



User Manual

Dust Collector Controller

Model: DCC

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Notices

Please read this user manual in full and carefully observe the notes and instructions before and during installation, operation and maintenance. The manufacturer cannot be held liable for any damage which occurs as a result of non-observance or noncompliance with this user manual.

Should the device 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 device is designed exclusively for the described application.

This user manual should be read carefully by the technician / qualified personnel and the end user. This manual should be kept with the Dust Collector Controller and made available to relevant personnel. In case of any obscurities or questions, regarding this manual or the product, please contact Compressed Air Alliance.



Electrical Safety

Users should be suitably qualified, licensed and experienced to use this product. Incorrect use or installation could result in serious injury or death. Compressed Air alliance is not liable for any injury or incident occurring from using this product.

The user should follow all safety guidelines and legislation within the jurisdiction the controller is being installed.

Installing and maintaining the device

Preparation, assembly, commissioning, operation, maintenance and servicing may only be carried out by qualified personnel who is knowledgeable in the field.

The controller must be installed in compliance with the relevant electrical standards in the jurisdiction it is being used.

The user should follow all guidelines and recommendations made in this manual as well as all safety guidelines and instructions of the site or facility the controller is being installed.

- 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 qualified personal.
- The user should follow all safety information of any other electrical or mechanical components supplied by third parties and connected to the Dust Collector Controller.
- The product should be maintained and checked for faulty wiring on a regular basis

Note: The Dust Collector Controller must be installed properly and maintained. Incorrect installation or maintenance may void the warranty and result in:

- electric shock or electrocution
- damage to the Dust Collector Controller or other equipment
- incorrect operation of the device.

Using the device

- The Dust Collector Controller is not to be used in explosive or hazardous areas. Please speak to Compressed Air Alliance if you require a dust collector controller for a hazardous area.
- Do not exceed or undercut the permitted operating parameters.
- Do not exceed or undercut the permitted storage parameters.
- See Specifications section for permitted operating and storage parameters.

Note: any operation exceeding maximum or minimum permitted parameters can lead to malfunction and may damage the device. It may also void the warranty.

Dust Collector Controller

Where most baghouse dust collectors rely on continuous pulse cleaning processes to maintain plant efficiency the Compressed Air Alliance Controller provides an inbuilt differential pressure sensor to accurately measure the performance of a dust collection installation, and based on those measurements, manage the number of pulse cleaning cycles required to optimise baghouse productivity.

Pulse control can save you up to 50% of the compressed air being used and increased filter life of up to 30%.

This dust collector differential pressure controller optimises baghouse productivity. Inbuilt sensors measure the performance of a dust collection installation then manage the number of pulse cleaning cycles.

The controller is can be retro-fitted to existing dust collectors in less than one hour and the savings start immediately.

Selecting the right controller

When selecting the correct dust collector controller, match the:

- available input power type and voltage (240VAC or 24VDC for example), and
- ratings of the solenoid valves (240VAC or 24VDC for example).

Selecting the wrong controller or solenoid valves will result in damage to the equipment.

Why should you optimise baghouse productivity?

Optimising baghouse productivity can power can:

- result in fewer cleaning cycles
- reduce maintenance hours
- use up to 50% less compressed air
- extend filter life
- reduce energy costs
- reduce carbon emissions

Key Features of the controller

- On demand differential pressure cleaning of dust collectors
- Reduce dust collector compressed air use between 10-50%
- Metal Enclosure
- Differential pressure monitoring with tube clearing function
- Basic unit has 10 valves with extensions available for up to 60 valves
- Adjustable pressure levels
- Adjustable pulse duration
- Maintenance mode for pulse valve fault diagnosis
- Two voltage options
 - 24vDC
 - 100-240vAC
- Outputs
 - Alarm Relay
 - 4-20mA for differential pressure
- Alarms
 - Solenoid Failure
 - Differential Pressure
 - Low pressure
 - Broken bag detection (with optional dust sensor)

Installation Requirements

Installing dust collector controllers is not difficult but should be done by suitably qualified and experienced technicians. Some knowledge of MODBUS communications is required to connect the power meters to your network.

Specifications

General Specifications

Dust Collector Controller Details			
Type	Industrial dust collector controller		
Applications	Measure the performance of a dust collection installation, and manage the number of pulse cleaning cycles required to optimise baghouse productivity.		
Casing	Metal Enclosure		
Display	LCD Display		
Installation Type	Permanent installation		
Warranty	12 months		
Valve sequencing	Sequential or Arbitrary Series or Parallel		
Modes of operation	On Demand or Timed		
Fault Diagnostics	Maintenance mode (ability to pulse valves and determine fault status) Solenoid valve electrical short and open circuit detection Diaphragm valve mechanical fault detection (requires pressure switch) Broken bag detection (requires dust probe)		
Power			
Power supply	100 to 240 VAC or 24 VDC. Others by request		
Voltages	AC In / DC Out In: 100VAC to 240VAC Out: 24VDC	DC In / DC Out In: 24VDC Out: 24VDC	AC In / AC Out In: 100VAC to 240VAC Out: Same as input voltage
Timer Operation			
Number of valves	Up to 60 valves		
ON Time	50 – 999 milliseconds (ms)		
OFF Time 1	1 – 999 seconds (s)		
OFF Time 2 (fast)	1 – 999 seconds (s)		
Pulsing mode	Sequential or Arbitrary (user defined)		
Clean after shutdown	1 - 255 cycles		
Autocycle Forced Pulsing	1 - 24 hours		
On Demand Cleaning			
Differential Pressure (DP)	KPa, mm H2O or inWG		
Ultra low level	Unit in Standby		
Low level	Pulsing stops		
High level 1	Pulsing starts		

High level 2	Pulses faster
Alarm level	Local and remote, General and Critical
Tube Cleaner	Duration (s) and interval (mins)
Input	
Input sensors	4 input sensors User selectable - Interrupt, general, critical, mechanical fault, broken bag User selectable - Digital voltage free, analogue voltage or current
Input Sensor Types	Dust Probe, pressure sensor, pressure switch, level probe
Output	
Solenoid valves	100 to 240 VAC or 24 VDC
System active relay	Dry contact (NO/NC)
Three (3) configurable alarms	Dry contact (NO/NC)
Differential pressure	4-20mA
Output relays	4 output relays System active, general alarm, critical alarm, faulty coils

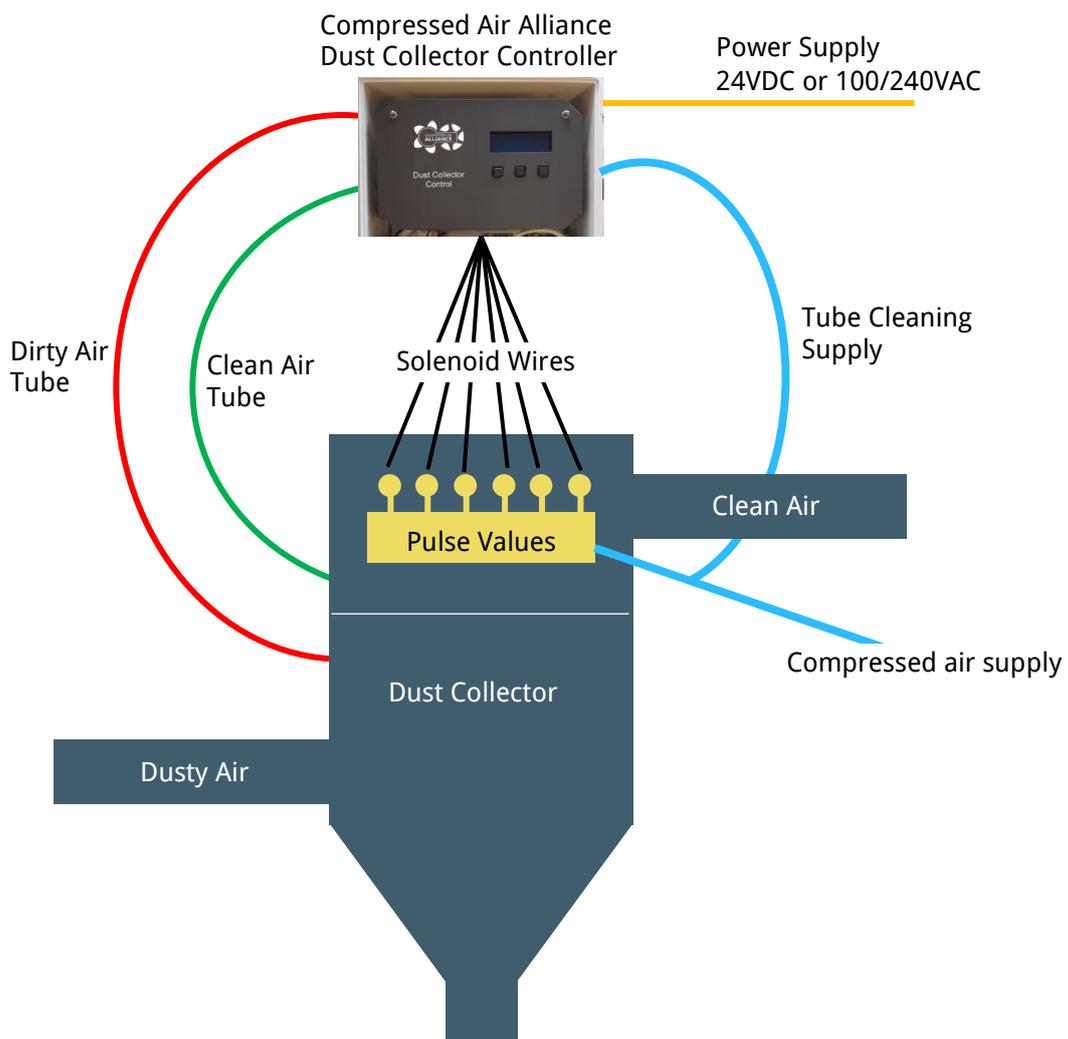
Modbus RS485

Communication	
Transmission mode	RS485 port
RS485 link	2 wire (master and slave comms)
Communication protocol	MODBUS RTU
Settings	
Communication address	1 to 247 (default 1)
Baud rate (communication speed)	1200 to 57600 baud (default 9600)
Parity	Even, Odd, None (default)
Data Bit	8
Stop bit	2

Installation

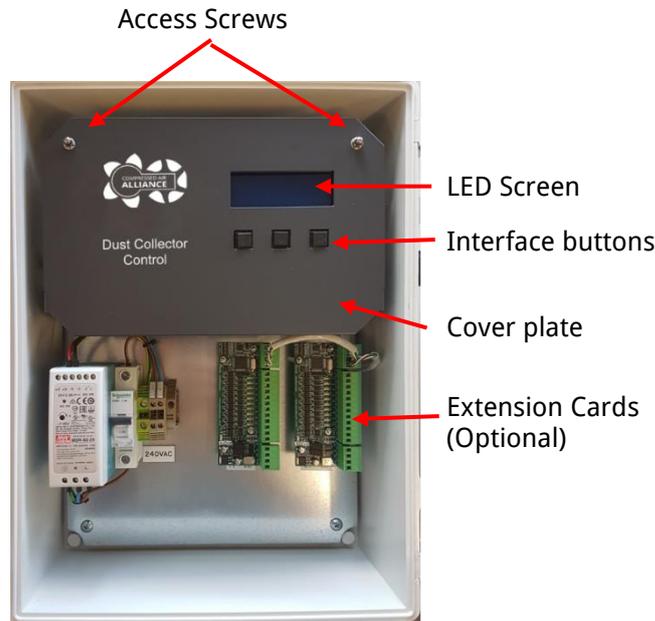
If there is an existing Dust Collector Controller, remove it and install the new Compressed Air Alliance Controller. Otherwise, just install the Compressed Air Alliance Controller

- Connect dirty and clean air tubes to the new Controller. Install tubes if they are not present.
- Connect tube cleaning supply from the compressed air supply to the new Controller.
- Connect solenoid wires from the existing pulse valves to the new Controller. If solenoids are installed existing controller, move them to the pulse valves and run wiring.



Dust Collector Controller Box

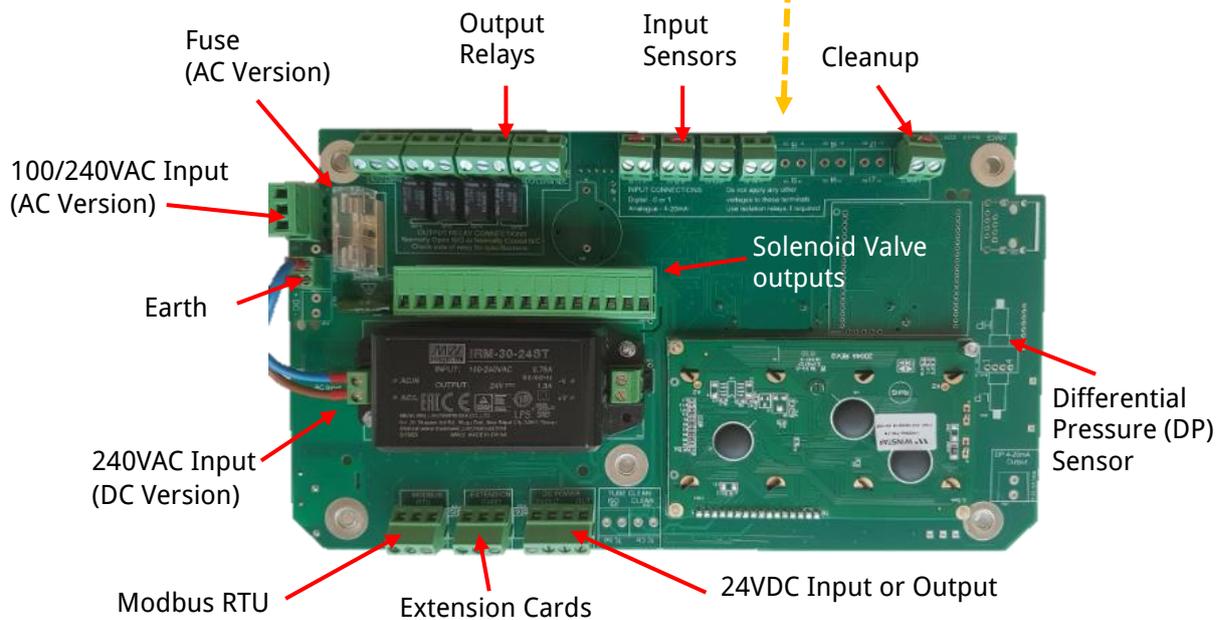
External Layout



Internal Layout

To connect power and solenoid valve wires:

1. Remove access screws
2. Tilt cover plate forward



Note: the AC Version is shown here

Electrical Connection

Connecting input power and output connection to the solenoid valves is a very simple procedure that can be completed in a very short period of time.

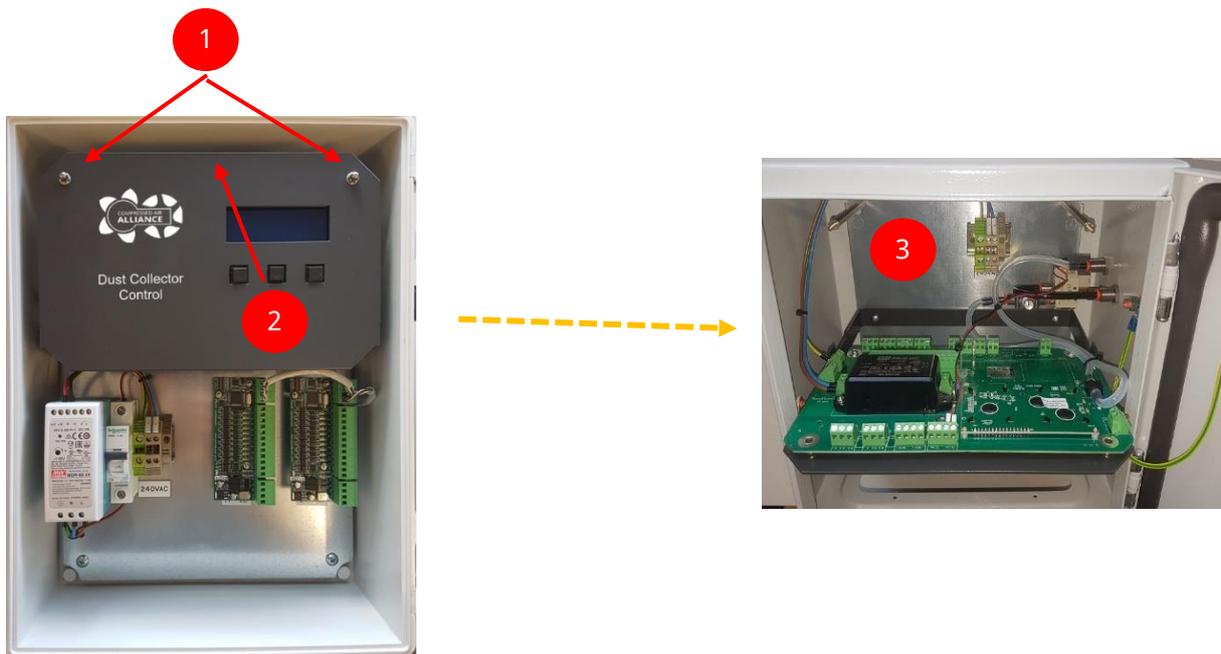
The Controller uses an encapsulated DC power module that is removable and replaceable. For the DC version of the board connection of AC power is directly to the power supply.

-  DO NOT double up solenoid valves, only connect one solenoid valve per position.
- DO NOT mix commons between the main and extension cards if extension cards are connected.
- Doing both these will cause the Controller to detect valve faults.

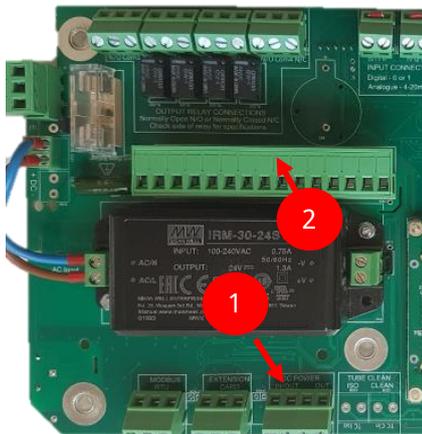
Accessing Power and Connectors

To connect power and solenoid valve wires

1. Remove access screws
2. Tilt cover plate forward
3. Remove the board from the brass spacers to access the bottom of the board.



Power and Solenoid Connections - DC Solenoids

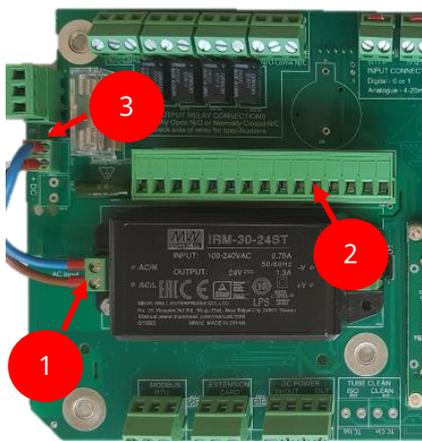


DC SOLENOID VERSION

DC input power and DC solenoid output

For this configuration the DC input voltage can be between 10-30VDC and the output voltage to the coils is identical to the input voltage. So 10VDC in, 10VDC out. 24VDC in, 24VDC out etc.

1. Connect the DC incoming power supply to terminal marked DCVI (terminal J104)
2. Connect the 24VDC solenoid coils to terminal marked SOLENOIDS (terminal J306). This plug is removable to assist the installation process.



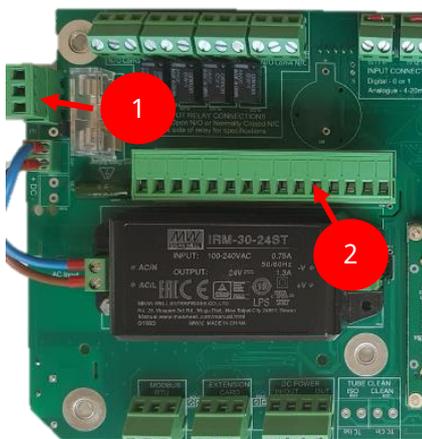
DC SOLENOID VERSION

AC input power and 24VDC solenoid output

For this configuration the AC input voltage can be between 100-240VAC, but the output voltage is fixed at 24VDC

1. Connect the 100 to 240V AC incoming power supply directly to the power supply
2. Connect the 24VDC solenoid coils to terminal marked SOLENOIDS (terminal J306). This plug is removable to assist the installation process.
3. Connect the earth if required. The jumper plug behind the earth terminal connects earth to the 0V of the PCB

Power and Solenoid Connections - AC Solenoids



AC SOLENOID VERSION

AC input power and identical AC solenoid output

For this configuration the AC input voltage can be between 100-240VAC and the output voltage to the coils is identical to the input voltage. So 240V in, 240V out. 110V in, 110V out etc.

1. Connect the 100 to 240V AC incoming power supply to terminal marked ENA (terminal J103). This plug is removable to assist the installation process.
2. Connect the 100 to 240V AC solenoid coils to terminal marked SOLENOIDS (terminal J306). This plug is removable to assist the installation process.

Input Connections

The Dust Collector Controller has a total of eight (8) inputs that can be either dry contact, voltage or analogue current.



DIGITAL DRY CONTACT

The digital inputs need to be a voltage free dry contact. This means no energy is supplied to the contacts (completely passive and isolated).

1. Connect the incoming digital signal into the input terminals 1 to 8 marked IN and 0V.



Applying any AC or DC voltage directly to the input will damage the controller. An isolation relay may be required.



2. If the input is not used and a terminal bridge is installed (as shown in the diagram), ensure the input has been isolated in the software.



If the input interrupt feature is not used then the wire link must be left installed in terminals 1, 2, 5 and 8. If the link is not installed then the Controller will stop pulsing.



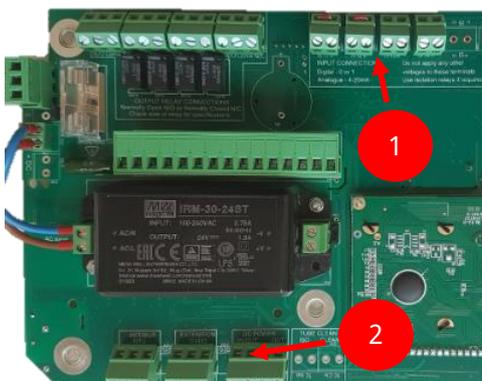
ANALOGUE VOLTAGE

The Controller can accept an analogue voltage input but it must not exceed 3.3V.

1. Connect the incoming analogue voltage signal into the input terminals marked IN and 0V on any input terminal that has been set for an analogue voltage sensor.



The voltage cannot exceed 3.3 volts DC. Exceeding this voltage will cause damage to the controller.



ANALOGUE 4-20MA LOOP POWERED SENSOR

The Controller can accept an analogue current loop powered in the range of 4-20mA.

1. Connect to the IN position on any input terminal that has been set for an analogue current sensor
2. Connect to the +24VDC line of terminal J102 to the +ve input terminal on the loop powered sensor

Cleanup Connection

The cleanup function is used to continue pulsing the dust collector for a number of cycles after the fan motor has been switched off. This ensures the filter bags are clean before the start of the next shift. It can also ensure that certain types of dust that can harden in the presence of humidity is fully removed.



Compressed Air Alliance does not recommend offline cleaning be used in dust collectors with a soft explosion relief membrane. Activation of the cleaning mechanism in the absence of the static head generated by the fan could damage these explosion membranes.



Connect the cables from input 8 (terminal J202 Clean) to the contactor on the normally open N/O motor controller.

When the motor is in operation the contact will be closed and the dust controller will operate as normal.

When the motor is switched off the contact will open. This will trigger the cleanup cycle on the Controller.



If the cleanup function is not used, then the wire link must be left installed in terminal 8. If the link is not installed then the Controller will enter the cleanup cycle on start-up, pulse the designated number of cycles and will then stop pulsing.

Relay Output Connection

There are four (4) relay outputs on the Dust Collector Controller. The relays are triggered by the status and alarms that are programmed into the board by the user.



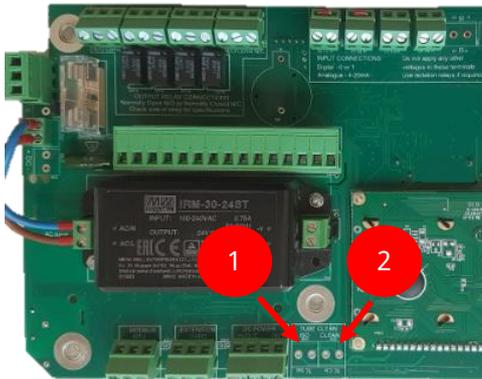
- Relay 1 – System Active
- Relay 2 – General Alarm
- Relay 3 – Critical Alarm
- Relay 4 – Faulty Coil Alarm

Each relay can be either normal closed N/C or normally open N/O.

1. Connect either the N/C or N/O relay to the PLC Board or other device to control such as a light or siren. The relay terminals are J210, J211, J212 and J213.

Tube Cleaning Valves

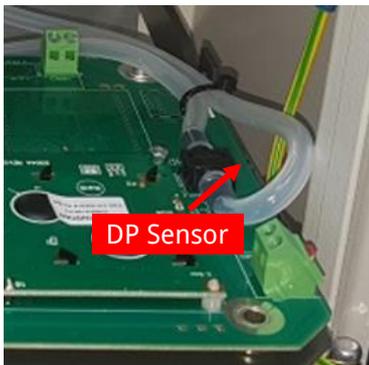
The tube cleaning valves are used to keep the differential pressure measurement tubes free from dust and blockages.



1. **Isolate (ISO).** The isolation valve is used to disconnect and isolate the differential pressure measurement sensor from the cleaning compressed air.
2. **Clean.** The cleaning valve is used to switch on and off the compressed air for tube cleaning purposes.

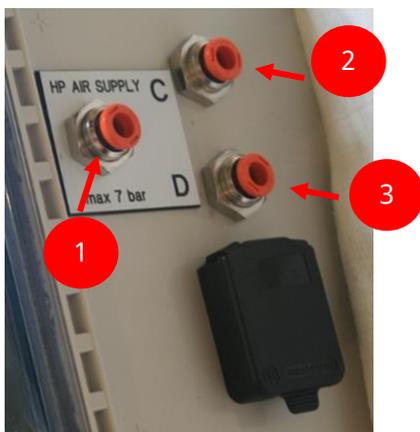
The isolation valves used are 24VDC. Do not use any other voltages.

Differential Pressure (DP) Measurement (Internal Sensor)



The controller has an onboard pressure sensor used to measure the differential pressure over the filter bags.

The controller comes with the Differential Pressure (DP) sensor already connected via silicone based flexible hoses.



Bulkhead fittings are provided on an external point on the enclosure (see picture to the left).

1. The high pressure (HP) air supply must not exceed 7 bar. This is the cleaning air used to clean the measurements tubes.
2. The clean side measurement (C or L) must be connected to the clean low-pressure side of the baffle plate.
3. The dirty side measurement (D or H) must be connected to the dirty side of the baffle plate.



DO NOT connect high pressure air into the clean or dirty side tube connections. This will damage the differential pressure sensor and result in the board not operating correctly.

Differential Pressure Output (4-20mA)

The Controller can output the raw 4-20mA valve measured by the onboard differential pressure sensor. This can be connected to an external device such as a PLC.



A 4-20mA current loop isolation device **MUST** be installed between the output terminal and the PLC. Do not connect the 4-20mA output directly to the PLC.



Connect the 4-20mA from the output terminal to the current loop isolation device. Do not connect the 4-20mA output directly to an external system.

This output terminals from the current loop isolation device can then be connected to an external system such as a PLC.



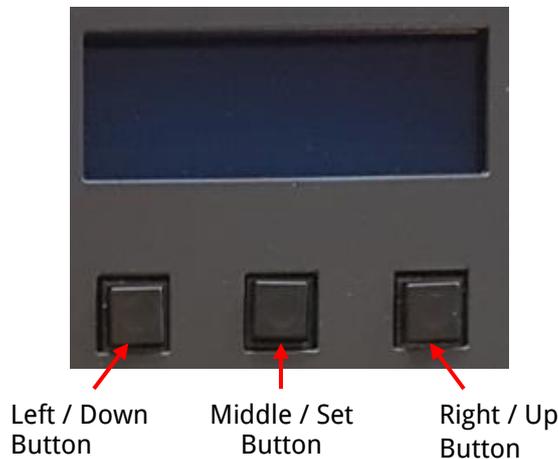
If an external 4-20mA reading is not taken, then the wire link **MUST** remain installed in the green terminal. If the wire link is removed, then the differential pressure sensor will not work and will result in a DP reading of 0mmH₂O.

Extension Card Connections

The Dust Collector Controller will come with extension cards pre-installed based on the number of valves ordered. If you need to add extra cards, contact Compressed Air Alliance.

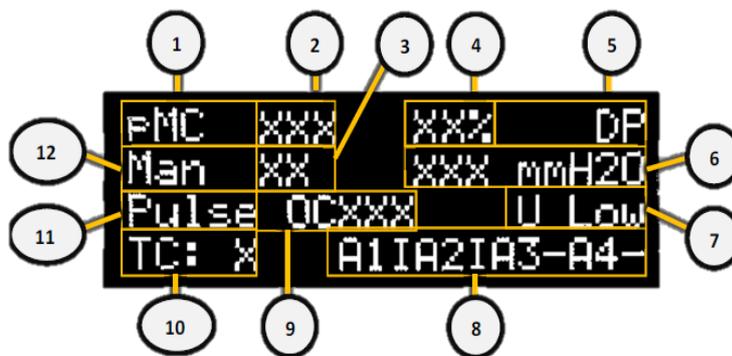
User Interface

The user interface for the Dust Collector Controller consists of three push buttons and an LCD screen. All functionality of the Controller can be accessed using this interface.



Main Run Page

The main run page gives the user a snap shot of the current status of the dust collector. There is a lot of information on this screen so please take a minute to read this section.

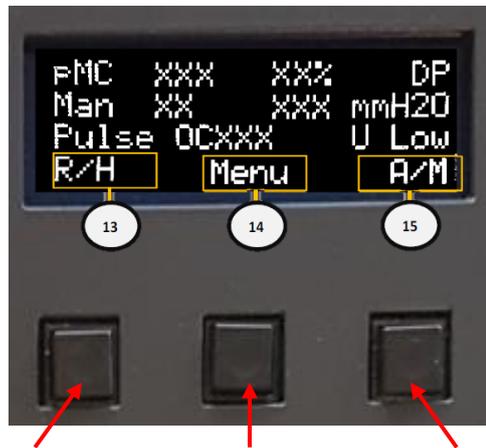


1	Model Name	Indicates the model of the Dust Collector Controller.
2	Count Down Time	Indicates the time in seconds until the next valve pulses.
3	Next Valve	Indicates the next valve that will pulse. This will be a number between 1 and 240 depending on setup and how many extension cards are connected.
4	Percentage Savings	Indicates the number of pulses saved operating in differential pressure mode when compared to a sequential timer with identical on and off time settings. The higher the value, the greater the savings achieved.

5	Differential Pressure Sensor	<p>Indicates whether an internal or external DP is being using to control the dust collector.</p> <ul style="list-style-type: none"> • DP = The internal differential pressure sensor is controlling the dust collector • XDP = An external differential pressure sensor is controlling the dust collector
6	Differential Pressure Value	<p>Indicates the current differential pressure over the filter bags. The units of measurement can be.</p> <ul style="list-style-type: none"> • mmH2O = mm of water column • inH2O = inches of water column • kPa = kilopascals
7	Differential Pressure Alarm	<p>Indicates what alarm level the current differential pressure reading is at; this is a user defined setting.</p> <ul style="list-style-type: none"> • U Low = Ultra Low Differential Pressure • Low = Low Differential Pressure • High = High Differential Pressure, timer OFF time 1 active • Fast = Higher Differential Pressure, timer OFF Time 2 active • Alarm = Differential Pressure above selected alarm level
8	Alarm State	<p>Indicates the alarm status for alarms 1 to 8 (the screen will toggle between A1IA2IA3-A4+ and A5IA6-A7-A8-).</p> <ul style="list-style-type: none"> • I = Interrupt • - = alarm disabled • + = alarm enabled • * = alarm enabled and ON (activated)
9	Solenoid State	<p>Indicates the last solenoid valve that fired and what the result of the valve as (whether the coil of the last valve is faulty or not).</p> <ul style="list-style-type: none"> • OK = NO Fault • OC = Open Circuit • SC = Short Circuit
10	Tube Cleaner	<p>Indicates the number of times the tube cleaning valves have fired.</p>
11	Manually Stopping the Dust Collector	<p>Indicates the current state of the controller. The dust collector can be manually halted if required.</p> <ul style="list-style-type: none"> • Halt = The dust collector has been halted either manually or by the differential pressure cleaning mode • Pulse = The dust collector is pulsing
12	Mode Of Operation	<p>Changes the operation of the dust collector from between manual (sequential) or auto (on demand) modes.</p> <ul style="list-style-type: none"> • Auto = The dust collector is running in on demand mode, it is using the differential pressure sensor to control the pulsing

	<ul style="list-style-type: none"> Man = The dust collector is running in manual mode and is operating as a basic sequential timer
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If any of the three buttons are pressed the following screen will appear. This allows the user to change between auto or manual mode, pulsing or halting and allow the user to enter the Menu section.

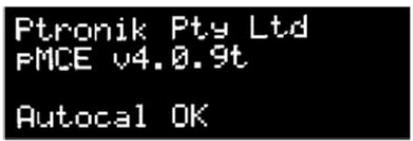
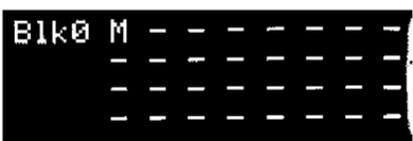


Left / Down Middle / Set Right / Up

13	Pulse or Halt	<p>Press on the left button to manually change the state between Halted and Pulsing.</p> <p> This option is only available in manual mode. If the unit is in Auto mode it cannot be manually halted.</p>
14	Menu	<p>Press on the middle button to check alarms, enter maintenance mode or to alter the settings of the controller.</p>
15	Auto or Manual	<p>Press on the right button to manually change the controller between Manual and Auto mode.</p>

Powerup Screens

On powering up the controller (or after a reset) the following screens appear. This gives the user information about how many extension cards are connected and how they are configured.

	<p>This screen gives the user information about the controller tpe (E10, Eco or pMC) and if the auto calibration has been completed successfully.</p>
	<p>This screen displays how many extension cards are connected. If the extension cards have been setup for parallel pulsing (if there are more than 1 blocks then parallel pulsing has been activated).</p>
	<p>This screen displays a matrix showing visually the number of extension cards and how they are connected.</p>

Alarm Matrix

The inputs and alarms page give the user an overview of the status of solenoid coils experiencing an electrical short or open circuit; diaphragm valves that are experiencing a mechanical fault; filter bags that have been detected as having a hole or sensors connected to the inputs of the Controller that are in alarm.

	<p>If the middle "Menu" button is pressed, then the inputs and alarm pages will be shown.</p>
	<p>If the Controller has detected an alarm on inputs 1 to 8 it will flash INPUT X ON! on the main screen. To acknowledge the alarm, press the middle / ACK button</p>



If the Controller has detected an electrical valve fault (short or open circuit) or broken bag, then a matrix of faults will be displayed. This assists the user to identify where the fault has occurred.

- **ALARM VALVES** - The number of faulty coils that have been detected. Faulty coils are caused by open or short circuits. The page shows the total number of valves with faults and the position of the faulty valves
- **DUST ALARM VALVES** - The number of broken bags that have been detected. The page shows the total number of valves with faults and the position of the faulty valves.

To go to next page, press the **Middle / Next button**.



To enable the broken bag detection, feature a dust probe needs to be connected to the controller.

Controller Information

The following pages show the key settings that have been programmed into the controller. These can be altered by logging into the settings area.



These pages show differential pressure cleaning settings

- **VALVES** = The number of solenoids valves the Controller has been programmed for
- **ORDER** = The order sequencing of the valves
- **CCYC** = The number of cleanup cycles
- **ONTMS** = The solenoid pulse duration in milliseconds
- **OFFT** = The OFF time 1
- **OFFT2** = The OFF time 2

<pre> Low = 70 mmH2O High= 120 mmH2O Fast= 150 mmH2O BACK NEXT HELP Alarm 220 mmH2O TC(h)= 30 TConT= 3 BACK NEXT HELP </pre>	<p>These pages show differential pressure cleaning settings</p> <ul style="list-style-type: none"> • LOW = Low Differential Pressure setting. When the differential pressure drops below this value the Controller will stop pulsing the solenoid valves. • HIGH = High Differential Pressure. When the differential pressure is between the Low and High settings then the Controller will use the OFF time 1 setting to pulse the solenoids valves. • FAST = Higher Differential Pressure. If the differential pressure keeps increasing past the High setting, then the dust collector is not pulsing frequently enough. When the differential pressure exceeds the Fast setting then the Controller will use the OFF time 2 setting to pulse the solenoids valves. • ALARM = Alarm level. If the differential pressure continues to increase, then the dust load is either too high or there has been multiple failures of the solenoid valves. • TC(h) = The cleaning frequency of the tube cleaning valves. • TConT = The on time for the tube cleaner, this is how long the tube cleaning valves clean for.
<pre> Counters Op Hrs 0 Pulses 7 BACK NEXT HELP Tot Hrs 1 Auto Cycle Hrs= 10 Time till AC 09:59 BACK NEXT HELP </pre>	<p>These pages show the counter information</p> <ul style="list-style-type: none"> • OP HRS – the operational hours of the dust collector. This is the time the system has been in the pulsing state. • PULSES – the number of valves the dust collector has pulsed. • TOT HRS – the total hours the dust collector has been powered for in either the halted or pulsing state. • AUTO CYCLE HRS = the time between forced pulsing • TIME TILL AC = Countdown until next auto-cycle forced pulsing
<pre> I1 Lo I2*Hi I3*Hi I4*Hi BACK NEXT I1 INT I2*GEN I3*--- I4*--- BACK NEXT </pre>	<p>The status of the inputs and alarms</p> <ul style="list-style-type: none"> • LO = The input is currently in the low state, an alarm has not been triggered • Hi = The input is currently in the high state, an alarm has not been triggered • * = The alarm has been enabled • INT = The input has been configured as an interrupt • GEN = The input has been configured as a general alarm • XDP = The input has been configured for an external differential pressure sensor

	<ul style="list-style-type: none">• DUG = The input has been configured as a general dust alarm (requires a dust probe)• DUC = The input has been configured as a critical dust alarm (requires a dust probe)• MEC = The input has been configured for mechanical fault detection (requires a header pressure sensor)• --- = The input has been disabled.
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Programming the Controller

All changes to time settings, valve settings and sequencing is access behind a password protected area. The following section describes in detail all the programming functionality of the Controller.

Password Protected Area

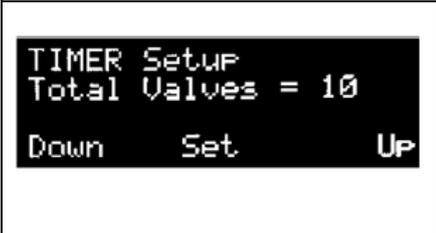
To enter the settings area of the controller a passcode must be entered. This is a basic security procedure to prevent accidental modifications of the settings.

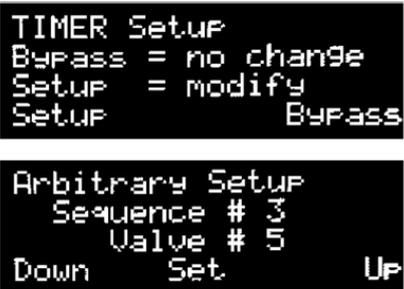
From the main screen, continue pressing the middle button unit the **Enter CODE** page appears.

	<p>To enter the code, press the Left / Down or Right / Up buttons.</p> <p>The password code for all controllers is set to 4.</p> <p>When this has been entered press the Middle / Set button.</p>
	<p>If the password has been entered successfully the word SUCCESS will flash on the screen.</p>

Timer Settings

The Timer Settings menu allows the user to change the settings of the controller such as number of valves, sequencing, the pulse on and off times. Keep pressing NEXT (Right button) until the **TIMER Setup** page is displayed.

	<p>To modify the controller timer settings, press the Middle / Select button.</p>
	<p>The Total Valves page specifies the number of valves connected to the Controller.</p> <p>To alter the number of valves connected to the system use the Left / Down or Right / Up buttons. When the desired number of valves has been entered press the Middle / Set button.</p>

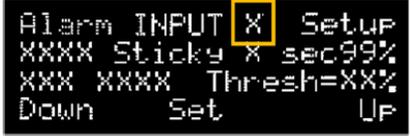
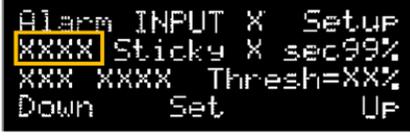
	<p>This page specifies the sequencing of the pulse valves. The two options are.</p> <ul style="list-style-type: none"> • SEQ – The pulsing sequence is in a sequential order meaning the valves will pulse 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. • ARB – The pulsing sequence is in an arbitrary order and user definable. The user can enter any valve pulsing order for example 1, 3, 5, 7, 9, 2, 4, 6, 8, 10 or 10,8,6,4,2,9,7,5,3,1 or any other combination the user requires. <p>To alter the sequencing of the valves, press the Left / SEQ button to enter sequential or Right / ARB button to enter user defined arbitrary mode.</p> <p>When the desired sequencing of valves has been entered select the Middle / SET button.</p>
	<p> The following page will only appear if the user has selected the arbitrary sequence mode.</p> <ul style="list-style-type: none"> • If the user <u>does not</u> want to review or alter the current arbitrary sequence press the right / BYPASS button. • If the user does want to review or alter the current arbitrary sequence press the left / SETUP button. <p> The following page will only appear if the user has selected to modify the current arbitrary sequence.</p> <p>To alter the sequencing of the valves, press the Left / DOWN or Right / UP button to enter the valve corresponding to the desired sequence number. When the desired sequencing of valves has been selected enter the Middle / SET button.</p> <ul style="list-style-type: none"> • SEQUENCE – This is the sequence number and will be a sequential number from 1 to maximum number of valves entered. • VALVE – This is the valve number that is to correspond to the sequence number. <p>It can help in this step to assemble a pulsing sequence table.</p>
	<p>The Valve On Time page modifies the length of the pulse duration. The pulse duration is user selectable in milli seconds (ms) and can be between 1ms to 999ms in length.</p> <p>To alter the on time OnTime press the Left / Down or Right / Up buttons. When the desired on time has been entered press the Middle / Set button.</p> <p>In this example the on time is 150 milli seconds.</p>

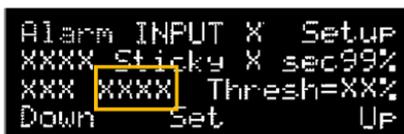
	 <p>The on time settings of the controller must not exceed the duty cycle of the solenoid valves the user connects. Running the valve outside the manufacturers recommended settings can cause damage to the valve and the Dust Collector Controller.</p>
<pre>TIMER Setup Valve OffTime1 = 15 Down Set Up TIMER Setup Valve OffTime2 = 7 Down Set Up</pre>	<p>The Valve Off Time pages modify the length of time between pulses. The interval between pulses is user selectable in seconds (sec) and can be between 1s to 999s in length.</p> <ul style="list-style-type: none"> • OffTime1 - This is the off time used during normal operation when the differential pressure is between Low and Fast settings (see ODC Settings below) • OffTime2 - This is the off time used during normal operation when the differential pressure is between Fast and High settings (see ODC Settings below) <p>To alter the off times, press the Left / Down or Right / Up buttons. When the desired off time has been selected press the Middle / Set button.</p> <p>In this example off time 1 is 15 seconds and off time 2 is 7 seconds.</p>  <p>The off time setting of the controller must be shorter than the duty cycle recommended by the manufacturer. This can cause damage to the valve and the Dust Collector Controller.</p>
<pre>TIMER Setup Cleanup Cycles= 0 0=INT Down Set Up</pre>	<p>This page specifies the number of cycles the dust collector should continue pulsing for after the fan motor has been shut down. This ensures the bags are completely clean when the unit is restarted.</p> <p>To utilise this feature will require input 8 to be connected to the motor contactor.</p> <p>To alter the number of cycles CCycle press the Left / DOWN or Right / UP buttons. When the desired number of cycles has been selected press the Middle / SET button.</p> <p>If the number of cleanup cycles is set to 0 then input 8 can be used as an interrupt input.</p>  <p>The cleanup input signal connected between input 8 and the motor contact must be voltage free. Do not connect AC or DC voltage directly to this terminal.</p>
<pre>TIMER Setup Auto Cycle Hrs= 10 0=disabl Down Set Up</pre>	 <p>Auto cycle only operates in Auto mode. The Autocycle feature is not available if the controller is in manual mode.</p> <p>This page specifies how often the controller forces the dust collector to pulse. This feature is used for the types of dust that can harden on bags over a short period of time.</p>

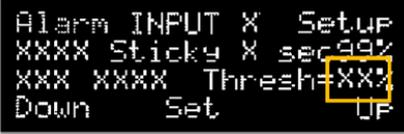
	<p>To alter the number of hours for forced pulsing press the Left / DOWN or Right / UP buttons. When the desired number of cycles has been selected press the Middle / SET button.</p> <p>If the number of Auto Cycle hours is set to 0 then the features is disabled.</p>
--	--

Alarm and Input Settings

This menu allows the user to change the alarm and input settings.

	<p>To modify the alarm & input settings press the Middle / SELECT button.</p>
	<p>INPUT X – Identifies the input number. The X value will be either 1, 2, 3 or 4.</p>
	<p> Not all alarm type options are available on all inputs. Read the information below carefully.</p> <p>ALARM TYPE – Identifies what type of alarm the input sensor has been configured for. The value XXXX can be any of the following.</p> <ul style="list-style-type: none"> • INT = Interrupt. Interrupt the controller if the input is triggered. The controller will enter the HALT condition. This can be used for remote start / stop command. • GEN = General Alarm. If this input type is selected and triggered it will display an Alarm on the main run page, the dust collector will continue to operate and will energise the general alarm relay. • CRIT = Critical Alarm. If this input type is selected and triggered it will display an Alarm on the main run page, the dust collector will HALT and will energise the critical alarm relay. • MECH = Mechanical fault. If this input type is selected and triggered it will display an alarm on the main run page, the dust collector will continue to run and will energise the general alarm relay. • DUSTG = Broken Bag detection set as a general alarm. If this input type is selected and triggered it will display an Alarm on

	<p>the main run page, the dust collector will continue to run and will energise the general alarm relay.</p> <ul style="list-style-type: none"> • DUSTC = Broken Bag detection set as a critical alarm. If this input type is selected and triggered it will display an Alarm on the main run page, the dust collector will HALT and will energise the critical alarm relay. • XDP = External differential pressure sensor. • -- = Disabled. The input is disabled in software. <p> Not all alarm type options are available on all inputs. Read the information below carefully.</p> <ul style="list-style-type: none"> • Input 1 = INT, GEN, CRIT, XDP • Input 2 = INT, GEN, CRIT • Input 3 = --, GEN, CRIT, DUSTG, DUSTC • Input 4 = --, GEN, CRIT, HdPr
	<p> This option will only appear if Mechanical Fault or Dust General or Dust Critical have been selected as the input sensor type</p> <p>STICKY - This is abbreviated for sticky window or the length of time the Controller looks for a sensor input after the solenoid has been fired.</p> <p>If mechanical or dust is selected the user will be prompted to enter a window length in seconds. Available options are 1, 4 or 8 seconds.</p>
	<p>SENSOR TYPE - Identifies if what connection it has been configured for. The value XXX can be any of the following.</p> <ul style="list-style-type: none"> • DIG = A digital, voltage free dry contact input connection • ANI = An analogue current, 4-20mA sensor input connection • ANV = An analogue voltage, 0-3.3v sensor input connection. Do not apply voltage higher than 3.3V.
	<p> This option will only appear if an analogue input type has been selected</p> <p>RISING OR FALLING - If the input has been configured for an ANALOGUE input then the alarm can be triggered by the following two methods</p> <ul style="list-style-type: none"> • RISE = The alarm is triggered when the signal rises past the threshold alarm level (RISING) • FALL = The alarm is triggered when

	<p> This option will only appear if an analogue input type has been selected</p> <p>THRES = If the input has been configured for an ANALOGUE input then the user can select the threshold value to trigger the alarm. The % threshold value is directly related to the mA value</p> <ul style="list-style-type: none"> • 0% = 4mA • 25% = 8mA • 50% = 12mA • 75% = 16mA • 100% = 20mA
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On Demand Cleaning (ODC) Settings

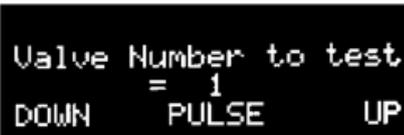
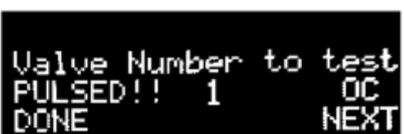
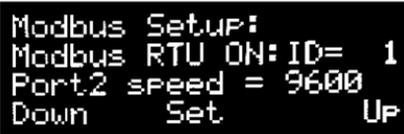
This menu allows the user to change the differential pressure settings that initiate and terminate the cleaning cycle. Keep pressing NEXT (Right button) until the ODC Setup page is displayed.

	<p>To modify the on demand cleaning settings, press the Middle / Select button.</p>
	<p>The Pressure Units page specifies the units for differential pressure measurement.</p> <p>The user has three options</p> <ul style="list-style-type: none"> • mmH2O – this unit of measurement is millimetres of water gauge. The range of measurement is 0 to 250mm H2O • inH2O – this unit of measurement is inches of water gauge. The range of measurement for this unit is 0 to 10" water • KPa – this unit of measurement is kilopascals. The range of measurement for this unit is 0 to 2.5KPa. <p>To alter the units, press the Left / Down or Right / Up buttons. When the desired units have been selected press the Middle / Set button.</p>

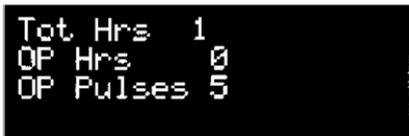
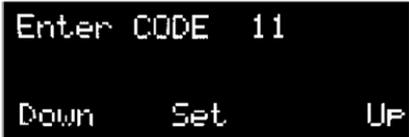
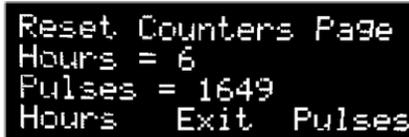
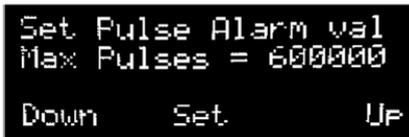
<pre> ODC-Setup Set Pressure levels Low = 70 mmH2O Down Set Up ODC-Setup Set Pressure levels High = 120 mmH2O Down Set Up ODC-Setup Set Pressure levels Fast = 150 mmH2O Down Set Up ODC-Setup Set Alarm levels Alarm = 220 mmH2O Down Set Up </pre>	<p>The Set Pressure Levels page specifies the differential pressure levels to initiate and terminate the pulsing sequence. The user needs to program four differential pressure levels</p> <ul style="list-style-type: none"> • Low = Low Differential Pressure. When the differential pressure drops below this value the Controller will stop pulsing the solenoid valves. • High = High Differential Pressure. When the differential pressure is between the Low and High settings then the Controller will use the Valve OFF time 1 setting to pulse the solenoids valves (see Timer Settings above for Off Time 1). • Fast = Higher Differential Pressure. If the differential pressure keeps increasing past the High setting, then the dust collector is not pulsing frequently enough. When the differential pressure exceeds the Fast setting then the Controller will use the OFF time 2 setting to pulse the solenoids valves (see Timer Settings above for Off Time 2). • Alarm = Alarm level. If the differential pressure continues to increase, then the dust load is either too high or there has been multiple failures of the solenoid valves. <p>To alter the differential pressure values, press the Left / Down or Right / Up buttons. When the desired units have been selected press the Middle / Set button.</p>
<pre> ODC-Setup Set Tube Clean Tube Clean ON = 3 s Down Set Up </pre>	<p>This page specifies the how long the tube cleaning will pulse for when the command is given.</p> <p>To alter the tube cleaning times, press the Left / DOWN or Right / UP buttons. When the desired time has been selected press the Middle / SET button.</p> <p>In this example the tube cleaner is instructed to clean for 3 seconds.</p>
<pre> ODC-Setup Set Pressure levels Tube Clean INT =30 H Down Set Up </pre>	<p>This page specifies the frequency of cleaning the differential measurement tubes.</p> <p>To alter the tube cleaning times, press the Left / DOWN or Right / UP buttons. When the desired time has been selected press the Middle / SET button.</p> <p>In this example the tube cleaner is instructed to clean every 30 hours.</p>

Maintenance Mode

Maintenance mode allows the user to manually pulse and test the valves. This can help in diagnosing failed solenoid or diaphragm valves. Keep pressing NEXT (Right button) until the **Maintenance** page is displayed.

 <pre> Maintenance... EXIT Select NEXT </pre>	<p>To enter maintenance mode, press the Middle / Select button.</p>
 <pre> Valve Number to test = 1 DOWN PULSE UP </pre>	<p>This page allows the user to select the valve to test. To select the valve to pulse, press the Left / Down or Right / Up buttons. When the valve to be tested has been selected press the Middle / Pulse button to test the valve.</p>
 <pre> Valve Number to test PULSED!! 1 OC DONE NEXT </pre>	<p>This page shows the test result of the valve just pulsed. The test result of the coil will be shown to the right of the PULSED! text and will be one of the following three possibilities</p> <ul style="list-style-type: none"> • OK - The solenoid valve is functioning correctly • SC - The solenoid valve is showing a short circuit. • OC - The solenoid valve is showing an open circuit. This could mean the valve is not connected or the coil has burnt out. <p>Press the Left / Done button to return to the main menu or press the Right / Next button to test and pulse another valve.</p>
 <pre> Backlight mode is: Auto AUTO SET ON </pre>	<p>The user has the ability to modify the backlight operation.</p> <ul style="list-style-type: none"> • STAY ON - The backlight will stay on permanently. • AUTO - The backlight will turn off after a period of time. When an alarm is detected the screen will flash periodically. <p>When the desired backlight setting has been selected press the Middle / SET button.</p>
 <pre> Modbus Setup: Modbus RTU ON: ID= 1 Port2 speed = 9600 Down Set Up </pre>	<p>The Modbus settings can be altered on this page.</p> <ul style="list-style-type: none"> • ID - The ID of the Modbus device the user wishes to assign • PORT SPEED - The baud rate <p>When the desired Modbus setting has been selected press the Middle / SET button.</p>

Counter Setup

	<p>To enter counter setup, select the Middle / SELECT button.</p>
	<p>This page shows the current counter information. There are three counters:</p> <ul style="list-style-type: none"> • Tot Hrs - Total hour count since the unit left the factory (not alterable) • OP Hrs - The operational hours since the unit was last reset (see below) • OP Pulses - The operational pulses since the unit was last reset (see below)
	<p>To reset the counters, press on both left & right push buttons at the same time.</p> <p>To enter the code, press the Left / DOWN or Right / UP buttons.</p> <p>The password code for all controllers is set to 11.</p> <p>When this has been entered press the Middle / SET button.</p>
	<p>This page allows the user to reset the operational counters.</p> <p>To reset the operational hours, press the Left / HOURS button.</p> <p>To reset the operational pulses, press the Right / PULSES button.</p>
	<p>This page allows the user to set the operating hours that will trigger an alarm.</p> <p>To alter the operating hours, press the Left / DOWN or Right / UP buttons.</p> <p>When the desired time has been selected press the Middle / SET button.</p>
	<p>This page allows the user to set the operating pulses that will trigger an alarm.</p> <p>To alter the operating pulses, press the Left / DOWN or Right / UP buttons.</p> <p>When the desired time has been press the Middle / SET button.</p>

Troubleshooting

Display	
No characters shown on the screen	<ul style="list-style-type: none"> • Check input power supply is connected • Check power supply is functioning correctly • Check fuse has not blown (on AC version) • Check if any LED's light up on the board • Check for dust on the board that could be creating an electrical short, gently blow off with compressed air • If LED's are on, backlight is on, and nothing is displayed contact Compressed Air Alliance
Random characters shown on screen	<ul style="list-style-type: none"> • Check solenoids for short or open circuits • Check soldered fuse has not burnt out • Check for dust on the board that could be creating an electrical short, gently blow off with compressed air
No backlight but characters can be seen	<ul style="list-style-type: none"> • Backlight turned off, follow instructions to turn back on • Backlight has malfunctioned. Contact Compressed Air Alliance.
Display is flashing	<ul style="list-style-type: none"> • There is an alarm condition present on the board that needs to be rectified
Pulsing	
All valves not pulsing	<ul style="list-style-type: none"> • Check if the system is in HALTED state on the main run page • Make sure the links are installed on the input and clean-up terminals if external sensors and the clean-up feature are not being used • Make sure the solenoids are connected to the main board and the header plug has not been disconnected. • Make sure the commons have not been mixed (applies to extensions only). • Check the coil specifications match the boards. Are the coils 24VDC or 240VAC?
Valves pulsing weak	<ul style="list-style-type: none"> • Check compressed air • Check for short-circuits
Faults on all coils	<ul style="list-style-type: none"> • Check the commons from the extension card solenoids are wired back to the extension card. • DO NOT wire the solenoid commons from valves connected to the extension card to the main card; this will result in an error.

<p>Fault appears after valve pulsing</p>	<ul style="list-style-type: none"> • Check the solenoid valve • Check the voltage of the coils matches the voltage selected in the menu • Ensure only one solenoid is connected per output channel
<p>Extension card</p>	
<p>Controller does not recognise the extension card</p>	<ul style="list-style-type: none"> • Ensure the extension card RS485 cable has been connected correctly. • Are you using the correct cable that meets the minimum standard (CAT-5) • Is the cable installed in a location with HIGH INTERFERENCE, if so, do you need to consider shielded cable? • Check DIP switch settings on board is correct • Reboot the system

Warranty and Help

Warranty

Compressed Air Alliance provides a 12-month warranty for all Power Meters. The warranty covers material 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. The warranty covers the device only, it does not cover other services such as labour to remove or reinstall the instrument, transport and packing. Warranty repairs or replacements do not extend the original 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.

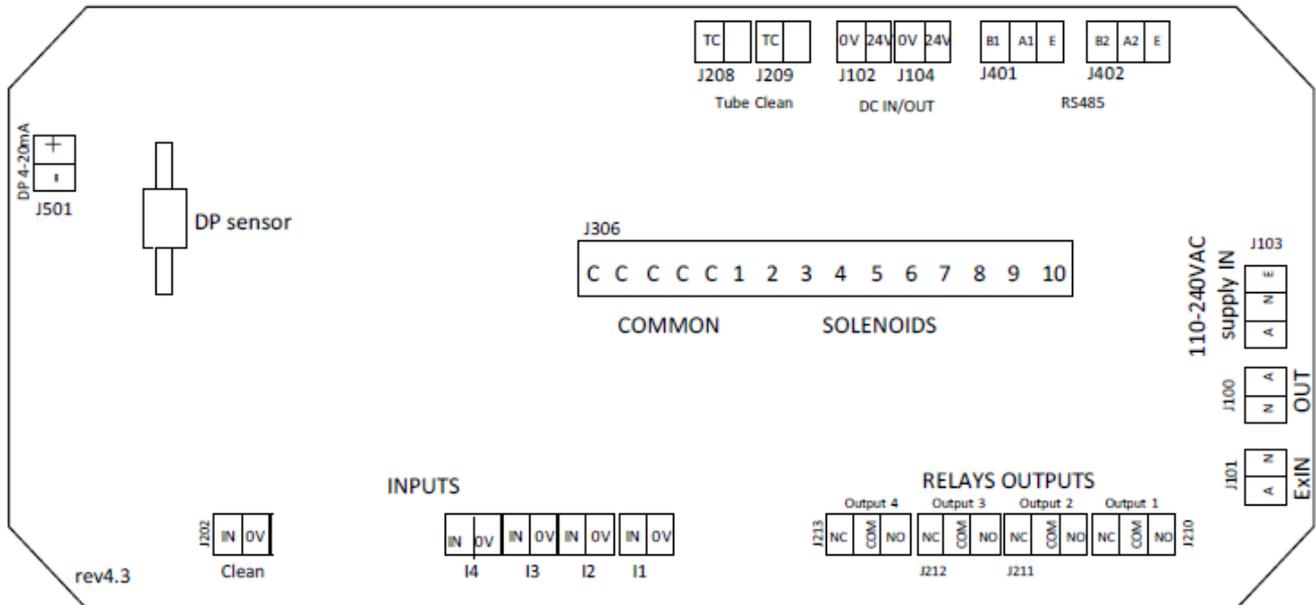
Other claims, especially damage occurring on the outside of the instrument (eg dents, marks), are not included unless responsibility is legally binding.

Need help?

You can contact Compressed Air Alliance via:

- Phone (Australia): 1300 558 526
- E-mail: sales@compressedairalliance.com
- Website: www.compressedairalliance.com

Appendix 1 - Detailed Board Connections



- J100:** AC supply to Extender driver boards
- J101:** AC supply to Extender driver boards if different from main AC supply applied on J103
- J102:** 24VDC supply OUT to Extender Driver boards
- J103:** Supply IN 110-240VAC
- J104:** Supply IN 24VDC
- J200:** Input 1- Sensor Input (General or Critical) or Interrupt or External Differential Pressure (XDP)
- J201:** Input 4- Sensor Input (General or Critical) or Header Pressure Sensor (Mechanical Fault)
- J202:** Input 8 - CLEAN UP/BLOW DOWN or Sensor Input (General or Critical) or Interrupt
- J203:** Input 2- Sensor Input (General or Critical) or Interrupt
- J205:** Input 3- Sensor Input (General or Critical) or Dust Sensor (Broken Bag Detection)
- J208:** Tube Cleaner valve – Cleaning
- J209:** Tube Cleaner valve – Isolation
- J210:** System Active **relay** output contacts
- J211:** General Alarm **relay** output contacts
- J212:** Critical Alarm **relay** output contacts
- J213:** DP, OC & SC alarm **relay** output contacts (triggered when display is flashing)
- J306:** Solenoid valves actives & commons
- J401:** RS485 communication bus to Extender Driver boards
- J402:** RS485 communication bus to ModBus RTU
- J501:** Differential Pressure (DP) 4-20mA loop.

Appendix 2 - Connecting the Controller via Modbus RTU

In order to view the parameters, set for ModBus use a software like “ModbusPollSetup”. There are a range of selectable parameters in the ModBus register, the majority are read only. The ModBus register can be found later in this chapter.

ModBus RTU Test Software

Modbus test software can be downloaded from the following location
<https://modbustools.com/download.html>.

Run “ModbusPollSetup.exe” to setup “Modbus Poll”

Modbus RTU Testing

The user can use the ModBus Poll software to view the Dust Collector Control’s ModBus registers. Double click on the ModBus Poll icon and open the test software.



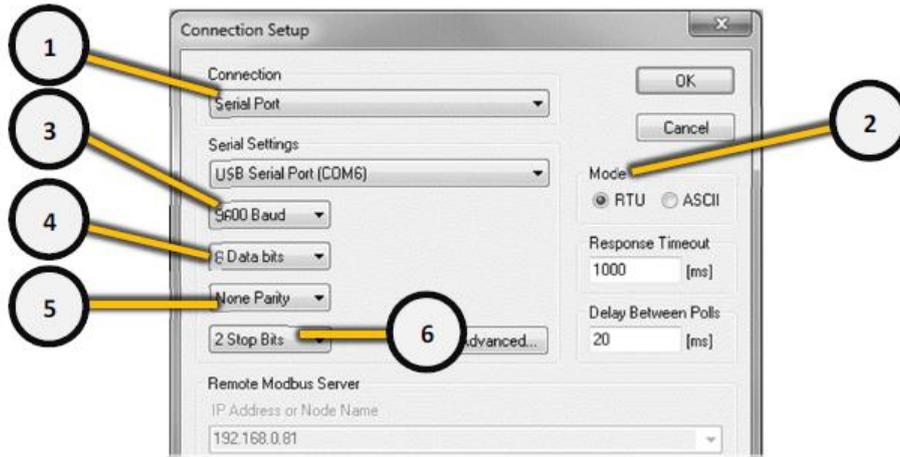
The screenshot shows a window titled "Mbpoll1" with a status bar at the top displaying "Tx = 375: Err = 138: ID = 1: F = 03: SR = 1000ms". Below the status bar, the text "Timeout Error" is visible. A table with two columns, "Alias" and "Value", is shown. The table contains the following data:

	Alias	Value
0		00000
1		0
2		1
3		1
4		1
5		6
6		9
7		133
8		3
9		0
10		2

Press “F3” to open “Connection Setup” form.

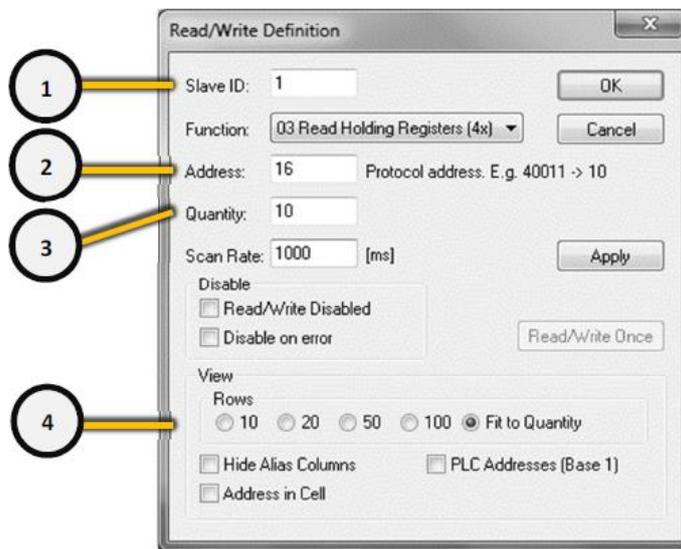
Select “Register later” to ignore the register form.

The following window will appear....



1	Connection	Select "Serial Port" and change the settings as below.
2	Mode	Select "RTU".
3	Baud	Select "9600 Baud".
4	Data Bits	Select "8 Data Bits".
5	Parity	Select "None Parity".
6	Stop Bits	Select "2 Stop Bits". Select OK.

Setup registers within Modbus Poll, press "F8" to open "Read/Write Definition" form.



1	Slave ID	Select your "Slave ID". In this example we're using "1". Each board will have its own "Slave ID", by default the first board you receive will be set to "1", the remaining boards will be assigned its own Slave ID, for example 2, 3 and so on.
2	Address	Select the starting register. Example - To select registers 40016-40025 select the starting address of 16.
3	Quantity	Select the quantity of registers to display.

		Example - To select registers 40016-40025 select the quantity to 10.
4	View	Select how many rows to display. Set to "Fit to Quantity". Select OK.

Modbus Poll should now display registers 4016 – 4025 as below.



ModBus Register

The Dust Collector Controller can be connected to any PLC or monitoring system using Modbus RTU. The Modbus register is shown below. The Modbus slave ID is used defined on the Controller. Other settings required for Modbus RTU are as follows.

1. Baud: 9600
2. Data Bits: 8
3. Parity: None
4. Stop Bits: 2

Address	Digital (D) / Analog (A)	Read (R) / Write (W)	Description	Note	FC 3 Support	FC 16 Support
40001	D	R/W	System State	0 - Halt 1 - Run	Y	Y
40002	D	R/W	System Mode	0 - Manual 1 - Auto	Y	Y
40003	D	R/W	Cleanup Cycles (>0 active)	0 - Off 1+ - On	Y	Y
40004	A	R	Next Valve		Y	N/A
40005	A	R	Countdown Timer		Y	N/A
40006	A	R	Pressure (mmH2O)	Unit mmH2O	Y	N/A
40007	A	R	Differential Pressure (DP) status	0 - Normal 1 - Ultra Low	Y	N/A

Address	Digital (D) / Analog (A)	Read (R) / Write (W)	Description	Note	FC 3 Support	FC 16 Support
				2 - Low 3 - High 4 - Fast 5 - Alarm		
40008	A	R	Cleanup/Tube Clean Status	0 - Not Triggered 1 - Cleanup On 2 - Tube Clean ON	Y	N/A
40009	A	R	Last Valve Error	0 - No Error 1 - Short Circuit 2 - Open Circuit 3 - Mechanical Fail	Y	N/A
40010	A	R	Last Error Valve Number		Y	N/A
40011	D	R	Alarm Status Triggered [1]	0 - Not Triggered 1 - Triggered	Y	N/A
40012	D	R	Alarm Status Type [1]	1 - INTerrupt 2 - General 3 - Critical 8 - XDP	Y	N/A
40013	D	R/W	Alarm Status ACKed [1]	0 - Not Acked 1 - Acked	Y	Y
40014	A	R	Alarm Input Value [1]	Analogue 0..255 Digital 0/1	Y	N/A
40015	D	R	Alarm Input Type [1]	0 - Analogue 1 - Digital	Y	N/A
40016	D	R	Alarm Status Triggered [2]	0 - Not Triggered 1 - Triggered	Y	N/A
40017	D	R	Alarm Status Type [2]	1 - INTerrupt 2 - General 3 - Critical	Y	N/A
40018	D	R/W	Alarm Status ACKed [2]	0 - Not Acked 1 - Acked	Y	Y
40019	A	R	Alarm Input Value [2]	Analogue 0..255 Digital 0/1	Y	N/A
40020	D	R	Alarm Input Type [2]	0 - Analogue 1 - Digital	Y	N/A
40021	D	R	Alarm Status Triggered [3]	0 - Not Triggered 1 - Triggered	Y	N/A
40022	D	R	Alarm Status Type [3]	0 - None/Disabled 2 - General 3 - Critical 4 - DustG 5 - DustC	Y	N/A

Address	Digital (D) / Analog (A)	Read (R) / Write (W)	Description	Note	FC 3 Support	FC 16 Support
40023	D	R/W	Alarm Status ACKed [3]	0 - Not Acked 1 - Acked	Y	Y
40024	A	R	Alarm Input Value [3]	Analogue 0..255 Digital 0/1	Y	N/A
40025	D	R	Alarm Input Type [3]	0 - Analogue 1 - Digital	Y	N/A
40026	D	R	Alarm Status Triggered [4]	0 - Not Triggered 1 - Triggered	Y	N/A
40027	D	R	Alarm Status Type [4]	0 - None/Disabled 2 - General 3 - Critical 7 - HP	Y	N/A
40028	D	R/W	Alarm Status ACKed [4]	0 - Not Acked 1 - Acked	Y	Y
40029	A	R	Alarm Input Value [4]	Analogue 0..255 Digital 0/1	Y	N/A
40030	D	R	Alarm Input Type [4]	0 - Analogue 1 - Digital	Y	N/A
40046	D	R	Alarm Status Triggered [8]	0 - Not Triggered 1 - Triggered	Y	N/A
40047	D	R	Alarm Status Type [8]	0 - None/Disabled 2 - General 3 - Critical 9 - Clean Up	Y	N/A
40048	D	R/W	Alarm Status ACKed [8]	0 - Not Acked 1 - Acked	Y	Yes
40049	A	R	Alarm Input Value [8]	Analogue 0..255 Digital 0/1	Y	N/A
40050	D	R	Alarm Input Type [8]	0 - Analogue 1 - Digital	Y	N/A
40051	A	R/W	Pulse On time (ms)	Analogue 0..255	Y	Y
40052	A	R/W	Countdown Off time 1 (sec)	Analogue 0..255	Y	Y
40053	A	R/W	Countdown Off time 2 (sec)	Analogue 0..255	Y	Y
40054	A	R/W	DP Low Level (mmH2O)	Analogue 0..255	Y	Y
40055	A	R/W	DP High Level (mmH2O)	Analogue 0..255	Y	Y
40056	A	R/W	DP Fast Level (mmH2O)	Analogue 0..255	Y	Y
40057	A	R/W	DP Alarm Level (mmH2O)	Analogue 0..255	Y	Y