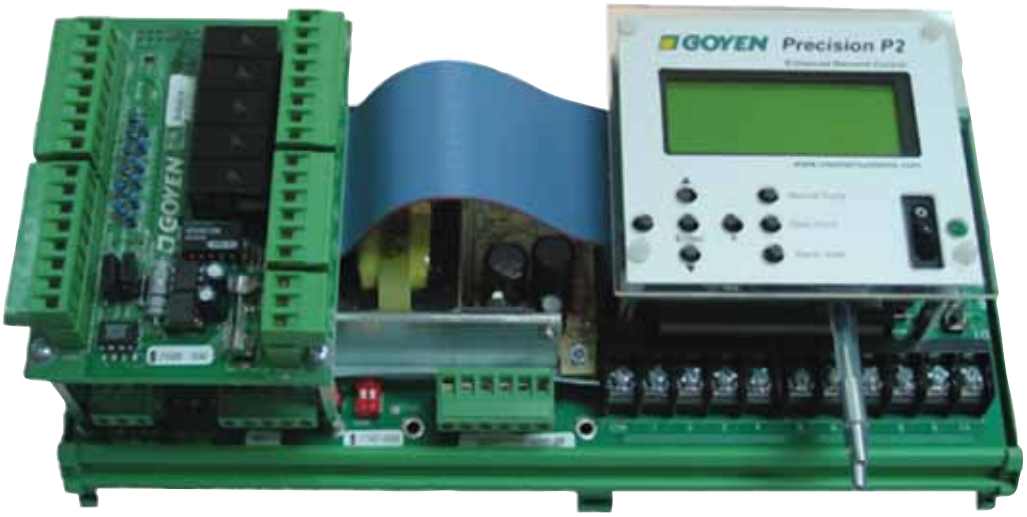
GOYEN



Precision®
Filter Cleaning System Controls

Installation and Operating Instructions
Owner's Record

for P1, P2, PS-L, PS-C, PS-LA, PS-CA, P-CTX and P-MOD
Deine-007

tyco / Flow Control / Environmental Systems

Rev5 - May 2010

Instruction Manual
Contents

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Warning

To avoid product malfunction or electrical shock, do not expose Precision circuit boards to rain or moisture. Installation must be performed using qualified technicians.

Caution

Use of controls or adjustments or performance or procedures other than those specified in this manual may result in product failure, or poor product performance. You are cautioned that any changes or modifications to the product not expressly approved in this manual could void your product warranty.

Note

The P1, P2, PS-L, PS-C, P-CTX and P-MOD have been tested and found to comply with EN55024:1998, EN61000-4-2, EN61000-4-4, EN61000-4-5 and EN61000-4-11 for immunity to ESD, immunity to EFT and bursts, immunity to surges and immunity to voltage dips and interruptions. This equipment did not become dangerous or unsafe as a result of the application of the tests defined in EN55024:1998.

Precision Program Commissioning Log

Use this log during system commissioning to keep a permanent record of controller settings.

Parameter		Default			
Language		English			
On time (ms)		100			
Off time (s)		50			
Display units*		kPa			
Demand cleaning* (by limits; default)	High dP Low dP	1.0 kPa 0.5 kPa			
Demand cleaning* (by bandwidth)	High dP % band	1.0 kPa 40			
Alarm delay(s) *		0			
High dp alarm*		2.0 kPa			
Precoating*		None			
Pattern cleaning*		Off			
Blowdown cycles		None			
Remote stop*		Hardwired			
Tube cleaner CTX		Off			
Maximum Interval* (s)		Off			
Network MOD		Off			

** Only with P2 controllers*

CTX *Available on the AC/AC baseboard otherwise only when P-CTX fitted*

MOD *Only when P-MOD fitted*

Notes

Product Description

The Precision (or controller) is an advanced filter cleaning control system for reverse pulse jet dust collectors. This system may be specified with a selection of control interfaces and signal output options. The controller may be easily upgraded from simple sequential mode control (P1 interface) to Enhanced Demand Mode (P2 interface). An RS-485 Modbus RTU compliant communications card (P-MOD) provides full networking and remote programming for DCS and SCADA systems. An I/O card (P-CTX) provides voltage free contacts for alarms, 4-20mA output (for dP reporting, P2 only), and basic remote control. The solenoid outputs can be expanded up to 200 outputs through the use of the PS-L or PS-C expansion cards (or slave cards) with the AC/DC baseboard (AC voltage input, DC voltage output) or DC/DC baseboard (DC input and output) and PS-LA or PS-CA expansion cards on the AC/AC baseboard (AC input and output)

Identifying the Parts

Your system may have some or all of these components. Note that terminal headers are supplied for all push-in contacts.

Figure 1: P1 Interface and Controller, Top View

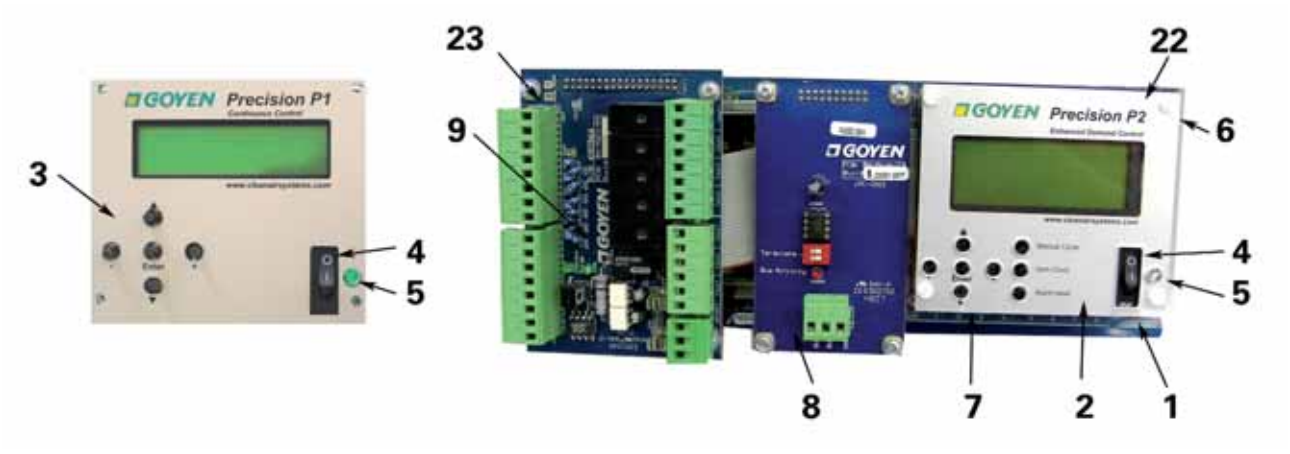
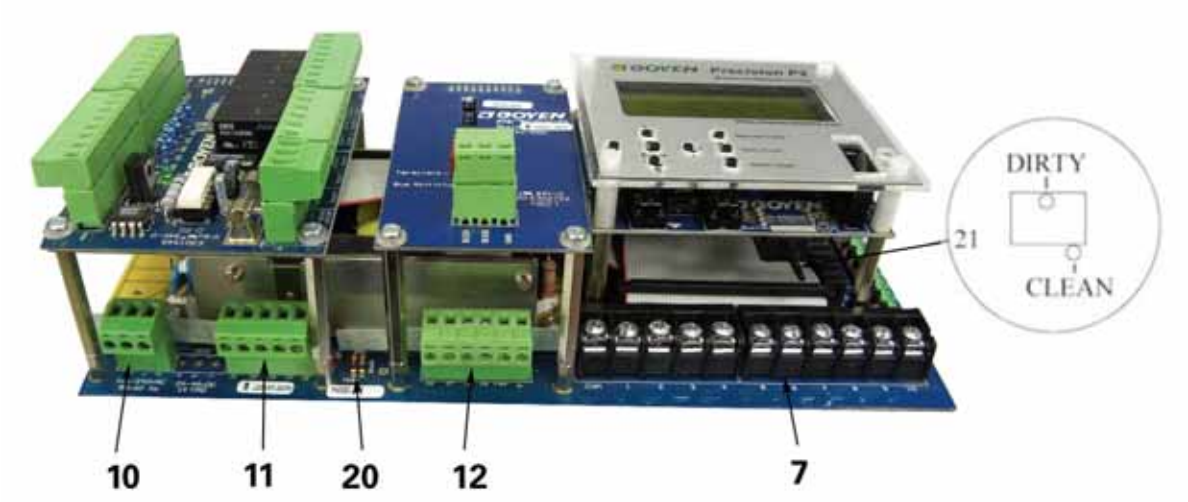


Figure 2: Controller, Front View



Note: Controller assemblies in Figure 1 and 2 include (left to right) P-CTX, P-MOD, and P2 interface all mounted on the AC/AC baseboard.

Figure 3: PS-C, DC Output Compact Terminal Expansion Card

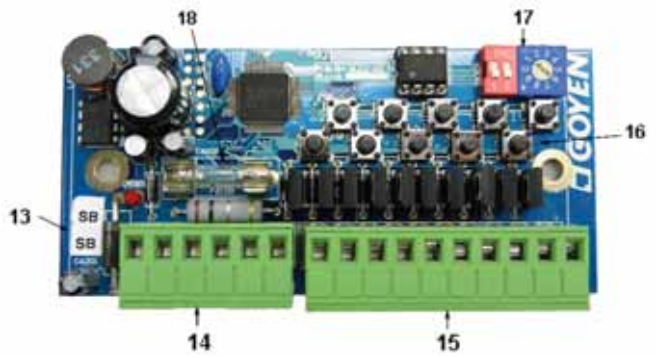
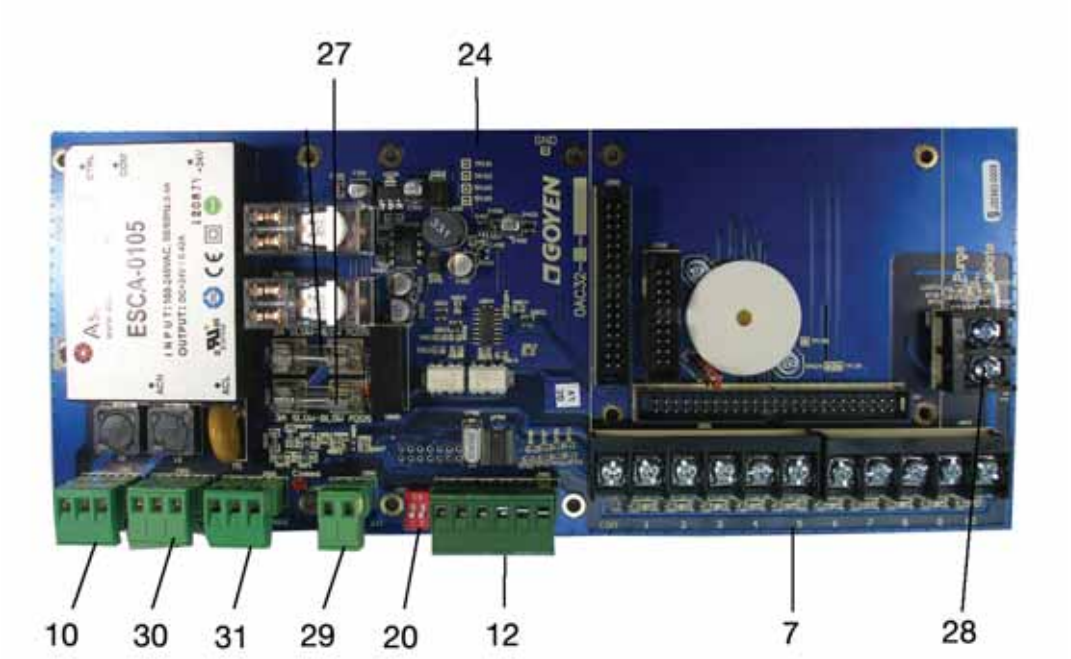


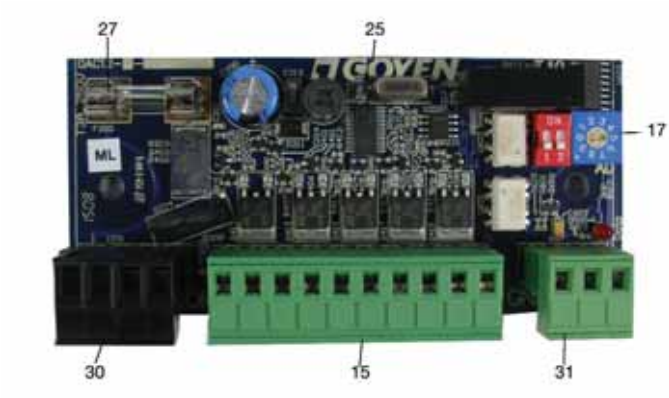
Figure 4: PS-L, DC Output Large Terminal Expansion Card

Figure 5: AC/AC Baseboard Top View



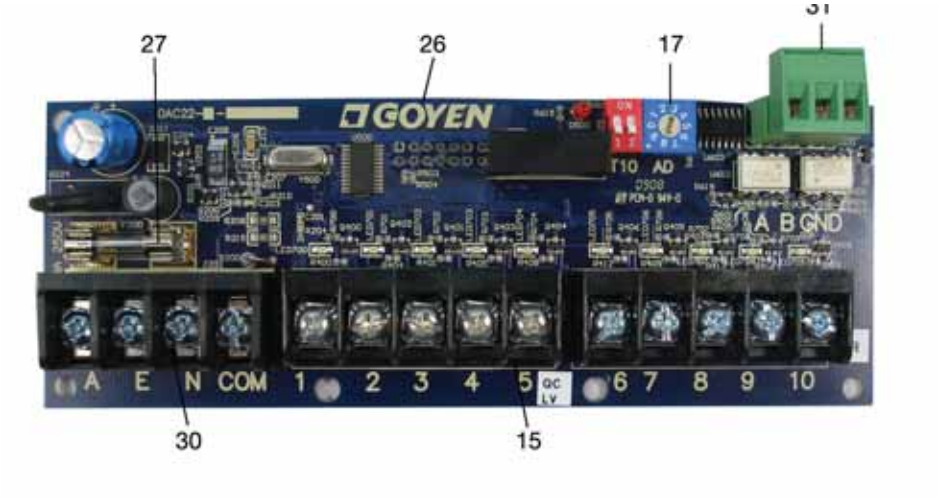
Note: AC/AC baseboard comes with the tube cleaner mounted on the baseboard. For the AC/DC and DC/DC baseboards it comes separately on the P-CTX card.

Figure 6: PS-CA AC output Compact Terminal Expansion Card



Note: No LEDs for AC output Compact Terminal Expansion Card

Figure 7: PS-LA AC output Large Terminal Expansion Card



Note: All AC output products (Figure 5-7) have no manual solenoid triggers

Key to Figures 1 to 7

1. Precision motherboard (10 output)
2. P2 Enhanced Demand Mode interface
3. P1 Sequential Mode interface
4. Power on switch
5. Power LED
6. Motherboard manual solenoid triggers and LEDs.
7. Motherboard solenoid terminals
8. P-MOD, Modbus card (optional)
9. P-CTX, I/O card (optional)
10. Power in
11. Expansion card connection

12. Fan contacts
13. PS-C, compact expansion card (10 output)
14. Expansion card contacts
15. Solenoid terminals and LEDs
16. Expansion card manual solenoid triggers and LEDs.
17. Expansion card terminating resistor and addressing switches -

Switch No.1:	Turns on terminating resistor*
Addresses 1 to 9:	Turn DIP switch No. 2 to 'OFF' position and use Rotary switch to select address
Addresses 10 to 19:	Turn DIP switch No. 2 to ON' position and use Rotary switch to select address

*Terminating resistor is turned to 'ON' position on last slave card.

18. Expansion card fuse
19. PS-L, large expansion card (10 output)
20. Motherboard terminating resistor (DIP switch no 1)
21. Pressure Transducer
22. 24V Rail Fuse – 250V 4A (located on motherboard)
23. Mains Fuse – 250V 2A (locatedon motherboard)
24. AC/AC Baseboard
25. PS-CA Compact expansion card
26. PS-LA Large expansion card
27. T3A 250V slow blow fuse 20mm
28. Isolate and Purge contacts
29. 24VDC additional voltage in
30. Power to expansion cards
31. Communications with expansion cards and baseboard

Installation - General

Mechanical

The Precision may be supplied as PCB only, in 316 stainless steel IP65 (Nema 4) enclosures, or in painted steel IP65 (Nema 4) enclosures.

General

- Install Precision in areas of minimal vibration.
- Install in an area free from high electrical noise or interference.
- Install in an area where there is low risk of impact to the Precision.
- The Precision will operate in ambient temperatures of 70°C (158°F), at temperatures higher than this the display may become difficult to read and the high temperature alarm will activate. Cooling should be provided if the Precision is to be installed in conditions with ambient temperatures of 70°C (158°F) or higher.

P2 Enhanced Demand Mode

- Ensure pneumatic sensing lines are kept as short as possible to minimise pressure losses.
- Ensure pneumatic sensing lines are free from blockages, kinks or leaks.

Installations where PCB only has been supplied

- Ensure that installation is made into enclosures chosen with due consideration of the nature of the location, and that the boards are protected from moisture, heat above 70°C (158°F), dust, and chemical attack.
- Ensure a common earth connection is present for all conductive material within immediate proximity to the device been powered, e.g. A common earth connection between the baseboard and mounting bracket, enclosure etc. Please follow all local electrical standards.

Electrical Installation

Warnings:

- Electrical installation to be undertaken by suitably qualified technicians.
- Ensure that mains power has been isolated before conducting any work on the Precision.

Connecting power to the Precision

Applying power to the AC/DC and AC/AC Precision motherboard (AC Voltage models):

- Ensure input voltage is 110 or 240VAC (+/- 10%), 50/60Hz
- Ensure power supply is not affected by high load or noisy electrical machinery such as fans, that may cause unreliable system operation.
- Connect Earth, Active and Neutral supply to their respective terminals (ref Figs 2 and 5, item 10).

Applying power to the DC/DC Precision motherboard (DC Voltage models):

- Ensure input voltage is 24 to 48 VDC (+/- 10%)
- Ensure power supply is not affected by high load or noisy electrical machinery such as fans, which may cause unreliable system operation.
- Connect Earth, Positive and Negative supply to their respective terminals (ref Fig 2, item 10).

Surge Protection and Earthing

- Goyen Controls recommends the use of a Metal Oxide Varistor (MOV) based surge protection device between the supply voltage and the Precision. Clamping voltage = 275VRMS (approx.), Energy Absorption = 175 joules (approx.)
- Ensure that when using a metal enclosure both lid and box are connected to the supply earth.

Connection of solenoid valves and expansion cards to Precision outputs

Please refer to the system wiring diagrams (Figures 8-11) on pages 7-10.

- The Precision baseboard has ten outputs. A further 190 outputs may be added in increments of 10 by serial connection (19 maximum expansion cards per baseboard) by either PS-C and PS-L terminal expansion boards connected to AC/DC or DC/DC baseboards, and PS-CA and PS-LA connected to AC/AC baseboards.
- PS-C, PS-L expansion cards, AC/DC and DC/DC baseboards have 24VDC output at each terminal, each capable of powering three 24VDC, 20W solenoids simultaneously to a maximum of 2.5A at each DC output terminal. With a maximum of 19 expansion cards connected to the baseboard (200 outputs) the controller can pulse 600 solenoids.
- PS-CA and PS-LA expansion boards and AC/AC baseboards have 110VAC or 240VAC output (depending on mains input power) at each terminal each capable of powering ten 110VAC, 22W or 240VAC, 25W solenoids simultaneously to a maximum of 2.4A at each AC output terminal. With a maximum of 19 expansion cards connected to the AC/AC baseboard (200 outputs) the controller can pulse 2000 solenoids.
- Terminal expansion board types may be mixed between compact and large expansion cards but not between AC and DC output voltage.
- DC expansion cards are connected to the baseboard in series via terminals 11 and 14 in figures 2, 3, and 4. AC expansion cards are connected via terminals 30 and 31 in Figures 5, 6 and 7. Please refer also to the system wiring diagram in Figures 8, 9 and 10 for connecting details.
- Communication between baseboard and DC output expansion cards is via a multi-drop RTU two wire RS485 connection. Four core shielded mains-flex cable is recommended for the connection of expansion cards. Suggested wire gauge is 11/0.2 x 4 core plus shield (drain) such as a Belden 9534 data cable or equivalent. Two cores are used for communication between baseboard and expansion cards, the remaining two cores are required for power supply to the solenoids, plus drain. Note that solenoid power is provided by this connection, no additional external power is required.

- Communication between baseboard and AC output expansion cards is via an isolated multi-drop RTU two wire RS485 connection (7/0.2) plus drain cable. Power is supplied via 2 core plus earth (1.5mm^2) cable. Note solenoid power is provided through this connection, no additional external power is required. Please follow any local standards for segregation of power and communications cables.
- Ensure each expansion card is given a sequential address by using the rotary switch and DIP switch no. 2 (see item 17, Figures 3, 4, 6 and 7). Do not assign an address of zero on expansion cards, zero is reserved for the baseboard.
- For solenoid connections, connect up to 2.5mm^2 stranded cable from the output terminal to the relevant valve solenoid. Link the common terminal of all solenoids and return to the common on the baseboard or on the expansion cards.
- When connecting expansion cards set DIP switch 1 (Figures 2 and 5, item 20) to the 'ON' position. This enables the 120 ohm terminating resistor. No separate resistor is required. Repeat this process on the last expansion card on the Modbus network.

Note: The precision automatically detects all expansion cards and solenoids connected to the system.

Fan contact connections

These contacts (Figures 2 and 5, item 12) are used to trigger blowdown cycles if the blowdown cleaning cycles are selected, this feature is triggered through electrical contacts. Optionally, blowdown cycles may be triggered by the dP of the collector (this is a feature of the P2 interface). Please refer to the system wiring diagrams in Figure 8.

- These are voltage free contacts
- Connect the normally open voltage free contacts on the dust collector fan motor to the 'Fan' and 'GND' contacts on the baseboard (refer Figures 2 and 5, item 12). When the system fan is turned off, the motor contacts close and the 'Fan' and 'GND' contacts are bridged on the Precision baseboard. This triggers the blowdown cycles to commence for the programmed number of cycles.

Figure 8: Wiring Diagram for the AC/DC and DC/DC Baseboard with P-CTX (CTX Card), P-MOD (Modbus), Expansion Cards and Tube Cleaner

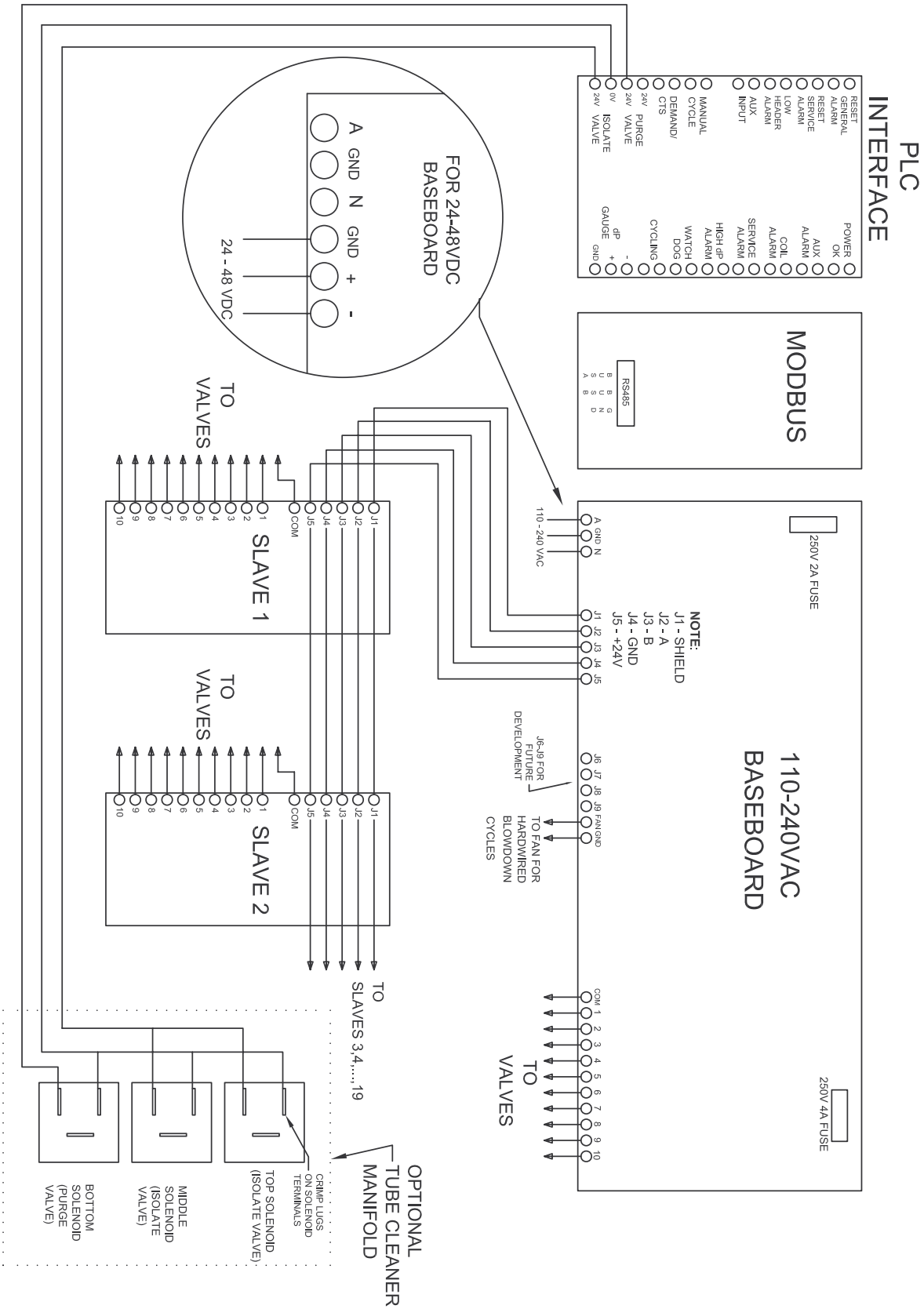


Figure 9: Wiring Diagram for the AC/AC Baseboard with P-CTX (CTX Card), (P-MOD) Modbus, P1 and P2 Option

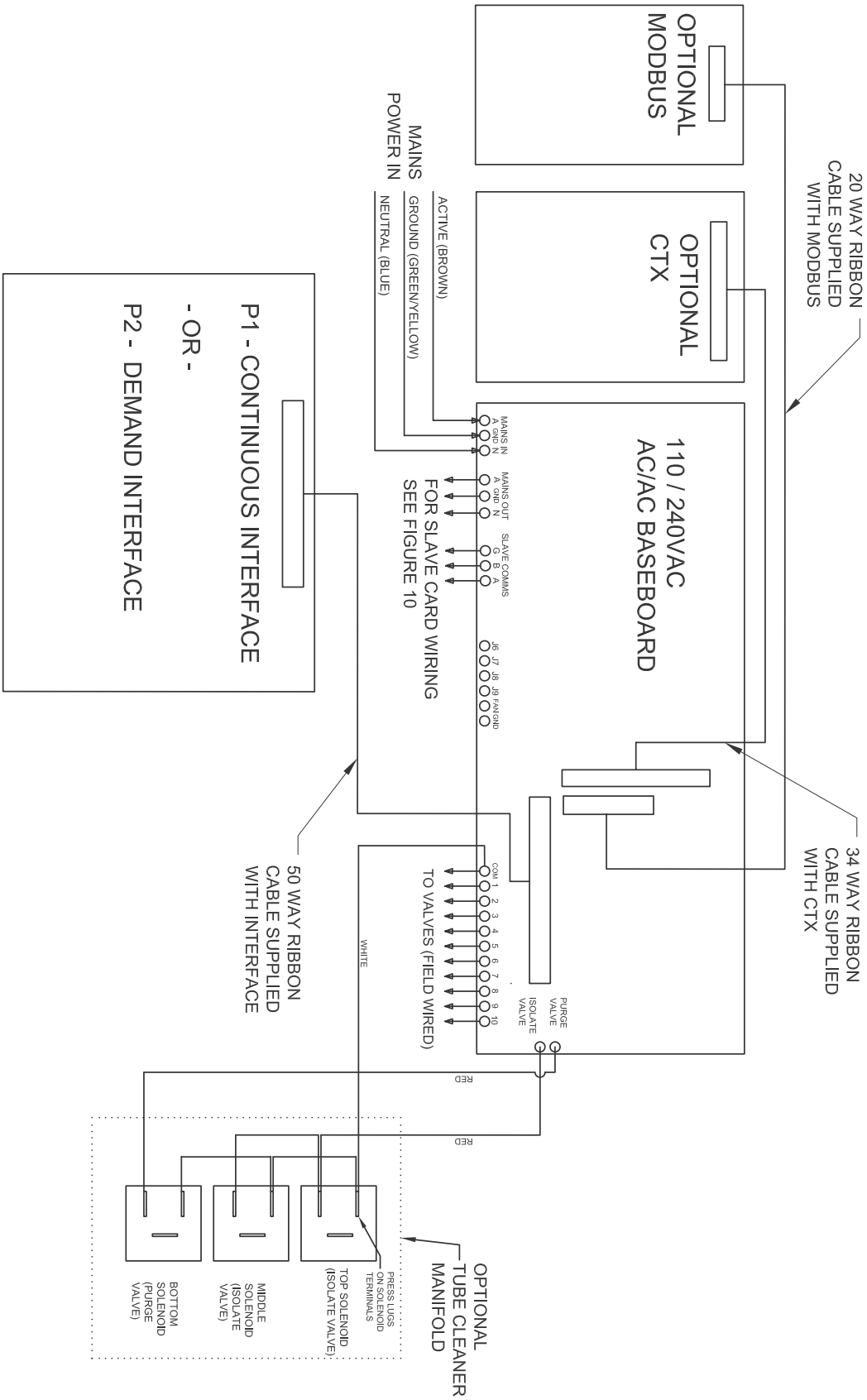


Figure 10: Wiring Diagram for Compact Expansion Cards on the AC/AC Baseboard

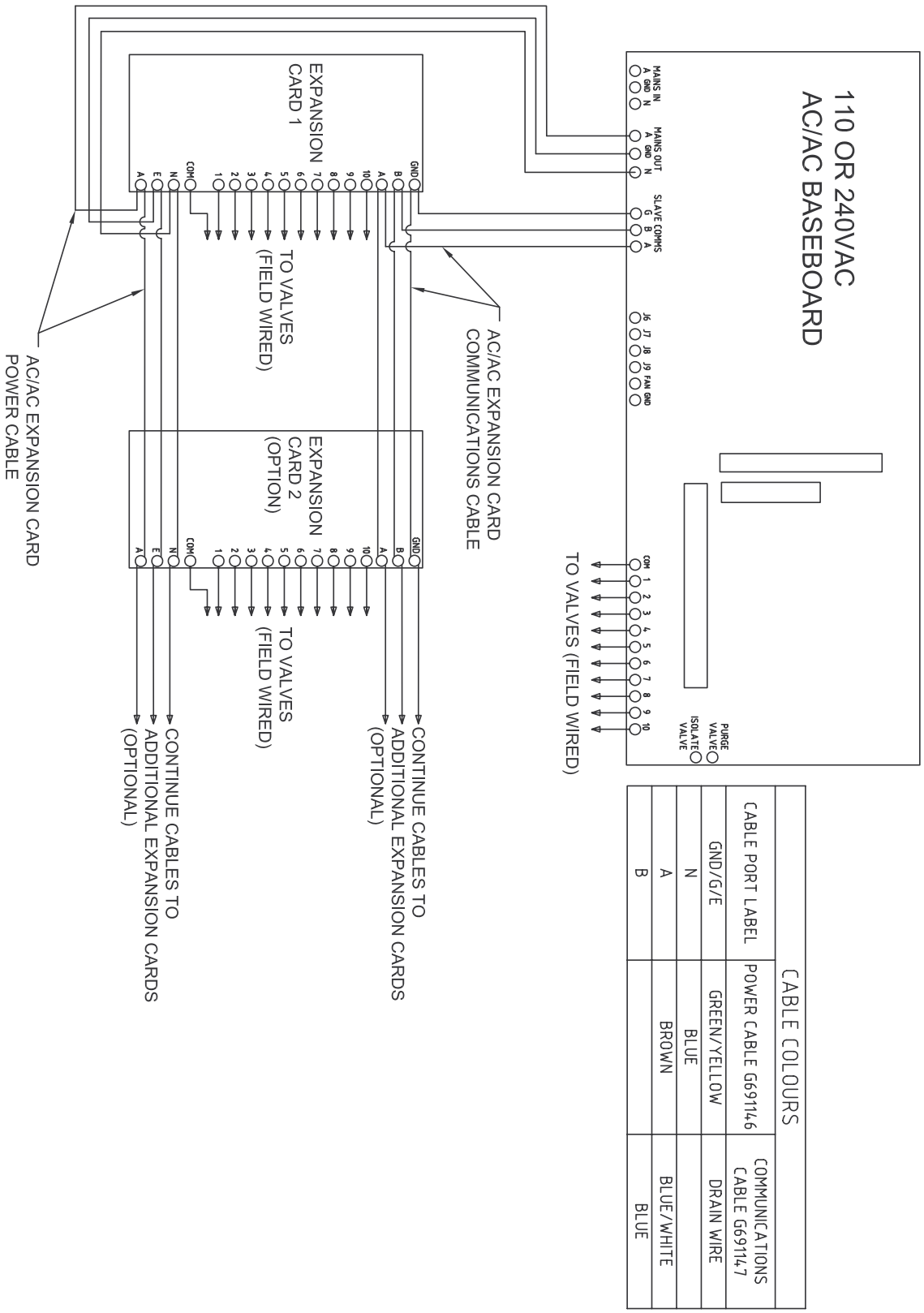
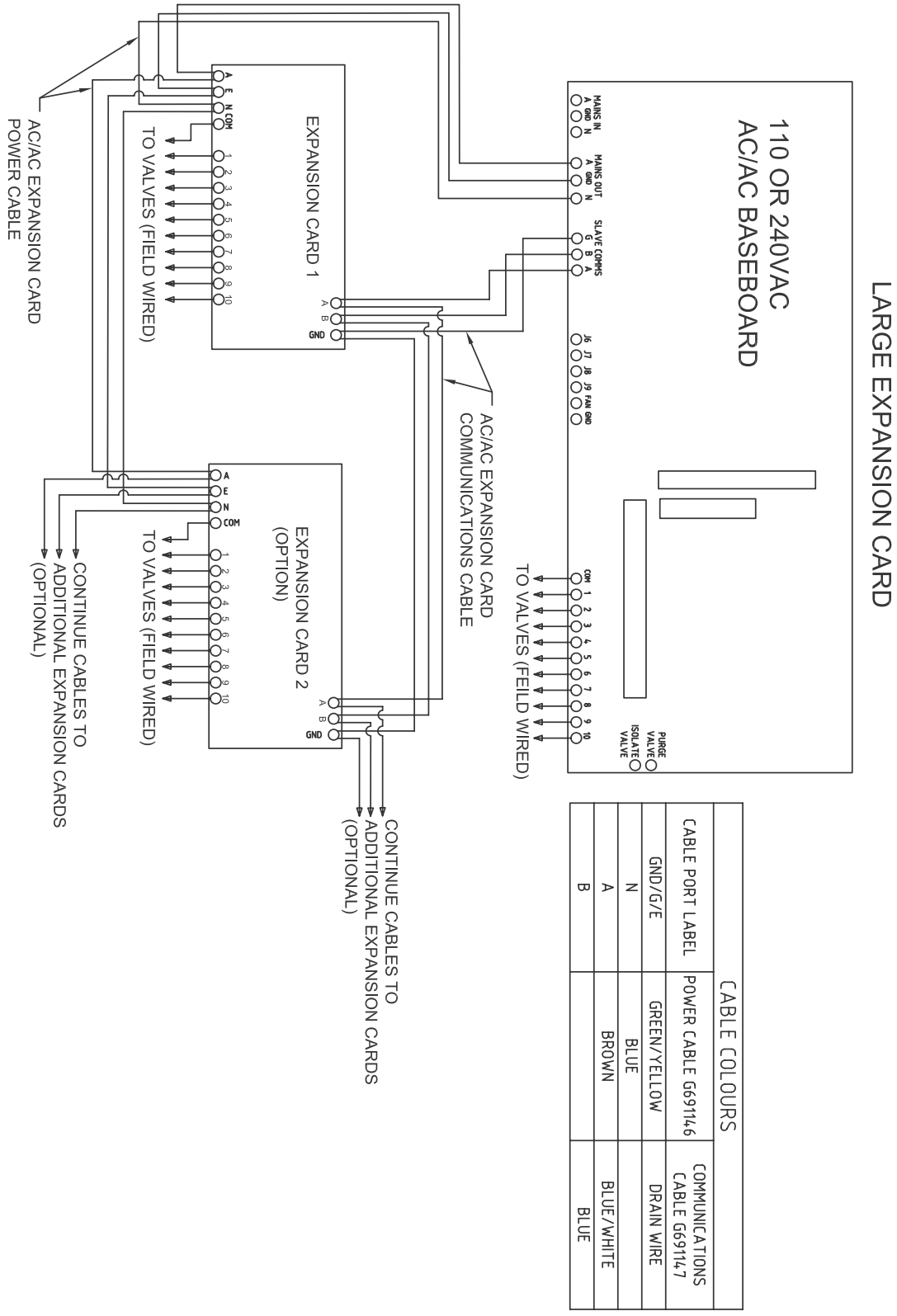


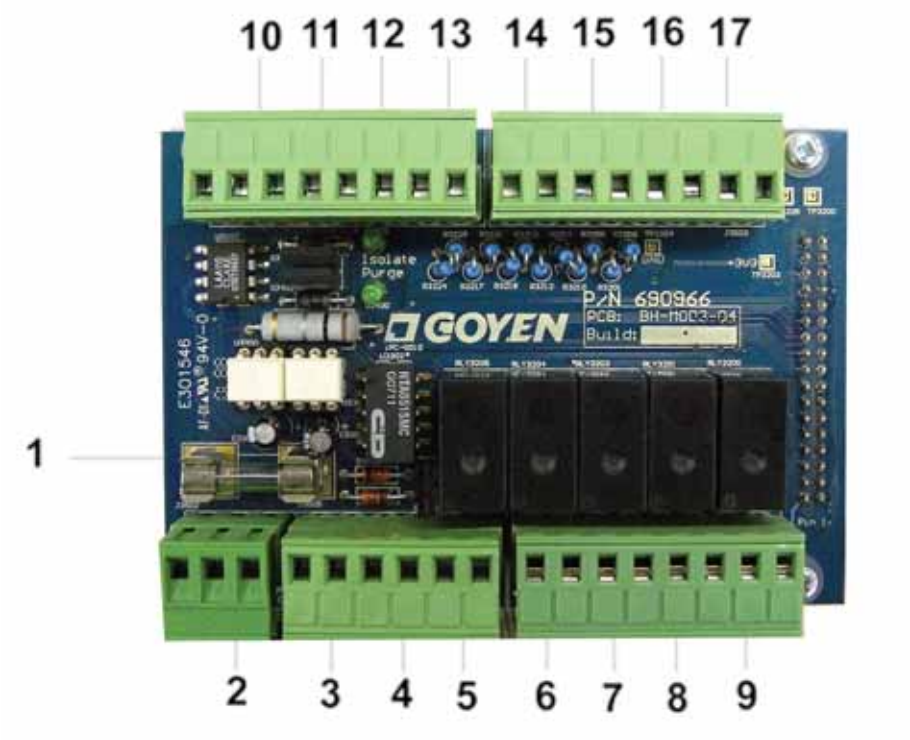
Figure 11: Wiring Diagram for Large Expansion Cards on the AC/AC Baseboard



Installation - Optional Accessories

P-CTX: I/O Card

Figure 12: P-CTX



Basic Information

The P-CTX card provides voltage free contacts for alarm outputs, basic remote control inputs and a 4-20mA output for differential pressure reporting (P2 only). Figure 2 shows the P-CTX mounted correctly on the left side of the baseboard. The table over the page provides a description of each I/O point, which may be connected to remote push-buttons, lights, sirens, data-loggers, control panels and programmable logic controllers.

Voltage Free Outputs

The P-CTX provides a number of voltage free output contacts that can be used for alarm reporting. Each alarm output consists of an output terminal and a common terminal. Any voltage applied to the common terminal will be present on the output terminal when the alarm is raised.

Voltage Free Inputs

The P-CTX provides a number of voltage free input contacts that can be used for basic remote control of the P1 or P2. Each input consists of an input terminal and a common terminal, bridging these two contacts triggers the corresponding function.

4-20mA Output

The P-CTX features a 4-20mA output that can be used for differential pressure reporting. The output consists of a ground terminal, 24VDC terminal and 0VDC. An output current of 4mA corresponds to a dP = 0 kPa and 20mA corresponds to a dP = 2.5 kPa.

The table over the page provides a description and details of each output terminal on the P-CTX.

	Description	Type	Details
1	Fuse		
2	4-20mA differential pressure output GND + -	Output Output Output	Ground 24 VDC 0 VDC
3	Cycling Remote indication of when a valve is being actuated.	Output Common	Voltage free Voltage free
4	Watchdog alarm Indicates failure of microprocessor.	Output Common	Voltage free Voltage free
5	High dP alarm Indicates that dP has reached the programmed alarm trigger.	Output Common	Voltage free Voltage free
6	Service alarm Indicates that either 100K, 500K, or 950K cycles have been completed.	Output Common	Voltage free Voltage free
7	Coil failure alarm Indicates solenoid failure on the system.	Output Common	Voltage free Voltage free
8	Auxiliary alarm Indicates the alarm state of an auxiliary input device (see 14)	Output Common	Voltage free Voltage free
9	Power ok signal Indicates system power is OK.	Output Common	Voltage free Voltage free
10	Isolate valve (for optional tube-cleaner function only)*	Output Common	24 VDC**
11	Purge valve (for optional tube-cleaner function only)*	Output Common	24 VDC**
12	Demand/Continuous switch Allows remote switching between continuous and demand control modes (when P2 interface is fitted).	Input Common	Voltage free Voltage free
13	Manual cycle Forces a full cleaning cycle.	Input Common	Voltage free Voltage free
14	Auxiliary input Allows the connection of an auxiliary device. (eg pressure switch, broken bag detector etc)	Input Common	Voltage free Voltage free
15	Low header (tank pressure) alarm Indicates low tank pessure, when connected to an appropriate pressure switch (not supplied).	Input Common	Voltage free Voltage free
16	Reset service alarm Resets the service alarm signal.	Input Common	Voltage free Voltage free
17	Reset general alarm Resets all alarms, with the exception of the service alarm.	Input Common	Voltage free Voltage free

Note: The 4-20mA output (2) is internally powered from the control system. No additional power supply is required.

** The Isolate and Purge functions are disabled on the P-CTX card when attached to the AC/AC baseboard only.*

*** Isolate and Purge contacts on the AC/AC baseboard have an output voltage equal to mains input voltage (110VAC or 240VAC).*

P-MOD: Modbus Communications Card

Figure 13: P-MOD

1. Switch for terminating resistor (DIP switch no.1)
2. Communications LED
3. Bus A (RS485+)
4. Bus B (RS485-)
5. GND (Ground/Drain)

Basic Information

The P-MOD card is a network card which operates using the Modbus RTU communication protocol. Via the P-MOD the controller can be connected to a DCS or SCADA system, allowing remote programming and monitoring of all menu items, alarms and system details.

RS485 Modbus system specification is:

Item	Detail
Protocol	Modbus RTU
Hardware layer	2 wire, half duplex RS485
Communications speed	9600 BPS
Stop bits	1
Data bits	8
Parity	None

If the P-MOD is the last device connecting the Modbus RTU network ensure DIP 1 of the terminating resistor switch (Figure 13, item 1) is set to ‘ON’. This enables the 120 ohm resistor on the P-MOD, no separate resistor is required.

Operation

Powering Up the System

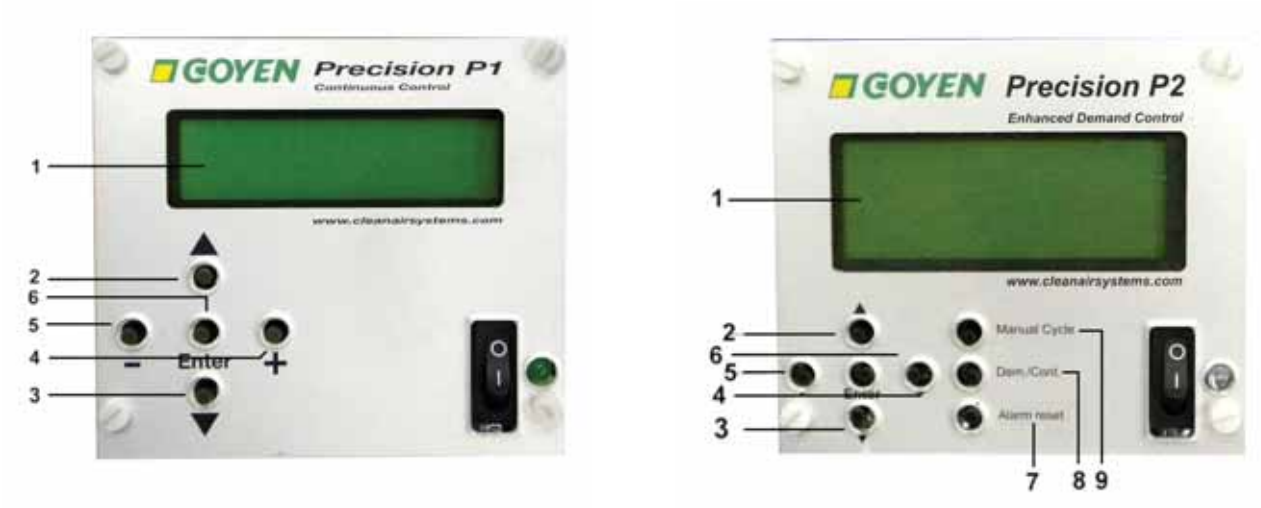
See Figure 1 (items 4 and 5). Moving the power switch into the on position will power up the Precision. The Power LED will light, and the backlit interface display will light up.

The Precision performs a self diagnostic routine, confirming all attached modules and reporting automatically all attached solenoids and expansion cards. The Precision will then operate according to its programmed modes.

Note that the Precision automatically identifies all connected expansion cards, modules, and solenoids. No programming is required.

The Display and Interface

Figure 14: P1 and P2 Interfaces



1. Backlit LCD
2. Previous menu item
3. Next menu item
4. Increment
5. Decrement
6. Enter
7. Alarm reset
8. Demand/Continuous mode toggle
9. Manual Cleaning Cycle

P1 – Continuous Control Interface

The P1 interface provides sequential and continuous pulse cleaning control.

While in RUN mode, the two line LCD will show:

Line 1: Scrolling display of system settings & alarms

Line 2: Time to next pulse (seconds)/Output ID of next pulse

P2 – Enhanced Demand Interface

The P2 interface provides cleaning on Demand basis (i.e. in accordance with the differential pressure across the filters), minimising air consumption and valve wear, and maximising filter life. The P2 also provides enhanced pulse control functions, including Pattern Cleaning and Maximum Interval between cleaning cycles.

While in RUN mode, the four line LCD will show:

Line 1: Scrolling display of system settings & alarms

Line 2: Differential pressure & units (Pa, kPa, InWG, mm H2O, or mmHg)

Line 3: Pulsing status (cycling, paused, stopped)

Line 4: Time to next pulse (seconds)/Output ID of next pulse

Manual Activation of Solenoid Outputs

See Figure 1 (item 6) and figures 3 and 4 (item 16).

Pushing the manual output triggers will power their corresponding output for 100ms if there is a solenoid connected. Simultaneously the output LED will light. Note this function has been removed for all AC output boards to comply with safety standards. Alternatively, pressing the manual cycle button on the P2 interface (Figure 14, item 9) will force a single complete pulsing sequence for all baseboards, AC and DC output. This feature can be used for confirming valve operation and diagnosing filter cleaning problems.

Programming and Advanced Features

To enter programming mode, press Enter (Figure 14, item 6), followed by:

+ - - + Enter

UP (Figure 14, item 2) scroll to previous menu item, DOWN (Figure 14, item 3) scroll to next menu item

P1 – Continuous Control

Menu Structure

	Level 1 Entry	Level 2 Menu Item	Level 3 Options
1	Code		
2 2a 2b 2c 2d 2e		Language	 English Italian Spanish German French
3		Reset Factory Defaults	
4		On Time	
5		Off Time	
6		Blowdown Cycles	
7		Hour Counter	
8		Number Of Slaves	
9		Total Cycles	
10 10a 10b		Tube Cleaner*	 Period Duration
11		Network**	
12		Run	

**Available on the AC/AC baseboard otherwise only when P-CTX is fitted.*

***Only when P-MOD is fitted.*

Description of Menu Items

Language

Precision may be run in one of five languages, as listed above.

Reset Factory Defaults

Puts all settings back to defaults (set at time of manufacture).

On Time

Sets electrical output duration between 30 and 500 ms.

Off Time

Sets pause between pulses between 1s and 999s.

Blowdown Cycles

Sets the number of off line cleaning cycles to be executed after the dust collector fan is shut down. Off to 10 cycles. This only operates when the fan contacts (Figure 2, item 12) are closed.

Hour Counter

Displays the total hours that the controller has been running for. Pressing [Enter] allows the hour counter to be reset.

Number of slaves

Displays the number of expansion cards connected to the system.

Total Cycles

Displays the total number of cycles completed. This will trigger a service alarm at 100K, 500K, and 950K cycles. Pressing [Enter] allows the cycle counter to be reset. 0 to 1,000,000 cycles.

Tube Cleaner

Available on the AC/AC baseboard otherwise only when P-CTX is fitted. This allows the tube cleaning parameters to be specified:

Select ON or OFF, then

Period: The frequency of the tube cleaning pulse. 1 to 999 minutes.

Duration: The duration of the tube cleaning pulse. 1 to 60 seconds.

This feature is used to control the pulse cleaning of the differential pressure sensing lines. In the case of the P1 with P-CTX, these may be used to clear the pressure lines of third party pressure gauges installed on the dust collector.

Network

Allows the network address to be set for controllers running on a DCS. Values 0 to 255, and OFF. Setting to OFF takes the Precision off the network.

Run

Returns the controller to operating mode.

P2 – Enhanced Demand Control

Menu Structure

	Level 1 Entry	Level 2 Menu Item	Level 3 Sub-menu Options	Level 4 Options
1	Code			
2		Language[1]		
2a			English	
2b			Italian	
2c			Spanish	
2d			German	
2e			French	
3		Factory Defaults[1]		
4		On Time[1]		
5		Off Time[1]		
6		Display Units		
6a			kPa	
6b			Pa	
6c			inWG	
6d			mmH^2O	
6e			mmHg	
7		Demand Cleaning		
7a			Limits	
7ai				Low Dp
7aii				High Dp
7b			Bandwidth	
7bi				High Dp
7bii				Bandwidth %
8		Alarm Delay		
9		High Dp Alarm		
10		Precoating		
11		Pattern Cleaning		
12		Blowdown Cycles[1]		
13		Remote Stop		
13a			Hardwired	
13b			Automatic	
14		Tube Cleaner[1]*		
14a			Period	
14b			Duration	
15		Maximum Interval		
16		Hour Counter[1]		
17		Number Of Slaves[1]		
18		Total Cycles[1]		
19		Network[1]**		
20		Run[1]		

[1] *As described for the P1 interface.*

**Available on the AC/AC baseboard otherwise only when P-CTX is fitted.*

***Only when P-MOD is fitted.*

Description of Menu Items (P2 specific)

Display Units

Allows the display units for pressure to be set to one of five commonly used measures. See table above. The selected units will then be used for all differential pressure related settings, and network reporting via P-MOD.

Demand Cleaning

Allows the parameters associated with demand cleaning control to be specified.

Limits

High DP – The differential pressure at which pulse cleaning is to start.

Low DP – The differential pressure at which pulse cleaning is to stop.

Alternatively,

Bandwidth

High DP – The differential pressure at which cleaning is to start. (up to 10”WG or 2.49 kPA)

Bandwidth % - The % range in which the differential pressure is to be maintained. (5 to 50%)

Alarm Delay

Used in conjunction with High DP Alarm, this allows the specification of a delay before an alarm is triggered. This can be used to eliminate false alarms caused by spikes in the pressure readings. 255 seconds maximum delay.

High DP Alarm

Assigns the differential pressure at which a high dP alarm is to be triggered. Maximum value is 10”WG or 2.49 kPa.

Precoating

Allows filter seeding/precoating before the controller moves into its regular cleaning program mode. This is specified by a differential pressure value at which the regular cleaning program is to activate. Maximum value is 10”WG or 2.49 kPA.

Pattern Cleaning

This allows the selection of a pulse cleaning pattern to minimise dust re-entrainment. Selecting a cleaning pattern allows solenoids to be wired in a sequential manner to the controller outputs, while pulsing in a non-sequential manner. Three options are available: OFF, SKIP 1, SKIP 2.

With baseboard outputs only valves fire in the following sequence:

OFF	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
SKIP 1	1, 3, 5, 7, 9, 2, 4, 6, 8, 10
SKIP 2	1, 4, 7, 10, 2, 5, 8, 3, 6, 9

Where expansion cards are connected (example below shows 2 cards connected):

OFF	1 … 10, 1C1 … 10C1, 1C2 … 10C2
SKIP 1	1M, 1C1, 1C2, 3M, 3C1, 3C2, 5M, 5C1, 5C2, 7M, 7C1, 7C2, 9M, 9C1, 9C2, 2M, 2C1, 2C2, 4M, 4C1, 4C2, …
SKIP 2	1M, 1C1, 1C2, 4M, 4C1, 4C2, 7M, 7C1, 7C2, 10M, 10C1, 10C2, 2M, 2C1, 2C2, 5M, 5C1, 5C2, 8M, 8C1, 8C2 …

M refers to baseboard output, C1 refers to expansion card 1, C2 refers to expansion card 2.

Remote Stop

Used in conjunction with Blowdown Cycles. This allows the blowdown cycles trigger to be selected from either:

Hardwired – blowdown cycles are started when the fan contacts are closed (Figure 2, item 12).

Automatic – blowdown cycles are started when differential pressure drops to a set value (0.1 to 2.0 kPa or 0.4 to 8.0”Wg). No electrical connections to the dust collector fan are required. If the dP rises above the set value, normal operation resumes regardless of the number of blowdown cycles completed.

Maximum Interval

Only functions when the P2 is in Demand cleaning mode. This specifies a maximum pause duration between pulsing cycles when in Demand mode. This may be set to OFF, or from 1 minute to 999 minutes. When the cycle is triggered on the basis of Maximum Interval, one complete cleaning cycle is executed. This mode can act as a backup cleaning mode when differential pressures do not rise to the preset level for cleaning to commence, or when there is a blockage or leak in the differential pressure sensing lines.

Messages and Alarms

Messages

Scrolling Display

Display	Description
Model xx.xx	Software version number
Continuous Mode[P2]	Controller is in Continuous Mode
Demand Mode[P2]	Controller is in Demand Mode
On Time = xxx ms	Electrical On Time of Solenoid
Off Time = xxx sec	Electrical Off Time of Solenoid
Slaves = xxxx	Number of Slaves connected to Controller
Blowdown cycles = xxxx	Number of complete cleaning cycles the controller performs after the fan has been switched off
Remote Stop = Hardwired[P2]	Remote Stop is hardwired to the fan or circuit breaker
Remote Stop = Automatic[P2]	Remote Stop is dependent on dP of system
Hour Counter = xxHrs	Number of hours the controller has been operational
Total Cycles = xxxxxx	Number of complete cleaning cycles the controller has performed
Max. Interval = xxx[P2]	The maximum time that can elapse before a cleaning operation takes place (only in use when in Demand Mode)
Pattern Cleaning = xxx[P2]	Allows the controller to “Off”, “Skip 1”, or “Skip 2” outputs (refer to cleaning patterns)
Alarm Delay = xxx sec[P2]	Delays high dP and Auxiliary Alarm for this amount of time to avoid false alarms due to system spikes etc
Tube Cleaner = xxxx	“Off”, “Tube Cleaner Duration” and “Tube Cleaner Period”
Units = xxx[P2]	Current units being used for display of dP

[P2] *Only for the P2 interface.*

General Messages

Display	Description
dP = xxxx (units)[P2]	Current dP
Stopped (dP)[P2]	Remote Stop due to Automatic Blowdown dP measurement
Stopped (Fan)	Remote Stop due to Hardwired Blowdown
Manual Cycle[P2]	Either the Manual Cycle button or contact (P-CTX)has been activated. The controller is now performing one complete cleaning cycle with the programmed On and Off Time.
Cycling – Paused[P2]	Controller waiting for dP to exceed High dP Limit value
Cycling –(Precoating)[P2]	Controller waiting for dP to exceed Precoating value
xxx sec	Countdown to next solenoid operation
xx:xx	Next SLAVE# : OUTPUT# to operate
Tube Cleaner xx sec	Controller is performing a Tube Clean operation with xx sec remaining

[P2] *Only for the P2 interface.*

Alarm Messages

Display	Description
Coil OC Fail – xx:yy*	Coil yy on Slave xx has failed Open Circuit – replace coil
Coil CC Fail – xx.yy*	Coil yy on Slave xx has failed Closed Circuit – replace coil
Low Coil Voltage – xx.yy	Voltage outside the recommended voltage is being delivered to the coil yy on Slave xx or to the baseboard – check connections.
Slave Removed - xx	Slave xx has been lost since power-up. – check connections
Over Temperature – Slowed	Power Supply is warm, Off Time has been increased to allow the Power Supply to return to normal.
Over Temperature – Stopped	Power Supply is hot. Controller has ceased to function to allow the Power Supply to return to normal temperature. The controller will then automatically operate.
Power Supply Low	Power Supply voltage is below the minimum voltage. Once voltage is within operating range, the controller will automatically operate normally.
Stop (Over Temp)	Power Supply is hot. Controller has ceased to function to allow the Power Supply to return to normal temperature. The controller will then automatically operate.
Bad MOD board xx	A faulty “plug in” board has been identified as number xx where xx is: 3 – P-CTX 4 – P-MOD Contact Goyen for replacement board.
Unknown Fault xx	Firmware Error – Contact Goyen
Exception # xx	Contact Goyen with Exception category # and Exception number xx – Contact Goyen 1 - P2 interface Board requires calibration 2 - Could not communicate to baseboard slave (may indicate problem with external slave bus, but most likely a problem with the micro or the RS485 comms on the baseboard - other options are a fault on the micro on the P1/2 interface or possibly the 50-way cable) 3 - 3.3V rail is low (< 3V) - this message indicates a fault in the 3V3 supply on the baseboard
Aux. Alarm	Auxiliary Alarm is present (P-CTX must be present).
Low Header P	Insufficient compressed air pressure exists in header. Solenoid operation is ceased until pressure is at acceptable levels once again (P-CTX must be fitted).
Service Alarm 100,000 cycles	100,000 complete cleaning cycles have been completed – Check control system parameters
Service Alarm 500,000 cycles	500,000 complete cleaning cycles have been completed – Check condition of filter elements
Service Alarm 950,000 cycles	950,000 complete cleaning cycles have been completed – Replace kits in valves

**In the case of solenoid failure, all other solenoids will continue to operate. Alarm will be automatically cancelled on connection of a good solenoid to the output in question.*

Troubleshooting

The Precision is programmed with system self-diagnostics. Most issues can be resolved by reference to the system messages and alarms present on the interface and listed in the previous section, ‘Messages and Alarms’. For issues which cannot be resolved in this way, refer to the table below or contact your system supplier.

General/Startup

Symptom	Cause	Resolution
System does not power up. Power LED remains off.	Power is not connected to the baseboard.	Check connection.
	Power wiring is incorrect.	Check wiring to socket is in accordance with this manual.
	Power supplied is below the minimum required to operate the controller.	Check power supply is within tolerance.
	Ribbon cable to P1 or P2 interface is loose.	Check and ensure fit to interface and baseboard is secure.
	Blown fuse	Replace fuse.
	Defective on-board power supply or interface.	Contact your supplier.
Some or all expansion cards are not detected on startup.	Cabling between expansion cards and the baseboard is incorrect.	Check connections are in accordance with this manual.
	Broken cabling between expansion cards and the baseboard.	Replace cable.
	Damaged fuse on expansion card or baseboard.	Replace fuse.
Some or all connected solenoids are not detected on startup.	Cabling between expansion cards and the baseboard is incorrect.	Check connections are in accordance with this manual.
	Broken cabling between expansion cards and the baseboard.	Replace the cable.
	The common terminals between each bank of solenoids (or between solenoids) are not linked or returned to the common terminal on the relevant baseboard or expansion card.	Ensure commons are linked.
	The solenoid active terminal is not properly linked to its relevant system output terminal.	Check connections and repair if necessary.
	Damaged fuse on expansion card or baseboard.	Replace fuse.

Operational

Symptom	Cause	Resolution
P2 does not go into cleaning mode on startup. Display shows: “Precoating”. Valves do not pulse.	P2 is waiting for differential pressure to rise above the factory preset Precoating value (1.5kPa, 6”WG) or the user set value.	Enter the menu and set Precoating to off, or wait for differential pressure to rise.
P2 does not go into cleaning mode on startup. Display shows: “Stopped (dP)”. Valves do not fire.	P2 is waiting for differential pressure to rise above the factory preset Remote Stop trigger value (0.5 kPa or 2”WG) to commence operation.	Enter the menu and set remote stop dP to the preferred value or to “Hardwired”, or wait for the dP to rise.
P2 does not go into cleaning mode on startup. Display shows: “Stopped (FAN)”. Valves do not pulse.	Fan contacts are closed on the baseboard.	Check wiring to fan contacts, if the fan or another circuit breaker is not connected to the Precision the fan contact terminals should be open. If the fan is connected to the baseboard check that the contacts at the fan are normally open type, and check the wiring.
Valves on multiple expansion boards are firing simultaneously. The outputs correspond to each other.	Two or more expansion cards are set with the same address.	Check each output is assigned a unique address.
Expansion cards are not pulsing sequentially (Pattern cleaning mode is off).	Expansion card addresses have not been assigned in sequential order.	Re-assign expansion card addresses in numerical order.

P-MOD Modbus Communications

Symptom	Cause	Resolution
System is not recognised on the DCS or plant SCADA system. P-Mod is recognised by Precision on startup.	Modbus communications is turned OFF in the menu Diagnostics on startup will indicate Network is OFF.	Enter the menu, and at the network menu item ensure the network is given an address, rather than set to off.
	Network address of controller is incompatible with address assigned at DCS level.	Check address setting on the Precision matches the DCS

Precision System Specifications

Element	Details
P2 on board pressure transducer	Operating Pressure Range: 0 to 2.5 kPa (0 to 10 “WG) Accuracy: +/- 2.5% FSS Burst pressure: 20 kPa (83 ”WG) Vibration resistance: to 10G at 20 – 2000 Hz Response time: 8ms Temperature compensated ASIC signal conditioning
DC/DC baseboard	Input voltage: 24 to 48 VDC (+/-10%) Input current: 3A maximum Permissible transients: 60V maximum
AC/AC baseboard	Input voltage: 110 or 240 VAC (+/-10%) 50/60Hz Input current: 3A maximum Permissible transients: 300V maximum
AC/DC baseboard	Input voltage: 110 to 240 VAC (+/-10%) 50/60Hz Input current: 2A maximum Permissible transients: 300V maximum
DC Output terminals	Voltage: 24VDC Output current: 2.5A maximum 10 on baseboard, 10 on each expansion card
AC Output terminals	Voltage: Equal to input voltage Output current: 2.4A 10 on baseboard, 10 on each expansion card
Maximum number of expansion	19 giving 200 outputs total cards connected
Maximum distance between	100m expansion cards
Tube cleaner output (P-CTX) AC/DC or DC/DC baseboard	Voltage: 24VDC Output current: 2.5A maximum
Tube cleaner output (P-CTX) on AC/AC baseboard	Voltage: Equal to input voltage Output current: 2.4A
Analog output (P-CTX)	Type: Internally powered 4-20 mA Voltage: 24VDC Output current: 20 mA maximum
Digital I/O (P-CTX)	Type: Voltage free (dry) contacts Maximum applied voltage: 300 VAC
FAN & GND contacts (baseboard)	Type: Voltage free (dry) contacts Maximum applied voltage: 300 VAC
RS485 contacts (P-MOD)	Type: Data Maximum applied voltage: 24VDC
Modbus implementation	Layer: 2 wire, half duplex, RS485 serial Protocol: Modbus RTU Baud Rate: 9600 Data bits: 8 Stop Bits: 1 Parity: None Address range: 0 – 255
System safe operating temperature	0 to 70°C (32 to 158°F)
System humidity allowance	Non-condensing to 85%

Register Definitions P-MOD (Modbus)

Holding Register Address	Integer Address	Name (*means READ ONLY)	Data Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40001	0	*About	P2	Firmware Version							Firmware Revision							
40002	1	Reserved	Reserved															
40003	2	Language	0 English 1 Italian 2 Spanish 3 German 4 French															
40004	3	Coil On Time	Electrical on Time of Solenoids in ms															
40005	4	Coil Off Time	Electrical Off Time of Solenoids in s															
40006	5	Display Units	0 kPa 1 Pa 2 IN WG 3 mm WG 4 mm Hg															
40007	6	Demand Type	0 Limits 1 Bandwidth															
40008	7	Low dP Limit bytes 0-1	Differential Pressure at which to pause the cleaning operation, in current units															
40009	8	Low dP Limit bytes 2-3																
40010	9	High dP Limit bytes 0-1	Differential Pressure at which to start the cleaning operation, in current units															
40011	10	High dP Limit bytes 2-3																
40012	11	dP Bandwidth	% of High dP Limit to be used as "pause" in the cleaning cycle (only used if controller is using Bandwidth Cleaning)															
40013	12	Blowdown #	The number of blowdown cycles to be performed (if set to 0 ra blowdown is to be performed)															
40014	13	Blowdown dP bytes 0-1	The pressure below which the Automatic Blowdown (if used) is triggered in whichever measurement unit is currently selected															
40015	14	Blowdown dP bytes 2-3																
40016	15	Blowdown Type	0 Hardwired Blowdown (triggered by bridging "FAN" & "GND" contacts on Baseboard) 1 Automatic Blowdown (triggered by dP)															
40017	16	Tube Cleaner Enable	0 Disabled 1 Enab led															

Register Definitions P-MOD (Modbus) cont'd ...

Holding Register Address	Integer Address	Name (*means READ ONLY)	Data Bit															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40018	17	Tube Cleaner Off Time	The time between Tube Cleans in min if Tube Cleaner Enable is Enabled															
40019	18	Tube Cleaner On Time	The time which the dP sensing lines are purged (ie cleaned) in s															
40020	19	Maximum Interval Enable	0 Disabled (When in demand cleaning mode, only clean when required) 1 Enabled (When paused in demand cleaning mode and dP has not risen above High dP level, operate solenoid every Maximum Interval time)															
40021	20	Maximum Interval Time	The maximum time in min between solenoids operating (only used if Demand Cleaning is being used)															
40022	21	Alarm Delay	The time delay between when an alarm condition occurs to when the alarm is raised in s															
40023	22	Pattern Cleaning	0 Normal (OFF) 1 Skip 1 output 2 Skip 2 outputs															
40024	23	High dP Alarm bytes 0-1	The dP value at which an alarm is raised in whichever measurement unit is currently selected															
40025	24	High dP Alarm bytes 2-3																
40026	25	Precoating pressure 0-1	The dp value which must be reached before the FIRST cleaning cycle can begin after the machine is powered up in whichever measurement unit is currently selected 0 = OFF															
40027	26	Precoating pressure 2-3																
40028	27	Demand/ Continuous	0 Continuous 1 Dem and 2 Follow P-CTX															
40029	28	Hour Counter	The number of hours that the controller has been running in hrs (resets when it reaches 10,000)															
40030	29	Cycle Ctr Low	The total number of cycles which the controller has completed (low 16 bits)															
40031	30	Cycle Ctr High	The total number of cycles which the controller has completed (high16 bits)															
40032	31	*Instantaneous dP bytes 0-1	The instantaneous dP of the system in whichever measurement units are currently selected															
40033	32	*Instantaneous dP bytes 2-3																
40034	33	*Other Modules						PHLO	PHHI	EXT	VALID	PFUS	PFIN	M3	M43	M42	M41	M40
								Photo LO	Photo HI	FAN & GND Cont	Capability bits finalised	Photohelic in use	Photohelic installed	P-CTX installed	MODBUS 0 no MODBUS 1 RS485 MODBUS 2-15 Unused			

Register Definitions P-MOD (Modbus) cont'd ...

Holding Register Address	Integer Address	Name (*means READ ONLY)	Data Bit															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40035	34	Next coil to fire	The number of the next coil to fire from 1-200															
40036	35	Fire countdown	The number of seconds until the next coil is to fire															
40037	36	*# of Slaves	The number of slaves on the system															
40038	37	*# of Coils	The number of coils on the system															
40039	38	Activate Output	Writing a number to this register will fire the appropriate coil (1-200). Writing a zero has no effect, and this register will always read back a zero.															
40040	39	Remote Stop	0 Do whatever the Baseboard contacts or dP sensor dictate 1 Stop (Override Baseboard contacts and dP Sensor) - this begins blowdown 2 Run (Override Baseboard contacts)															
40041	40	Manual Cycle	To this address, write a 1 to begin a manual cycle. On a read this gives 1 if currently performing a manual cycle. Writing a zero has no effect.															
40042	41	*Cycling	Returns the current state of whether the device is cycling or not 0 Precoating (waiting for dP to rise above Precoating limit before beginning to cycle) 1 Precoating Fault (eg: low header pressure, will not go on to cycle) 2 Cycling (normal operation) 3 Cycling Pause (eg low dP) 4 Cycling Pause Fault (eg low header pressure) 5 Blowdown (stoppi ng) 6 Blowdown Pause Fault (eg low header pressure) 7 Idle (stopped)															
40043	42	*Power Alarm	0 Power is good 1 Power is outside acceptable range															
40044	43	Service Alarm	0 No Service Alarm pending 1 Service Alarm pending (NOTE: writing a 0 to this address will reset the Service Alarm)															
40045	44	General Alarm	0 No General Alarm pending 1 General Alarm pending (NOTE: writing a 0 to this address will acknowledged the General Alarm)															
40046	45	Reset Factory	Writing a 1 to this address will reset all the setting sot the Factory Default Settings. Writing a zero has no effect. This will always read back a zero.															
40047	46	*P-CTX Inputs									SP2 spare	SP1 spare	GEN reset	SERV reset	LHDR press	AUX alarm	MAN cycle	CTS/ DEM
40048	47	*P-CTX Outputs							PURGE	ISOLATE	HIDP alarm	SERV alarm	COIL FAIL alarm	HEART beat	AUX alarm	POWER OK	CYCL 1 sec	SP1
40049	48	P-MOD - Modbus address	For systems with a Modbus P-MOD connected, this is the system's Modbus address. 0 = Not connected For systems without a Modbus P-MOD installed, this area is reserved. Warning: This register is writable, but care must be taken when writing to it!															
40050	49	(Reserved)																
40051	50	Master Info						SL0	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1

Register Definitions P-MOD (Modbus) cont'd ...

Holding Register Address	Integer Address	Name (*means READ ONLY)	Data Bit															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40052	51	SlaveInfo[1]						SL1	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40053	52	SlaveInfo[2]						SL2	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40054	53	SlaveInfo[3]						SL3	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40055	54	SlaveInfo[4]						SL4	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40056	55	SlaveInfo[5]						SL5	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40057	56	SlaveInfo[6]						SL6	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40058	57	SlaveInfo[7]						SL7	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40059	58	SlaveInfo[8]						SL8	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40060	59	SlaveInfo[9]						SL9	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40061	60	SlaveInfo[10]						SL10	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40062	61	SlaveInfo[11]						SL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40063	62	SlaveInfo[12]						SL12	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40064	63	SlaveInfo[13]						SL13	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40065	64	SlaveInfo[14]						SL14	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40066	65	SlaveInfo[15]						SL15	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40067	66	SlaveInfo[16]						SL16	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40068	67	SlaveInfo[17]						SL17	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40069	68	SlaveInfo[18]						SL18	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40070	69	SlaveInfo[19]						SL19	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
								COILx is set I the cycling controller identified a coil as present on start-up. SLxx is set if the cycling controller identified a slave present at that address on start-up.										
40071	70	MasterSkip						SL0	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40072	71	SlaveSkip[1]						SL1	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40073	72	SlaveSkip[2]						SL2	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40074	73	SlaveSkip[3]						SL3	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40075	74	SlaveSkip[4]						SL4	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40076	75	SlaveSkip[5]						SL5	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40077	76	SlaveSkip[6]						SL6	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40078	77	SlaveSkip[7]						SL7	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40079	78	SlaveSkip[8]						SL8	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40080	79	SlaveSkip[9]						SL9	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1

Register Definitions P-MOD (Modbus) cont'd ...

Holding Register Address	Integer Address	Name (*means READ ONLY)	Data Bit															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
40081	80	SlaveSkip[10]						SL10	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40082	81	SlaveSkip[11]						SL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40083	82	SlaveSkip[12]						SL12	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40084	83	SlaveSkip[13]						SL13	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40085	84	SlaveSkip[14]						SL14	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40086	85	SlaveSkip[15]						SL15	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40087	86	SlaveSkip[16]						SL16	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40088	87	SlaveSkip[17]						SL17	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40089	88	SlaveSkip[18]						SL18	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40090	89	SlaveSkip[19]						SL19	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
								These bits are all cleared by default. Setting one of them will cause that coil (or the entire slave) to be skipped										
40091	90	*# errors	Number of errors in the error buffer															
40092	91	*Error[0]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40093	92	*Error[1]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40094	93	*Error[2]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40095	94	*Error[3]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40096	95	*Error[4]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40097	96	*Error[5]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40098	97	*Error[6]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40099	98	*Error[7]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40100	99	*Error[8]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40101	100	*Error[9]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40102	101	*Error[10]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40103	102	*Error[11]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40104	103	*Error[12]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40105	104	*Error[13]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40106	105	*Error[14]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40107	106	*Error[15]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40108	107	*Error[16]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40109	108	*Error[17]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40110	109	*Error[18]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40111	110	*Error[19]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0

Notes

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