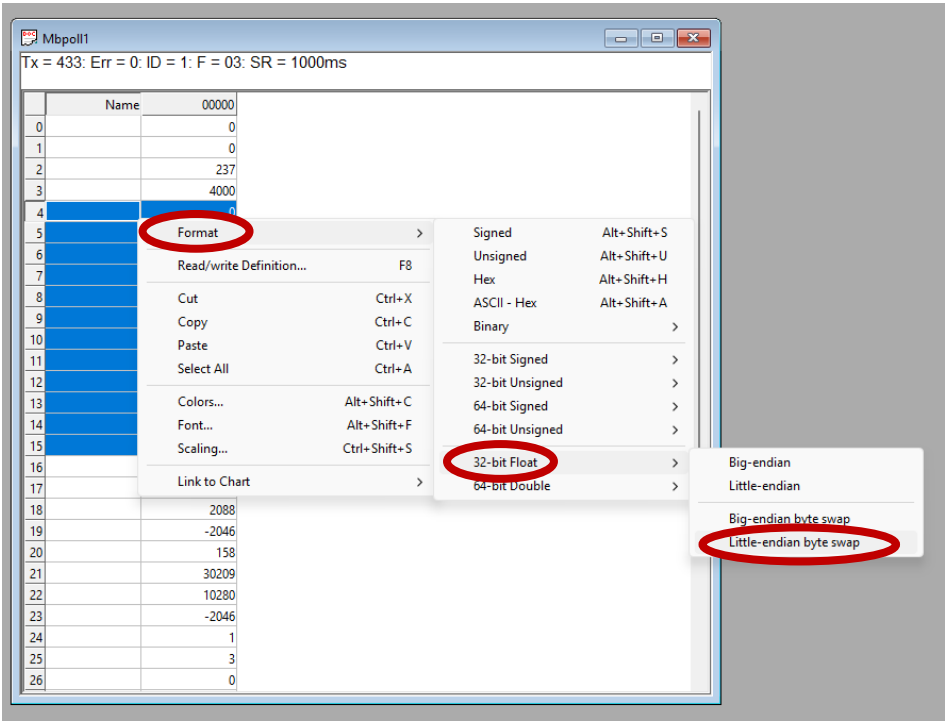
If you get a "**Timeout Error**" message, the Pressure Sensor is not set up correctly. Check your Modbus settings (Slave Address, Comm Port, Baud Rate, etc), then go back to the start of Step 5 and enter the correct information.



Change format of Registers 4 to 15

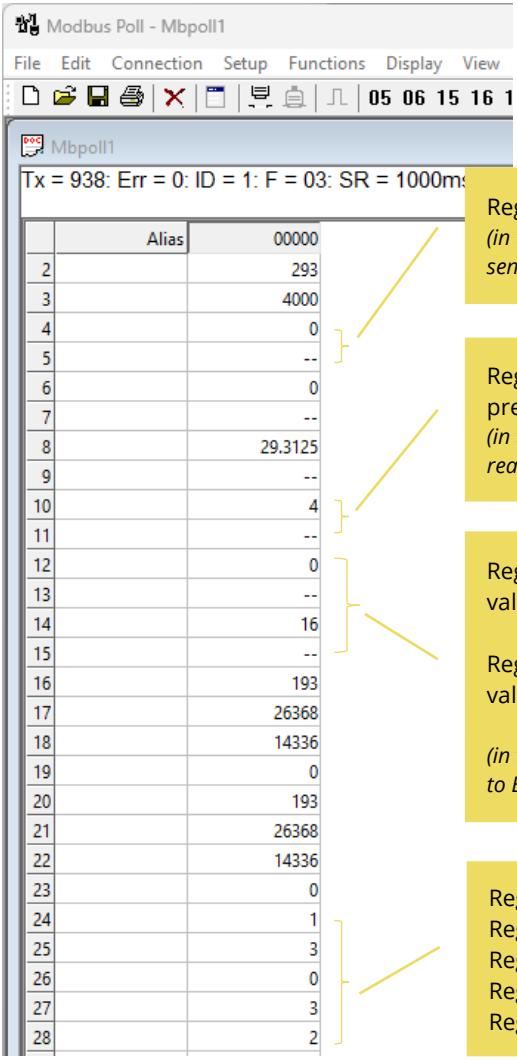
You will need to change the format of Registers 4 to 15 in order to read the data correctly. To do this:

- Select Registers 4 to 15
- Right click on the highlighted section
- Select “Format” > “32 Bit Float” > “Little Endian-Byte Swap”



Reading the Modbus Registers

The Modbus Registers are shown in Appendix 1. The image below shows the main Modbus Registers you will use. Don't forget to change the format of registers 4 to 15 to Float CD AB (see previous page)



	Alias	00000
2		293
3		4000
4		0
5		--
6		0
7		--
8		29.3125
9		--
10		4
11		--
12		0
13		--
14		16
15		--
16		193
17		26368
18		14336
19		0
20		193
21		26368
22		14336
23		0
24		1
25		3
26		0
27		3
28		2

Registers 4 and 5 = Pressure reading
(in this example, the pressure is 0 as the sensor is in ambient conditions)

Registers 10 and 11 = mA value for the pressure reading.
(in this example, the pressure is 0 so the mA reading is 4)

Registers 12 and 13 = Lowest pressure value

Registers 14 and 15 = Highest Pressure value

(in this example, the units of measure are set to Bar, so the pressure range is 0 to 16 Bar)

Register 24 = Slave ID / Modbus Address
Register 25 = Baud Rate
Register 26 = Modbus Check
Register 27 = Pressure Units
Register 28 = Number of decimal places

Step 6 - Optional - Change Modbus settings

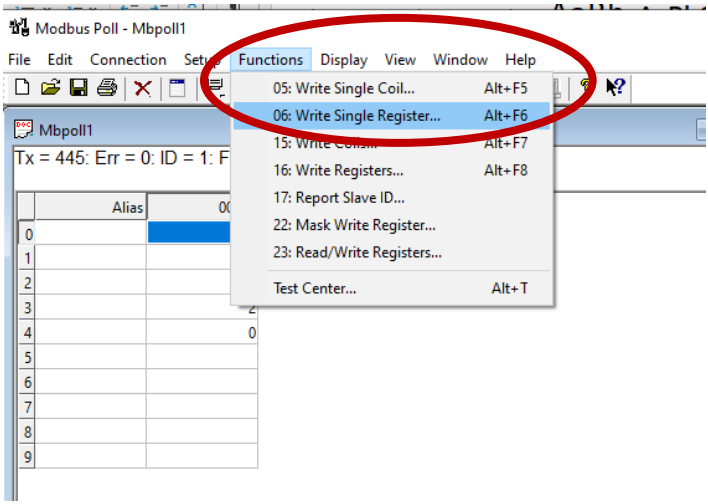
Note: This section only applies if you need to change the Modbus settings.

You can change the Slave Address, Baud Rate, Modbus Check, Pressure Units and Number of Decimal Places. **You need to make each change individually**.

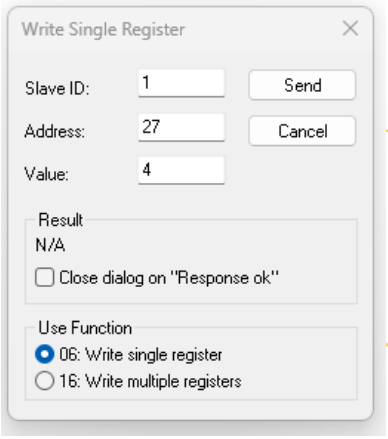
Example: if you want to change the Baud Rate and Pressure Units, you will need to repeat the steps below twice – once to change the Baud Rate and once to change the Pressure Units.

To change the Modbus settings:

- Select Functions Tab > 06.Write Single Register



- Make sure the Slave ID is correct
- Change the Register to the one you want to update (see Appendix 1)
- Change the value to the desired number (see Appendix 1)
- Click “Send”



Enter Address of the register you want to change (see Appendix 1).

In this example we are changing the Units of Measure, eg Bar, PSI, etc (Address 27)

Enter new Value (see Appendix 1)
Click 'Send'

In this example we are changing the units of measure to PSI (value 4)

If the Pressure Sensor is set up correctly, the numbers will change. If the new setting is correct, click 'Cancel'. Otherwise, continue to update the Registers with your preferred values.

- You might see a Timeout Error appear temporarily. This is normal. The message will disappear when the settings have been accepted and updated.

Upper Range of Pressure when units of measure = Bar

14		16
15		--

Upper Range of Pressure when units of measure = PSI

14		232.061
15		--

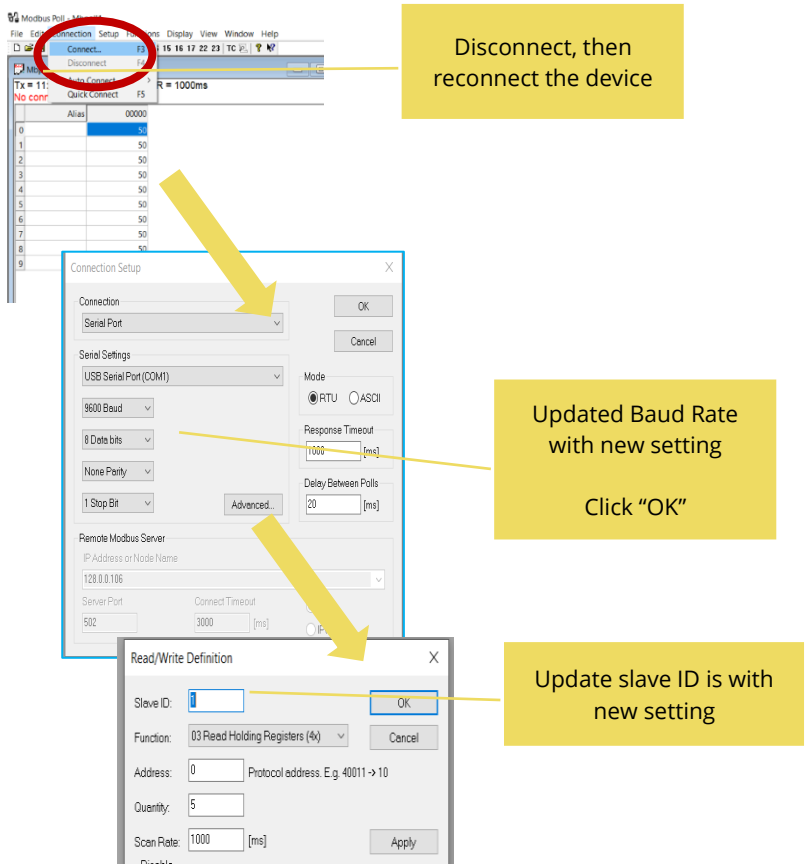
In this example we changed the unit of measure from Bar to PSI (Register 27).

This change is shown in Registers 14 and 15 which changed the changed the maximum pressure from 16 bar to 232 PSI

If you change the **Slave Address or Baud Rate**, you may note that the sensor stops communicating with Modbus Poll. If this occurs, you'll need to disconnect the software, then reconnect and update the software's communication settings (see steps below).

To disconnect, then reconnect Modbus Poll, go to:

- Connection > Disconnect
- Connection > Connect
- Follow Step 5 (above) to enter the correct Modbus settings (Baud Rate, Parity & Slave ID)



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