PENTAIR

GOYEN P-GT

FILTER CLEANING SYSTEM CONTROLS

PENTAIR CLEAN AIR SYSTEMS | INSTALLATION AND OPERATING INSTRUCTIONS – OWNER'S RECORD

P-GT
FILTER CLEANING SYSTEM CONTROLS

Installation and Operating Instructions – Owner's Record

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WARNING

To avoid product malfunction or electrical shock, do not expose P-GT 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 Precision series of filter cleaning controls 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.

PRODUCT DESCRIPTION

The P-GT (or controller) is an advanced filter-cleaning control system for gas turbine filter intake systems. 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, 4–20 mA output, and basic remote control. The solenoid outputs can be expanded up to 950 outputs through the use of the expansion cards (or slave cards) with the AC/DC baseboard.

IDENTIFYING THE PARTS

Your system will be comprised of all of the components below. Note that terminal headers are supplied for all push-in contacts.

Figure 1: P-GT Top View

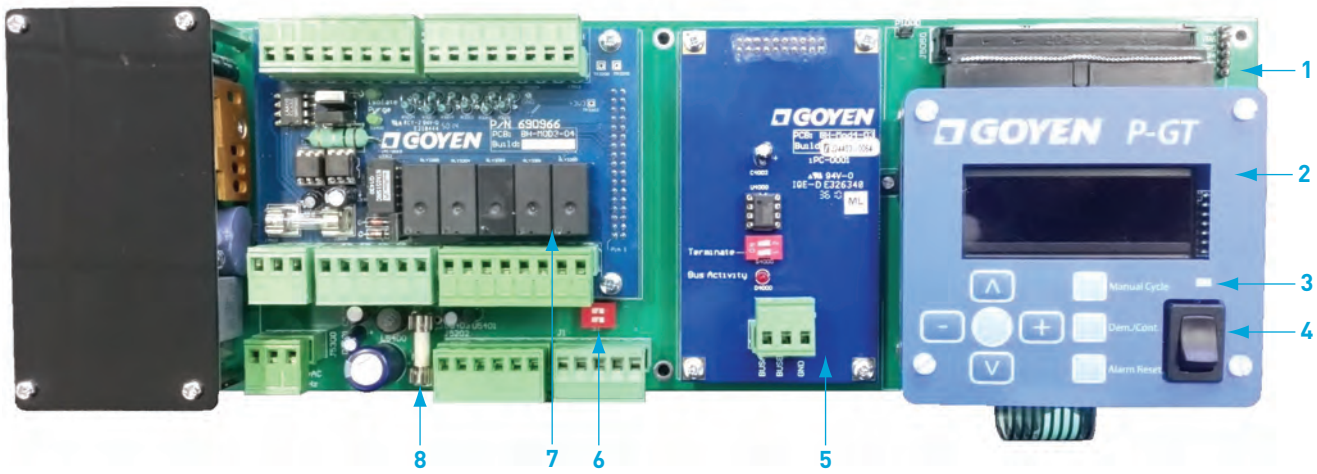
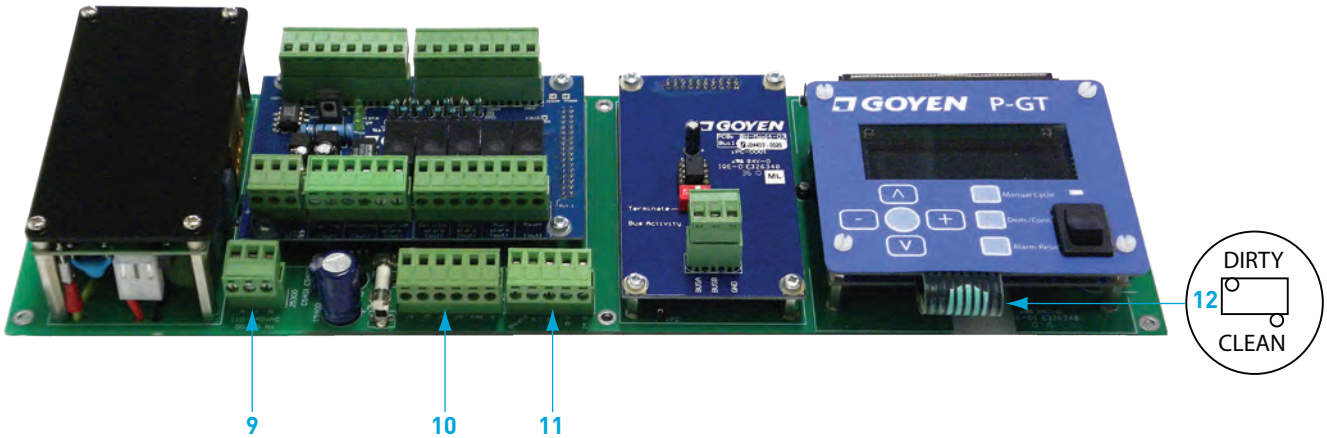


Figure 2: P-GT Front View



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

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

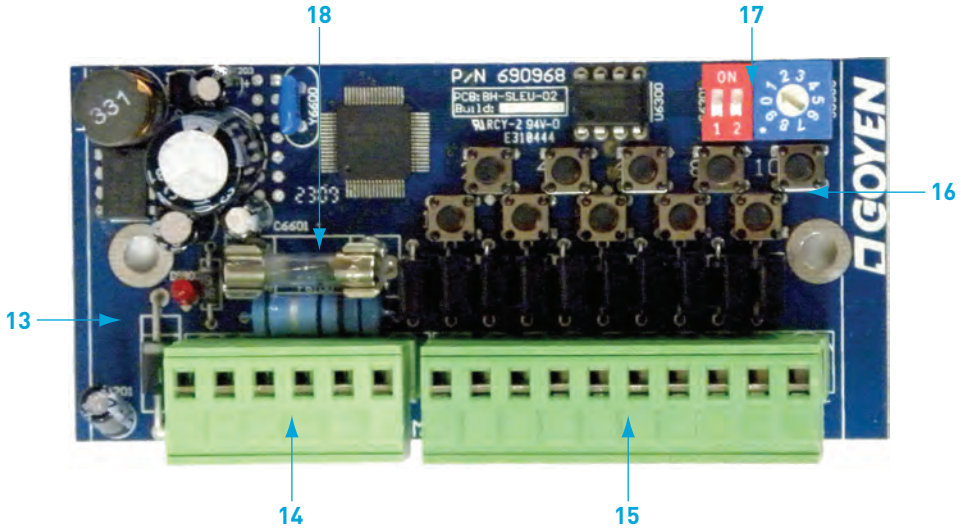
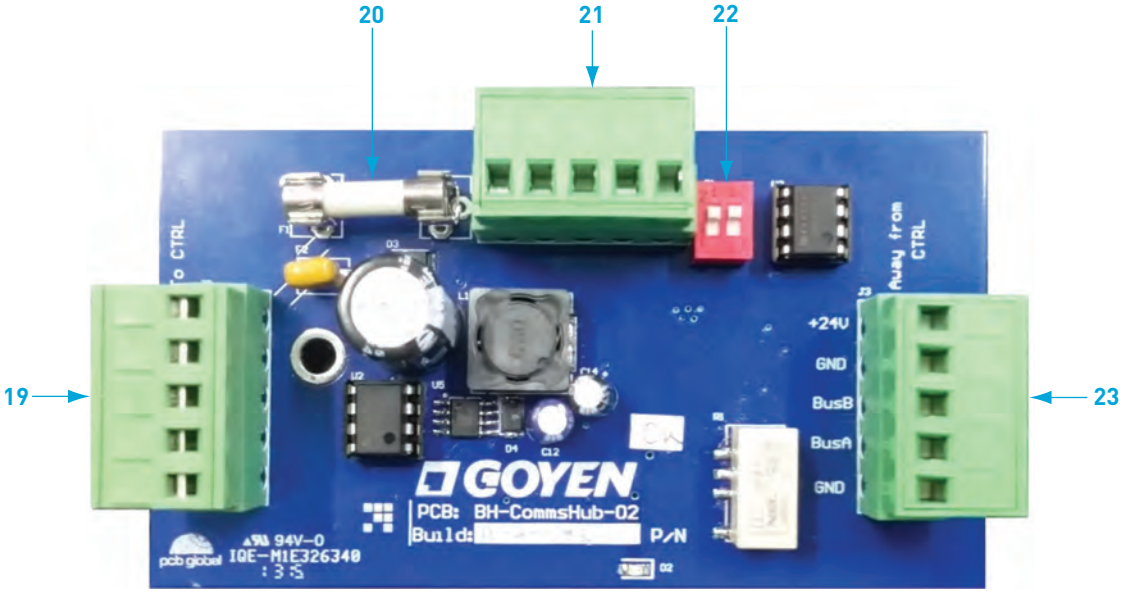


Figure 3A: Hub



Key to Figures 1 to 3A

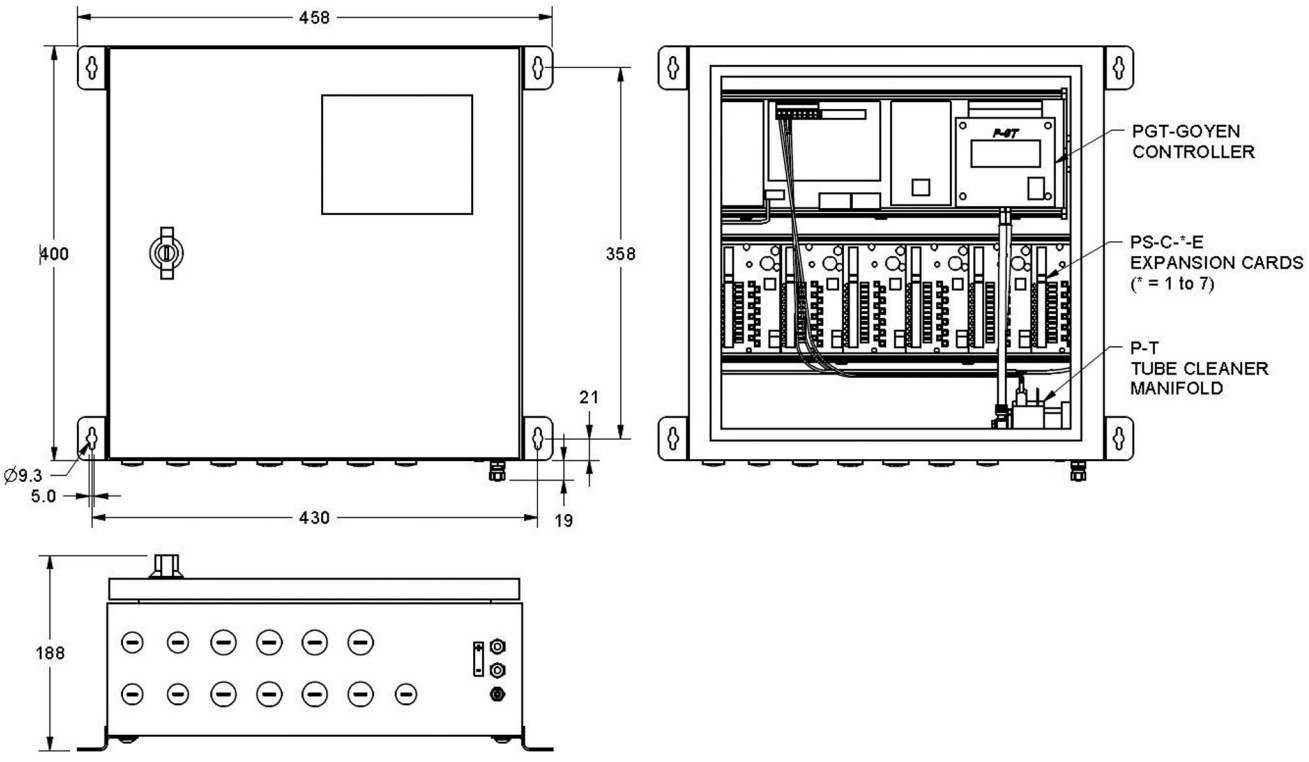
FIGURE 1: P-GT TOP VIEW	
1	P-GT motherboard
2	P-GT Enhanced Demand Mode interface
3	Power LED
4	Power-on switch
5	P-MOD, Modbus card
6	Motherboard terminating resistor (DIP switch No. 1)
7	P-CTX, I/O card
8	24 V Rail Fuse – 250 V 4 A (located on motherboard)
FIGURE 2: P-GT FRONT VIEW	
9	Power in
10	Fan contacts (Remote start/stop contacts)
11	Branch expansion card/Hub connection
12	Pressure transducer

FIGURE 3: PS-C, DC OUTPUT COMPACT TERMINAL EXPANSION CARD	
13	PS-C, compact expansion card
14	Expansion card contacts
15	Solenoid valve terminals and LEDs
16	Expansion card manual solenoid triggers
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

FIGURE 3A: HUB	
19	From controller
20	Hub fuse
21	To expansion card
22	Hub terminating resistor and addressing switches Switch No.1 or 2: Turns on terminating resistor.* * Terminating resistor is turned to 'ON' position on last slave card.
23	To next Hub

ENCLOSURE	
PGT-GOYEN-T-SS	1 × P-GT controller in S/S enclosure with tube cleaner fitted
PS-C-E	1 × 10 way expansion card enclosure mount
PS-C-2-E	2 × 10 way expansion card enclosure mount
PS-C-3-E	3 × 10 way expansion card enclosure mount
PS-C-4-E	4 × 10 way expansion card enclosure mount
PS-C-5-E	5 × 10 way expansion card enclosure mount
PS-C-6-E	6 × 10 way expansion card enclosure mount
PS-C-7-E	7 × 10 way expansion card enclosure mount

PGT-GOYEN-T-SS can be supplied with up to 6 × PS-C-E expansion cards assemblies in the enclosure. Both the P-GT and expansion cards are mounted on DIN rails.



INSTALLATION

GENERAL

MECHANICAL

The P-GT is supplied as PCB mounted in a DIN tray and preassembled on a DIN rail.

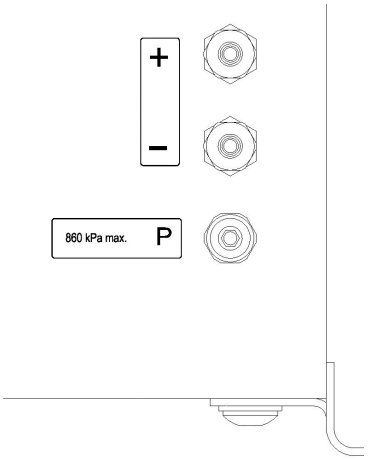
General

- Install P-GT 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 P-GT.
- The P-GT will operate in ambient temperatures of –40°C (–40°F) to 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 P-GT is to be installed in conditions with ambient temperatures of 70°C (158°F) or higher.
- The PGT-GOYEN-T-SS will maintain its IP66 rating when operated in the ambient temperature range of –30°C to +60°C.

P-GT Enhanced Demand Mode

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

The PGT-GOYEN-T-SS is equipped with a tube cleaner function. This is activated via the menu and it is possible to select duration and period of cleaning. When activated, 24 V DC valves connected to the tube cleaner manifold are energised and allow clean air to circulate through the tubing. At right is a view of the air fittings external to the enclosures and markings for connections.



ELECTRICAL INSTALLATION

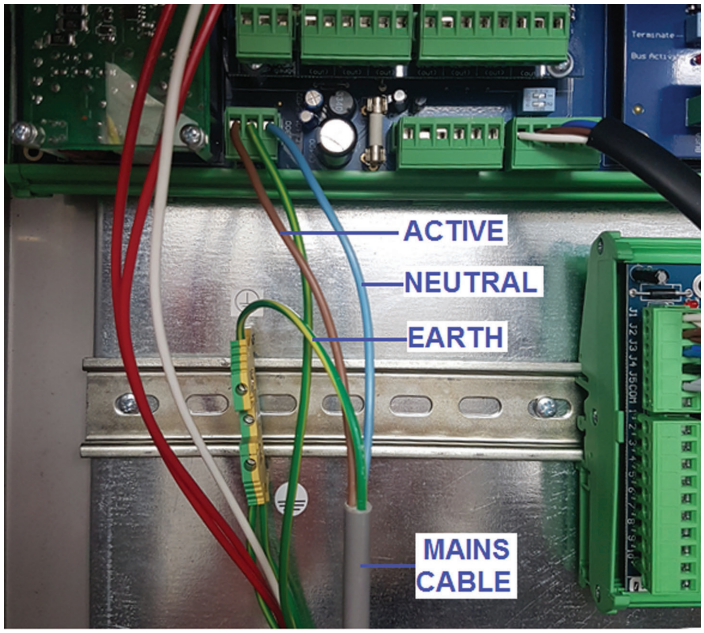
Warnings:

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

Connecting power to the P-GT

Connect active and neutral from the incoming mains supply to their respective terminals on the P-GT mainboard (**refer to Picture**).

- Ensure input voltage is 110 or 240 V AC (+/–10%), 50/60 Hz.
- 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 (refer Figure 2, item 9).
- For the PGT-GOYEN-T-SS connect the protective earth conductor from the incoming mains supply to the pin marked with symbol ⏚ of the earth terminal block on DIN rail. This is the primary earth connection point and must be the first point that electrical earth is connected to. This connection should be unique to the protective earth conductor. The earth pin on the P-GT mainboard, marked with the symbol ⏚, should always remain connected to the other connection of the earth terminal block on DIN rail.

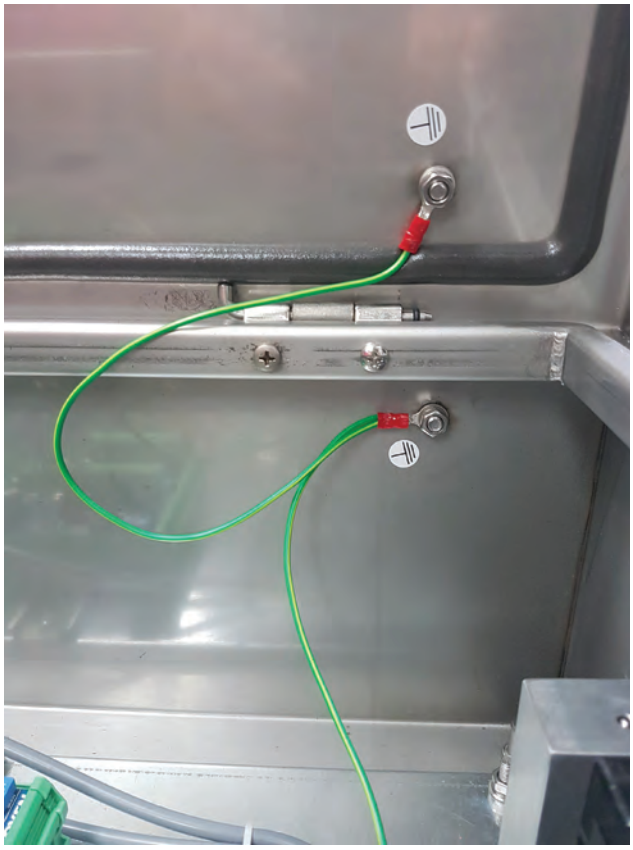


Note: All wire colours are subject to local legislation.

Surge Protection and Earthing

- We recommend the use of a Metal Oxide Varistor (MOV)-based surge protection device between the supply voltage and the P-GT. Clamping voltage = 275 V RMS (approx.), Energy Absorption = 175 joules (approx.).
- For the PGT-GOYEN-T-SS, all the accessible conductive parts that carry a risk of becoming hazardous live in case of single fault condition (i.e. mainboard, backing plate, enclosure box and lid) have a common earth connection and are protectively bonded to the electrical earth of the incoming mains supply. Each protective bonding connection of such type is marked with the symbol ⏚.

  Please follow all local applicable electrical standards. The safety of any system incorporating the supplied equipment is the responsibility of the assembler of the system.



Note: All wire colours are subject to local legislation.

Connection of solenoid valves and expansion cards to P-GT outputs

Please refer to the system wiring diagrams shown in Figure 4 and Figure 5.

- The expansion cards and/or hubs are connected to the baseboard via the connector shown in Figure 2. They have 24 V DC output at each terminal, each capable of powering three 24 V DC, 20 W solenoids simultaneously to a maximum of 2.5A at each DC output terminal.
- Do not assign an address of zero to an expansion card.
- Suggested wire gauge is 11/0.2 × 4 core plus shield (drain) such as a Belden 8723NH 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.
- All DIP switch settings are factory preset.
- Ensure each expansion card is given a sequential address by using the rotary switch and DIP switch No. 2. Do not assign an address of zero on expansion cards; zero is reserved for the baseboard.
- For solenoid connections, connect up to 2.5 mm^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.

Note: The P-GT automatically detects all expansion cards and solenoids connected to the system.

Fan contact connections (start/stop connections)

These contacts (Figure 2, item 10, page 4) are used to trigger start/stop of the pulse cleaning system; this feature is triggered through electrical contacts. Optionally, blowdown cycles may be triggered by the dP of the collector.

- 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 Figure 2, item 10, page 4).

Figure 4: P-GT Main Board and Expansion Card Wiring Diagram

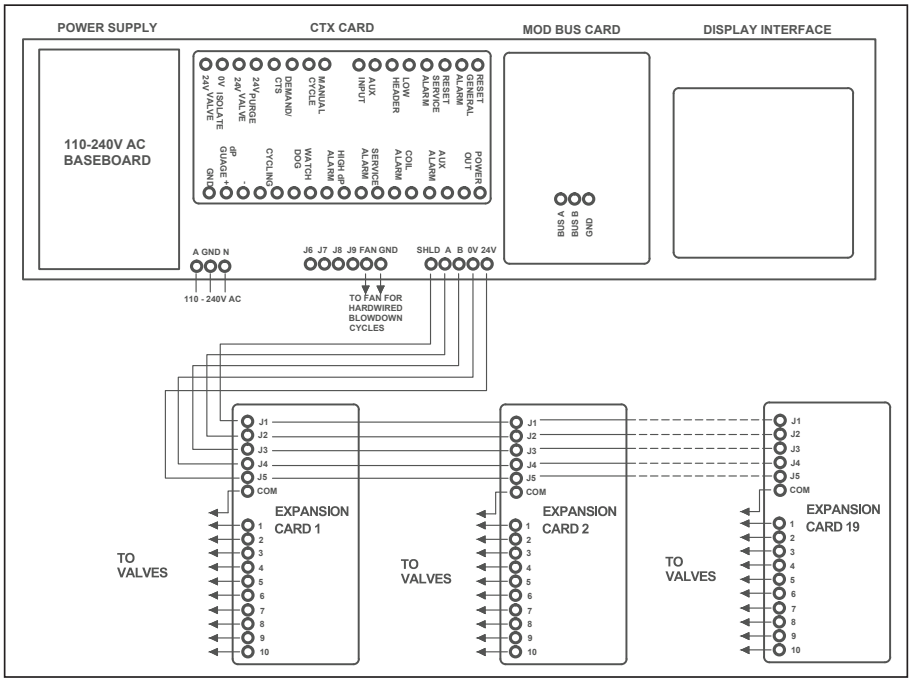
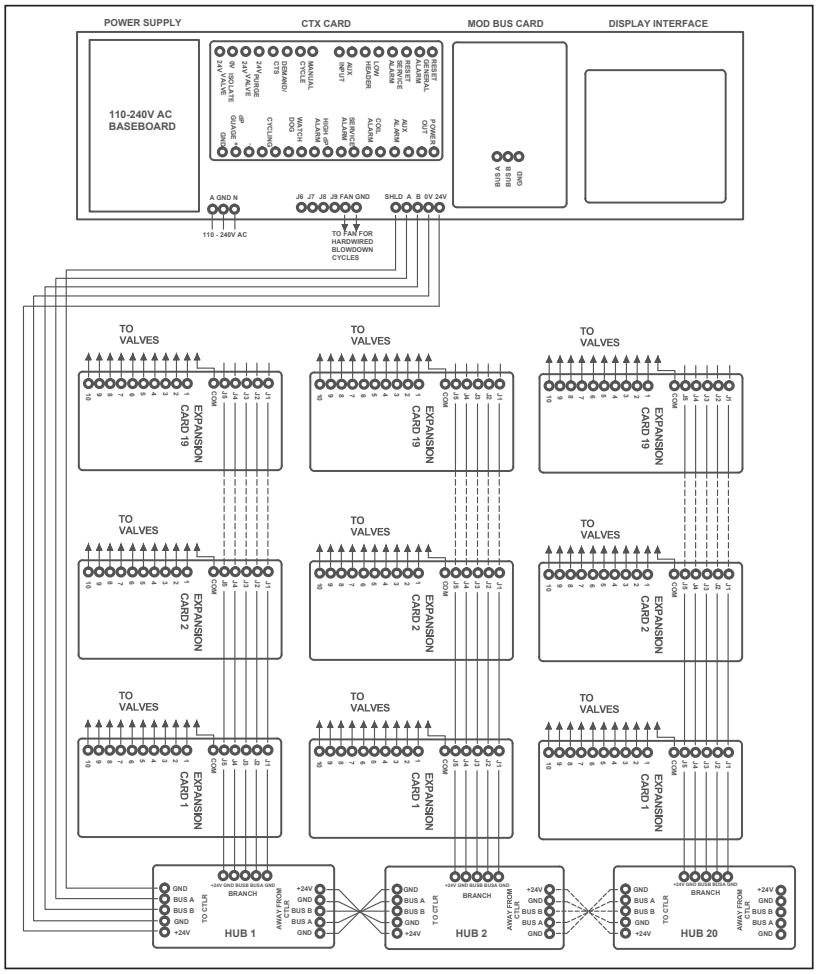


Figure 5: P-GT Main Board, Hub and Expansion Card Wiring Diagram

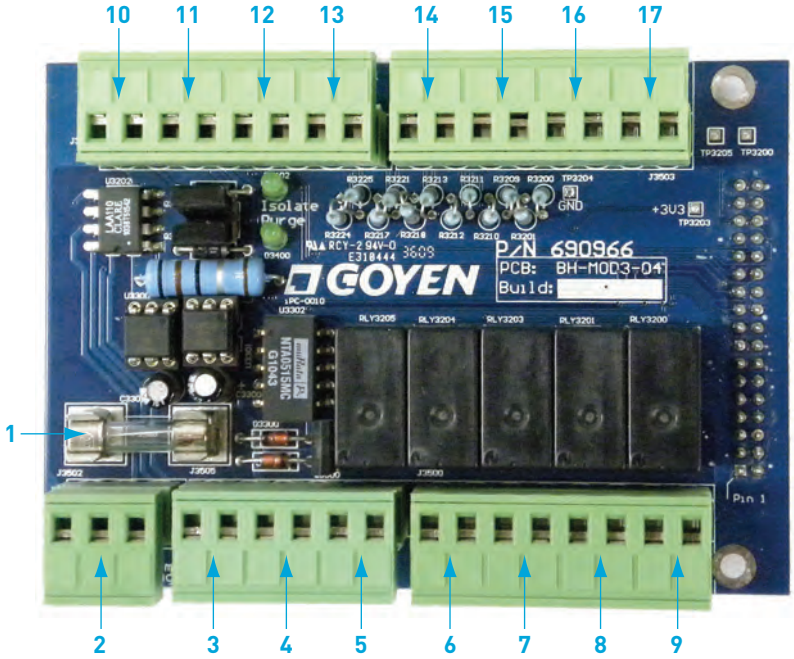


INSTALLATION

OPTIONAL ACCESSORIES

P-CTX: I/O CARD

Figure 6: P-CTX



BASIC INFORMATION

The P-CTX card provides voltage-free contacts for alarm outputs, basic remote control inputs and a 4–20 mA output for differential pressure reporting. 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 P-GT. Each input consists of an input terminal and a common terminal; bridging these two contacts triggers the corresponding function.

4–20 mA Output

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

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

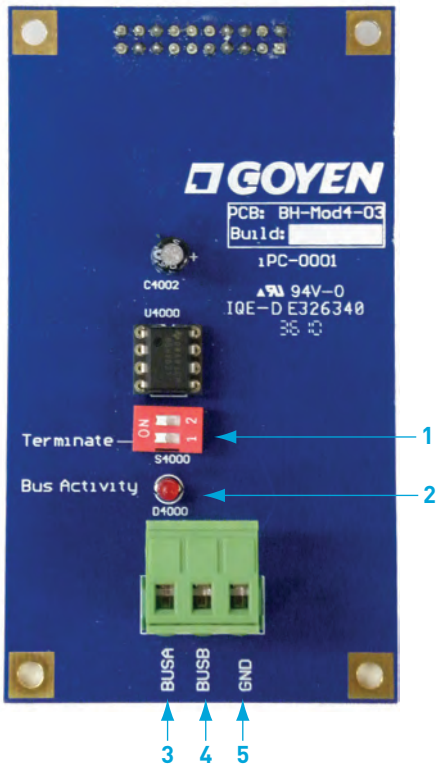
Key to Figure 6

	DESCRIPTION	TYPE	DETAILS
1	Fuse		
2	4–20 mA differential pressure output GND + –	Output Output Output	Ground 24 V DC 0 V DC
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 100 K, 500 K, or 950 K 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 V DC
11	Purge valve (for optional tube-cleaner function only)	Output Common	24 V DC
12	Demand/Continuous switch Allows remote switching between continuous and demand control modes.	Input Common	Voltage free Voltage free
13	Manual cycle Forces a full cleaning cycle.	Input Common	Voltage free Voltage free
14	Humidity initiates one full cleaning cycle within a 24 hr period if triggered.	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 4–20 mA output (2) is internally powered from the control system. No additional power supply is required.

P-MOD: MODBUS COMMUNICATIONS CARD

Figure 7: P-MOD



Key to Figure 7

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 7, 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

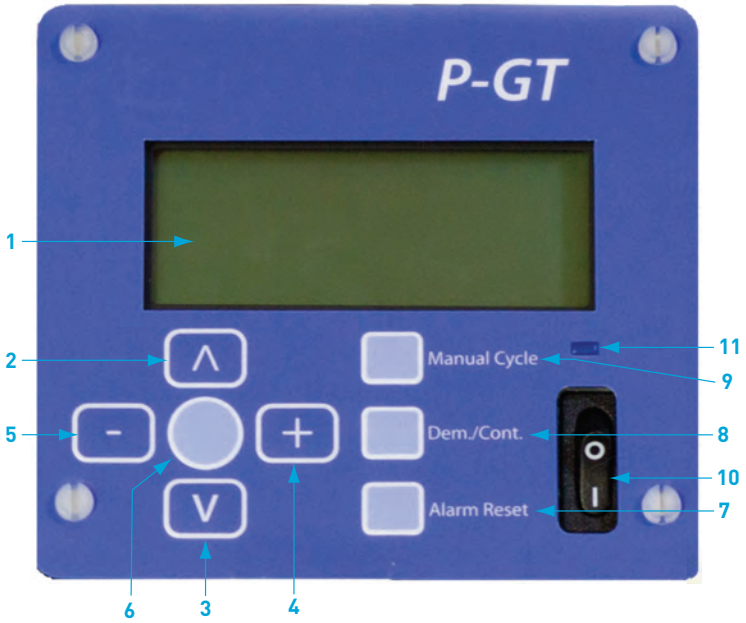
See Figure 8 (items 10 and 11). Moving the power switch into the ON position will power up the P-GT. The Power LED will light, and the backlit interface display will light up.

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

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

THE DISPLAY AND INTERFACE

Figure 8: P-GT Interface



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
10	Power-on switch
11	Power LED

P-GT – Enhanced Demand Interface

The P-GT 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 P-GT also provides enhanced pulse control functions, including six specific filter cleaning sequences and a maximum Interval setting between cleaning cycles. It also provides sequential and continuous pulse cleaning cycles. These are in addition to the conventional sequential and continuous pulse cleaning controls.

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

Line 1: Scrolling display of system settings, alarms and cycle counting

Line 2: Differential pressure and units (Psi/Bar)

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

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

PROGRAMMING AND ADVANCED FEATURES

To enter programming mode, press Enter (Figure 8, item 6), followed by:

+ – – + Enter

UP (Figure 8, item 2) scroll to previous menu item, DOWN (Figure 8, item 3) scroll to next menu item.

P-GT – ENHANCED DEMAND CONTROL

Menu Structure

	LEVEL 1 – ENTRY	LEVEL 2 – MENU ITEM	LEVEL 3 – SUB-MENU OPTIONS	LEVEL 4 – OPTIONS
1	Code			
2 2a		Language	 English	
3		Reset Factory Defaults		
4		On Time		
5		Off Time		
6 6a 6b 6c 6d 6e		Display Units	 kPa Pa inWB mmH_2O mmHg	
7 7a 7ai 7aii 7b 7bi 7bii		Demand Cleaning	 Limits Bandwidth	 Low dP High dP High dP Bandwidth %
8		Alarm Delay		
9		High dP Alarm		
10 10a 10b		Precoating		
11		Pattern Cleaning		
12		Blowdown Cycles	 Hardwired Automatic	
13 13a 13b		Remote Stop		
14		Hour Counter		
15		Number of Slaves		
16		Total Cycles		
17		Network		
18 18a 18b 18c		Set Clock	 Hour Min Day	

	LEVEL 1 – ENTRY	LEVEL 2 – MENU ITEM	LEVEL 3 – SUB-MENU OPTIONS	LEVEL 4 – OPTIONS
19 19a 19b 19c		Edit Events	 Set Enable Set Hour Set Min	
20 20a 20b		Using Comms Hub?	 Using Comms Hub Not using Comms Hub	
21		Reset Comms Hub Addressing		
22		Retry Missing Coils		
23		Run		

DESCRIPTION OF MENU ITEMS

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 1 s and 999 s.

Display Units

Allows the display units for pressure to be set to one of five commonly used measures. See table on page 13. 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.

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

Allows the user to select a cleaning pattern.

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 10) are closed.

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 10). 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 P-GT 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.

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 100 K, 500 K, and 950 K cycles. Pressing [Enter] allows the cycle counter to be reset: 0 to 1 000 000 cycles.

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 P-GT off the network.

Set Clock

Enables setting of the internal clock in Min, Hour and Day.

Edit Events

Allows the setting of up to two times a day when the controller will automatically conduct a full cleaning cycle.

Using Comms Hub?

Enables the controller to operate with or without the use of the Communications Hubs.

Reset Comms Hub Addressing

Allows the controller to initiate a new search for Communications Hubs without having to manually cycle or reset the controller.

Reset Missing Coils

Allows the controller to initiate a new search for coils without having to manually cycle or reset the controller.

Run

Returns the controller to operating mode.

MESSAGES AND ALARMS

MESSAGES

Scrolling Display

DISPLAY	DESCRIPTION
Model xx.xx	Software version number
Continuous Mode	Controller is in Continuous Mode
Demand Mode	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	Remote Stop is hardwired to the fan, circuit breaker or an external switch
Remote Stop = Automatic	Remote Stop is dependent on dP of system
Hour Counter = xx Hrs	Number of hours the controller has been operational
Total Cycles = xxxxxx	Number of complete cleaning cycles the controller has performed
Max. Interval = xxx	The maximum time that can elapse before a cleaning operation takes place (only in use when in Demand Mode)
Pattern Cleaning = xxx	Displays which pattern cleaning system has been selected.
Alarm Delay = xxx sec	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	Current units being used for display of dP

General Messages

DISPLAY	DESCRIPTION
dP = xxxx (units)	Current dP
Stopped (dP)	Remote Stop due to Automatic Blowdown dP measurement
Stopped (Switch)	Remote Stop due to Hardwired Blowdown
Manual Cycle	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	Controller waiting for dP to exceed High dP Limit value
Cycling – (Precoating)	Controller waiting for dP to exceed Precoating value
xxx sec	Countdown to next solenoid operation
(a) xx:yy	Next [Module a] Slave xx: Coil yy to operate
Tube Cleaner xx sec	Controller is performing a Tube Clean operation with xx sec remaining

Alarm Messages

DISPLAY	DESCRIPTION
Coil OC Fail – [a] xx.yy	[Branch a] Coil yy on Slave xx has failed Open Circuit – replace coil.
Coil CC Fail – [a] xx.yy	[Branch a] Coil yy on Slave xx has failed Closed Circuit – replace coil.
Low Coil Voltage – [a] xx.yy	Voltage outside the recommended voltage is being delivered to the [Branch a] coil yy on Slave xx – check connections.
Slave Removed – [a] Slave xx	[Branch a] 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 – P-GT 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. To reset service alarm, press alarm reset on the P-GT.

TROUBLESHOOTING

The P-GT 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 P-GT 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
P-GT does not go into cleaning mode on startup. Display shows: 'Precoating'. Valves do not pulse.	P-GT is waiting for differential pressure to rise above the factory preset Precoating value (1.5 kPa, 6" WG) or the user set value.	Enter the menu and set Precoating to OFF, or wait for differential pressure to rise.
P-GT does not go into cleaning mode on startup. Display shows: 'Stopped (dP)'. Valves do not fire.	P-GT 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.
P-GT 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 P-GT, 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.
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 P-GT 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 P-GT matches the DCS.

MANUAL ACTIVATION OF SOLENOID OUTPUTS

See Figure 3A, item 21.

Pushing the manual output triggers will power their corresponding output for 100 ms if there is a solenoid connected. Simultaneously the output LED will light. This feature can be used for confirming valve operation and diagnosing filter cleaning problems.

P-GT SYSTEM SPECIFICATIONS

ELEMENT	DETAILS
P-GT 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 10 G at 20–2000 Hz Response time: 8 ms Temperature-compensated ASIC signal conditioning
AC/DC baseboard	Input voltage: 110 to 240 V AC (+/–10%) 50/60Hz Input current: 1 A maximum Permissible transients: 300 V maximum Output Voltage: 24 V DC
Maximum number of expansion cards	380 giving 3800 outputs
Maximum distance between	100 m expansion cards
Tube cleaner output (P-CTX)	Voltage: 24 V DC
Expansion Cards	Voltage IN and OUT: 24 V DC Output current each terminal: 2.5A maximum
Analogue output (P-CTX)	Type: Internally powered 4–20 mA Voltage: 24 V DC Output current: 20 mA maximum
Digital I/O (P-CTX)	Type: Voltage-free (dry) contacts Maximum applied voltage: 300 V AC
FAN & GND contacts (baseboard)	Type: Voltage-free (dry) contacts Maximum applied voltage: 300 V AC
RS485 contacts (P-MOD)	Type: Data Maximum applied voltage: 24 V DC
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	–40 to 70°C (–40 to 158°F)
System humidity allowance	Non-condensing to 85%
The P-GT boards have the following approvals:	CE RCM (Australia) c UL us UL Recognised Component, Engine Generators, for Canada and the US. AU6341.
The PGT-GOYEN-T-SS enclosure assembly with expansion cards has the following approvals:	CE RCM (Australia)

MODBUS REGISTER DEFINITIONS

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	MOD2	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															
			5 Psi															
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 unit															
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 no 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 Enabled															
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 (i.e. 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 solenid 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	System Type	0 System A – 6 × 22 H Modules (1,2 PS-C, 3,4 PS-12C)															
			1 System B – 7 × 24 H Modules (1-4 PS-C)															
			2 System C – 7 × 27 H Modules (1-3 PS-C, 4,5 PS-12C)															
			3 System D – 8 × 25 H Modules (1-5 PS-C)															

MODBUS REGISTER DEFINITIONS

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
			4 System E – 8 × 28 H Modules (1,2 PS-C, 3-5 PS-12C)															
			5 System F – 8 × 30 H Modules (1-5 PS-12C)															
			6 No system – just a flat mesh of coils; will fire all the coils on one slave, one at a time, then move on to the next slave.															
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 Demand															
			2 Follow MOD3															
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	MOD3 installed	MOD4			
															0 no MOD4			
															1 RS485 MODBUS			
															2–15 Unused			
40035	34	Reserved																
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	Reserved																
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	Write 1 to this address 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 (e.g. low header pressure, will not go on to cycle)															
			2 Cycling (normal operation)															
			3 Cycling Pause (e.g. low dP)															
			4 Cycling Pause Fault (e.g. low header pressure)															
			5 Blowdown (stopping)															
			6 Blowdown Pause Fault (e.g. low header pressure)															

MODBUS REGISTER DEFINITIONS

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
			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 acknowldged the General Alarm.)															
40046	45	Reset Factory	Writing a 1 to this adddress will reset all the settings to the Factory Default Settings. Writing a zero has no effect. This will always read back a zero.															
40047	46	**MOD3 Inputs									SP2 spare	SP1 spare	GEN reset	SERV reset	LHDR press	AUX alarm	MAN cycle	CTS/DEM
40048	47	**MOD3 Outputs							PURGE	ISOLATE	HIDP alarm	SERV alarm	COIL FAIL alarm	HEART beat	AUX alarm	POWER OK	CYCL 1sec	SP1
40049	48	MOD 4 – Modbus address	For systems with a Modbus MOD-4 connected, this is the system's Modbus address. 0 = Not connected															
			For systems without a Modbus MOD-4 installed, this area is reserved.															
			Warning: This register is writable, but care must be taken when writing to it!															
40050	49	Override Coil	Writing a coil parameter to this address will fire that coil once the off time has elapsed. If the off time has elapsed or the system is idle, then the coil will fire immediately.															
40051	50	**# errors	Number of errors in the error buffer															
40052	51	**Error[0]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40053	52	**Error[1]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40054	53	**Error[2]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40055	54	**Error[3]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40056	55	**Error[4]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40057	56	**Error[5]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40058	57	**Error[6]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40059	58	**Error[7]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40060	59	**Error[8]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40061	60	**Error[9]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40062	61	**Error[10]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40063	62	**Error[11]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40064	63	**Error[12]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40065	64	**Error[13]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40066	65	**Error[14]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40067	66	**Error[15]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40068	67	**Error[16]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40069	68	**Error[17]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40070	69	**Error[18]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
40071	70	**Error[19]	TYP3	TYP2	TYP1	TYP0	ERR3	ERR2	ERR1	ERR0	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1	PAR0
			'ErrParam – Error parameter is the detail to supplement the corresponding error; i.e. if there's a coil error logged as Error[0] then ErrParam[0] will contain the specifics for which coil on which slave on which branch and module. Coil is 0..9, Slave is 0..19; Branch is 0..4, Mod is 0..7'															

MODBUS REGISTER DEFINITIONS

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
40072	71	**ErrParam[0]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40073	72	**ErrParam[1]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40074	73	**ErrParam[2]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40075	74	**ErrParam[3]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40076	75	**ErrParam[4]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40077	76	**ErrParam[5]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40078	77	**ErrParam[6]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40079	78	**ErrParam[7]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40080	79	**ErrParam[8]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40081	80	**ErrParam[9]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40082	81	**ErrParam[10]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40083	82	**ErrParam[11]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40084	83	**ErrParam[12]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40085	84	**ErrParam[13]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40086	85	**ErrParam[14]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40087	86	**ErrParam[15]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40088	87	**ErrParam[16]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40089	88	**ErrParam[17]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40090	89	**ErrParam[18]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40091	90	**ErrParam[19]	0	MOD2	MOD1	MOD0	BRANCH2	BRANCH1	BRANCH0	SLAVE4	SLAVE3	SLAVE2	SLAVE1	SLAVE0	COIL3	COIL2	COIL1	COIL0
40092	91	**Current key pressed	Current key value															
40093	92	Do Calibrate zero	Writing the CAL_ZERO_PASSWORD to this address will calibrate the zero reading of the sensor. This register will always read back a zero.															
40094	93	Do Calibrate full scale	Writing CAL_FULL_PASSWORD to this address will calibrate the full scale reading of the sensor. This register will always read back a zero.															
40095	94	Full scale pressure bytes 0–1	Calibration: The full scale pressure of the sensor, in the current units.															
40096	95	Full scale pressure bytes 2–3																
40097	96	**ADC pressure	The uncalibrated pressure reading, in ADC counts (0–4095)															
40098	97	**ADC value at 0 pressure	Calibration: The ADC reading at zero differential pressure															
40099	98	**ADC value delta	Calibration: The ADC difference between zero and full pressure															
40100	99	Restore Factory Calibration	Writing CAL_FACTORY_PASSWORD to this address will copy the factory calibration to the user calibration.															
			This register will always read back a zero.															
40101	100	Factory Cal – Full Range (Bytes 0–1)	Factory Calibration: The full scale pressure of the sensor, in the current units															
40102	101	Factory Cal – Full Range (Bytes 2–3)																
40103	102	Factory Cal – ADC Zero	Factory Calibration: The ADC reading at zero differential pressure															
40104	103	Factory Cal – ADC value Delta	Factory Calibration: The ADC difference between zero and full pressure															
40105	104	Factory Cal -- Counter	This counter will increment when any 'Factory Cal' register is written to. That way we can track when the 'Factory' Cal is changed.															
			(It will be zero before first write, one after the first write, etc., etc., etc. Writing to the pressure registers counts as one increment.)															
40106-40110	**105-109**	**(Reserved)**																
40111	110	Branch[0].Slave[0]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1

MODBUS REGISTER DEFINITIONS

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
40112	111	Branch[0].Slave[1]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40113	112	Branch[0].Slave[2]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40114	113	Branch[0].Slave[3]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40115	114	Branch[0].Slave[4]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40116	115	Branch[0].Slave[5]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40117	116	Branch[0].Slave[6]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40118	117	Branch[0].Slave[7]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40119	118	Branch[0].Slave[8]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40120	119	Branch[0].Slave[9]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40121	120	Branch[0].Slave[10]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40122	121	Branch[0].Slave[11]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40123	122	Branch[0].Slave[12]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40124	123	Branch[0].Slave[13]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40125	124	Branch[0].Slave[14]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40126	125	Branch[0].Slave[15]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40127	126	Branch[0].Slave[16]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40128	127	Branch[0].Slave[17]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40129	128	Branch[0].Slave[18]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40130	129	Branch[0].Slave[19]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40131	130	Branch[1].Slave[0]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40132	131	Branch[1].Slave[1]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40133	132	Branch[1].Slave[2]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40134	133	Branch[1].Slave[3]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40135	134	Branch[1].Slave[4]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40136	135	Branch[1].Slave[5]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40137	136	Branch[1].Slave[6]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40138	137	Branch[1].Slave[7]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40139	138	Branch[1].Slave[8]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40140	139	Branch[1].Slave[9]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40141	140	Branch[1].Slave[10]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40142	141	Branch[1].Slave[11]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40143	142	Branch[1].Slave[12]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40144	143	Branch[1].Slave[13]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40145	144	Branch[1].Slave[14]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40146	145	Branch[1].Slave[15]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40147	146	Branch[1].Slave[16]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40148	147	Branch[1].Slave[17]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40149	148	Branch[1].Slave[18]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1

MODBUS REGISTER DEFINITIONS

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
40150	149	Branch[1].Slave[19]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40151	150	Branch[2].Slave[0]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40152	151	Branch[2].Slave[1]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40153	152	Branch[2].Slave[2]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40154	153	Branch[2].Slave[3]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40155	154	Branch[2].Slave[4]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40156	155	Branch[2].Slave[5]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40157	156	Branch[2].Slave[6]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40158	157	Branch[2].Slave[7]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40159	158	Branch[2].Slave[8]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40160	159	Branch[2].Slave[9]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40161	160	Branch[2].Slave[10]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40162	161	Branch[2].Slave[11]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40163	162	Branch[2].Slave[12]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40164	163	Branch[2].Slave[13]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40165	164	Branch[2].Slave[14]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40166	165	Branch[2].Slave[15]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40167	166	Branch[2].Slave[16]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40168	167	Branch[2].Slave[17]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40169	168	Branch[2].Slave[18]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40170	169	Branch[2].Slave[19]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40171	170	Branch[3].Slave[0]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40172	171	Branch[3].Slave[1]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40173	172	Branch[3].Slave[2]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40174	173	Branch[3].Slave[3]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40175	174	Branch[3].Slave[4]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40176	175	Branch[3].Slave[5]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40177	176	Branch[3].Slave[6]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40178	177	Branch[3].Slave[7]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40179	178	Branch[3].Slave[8]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40180	179	Branch[3].Slave[9]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40181	180	Branch[3].Slave[10]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40182	181	Branch[3].Slave[11]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40183	182	Branch[3].Slave[12]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40184	183	Branch[3].Slave[13]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40185	184	Branch[3].Slave[14]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40186	185	Branch[3].Slave[15]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40187	186	Branch[3].Slave[16]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1

MODBUS REGISTER DEFINITIONS

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
40188	187	Branch[3].Slave[17]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40189	188	Branch[3].Slave[18]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40190	189	Branch[3].Slave[19]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40191	190	Branch[4].Slave[0]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40192	191	Branch[4].Slave[1]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40193	192	Branch[4].Slave[2]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40194	193	Branch[4].Slave[3]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40195	194	Branch[4].Slave[4]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40196	195	Branch[4].Slave[5]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40197	196	Branch[4].Slave[6]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40198	197	Branch[4].Slave[7]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40199	198	Branch[4].Slave[8]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40200	199	Branch[4].Slave[9]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40201	200	Branch[4].Slave[10]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40202	201	Branch[4].Slave[11]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40203	202	Branch[4].Slave[12]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40204	203	Branch[4].Slave[13]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40205	204	Branch[4].Slave[14]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40206	205	Branch[4].Slave[15]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40207	206	Branch[4].Slave[16]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40208	207	Branch[4].Slave[17]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40209	208	Branch[4].Slave[18]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
40210	209	Branch[4].Slave[19]	SL	SL_IS_12			COIL12	COIL11	COIL10	COIL9	COIL8	COIL7	COIL6	COIL5	COIL4	COIL3	COIL2	COIL1
								COILx is set if 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.										
								SL_IS_12 is set if the slave is a 12-way slave.										

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