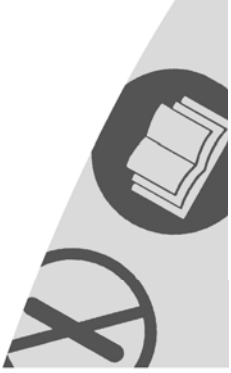
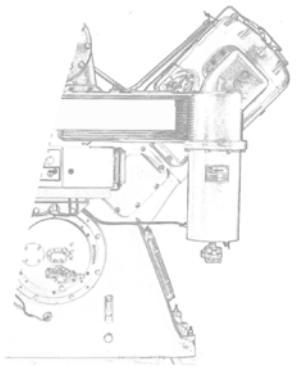
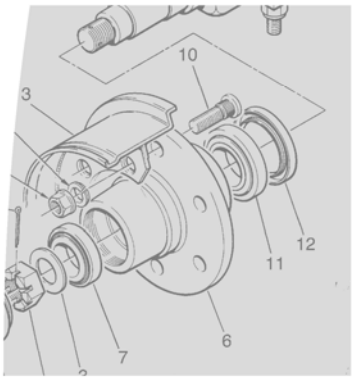
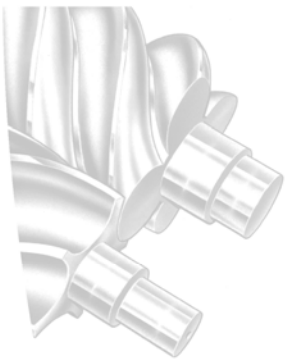
GARDNER DENVER



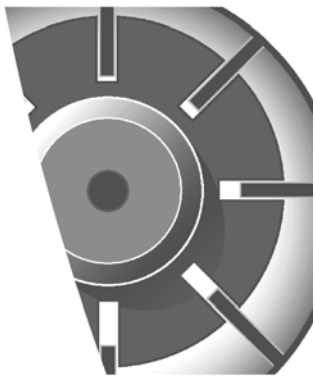






Original User Manual

GD Connect 4



EN March 2011

Contents:

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Section 1: Safety Warning:

Do not operate the GD Connect 4 until you and all personnel concerned have read and understood this software manual and the respective product hardware documentation

Operation may only be done by trained personnel according to safe engineering practises and with the observance of all relevant local health and safety requirements and regulations.

A requirement of fault-free operation and fulfilment of any right to claim under guarantee is that documentation is observed.

This document is subject to changes without notice, if in doubt, do not proceed!

Section 2: Version Revision notes:

Version	Revision notes
E**	Phase 1 release

Section 3: General description

3.1 GD Connect 4

Gardner Denver's flexible, easy to use and cost effective range of air compressor control and management products.

3.2 GD Connect 4

The GD Connect 4 is a specialised supervisory and control product designed to provide energy efficient optimised pressure and sequence control of up to 4 air compressors operating in a common compressed air system.

3.3 GD Connect 4 RS485

Each air compressor in the system can be integrated with the GD Connect 4 using RS485 where supported. A list of controller ID's that support RS485 can be found in this user manual

3.4 GD Connect 4 iPCB (I/O)

Each air compressor in the system can be integrated with the GD Connect 4 using an iPCB (interface printed circuit board) that is designed to enable connection to almost any positive displacement air compressor (regardless of make or manufacturer)

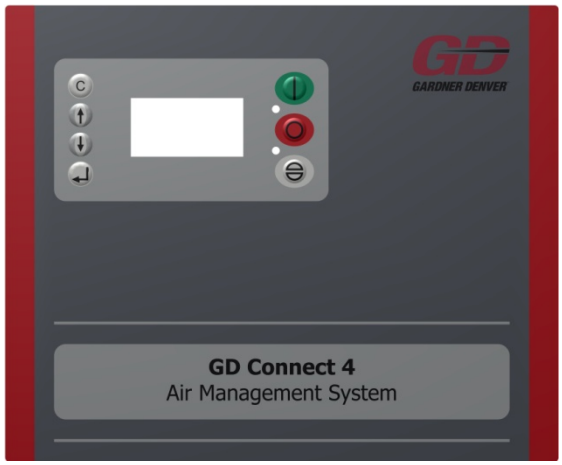
3.5 GD Connect 4 network card options

GD Connect 4 network card options are available.

GD Connect 4 network cards support networking with network protocols not directly supported by GD Connect 4 e.g. MODBUS, Profibus or DeviceNet etc

Section 4: User interface

4.1 Device human interface



4.2 Device keypad assignment

Key: image	Key: Function
	**Start**
	**Stop**
	**Reset**
	**Enter**
	**Up**
	**Down**
	**Escape**

4.3 Device LED assignment

Device Run Indicator (Green LED)

OFF – Not Active, Stopped
Slow Flash: Active, Standby

Mode
ON – Active, Running
Device Fault Indicator (Red LED)

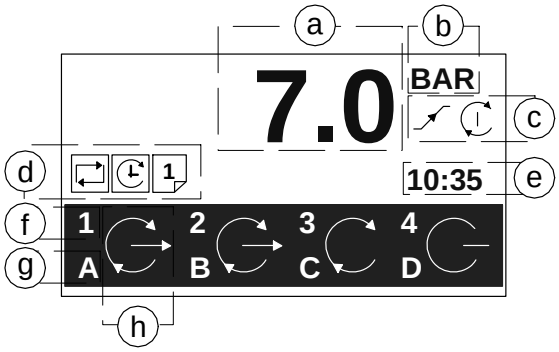
Flash: Shutdown (Trip)
ON – Alarm (Warning)

4.4 Device initialisation

At device initialisation, all display graphic elements and LED indicators are switched on for three seconds (display test mode), the display will then show the software version for a further 3 seconds before initialisation is complete and the default display (Home Page P00) is displayed.

4.5 Device graphical user interface

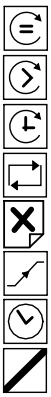
Default mode ('Home Page' P00):



a) System Pressure Value
b) System pressure Units
c) Device Status

Stopped
Standby
Started and Running

d) Device Active Functions



Equal Hours Run
First In First Out
Timer Rotation
Power Failure Auto-Restart
Standby
Pre fill function
Pressure schedule function
Function Inhibited

e) Time
f) Compressor Number
g) Compressor Sequence Assignment
h) Compressor Status

Standby (or Auto Restart)
Running Off load
Running On load
Inhibited from use in Table
Service Maintenance Active
Alarm (Warning)
Not Available (Stopped, Shutdown, Trip)

4.6 'Default mode' navigation

Display Item Structure:

To view status or values, that are not immediately visible on the display screen, press the UP or DOWN key.

'Home Page' P00 items cannot be adjusted.

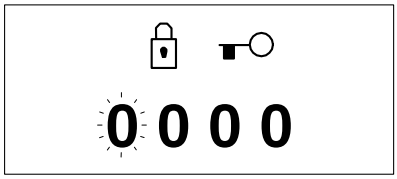
Menu 'Items' can be selected using the UP or DOWN keys at any time. Pressing the ENTER key will lock a selected Item display and inhibit return to the default display. When an Item display is locked the lock key symbol will be shown. To unlock an Item display press UP or DOWN to view an alternative Item display or press RESET or ESCAPE key.

If a message condition occurs the message code becomes the first list item and the display will automatically display the message code. More than one active message code item can exist at any one time and can be viewed by pressing UP or DOWN keys. The most recent 'active' fault will be at the top of the list.

Adjustable value, parameter or option item displays are grouped into 'menu mode' lists. To access 'menu mode' lists an access code must be entered.

4.6 'Menu mode' PIN access code

To access menu mode, simultaneously press the UP and DOWN keys; a PIN access code entry display screen is shown and the first code character will flash.



Use the UP or DOWN keys to adjust the value

of the first code character then press ENTER. The next code character will flash; Repeat for all four code characters.

ⓘ Use 0 if the code is less than 1000. e.g. 0011

To return to a previous code character press ESCAPE. When all four code characters have been set to an authorized code number press ENTER.


Access Code Accepted


Access Code Rejected

An invalid code will return the display to default mode

Access Code Timeout:

When in menu mode, if no key activity is detected for a period of time the access code is cancelled and the display will automatically reset to the default display.

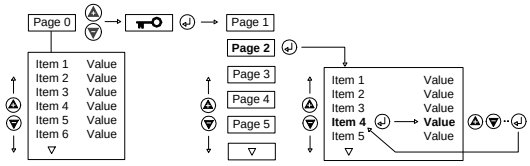
4.7 'Menu mode' navigation:

The menu 'page' number will be highlighted at the top of the display.

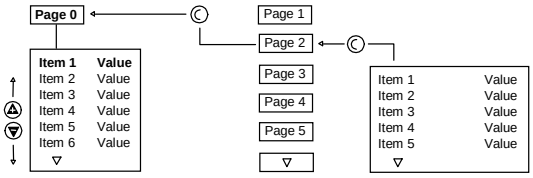
To select a menu 'page' press UP or DOWN. To enter the indicated menu 'page' press ENTER; the first item of the menu 'page' will be highlighted. Press UP or DOWN to scroll though the selected menu 'page' items.

To select an item value or parameters for edit press ENTER; an adjustment screen for the item will be displayed.

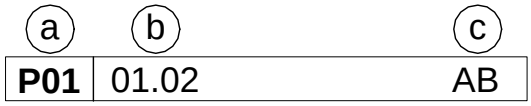
The value or option can now be modified by pressing UP or DOWN. To enter a modified value or options into memory press ENTER.



Press ESCAPE at any time in menu mode to step backwards one stage in the navigation process. Pressing ESCAPE when the page number is flashing will exit menu mode and return the display to default mode.



All menu items have a unique reference consisting of the menu page ID (a) and the menu page item number (b). Each item in a menu also has a unique two alphanumeric character code (c). All three references are visible at the top of every menu item display.



Some menu items may consist of several individual settings. Each setting of the menu item is also referenced as a sub-item number. For example: P01-01.02 references sub-item '02' of menu item '01' in menu page 'P01'. Sub-item settings, where applicable, are always displayed together on the same 'Item' adjustment display screen. Most menu items are single value or single option only in which case the single item is referenced as sub-item number '01' (for example: P01-01.01).

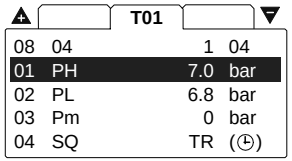
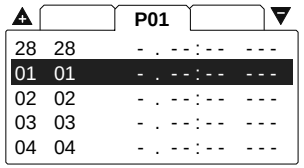
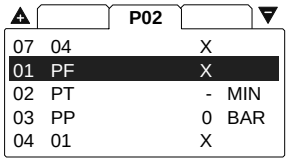
Press and hold RESET for several seconds to immediately exit menu mode and return to the default display.

ⓘ The GD Connect 4 will retain an 'access code' for a short period after menu exit allowing the menu structure to be re-entered without the need to re-enter the access code again. To immediately clear access code retention press and hold RESET for several seconds.

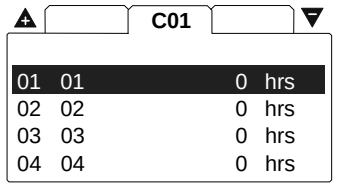
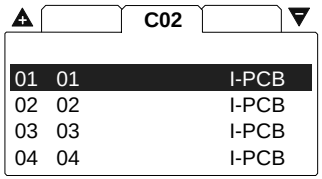
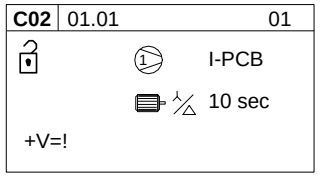
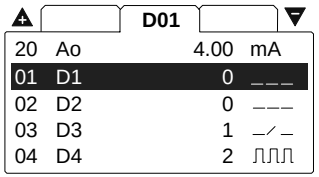
A 'locked' symbol displayed with any item indicates the item is locked and cannot be modified. This will occur if the Item is view only (not adjustable) or in instances where the item cannot be adjusted while the GD Connect 4 is in an operational state; stop the GD Connect 4 first.

4.8 Menu mode map (Display menus will vary based on device configuration)

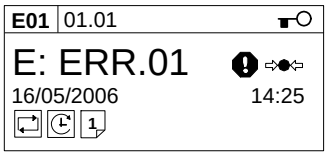
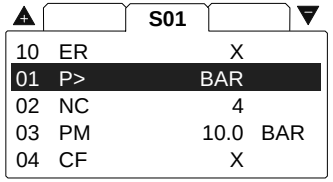
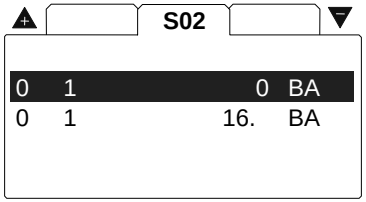
Access key:	Code: 0011	Code: 0032

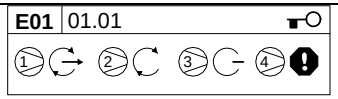
T01 – CONFIG	TO1 – CONFIG Display and Description	P01 – Pressure schedule	P01 – Pressure schedule Display and Description	P02 – Pre fill CONFIG	P02 – Pre fill CONFIG Display and Description
01 High pressure set point	 **PH** = High Pressure Set Point. The 'upper' or 'unload' pressure set point that will be used when the GD Connect 4 is started or active.			**01** Pre fill Function	 **PF** = Pre fill Function. Determines the 'Pre fill' strategy or function that will be used at equipment start up. X = OFF √ = Back up mode √ [!→X] = Standard mode
02 Low pressure set point	**PL** = Low Pressure Set Point. The 'lower' or 'load' pressure set point that will be used when the GD Connect 4 is started or active.			**02** Pre fill time	**PT** = Pre fill time. Sets the maximum time allowed for system 'Pre fill' during equipment start up
03 Minimum pressure alarm	**Pm** = Minimum Pressure Alarm. The minimum pressure 'Warning' or 'Alarm' level that will be used when the 'Table' is active.			**03** Pre fill pressure	**PP** = Pre fill Pressure If pressure is at, or above, this setting at equipment start up the pre fill function will be ignored
04 Rotation mode	**LR** = Control strategy. The active control strategy that will be used when the GD Connect 4 is started or active. **Equal hours run**			**04** Compressor 1	**01 ~ 04** = Compressor 1 to 4 The function of compressor 1 to 4 during the 'Pre fill' period.

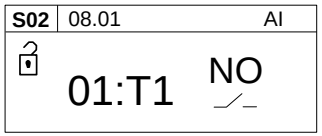
	First in first out **Timer rotation**				╳ = Do not use √ = Use for primary pre fill ! = Use for emergency pre fill
05 Comp 1 priority config	**01** = The 'priority' setting for compressor 1			**05** Compressor 2	
06 Comp 2 priority config	**02** = The 'priority' setting for compressor 2			**06** Compressor 3	
07 Comp 3 priority config	**03** = The 'priority' setting for compressor 3			**07** Compressor 4	
08 Comp 4 priority config	**04** = The 'priority' setting for compressor 4				
09 Clock set	**Ct** = Real time clock set (Hours, Minutes, Date, Month, Year) The 'Day of the Week' (1= Monday to 7=Sunday) is automatically calculated and set in accordance with the Day, Month and Year.				
10 Pressure schedule enable	**PS** = Pressure schedule enable / inhibit: ╳ = inhibit pressure schedule √ = enable pressure schedule				
11 Auto Restart enable	**AR** = Power failure auto restart enable / inhibit: ╳ = inhibit auto restart √ = enable auto restart The GD Connect 4 will only automatically restart when power is restored if the GD Connect 4 was in an operational (i.e. Started) when the power loss or disruption occurred				
12 Rotation interval	**RP** = Rotation interval Sets the equipment 'Rotation' interval or time.				

13 Display backlight level	**BL** = Display Backlight Adjust Adjustable: 1 to 7, default = 5 The display will temporarily increase brightness by 2 levels when a key is pressed and return to default setting after a period of no keypad activity.				
C01 – Comp run hours	**C01 – Comp run hours** **Display and configuration**	**C02 – Comp CONFIG**	**C02 – Comp CONFIG** **Display and configuration**	**D01 – Diagnostics**	**D01 – Diagnostics** **Display and description**
01 Comp 1 run hours **02** Comp 2 run hours **03** Comp 3 run hours **04** Comp 4 run hours	 **01 ~ 04** = Record of detected 'running' hours for each compressor. The run hour's value can be manually adjusted, at any time, to match the actual running hours of each compressor.	**01** Comp 1 config **02** Comp 2 config **03** Comp 3 config **04** Comp 4 config	  **I/O config:** Delcos1000, 3000, 3100L, R, DH, Miniscan, Surescan, Hydrovane, Airpilot, Digipilot, Smartpilot, Airbus485™, iPCB I/O **Start time:** Configure to match the time taken between a compressor stopped state to a compressor load state (typically main motor star delta time).	**01** Digital input 1 **02** Digital input 2 **03** Digital input 3 **04** Digital input 4	 The GD Connect 4 is equipped with comprehensive diagnostic functions. Each input can be examined individually and each output can be manually activated or manipulated individually. **Digital inputs:** ⎯⁄⎯ = OFF (open circuit) ⎯⎯⎯ = ON (closed circuit) ⎍⎍⎍ = Pulsing The pulse signal from an 'i-PCB' is 0V to 24VDC at 50/60Hz. A typical DC voltage meter, or multi meter, will detect this as 12VDC +-4V. **Relay outputs:** Each relay output can be energised and de-energised manually by selecting it. Use UP (plus) and DOWN (minus) to

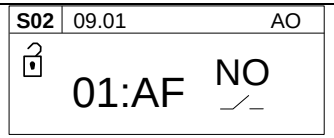
			This time is used by GD Connect 4 for 'staggered starting' of multiple compressors. An accurate value is important. **iPCB alarm input:** The voltage detection function for the 'i-PCB' Alarm input can be inverted **+V=!** An Alarm condition is generated if the 'i-PCB' Alarm input detects a voltage between 12-250Vac/dc (default). **0V=!** An Alarm condition is generated if the 'i-PCB' Alarm input detects no voltage.		adjust and ENTER. **Analogue Inputs:** The item will alternate between the detected value and the electrical measurement on the controller input terminals. An independent measuring device can be used to check the displayed electrical measurement. **A1**: System Pressure, 4-20mA **A2**:Digital Input #9, voltage **A3**:Auxiliary Digital Input, voltage A2 and A3 on GD Connect 4 are configured for use as digital inputs **Analogue Output:** The analogue output can be manually adjusted. Use UP (plus) and DOWN (Minus) to adjust and ENTER. The output will return to normal operational value upon menu exit.
				05 Digital input 5	
				06 Digital input 6	
				07 Digital input 7	
				08 Digital input 8	
				09 Digital input 9	
				10 Digital input 10	
				01 Relay output 1	
				12 Relay output 2	
				13 Relay output 3	
				14 Relay output 4	
				15 Relay output 5	
				16 Relay output 6	
				17 Analogue input 1	
				18 Analogue input 2	

				19 Analogue input 3	
				20 Analogue output 1	
E01 – Error Log	**E01 – Error Log** **Display and description**	**S01 - Configuration**	**S01 – Configuration** **Display and description**	**S02 – Sensor calibration**	**S02 – Sensor calibration** **Display and description**
01 Error log 1 ... **15** Error log 15	 Presented in chronological order **Entry 01** = most recent Each error log item will show the error code. To view details for the selected error log item press ENTER. The first information display shows the:  a) **The Error Code** b) **Any Error Code symbol** c) **The Error date** d) **The Error time** e) **The active operational** functions of the GD Connect 4 at the time the error occurred; (see: GD Connect 4 Status Display) To return to the main error log menu screen press ESCAPE. To view the second information screen press ENTER.	**01** Pressure units	 **P>** = Display pressure units: BAR, PSI, kPA	**01** Pressure offset	 **1O** = Pressure sensor offset
		02 Number of compressors	**NC** = Configures the number of compressors connected to, and controlled by, the GD Connect 4. This value must be configured during commissioning.	**02** Pressure range	**1R** = Pressure sensor range Configuration: Initially set the 'Offset' (minimum) to the minimum or lowest pressure value for the sensor. Set the 'Range' (maximum) to the maximum or highest value for the sensor. Calibration: a) Offset: Expose the sensor to atmosphere and adjust the 'offset' setting (if necessary) until the detected pressure display shows 0.0bar (0psi). b) Range: Apply an accurately know pressure to the pressure sensor and adjust the 'Range' setting until the detected pressure display matches the applied pressure. An applied pressure equal too, or greater than, the nominal system working pressure is recommended.

	 The operational status of each compressor, at the time the error occurred, is displayed symbolically (see: Compressor Status Displays). To return to the first information screen press ENTER or ESCAPE.				ⓘ The detected pressure is displayed with the calibration menu item and will change to match the new calibration setting as the setting is adjusted. ⓘ There is no need for the applied pressure to be static; it can be dynamic and changing. This enables calibration to be carried out on a fully operational system where changing system pressure can be accurately verified from another source. ❗ Correct pressure sensor set-up and calibration is critical for successful system operation. It is recommended that pressure sensor calibration is examined, and adjusted if necessary, annually or a pre-determined routine periodic basis.
		03 Maximum pressure alarm	**PM** = Maximum Pressure Alarm High pressure 'Fault' level. This value remains active at all times. Set just below system pressure relief value(s) and below the maximum system pressure rating of all air system components		
		04 Stop control function	**CF** = Stop Control Function Determines if the GD Connect 4 maintains control of the compressors when the GD Connect 4 is stopped. X = Return to local √ = Maintain control		

			(maintains GD Connect 4 control and continuously holds equipment 'off load')		
		05 Tolerance	**TO** = Tolerance: The pressure control 'Tolerance' band setting.		
		06 Damping	**DA** = Damping The pressure control 'Damping' setting.		
		07 Auxiliary input function	 **AI** = The function of the Auxiliary input. **TS** = Override > Standby **SS** = Remote Start/Stop ** **AA** = Remote Alarm (always active) **AR** = Remote Alarm (active when unit running, inhibited when unit stopped or in Standby) **TA** = Remote Trip (always active) **TR** = Remote Trip (active when unit running, inhibited when unit stopped or in Standby) ⎍ **NO** (Normally Open): The selected function is activated when the input is closed circuit (input terminals are connected together by remote volt-free contacts)		

			NC (Normally Closed): The selected function is activated when the input is open circuit (input terminals are open circuit) ** Remote Start/Stop Remote Start and Stop commands are activated by a 'change of state' of the Auxiliary input (a transition from open circuit to closed circuit or vice versa). The local panel Start and Stop functions remain active; both local and remote Start/Stop functions will function. The most recent command, from a local or remote source, will override any previous command, from a local or remote source. The Remote Start/Stop function can be selected for normally open (NO) or normally closed (NC) operation. For 'fail safe' operation select normally closed (NC); the GD Connect 4 will start if the Auxiliary input changes state from 'open circuit' to 'closed circuit' and stop if the input changes state from 'closed circuit' to 'open circuit'. Any remote cabling or switch contact failure that results in an open circuit condition will stop the GD Connect 4.		
		08 Auxiliary output function			

			 **AO** = Auxiliary Output Function: **AF** = Any Fault Any Alarm (Warning), Shutdown (Trip) or Compressor Not Available. **AT** = Any Trip any Shutdown (Trip) or Compressor Not Available. **CF** = Compressor Fault Any compressor Alarm (Warning), Shutdown (Trip) or Not Available **CA** = Compressor Alarm. Any compressor Alarm (Warning) **CT** = Compressor Trip. Any compressor Shutdown (Trip) or Not Available **SF** = System Fault Any unit Alarm (Warning) or Shutdown (Trip) **ON** = System On Unit Started and Active, including Pre-Fill period and Standby (not active when unit stopped) **SA** = System Active Unit Active, including Pre-Fill period (not active when unit stopped or in standby) **SP** = System Pressure Control Active Unit Active excluding Pre-Fill (not active when unit stopped, or in standby, or in Pre-Fill mode) **LP** = Low Pressure Alarm		

			HP = High Pressure Alarm **PO** = Pressure Control Override Normal, or Pressure Schedule' operation is being manually overridden ⎯/⎯ **NO** (Normally Open): The auxiliary output relay contacts are normally open and will close circuit when the set function is active or true. ⎯⎯ **NC** (Normally Closed): The auxiliary output relay contacts are normally closed and will open circuit when the set function is active or true; or in the event of a GD Connect 4 shutdown or power supply disruption. (!) The contacts of the Auxiliary output relay are rated for 115V (UL), 240V (CE), at 5 Amps maximum.		
		09 Error log reset	**ER** = Error log reset Clears and resets the 'Error Log'. Adjust the item setting to '**RST**' and press ENTER. The setting will return to normal and all existing entries in the error log will be permanently deleted.		

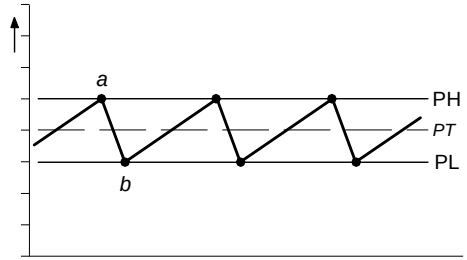
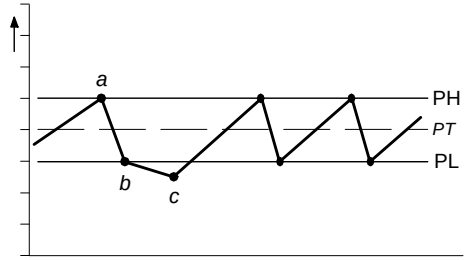
5.0 GD Connect 4 commissioning procedure

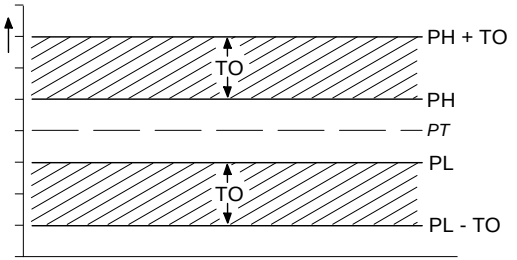
Procedure	Description	Additional information
General	When commissioning the GD Connect 4, carry out the following procedures before attempting to start the device. **Physical Checks...** Before applying power to the GD Connect 4 ensure that the power supply connections are correct and secure and that the operating voltage selector is set correctly for the power supply voltage in use; 115Vac or 230Vac (+-10%), 50/60Hz. Open the front panel of the GD Connect 4 and check the location of the link wire(s) connected to the 'Voltage Selection' terminals of the power supply PCB. If necessary, change the link wire locations to those illustrated for the voltage in use Switch the power supply to the GD Connect 4 ON The control program identification will be displayed for a short period followed by the default mode display Check the displayed system pressure. If the pressure is incorrect, or inaccurate, check the type and range of the sensor and carry out the pressure sensor commissioning and calibration procedure described in menu mode S02 of the menu mode map. **Unit configuration...** Before successful basic operation can be established the following parameters must be set **in the order shown** to suit installation requirements:  Features and Functions; Menu Items **S01 - NC** Number of Compressors **S01 - PM** Maximum Pressure Alarm **S01 - CF** Stop Control Function **C02 – 01/04** Compressor #1-4 Configuration **C01 - 01/04** Compressor #1-4 Running Hours **T01 - PH** High Pressure Set Point **T01 - PL** Low Pressure Set Point	It is recommended that an authorised and trained product installer carry out commissioning

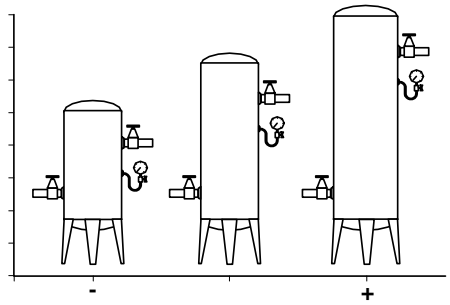
	T01 - Pm Minimum Pressure Alarm **T01 – LR** Control strategy **T01 – 01/04** Compressor #1-4 Priority **T01 - Ct** Real Time Clock Set **T01 - AR** Auto Restart Enable **T01 - RP** Rotation Interval Installation requirements may also involve the implementation of additional or optional functions and features; implement as required.	

6.0 Glossary of features, functions and terms used

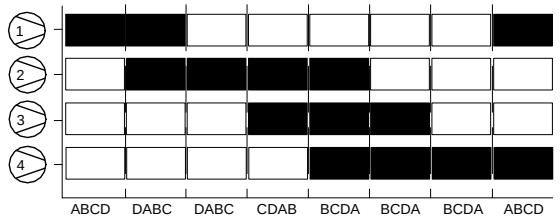
Function	Description	Additional information
Sequence control strategy	The GD Connect 4 provides three basic sequence control strategies or modes. Each sequence control strategy consists of two sub strategies: 1) The compressor 'Rotation' strategy 2) The compressor load 'Control' strategy	
Compressor rotation strategy	The 'Rotation' strategy defines how the compressors are re-arranged, or re-ordered, in to a new sequence at each routine 'Rotation' event. Rotation events are triggered by a cyclic interval time, a set time of day each day, or a set time of day once a week.	
Compressor load control strategy	The compressor load 'Control' strategy defines how the compressors are utilised in response to variations in system pressure. Compressor Sequence Arrangements: Each compressor in a system is initially assigned to the GD Connect 4 with a fixed and unchanging number reference, 1 to 4. The 'duty' that a compressor is assigned in any set 'Rotation' sequence arrangement is defined by a letter, A to D. A = the 'Duty' compressor, the first to be utilised. B = The 'Standby' compressor, the second to be utilised. C = The 'Second Standby' compressor, the third to be utilised. D = The 'Third Standby' compressor, the forth to be utilised.	

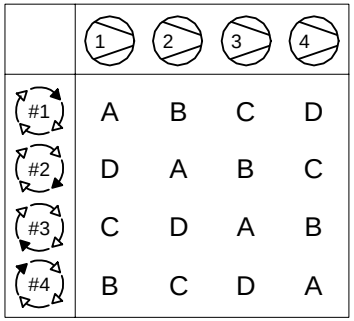
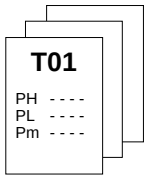
	Compressor ‘duty’ assignments are reviewed, and re-arranged as appropriate in accordance with the selected rotation strategy, at each rotation event.	
Compressor identification	Each compressor connected to the GD Connect 4 will have a unique assigned compressor identification number; starting at compressor 1 increasing sequentially to the number of compressors connected to the GD Connect 4.	
Pressure control	The primary function of the GD Connect 4’s pressure control strategy is to maintain system pressure between the ‘High Pressure’ set point (PH) and the ‘Low Pressure’ set point (PL) in conjunction with targeting optimum achievable system energy efficiency. The GD Connect 4 calculates a ‘Target’ pressure level, the mid-point between the two set points (PT), which is used as the nominal ‘target’ pressure level for the system. When system pressure increases to the High Pressure set point (a) a compressor is unloaded. Pressure is allowed to decrease to the Low Pressure set point (b) before a compressor is loaded again to add capacity output and increase pressure. This process will continue under a steady demand for air in a continuous stable cycle. If demand for air is abruptly, or significantly, increased, and the capacity output of the compressor loaded at the Low Pressure set point (b) is insufficient, the pressure will continue to decrease at a reduced rate. The GD Connect 4 will accommodate for this event by loading an additional compressor. The instance at which the additional compressor is loaded (c) is dynamically calculated and is determined by the rate of pressure decrease and the acceptable deviation of system pressure from the normal control limits. The same method is implemented in reverse (above the High Pressure set point) when an abrupt, or significant, decrease for air demand is experienced. Rate of change of pressure, and the stability of pressure control, is largely determined by system volume and the scale, and/or abruptness, of air demand fluctuations; these characteristics will differ from installation to installation. To accommodate for variations in installation characteristics the ‘Tolerance’ pressure level (TO) and an influence on the dynamic reaction time (or ‘Damping’) of the GD Connect 4 (DA) is adjustable.	 

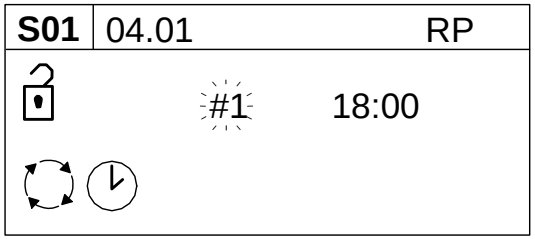
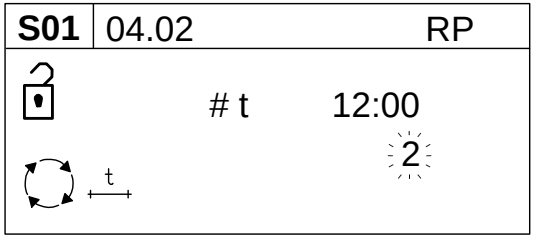
Tolerance	Tolerance is a pressure limit above and below the set pressure control levels that accommodates for an exceptional instance of abrupt and/or significant increase, or decrease, in demand without compromise to optimal energy efficient control. Tolerance (TO) is expressed as a pressure defining the width of the tolerance limit. For example; a tolerance setting of 3psi (0.2bar) means the GD Connect 4 will implement appropriate optimal energy efficient response(s) during a deviation of pressure 3psi below the set PL pressure level. If pressure ever deviates beyond the 'tolerance' limit the GD Connect 4 will proportionally increment an emergency response, abandoning optimum energy efficiency, until pressure is returned to normal levels. If system volume is inadequate, and/or demand fluctuations are significantly large, it is advisable to increase the 'Tolerance' band to maintain optimum energy efficiency, and reduce over-reaction, during such transition periods. If system volume is generous, rate of pressure change is slow and demand fluctuations are insignificant and gradual, the 'Tolerance' band can be reduced to improve pressure control without compromise to optimum energy efficiency.	
Damping	In situations where the loading of an additional compressor, at the PL pressure set point, is inadequate to match a significant and/or abrupt increase in air demand the additional reaction of the GD Connect 4, while pressure deviates into the 'tolerance' limit, is dynamically calculated. The time before an additional compressor is loaded, to increase generation capacity further, will vary in accordance with the urgency of the situation. The GD Connect 4's dynamic reaction algorithm is pre-set by default to accommodate for the majority of installation characteristics. In some situations, of which the following are examples, the rate of pressure change may be aggressive and disproportionate: a) Inadequate system volume b) Excessive air treatment equipment pressure differential c) Inadequately sized pipe work d) Delayed compressor response In such instances the GD Connect 4 may over-react and attempt to load an additional compressor that may not be necessary once the initial compressor is running, loaded, and	

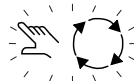
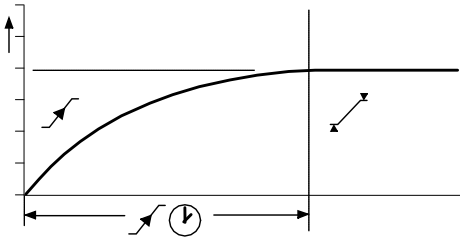
	able to contribute adequate additional generation capacity. If an increase in the 'tolerance' band is insufficient, the GD Connect 4's dynamic reaction response can be influenced by increasing the 'Damping' factor (DA) reducing tendency to over-react. The 'Damping' factor is adjustable and scaled from 0.1 to 10 with a default factor of 1. A factor of 0.1 equates to 10 times faster than default and a factor of 10 equates to 10 times slower than default.	
System volume	Pressure control of a system is a 'feedback loop' response derived from increasing, or decreasing, air generation output capacity. If output capacity is greater than demand for air the pressure in a system will increase, if demand is greater than output capacity system pressure will decrease. The rate of change of pressure to changing generation and demand capacity situations is largely dependent on system volume. If system volume is small in comparison to recommended size the rate of change of pressure will be fast and abrupt inhibiting effective control and compromising optimum system energy efficiency. If system volume is large the rate of change of pressure will be slow and gradual. In this instance an enhanced control of pressure can be achieved, the system response times can be reduced and optimum system energy efficiency will generally be increased as a result. The rule below provides an approximation for recommended minimum system volume: 1) For systems comprising of fixed capacity output (or fixed speed) compressors: **$m^3 = (m^3/min) / (bar.g - 1)$** (!) *The approximation only works in metric units; convert psi and ft^3 to metric units first.* 1.0 m^3 = 35.315 ft^3 1.0 m^3/min = 35.315 cfm 1.0 bar = 14.5 psi Example: for a system that operates with a maximum normal demand air flow of 36m^3/min at a nominal pressure of 7.0bar = 36m^3/min / (7.0bar – 1) = 6.0 m^3 (*212 ft^3*) 2) For systems consisting of variable output capacity (or variable speed) compressor(s) the system volume should be doubled. **$m^3 = 2 \times ((m^3/min) / (bar.g - 1))$**	

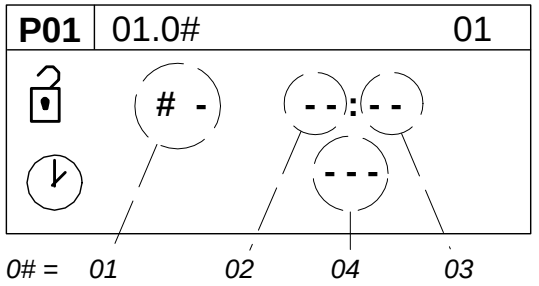
Equal Hours Run Mode	The primary function of EHR mode is to maintain a close relationship between the running hours of each compressor in the system. This provides an opportunity to service all compressors at the same time (providing the service interval times for all compressors are the same or similar). ⓘ EHR is not an energy efficient focused mode of operation. Rotation: Each time the rotation interval elapses, or the rotation time is reached, the sequence order of compressors is reviewed and re-arranged dependant on the running hours recorded for each compressor. The compressor with the least recorded running hours is assigned as the 'duty' compressor; the compressor with the greatest recorded running hours is assigned as the 'last standby' compressor. For systems with more than two compressors, the remaining compressor(s) are assigned in accordance with their recorded running hours in the same way. Example: The compressors in a four-compressor system have the following recorded running hours at the 'Rotation' time. Compressor 1 = 2200 hrs Compressor 2 = 2150 hrs Compressor 3 = 2020 hrs Compressor 4 = 2180 hrs The new sequence order arrangement after a rotation event would be: Compressor 1 = D Compressor 2 = B Compressor 3 = A Compressor 4 = C Compressor 3, which has the least recorded running hours, will now be utilised to a greater extent in the new sequence arrangement; potentially increasing the running hours at a faster rate. The GD Connect 4 continuously monitors the running status of each compressor and maintains a record of the accumulated running hours. These are available, and adjustable,	

	in the GD Connect 4's compressor running hour's menu. The GD Connect 4 uses these values in EHR mode. The GD Connect 4's running hours record should be routinely checked, and adjusted if necessary, to ensure a close match with the actual run hours displayed on each compressor. (!) If a compressor is operated independently from the GD Connect 4 the running hours record may not be accurately updated. (!) The running hours meter display on most compressors are intended for approximate service interval indication only and may deviate in accuracy over a period of time. Control: Compressors are utilised, in response to changing demand, using a 'FILO' (First In, Last Out) strategy. The 'duty' compressor (A) is utilised first followed by (B) if demand is greater than the output capacity of (A). As demand increases (C) is utilised followed by (D) if demand increases further. As demand reduces (D) is the first compressor to be unloaded, followed by (C) and then (B) if demand continuous to reduce. The last compressor to be unloaded, if demand reduces significantly, is (A). The compressor assigned as (A) in the sequence is the first to be loaded and the last to be unloaded.	
First In First Out Mode	The primary function of FIFO mode is to keep a compressor in a loaded condition for the maximum amount of time, dependant on demand fluctuations, while continuously sharing regulation and utilisation among the available compressors. (!) FIFO is not an energy efficient focused mode of operation. FIFO mode does not follow a fixed rotation interval, or set rotation time. Compressors are rotated at each load event. The 'Rotation' strategy also becomes the 'Control' strategy in this mode. Initially compressor 1 is loaded. As demand increases compressor 2 is loaded. If demand reduces compressor 1 is unloaded and compressor 2 is allowed to remain loaded for a longer period. If demand increases again compressor 3 is loaded followed by compressor 4 as demand continues to increase. If demand reduces compressor 2, the compressor that has been loaded for the longest period, is unloaded first followed by compressor 3 if demand continuous to reduce. If demand increases again compressor 1 will be loaded, this strategy continuous in a cyclic pattern.	

	At each load event the compressor that has just been loaded becomes (A), the compressor that has been loaded for the longest period becomes (D) and is the next compressor to be unloaded if demand decreases.	
Timer Rotation Mode	The primary function of Timer Rotation mode is to efficiently operate a compressed air system consisting of fixed capacity output compressors. The routine rotation assignments can be modified using 'Priority' settings to accommodate for a differentially sized or variable capacity output compressor(s). Rotation: Each time the rotation interval elapses, or the rotation time is reached, a sequence rotation occurs and the sequence assignment for each compressor is re-arranged. The compressor that was assigned for duty (A) is re-assigned as last standby (D) and all other compressor assignments are incremented by one. The sequence assignment pattern can be modified by 'Priority' settings.	
Priority settings	The GD Connect 4 operates priorities in accordance with settings that are configured into menu mode T01 parameters: 1) PH: High pressure set point 2) PL: Low pressure set point 3) Pm: Minimum pressure warning level 4) LR: Load strategy 5) 01: Compressor 1 Priority setting 6) 02: Compressor 2 Priority setting 7) 03: Compressor 3 Priority setting 8) 04: Compressor 4 Priority setting (!) The 'maximum' pressure fault level and the rotation interval, or rotation time, are set independently in a configuration menu. Pressure Change Time: When pressure set points change the GD Connect 4 will increase, or decrease, the pressure target levels towards the new settings in a gradual transition over a period of time.	

	This feature is intended to allow the system to react to changes in pressure target levels in a smooth and energy efficient manner without abrupt overreaction. The time the system will take to complete the transition from one pressure target to another is determined by the 'Pressure Change' time (PC). This value can be adjusted to accommodate installation characteristics to achieve the transition at optimal energy efficiency. If the GD Connect 4 is able to achieve the transition without compromising energy efficiency in a shorter time than set, the pressure change event time will be automatically reduced. (!) An aggressively short time setting will compromise system optimal energy efficiency.	
Sequence rotation	A sequence 'Rotation' event can be automatically triggered on a routine basis using a pre-determined interval, a pre-determined time each day or a pre-determined day and time each week. Enter the rotation period menu item (RP); the 'day' setting will flash. Select the 'day' or day function as required: **#1** = Monday to **#7** = Sunday **#8** = each day of the week, excluding Saturday and Sunday **#9** = each working day of the weekly (Monday through Friday inclusive) **#-** (dash) = deactivate Select the required hour and minutes of the day(s) using the same method. (!) A day starts at 00:00hrs and ends at 23:59hrs (24hr clock system). t To define an interval time (more than one rotation event a day) select '**#t**' for the day function and press Enter An 'intervals per day' value will appear and flash. Select the required number of rotation events per day (1 to 96). The hour and minutes display will now show the interval time between each rotation event; 1 = every 24hrs to 96 = every 15 minutes (example: 2 = every 12hrs).	 

	ⓘ The first automated rotation event each day will occur at 00:00hrs and then every set rotation interval time throughout the day.	
Manual sequence rotation	The sequence assignment can be manually rotated at any time. When viewing the 'Sequence Rotation' information screen press Enter The manual rotation symbols will appear and flash. Press Enter to execute a manual rotation or Escape to abandon the manual rotation. Automated sequence rotation is not disrupted by a manual rotation; the next scheduled automated sequence rotation event will still occur.	
Pre fill	The Pre fill feature provides a controlled and energy efficient method of increasing pressure to normal operating levels at system start. This feature avoids the inefficient potential for all available system compressors to start and load before pressure reaches the normal operating level. At system start (manual start or automated start from standby) the GD Connect 4 will only load compressors that have been pre-set for pre fill operation, for a pre-set period of time. The pre fill time (PT) can be adjusted to suit system characteristics. The aim is to increase pressure to normal operational levels, using only the pre-determined compressors, prior to the pre fill time expiring. If normal operational pressure is reached prior to the set pre fill time, the pre fill function will automatically cease and normal operational control begin. If normal operational pressure is not reached by the end of the pre fill time the GD Connect 4 will utilise as many available compressors as required to achieve normal operational pressure as quickly as possible. Normal operational control will then begin. Two pre fill modes are available; both function in the same way but differ in response to a failure, or loss, of a pre fill compressor. √ Backup Mode: Compressor(s) can be pre-selected as 'Primary Pre fill' compressor(s) or 'Backup Pre fill' compressor(s). If a primary pre fill compressor experiences a shutdown, or is stopped, it is replaced by a pre-defined backup compressor and pre fill continues. √ [!→X] Standard Mode: If one or more of the pre-defined pre fill compressors	

	experiences a shutdown, or is stopped, the pre fill function is cancelled and normal operation begins. (!) To manually skip Pre fill mode, press and hold START for several seconds.	
Pressure schedule	The GD Connect 4 is equipped with a real time clock feature and pressure schedule facility. The 'Pressure Schedule' function can be used to provide automation of the system. The pressure schedule consists of 28 individual settings that instruct the system to change from one target system pressure to another, or put the system in to 'Standby' mode, dependant on time of day and day of the week. The pressure schedule will cycle from 00:00 hours Monday (day #1) to 23:59 hours on Sunday (day #7) each calendar week. 01) Day of the Week #1 = Monday to #7 = Sunday #8 = every working day of the week; Monday to Friday, excluding Saturday and Sunday. #9 = every working day of the week. (!) Select "-" (dash) and enter to delete a setting from the schedule. 02) Hours; time of day (24hr format) 03) Minutes; time of day 04) The required table, T01 to T03, or "-X-" = Standby (unload all compressors). Adjust the 'day of the week' sub-setting first and then press ENTER to increment to the next setting. Repeat until all item sub-settings are entered. The complete 'Pressure Schedule' item will not be set in GD Connect 4 memory until the last sub-setting is entered. Press ESCAPE to step back one sub-item if required. Pressure Schedule menu item settings are automatically arranged and presented in chronological order (Monday to Sunday). When an 'empty' item setting is set-up and entered, the menu item number (01 to 28) may automatically change; this is normal. The 'Pressure Schedule' can be overridden, at any time, from the remote input using the auxiliary input facility or enabled/disabled from a single User menu setting (PS).	
Aux input function	The GD Connect 4 is equipped with an auxiliary input. The function of the input is menu selectable and can be adapted for differing application requirements. The input is designed	

	to detect a remote 'volt-free' switching contact (rated for a minimum 24VDC @ 10mA). See menu mode S01	
Aux output function	The GD Connect 4 is equipped with a remote relay contact output. The function of the output is menu selectable and can be adapted for differing application requirements. The remote output relay contacts are rated for 240V '***CE***' / 115V '***UL***' @ 5A maximum. See menu mode S01	
Stop	To stop the GD Connect 4 press Stop. The GD Connect 4 will respond dependant on set-up: PC=0) Pressure regulation control is automatically transferred back to each compressor. The compressor(s) will continue to operate using the pressure settings programmed or set in the individual compressor controller(s). PC=1) The GD Connect 4 will hold each compressor in an offload state. If the compressor is equipped with a main motor run-on-time function the compressor will run offload for a period of time and then stop in to a 'standby' or 'auto restart' state. (!) The design of some air compressor control systems may inhibit automatic transfer of pressure regulation control to local operation mode. In this instance the compressor will not continue production of compressed air – consult the air compressor manual or your air compressor supplier / specialist for details before installing the GD Connect 4.	
Start	To start the GD Connect 4 press Start. If the Pre fill function is enabled, and system pressure is below the set pre fill pressure, the system will enter Pre fill mode for the set Pre fill time. (!) To manually skip the Pre fill function, press and hold Start for several seconds. When Pre fill is complete, if applicable, the GD Connect 4 will enter normal operating mode. The GD Connect 4 will operate in accordance with the parameters and options set.	
Power failure auto restart	If the power failure auto-restart function is enabled the GD Connect 4 will automatically start, when power is restored after a disruption or failure, if the GD Connect 4 was in a 'started' state when the power disruption or failure occurred.	

	The GD Connect 4 will not automatically restart if the GD Connect 4 was in a stopped state when the power disruption or failure occurred.	
Failure mode	If the GD Connect 4 experiences a disruption to normal control, or a GD Connect 4 shutdown fault occurs, pressure regulation control is automatically transferred back to each compressor. The compressor(s) will continue to operate using the pressure settings programmed or set in the individual compressor controller(s).	
Reset	To reset a GD Connect 4 Alarm (Warning) or Shutdown condition press Reset. Compressor Alarm (Warning) conditions are automatically reset when the condition has been resolved and reset on the compressor. Compressor Not Available (Shutdown, Trip) conditions are automatically reset when the condition has been resolved and reset on the compressor; and the compressor has been restarted	

6.1 Glossary of Original User Manual language codes

Code	Language
CZ	Czech
DE	German
DK	Danish
EN	English
ES	Spanish
FI	Finnish
FR	French
IT	Italian
NL	Dutch
NO	Norwegian
PT	Portuguese
RU	Russian
SE	Swedish

6.2 Glossary of message codes

Message code	Description	Additional information

General	In the event of a unit or system ‘Fault’ the GD Connect 4 will display a message code. If more than one ‘active’ message code occurs, each will be displayed as a separate item; press UP or DOWN to view all active message codes or to view the normal status display.	
Message code types	Message codes are separated in to unit faults ‘**ERR**’ and system Alarms (Warning) ‘**SYS**’. Each message type has a unique numeric code. **ERR.01** Pressure Sensor **ERR.04** Internal 24V Fault **ERR.05** Emergency Stop **ERR.06** Real Time Clock Error **SYS.01** Excess Pressure (PM) **SYS.02** Min Pressure (Pm) **SYS.04** Insufficient Capacity **SYS.05** Remote Alarm (Warning). Auxiliary Input Function ‘AA’ **SYS.06** Remote Alarm (Warning). Auxiliary Input Function ‘AR’ **SYS.07** Remote Trip (Shutdown). Auxiliary Input Function ‘TA’ **SYS.08** Remote Trip (Shutdown). Auxiliary Input Function ‘TR’ Compressor fault states are displayed as part of the normal operational status display and do not generate fault codes. Examine the applicable compressor unit to establish the nature or description of the detected fault condition.	Alarm (Warning) Shutdown (Trip)
Other message codes	Other message codes: **E0836** PLL Unlock; Internal failure or excessively high external electrical interference **E0866** Controller internal power supply fault **E5000** Internal memory map error **E5001** Internal memory failure	

Display software version	To Display the Software Version: Press and hold Reset then press Escape. **The clock time display will change to show the software version ID (example: "E01")**	

6.3 Glossary of Controller ID's supported via RS485 (airbus485™ or MODBUS)

Controller ID	GD Connect 4 port assignment	Additional information
Airbus485™	X06	Some Gardner Denver, CompAir or Hydrovane products support the Airbus485™ protocol. Other air compressor types may also support the Airbus485™ protocol. Where applicable, use this setting to connect to an Airbus485™ compatible air compressor controller.
Airpilot	X06	
Delcos1000	X06	
DelcosProL	X08 of Airmaster T1	
Delcos3000	X08 of Airmaster T1	
Delcos3100DH	X08 of Airmaster T1	
Delcos3100L	X08 of Airmaster T1	
DelcosXL – L	X08 of Airmaster T1	
Digipilot	X06	
HydrovaneS1	X06	
Miniscan	X06	
Smartpilot	X06	
Surescan [1]	X06	

[1] Assumes Surescan has Airbus485™ capability. Some older Surescan products may not support Airbus485. If Airbus485 is not supported use iPCB.

7.0 Help and support

Help and support is available where necessary. Please following the following help and support guidelines before contacting us for help and support

7.1 What you need to do before seeking help and support

Before you go for help and support there's a number of checks you need to perform and some important information you will need...

Checks / Information	Additional information
Review your physical	Check the integrity of the physical installtion with the documentation provided with GD Connect 4

installation and software configuration before seeking help!	Check the integrity of the physical installtion between any iPCB(s) and its host air compressor Check our website and support resources for compressor iPCB connectivity drawings (www.ipcbcomp-connection.info) Check the integrity of the physical installtion of any iPCB(s) between the iPCB and GD Connect 4 Review the RS485 communication port assignment and configuration for the host air compressor controller ID (see 6.3) Review the host air compressors user manual for RS485 port assignment and configuration Be aware that GD Connect 4 is capable of operating both Airbus485™ and MODBUS networks simultaniously! Check the integrity and continuity of all RS485 network(s) Check the integrity and continuity of all electrical connections Check the integrity of the software configuration with thew original user manual
Physical installation	If you require help and support relating to the integrity of a physical installtion it is important that you have a comlete device and device system wiring diagram available in electronic format. You will likely be asked to email this to your source of help and support. It will likely NOT be possible to provide you with help and support without this information. This should include: Device product ID's, part numbers and serial numbers Device physical connections inclusive of pin to pin assignments Device cable specifications This may include: Device general arrangement diagram Air compressor associated wiring diagram(s) Without the aforementioned information help and support can only be offered at the discretion of the source of help and support
Software configuration	If you require help and support relating to the integrity of a software configuration it is important that you have a complete software configuration for the GD Connect 4 and also have the software version number for the GD Connect 4 concerned. This information must be available in electronic format. You will likely be asked to email this to your source of help and support. It will likely NOT be possible to provide you with help and support without this information. Without the aforementioned information help and support can only be offered at the discretion of the source of help and support
Troubleshooting	Check the integrity of air compressors that are managed by GD Connect 4 for error free use and their availability to GD Connect 4

	Review 6.0 Glossary of features, functions and terms used and... • Understand the physical and software relationship between the GD Connect 4 and the host air compressors available to it • Understand the demand for compressed air from the compressed network that GD Connect 4 serves and how GD Connect 4 responds to that demand Review 6.2 Glossary of message codes and supporting information

7.2 Where to go for help and support

Your status	Where to go...
User	Contact the company who supplied you the device or the locally authorised product dealer or distributor. If you don't know who your authorised product dealer or distributor is, visit our website at the address on the rear of this original user manual
Dealer	Contact your local OEM representatives. If you don't know who your local OEM representative is email us at the address on the rear of this original user manual
OEM subsidiary	Contact the product support channel for the product range

7.3 Product declaration of conformity

DECLARATION OF CONFORMITY

GARDNER DENVER

We,

Gardner Denver Deutschland GmbH
Argenthaler Str. 11
55469 Simmem—GERMANY

Declerate that under our sole responsibility

The Product:	**Compressor System Controller**
Type:	**GD Connect 4**
Trade Mark:	**Gardner Denver GD Connect 4 Compressor system controller**
Serial No:	**0001—9999**

Complies with the following relevant provisions

Low voltage - Directive 2006/95/EU
EMC - Directive 2004/108/EC

And that the harmonised standards and/or technical specifications referenced below have been applied

EN6100-6-4:2007	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emmission standard for industrial environments
EN61000-6-2:2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: general requirements

If the machine is modified in a way not agreed upon with us this statement will be void

Issued
on 01 03 2011 at Simmern
By Hans Otto Christ
Responsible Manager
Approval of Documentation Center

Gardner Denver Deutschland GmbH
Argenthaler Str. 11
55469 Simmern
Deutschland

Tel. +49 (0) 6761 832-0

www.gardnerdenver.com
E-mail: sales@gardnerdenver.com