# CMC
# Software Specification

## Standard
R1CMCSTD.E08 +

## R1 CONTROLLER

**CONTENT:**

# 1.0 General Description

## 1.1 Controller Model Variants

The general default settings and tables shown in this specification are applicable to the standard production R1 controller model R1-20-3500, functions available for alternative models can be set in configuration menus.

The model number defines the ACM types fitted: R1-XX**-ABCD**

XX = real time clock option and communications configuration
**A** = ACM for analogue input 1 (delivery pressure)
**B** = ACM for analogue input 2 (delivery temperature)
**C** = ACM for analogue input 3 (internal pressure option)
**D** = ACM for analogue input 4 (2nd temperature option)

ACM Types:

| | |
|---|---|
| 0 | no ACM fitted |
| 1 | digital input |
| 2 | 0-10Vdc |
| 3 | 4-20mA |
| 4 | 4-20mA (earthed referenced) |
| 5 | KTY or RTD, temperature |
| 6 | PT100, temperature |
| 7 | PT1000, temperature |

- Temperature detection and setting limits may differ on models fitted with alternative temperature sensor ACM types; the temperature sensor type must be set in configuration menu if other than default.

- Internal pressure detection, differential pressure detection and related functions will be unavailable on models that are not fitted with a secondary pressure sensor analogue input ACM on analogue input 3.

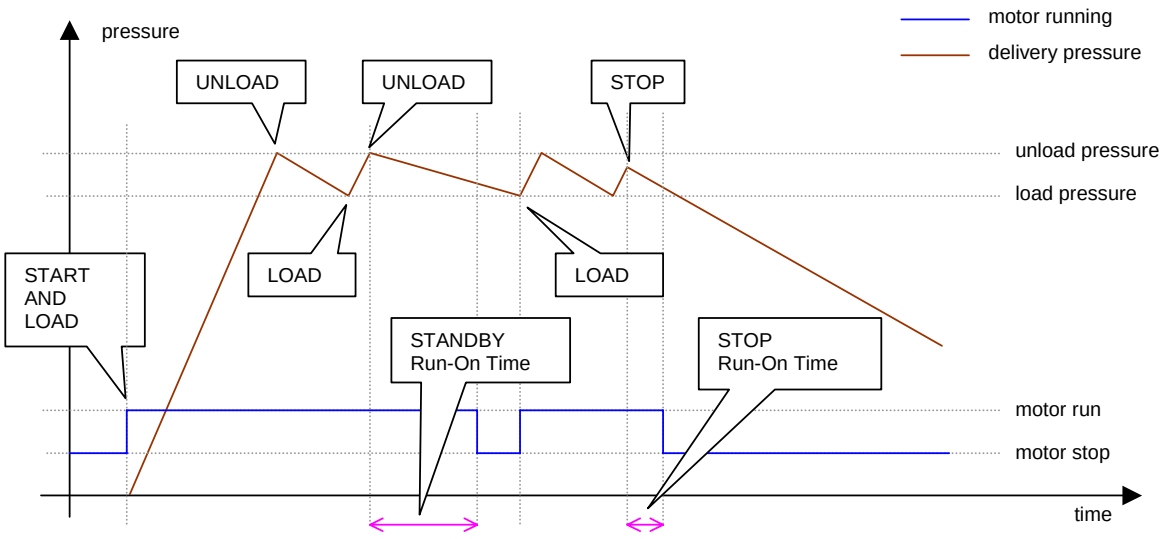
  Internal pressure detection must be enabled in the configuration menu for model types fitted with the secondary pressure detection ACM hardware.

- 2nd Temperature detection and related functions will be unavailable on models that are not fitted with a secondary temperature sensor analogue input ACM on analogue input 4.

  2nd temperature detection must be enabled in the configuration menu for model types fitted with the secondary temperature detection ACM hardware.

## 1.2 General Operation

In normal operation, the detected delivery pressure controls regulation of the compressor once the compressor has been started by pushing the start button, or by a remote start command if enabled. The controller will perform safety checks and start the compressor if no inhibiting conditions are detected.
If a start inhibiting condition exists the compressor will not enter the started condition and a start inhibit message is displayed. If a run inhibiting condition exists the compressor will enter the started condition but a main motor start is inhibited; the compressor will remain in the standby condition and a run inhibit message is displayed. If a load request is present, in accordance with internal pressure settings or by remote command, the main motor is started in a star/delta sequence. When running in delta configuration, after the star/delta time (adjustable) has expired, the load delay time (adjustable) prevents loading for a period to allow motor speed to stabilise. The load delay time can be set to one second if required. When the load delay time has expired the load valve output is energised and the compressor will load. If the unload pressure setting is reached, or a remote unload command is received, the load valve output is de-energised and the compressor will run offload for the standby run on time (adjustable) before the main motor stops and the compressor enters Standby mode. The compressor will load again if pressure falls below the load setting before the standby run on time expires. If in Standby mode, a motor start sequence followed by the load delay time is executed before loading.
In the event of a motor stop, initiated by a stop command or when entering standby mode, a blow down timer (adjustable) is started. If a start request is made during the blow down time the compressor will enter standby mode until the blow down time expires. If already in standby mode, and a load request is present, the compressor will remain in standby mode until the blow down time has expired. For units with internal pressure detection enabled, a minimum internal re-start pressure can also be set to prevent a motor start sequence before internal pressure is vented. In the event internal pressure fails to fall below the set minimum re-start pressure within two minutes after the set blow down time has expired, a blow down fault is generated and the compressor will shutdown. After an unload event a re-load timer (adjustable) is initiated that will prevent re-loading, this time can be adjusted to a minimum of one second if required. Normal automated operation is ended by pushing the stop button, a remote stop command or in the event of a shutdown fault.
When stopped manually, or by a remote command, the load value is de-energised and the main motor allowed to run-on for the stop run on time (adjustable). This time can be adjusted to a minimum of one second if required. Safety checks are made continuously, if there is a condition detected that presents a hazardous or damaging situation an immediate stop is performed and the reason displayed as a shutdown error message. If a warning condition is detected an Alarm message is displayed and normal operation continues.



# 2.0 I/O Description

## 2.1 Digital Inputs

Connector X03:

Connector type: 16 pole mini Combicon with 3.5mm pitch

| Pin | name | function | id | active state |
|---|---|---|---|---|
| 1 | C+ | contact input common | | |
| 2 | C1 | **Emergency stop** | digital input 1 | fault if open |
| 3 | C+ | contact input common | | |
| 4 | C2 | **Oil filter high DP** | digital input 2 | fault if open |
| 5 | C+ | contact input common | | |
| 6 | C3 | **Air filter high DP** | digital input 3 | fault if closed |
| 7 | C+ | contact input common | | |
| 8 | C4 | **air/oil separator DP** | digital input 4 | fault if open |
| 9 | C+ | contact input common | | |
| 10 | C5 | **Remote start/stop** | digital input 5 | stop if open/start on closure |
| 11 | C+ | contact input common | | |
| 12 | C6 | **Remote load enable** | digital input 6 | remote if closed |
| 13 | C+ | contact input common | | |
| 14 | C7 | **Remote load** | digital input 7 | load if closed, offload if open |
| 15 | C+ | contact input common | | |
| 16 | C8 | **PTC motor overload** | digital input 8 | fault if open |

Remote Stop:
When the remote start/stop function is enabled (P08), the compressor will execute a controlled stop, as if the control panel stop button had been pressed, when the remote start/stop input is open circuit.

Remote Start:
When the remote start/stop function is enabled (P08), the compressor will execute a normal start sequence when the remote start/stop input changes state from open to closed circuit. If closed, the remote start/stop input must be opened and closed again to initiate a remote start sequence. Local controller start is inhibited.

Remote load enable:
When the digital remote load enable input is activated, local or communications pressure regulation is ignored and the unit will respond to the digital remote load input. The unit will automatically respond to the pressure regulation method set in the configuration menu settings (local or communications) when the digital remote load enable is deactivated.

Remote load:
When the digital remote load enable is activated, the unit will load when the digital remote load input is activated and unload when the digital remote load input is deactivated. All pressure safety settings remain active when using remote load functions.

Note: If local detected delivery pressure exceeds the set Alarm level the load solenoid out is de-energised. The load solenoid output will remain de-energised for 10secs after the pressure falls below the Alarm level.

## 2.2 Digital Outputs

Connector X02: relays

Connector type: 14 pole Combicon with 5mm pitch

| Pin | name | function | id | active state |
|---|---|---|---|---|
| 1 | C-R123 | common for **star,delta, main contactor** | | |
| 2 | NO-R1 | **main contactor** | digital output 1 | energised |
| 3 | NO-R2 | **star contactor** | digital output 2 | energised |
| 4 | NO-R3 | **delta contactor** | digital output 3 | energised |
| 5 | C-R4 | common for **load solenoid** | | |
| 6 | R4 | **load solenoid** | digital output 4 | load when energised |
| 7 | BRIDGE | | | |
| 8 | BRIDGE | | | |
| 9 | NC-R5 | normal closed contact **relay 5** | | |
| 10 | C-R5 | common **relay 5** | | |
| 11 | NO-R5 | normal open contact **relay 5** | digital output 5 | |
| 12 | NC-R6 | normal closed contact **relay 6** | | |
| 13 | C-R6 | common **relay 6** | | |
| 14 | NO-R6 | normal open contact **relay 6** | digital output 6 | |

Terminals 7 and 8 are connected together on the PCB, maximum rating 250V @ 10A. These terminals provide a method of terminating a number of common wires together; there is no connection to PCB circuits.

The function of auxiliary relays 5 and 6 can be set in the configuration menu

Drain Function:

-When loaded:
cycle in accordance with drain open and drain interval time settings
reset to start of open time when status change to loaded, then cycle
-When not loaded **AND** in started state (optional; active if offload drain time set above zero seconds)
drain interval time = drain interval time x 10
drain open time = offload drain time setting
reset to start of interval time when status change to not loaded, then cycle

## 2.3 Analogue Inputs And Outputs

Note: All analogue device inputs have open circuit, short circuit and out-of-range fault detection functions

Connector X01: HMI + analogue inputs + analogue outputs

Connector type: 16 pole mini Combicon with 3.81mm (0.15") pitch

| Pin | name | function | id | type | range |
|---|---|---|---|---|---|
| 1 | HMI/+8V | HMI +8V power supply output | | | |
| 2 | HMI/GND | HMI supply ground | | | |
| 3 | HMI/L1+ | HMI RS485 L1+ line | | | |
| 4 | HMI/L2- | HMI RS485 L2- line | | | |
| 5 | C-ANA1 | **delivery pressure** +V common | | | |
| 6 | ANA1 | **delivery pressure** input | analogue input 1 | 4-20 mA | selectable |
| 7 | C-ANA2 | **temperature** 0Vcommon | | | |
| 8 | ANA2 | **temperature** input<br>(menu setting + ACM type) | analogue input 2 | KTY or<br>PT100,<br>PT1000<br>or<br>RTD | -10°C 132°C<br>or<br>-50°C 250°C<br>or<br>-40°C 150°C |
| 9 | C-ANA3 | **internal pressure** +V common | | | |
| 10 | ANA3 | **internal pressure** (option) | analogue input 3 | 4-20 mA | selectable |
| 11 | C-ANA4 | **2nd temperature** 0V common | | | |
| 12 | ANA4 | **2nd temperature** input | analogue input 4 | KTY or<br>PT100,<br>PT1000<br>or<br>RTD | -10°C 132°C<br>or<br>-50°C 250°C<br>or<br>-40°C 150°C |
| 13 | ANA-OUT1 | Function selectable** | analogue output 1 | 4-20 mA | |
| 14 | AGND1 | | 0Vdc | | |
| 15 | ANA-OUT2 | Function selectable | analogue output 2 | 4-20 mA | |
| 16 | AGND2 | | 0Vdc | | |

Analogue Inputs:
The R1 uses plug-in analogue conditioning modules (ACM's) that allow different sensor and signal types to be accommodated. Some analogue inputs have menu selectable types; the correct ACM for the type selected must be fitted. Units not fitted with ACM's on analogue inputs 3 and/or 4 will not be able to use the defined functions.

Analogue Output 1:

Standard (including data linked VSD application software variants)
The function of analogue output 1 can be set in the configuration menu

**Variable Speed Control Active (not including data linked VSD application software variants)
Fixed to 4-20mA signal for percentage motor speed in accordance with minimum and maximum speed settings. Intended for connection to speed control input of VSD unit.

Analogue Output 2:

The function of analogue output 1 can be set in the configuration menu

# 3.0 Machine State Diagram

Controller operational logic is shown in the machine state diagram as state blocks with an associating status block number. The state block determines the functionality of the controller at any given time. The controller can only be in one state at any given time. The controller will move from state to state in accordance with the defined exit and entry conditions of each state block and the defined connections between state blocks.

**Definitions:**

**Fault:**
A detected abnormal condition that must be indicated to operator personnel and that may require controller automated safety action, dependant on fault type and definition.

**Start Inhibit Fault (S):**
A start inhibit fault is a condition that may present a danger or cause damage to the compressor if started whilst the condition is present. Start inhibit faults are only triggered if a compressor start from the ready to start condition is attempted. Start inhibit faults are not triggered during an automated motor start sequence from the standby condition. Start inhibit faults are self-resetting. A start inhibit fault code is displayed when triggered but is not recorded in the fault log.

**Run Inhibit Fault (R):**
A run inhibit fault is a condition that may present a danger or cause damage to the compressor if the main motor is started whilst the condition is present. Run inhibit faults are only triggered if a motor start sequence is initiated. Run inhibit faults are self-resetting and do not prevent the compressor from entering a started condition. A Run inhibit will hold the compressor in a standby state and will allow a motor start sequence when the condition is no longer present. A Run inhibit fault code is displayed when triggered but is not recorded in the fault log.

**Alarm Fault (A):**
An alarm fault is a warning condition that does not present an immediate danger or potential damage to the compressor. An alarm state will not shutdown the compressor or affect normal operation. An alarm fault code is displayed that must be manually reset to clear once the condition has been resolved or no longer exists.

**Shutdown Fault (E):**
A shutdown fault is a condition that may present danger or potential damage to the compressor if the condition persists. A shutdown fault will cause the controller to stop the compressor. A shutdown fault code is displayed that must be manually reset to clear once the condition has been resolved or no longer exists. Two types of shutdown fault are definable a) non-emergency shutdown, an immediate controlled stop is executed, b) emergency shutdown, an instantaneous stop is executed.

**Unload Pressure**:
The unload pressure is the delivery pressure level (adjustable) at which the controller will de-energise the load solenoid output and the compressor will offload.

**Load Pressure**:
The load pressure is the delivery pressure level (adjustable) at which the compressor will energise the load solenoid output and the compressor will load. If in the standby state, an automated main motor start sequence is triggered prior to load.

**Main Motor Start Sequence:**
The controller will energise the Star contactor output followed by the Main contactor output 200ms later. After the Star/Delta timer (adjustable) expires the controller will execute an automated Star to Delta contactor output changeover with a 50ms star to delta transition time. If a Stop command is received during the start sequence the controller will continue to execute the start sequence before stopping. This action is intended to limit the break current of motor starter contactors.

**Load Delay Timer**:
The star to delta output transition is immediately followed by a load delay time (adjustable) that will inhibit the load solenoid output from energising until the load delay time expires. Intended to allow the main motor speed to stabilize and other pre-load functions to occur.

**Reload Delay Timer**:
The reload delay time (adjustable) is a period of time immediately following a load to unload event during which the load solenoid output is inhibited from energising.

**Blow Down Timer:**
The blow down time (adjustable) immediately follows a main motor stop event. During the blow down time a start request is recognised but is not initiated until the timer expires. If the optional internal pressure detection feature is enabled the restart inhibit is also dependant on internal pressure falling below the 'start inhibit pressure level' (adjustable). Failure of internal pressure to fall below the set pressure level for a period of two minutes after the set blow down timer expires will result in a blow down trip fault. The remaining time in seconds is show on the Information Item display.

**Standby Run-On-Time:**
When off load the standby run-on-timer will start. If the compressor remains in an off load condition and the timer expires the main motor will stop and the compressor will enter the Standby state. The compressor will automatically re-start and load as required. This function is intended to improve efficiency during low demand periods and to limit the number, and interval between, motor start events. The remaining time in seconds is show on the Information Item display.

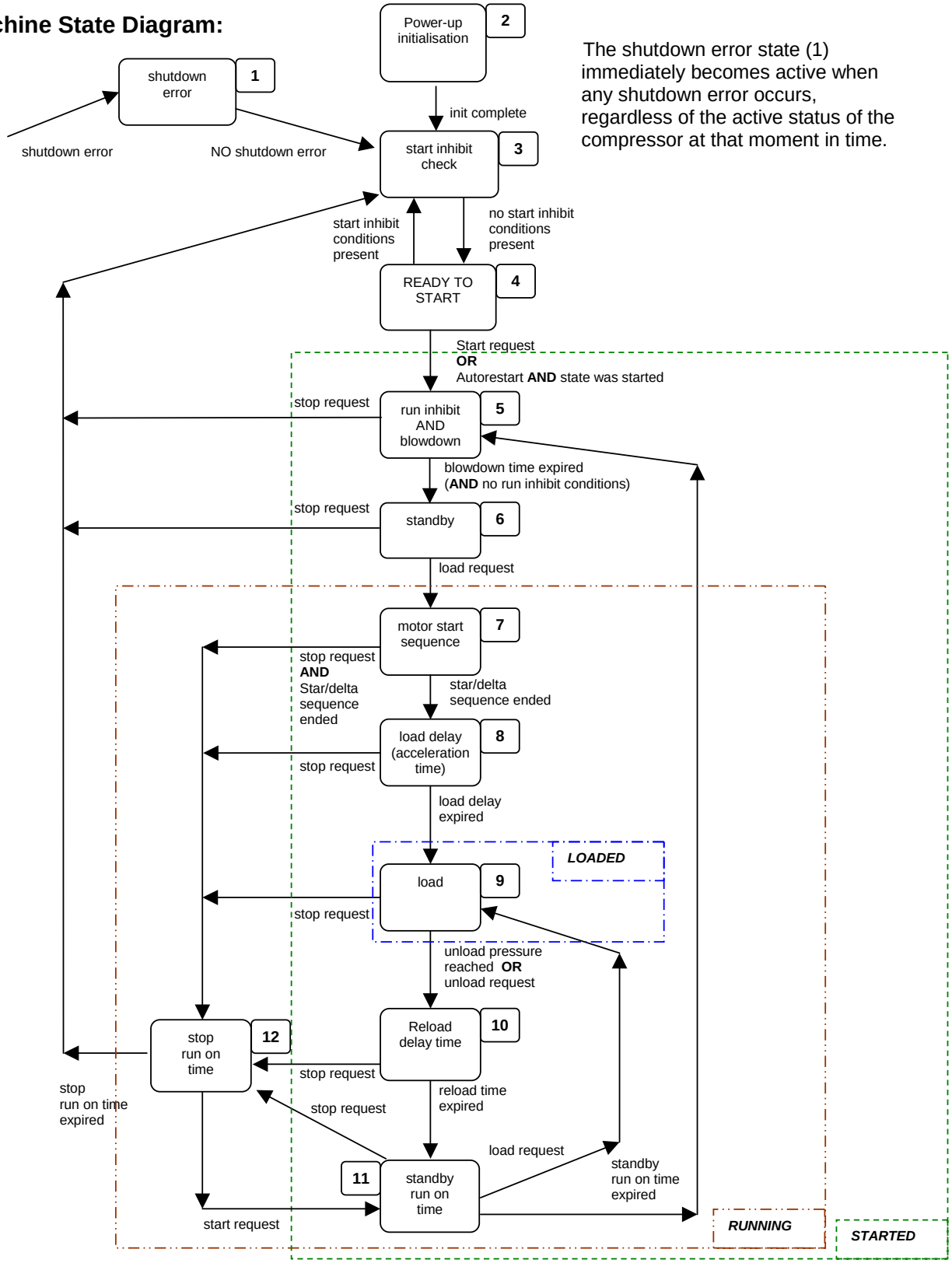
**Stop Run-On-Time:**
When stopped (stop button, remote stop input or remote stop command) the compressor will unload and the main motor continue to run for the stop run-on-time before stopping. This function is intended to allow for internal pressure venting and to limit lubrication oil aeration prior to the main motor stopping. The remaining time in seconds is show on the Information Item display.

**Started State:**
The unit has been started (start button, remote start input or remote start command) and is in an active condition ready to respond to changes in delivery pressure.

**Running State:**
The unit is in the Started state AND the main motor is running.

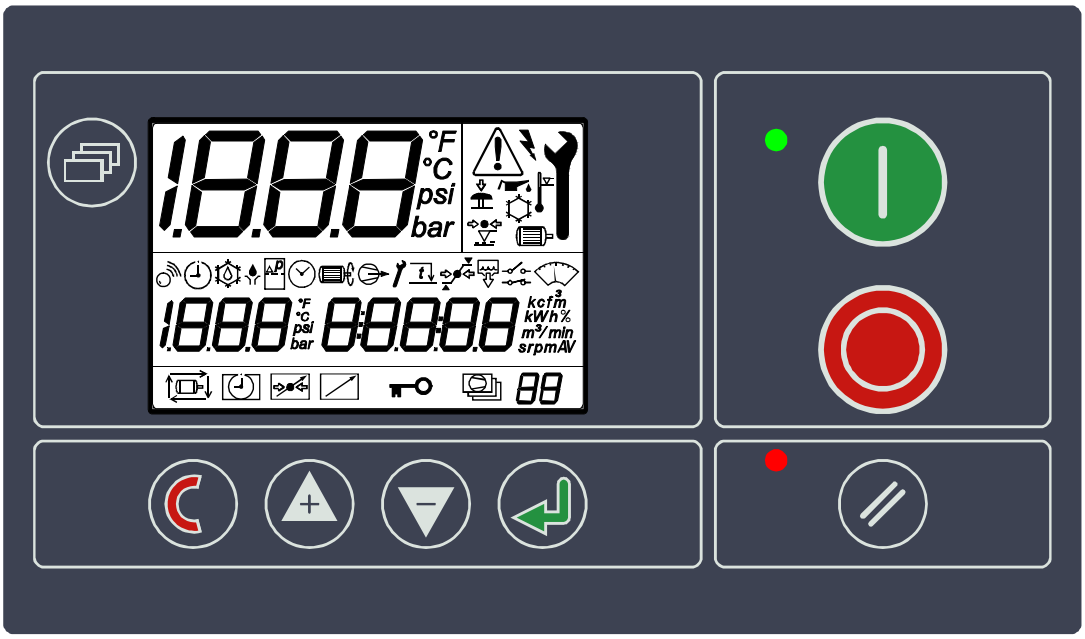
**Loaded State:**
The unit is in the Started state AND Running state AND the load solenoid output is energised.

## Machine State Diagram:




The shutdown error state (1) immediately becomes active when any shutdown error occurs, regardless of the active status of the compressor at that moment in time.

## 4.0 User Interface




Display : Custom backlit LCD
Indicators : 2 x LED
Controls : 8 x Tactile push buttons

## 4.1 Keypad

| | |
|---|---|
| START: | Enter STARTED condition |
| STOP: | Exit STARTED condition |
| RESET: | Reset and clear fault conditions |
| ENTER: | Confirm selection or value adjustments |
| MINUS/DOWN: | Scroll down through menu, menu item options or decrement value |
| PLUS/UP: | Scroll up through menu, menu item options or increment value |
| ESCAPE: | Step back one menu navigation level |
| MENU: | Initiate access code entry |

Start and Stop have one defined function and are not used for any other purpose.
Reset will initiate a display jump to the fault code item if a fault condition remains active or initiate a display jump to the information item if no active faults exist in normal display mode. If pressed and held for longer than two seconds in menu mode will exit menu mode to the normal operational display mode, page 00.
Escape will initiate a display jump to the information item in normal display mode, page 00.
Plus, Minus, Enter and Escape and used to navigate menu mode and adjust menu parameters.

## 4.2 Led Indicators

STATUS: Green, adjacent to Start button
FAULT: Red, adjacent to Reset button

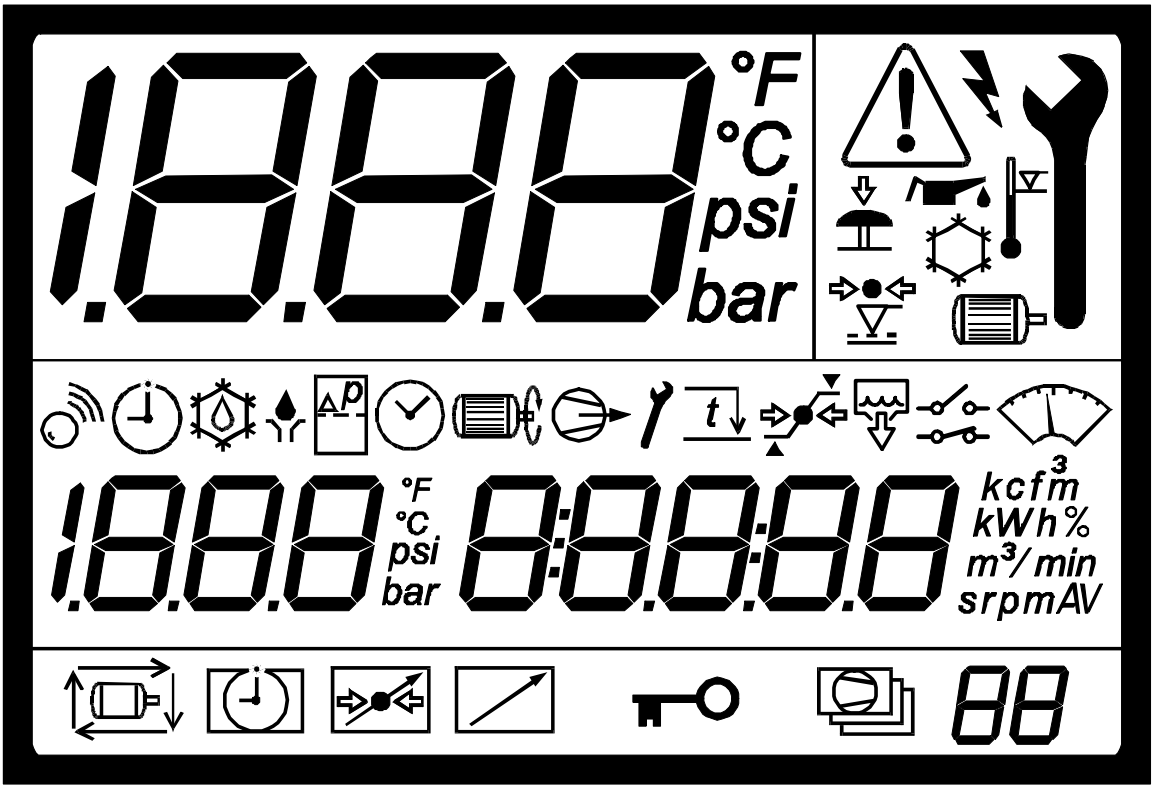
Indicator States:

ON: Illuminated continuously.
FF: Fast Flash: on/off four times per second.
SF: Slow Flash: on/off once per second.
IF: Intermittent Flash: on/off every four seconds.
OFF: Extinguished continuously.

| Machine State Number | Machine State | Status 🟢 | Fault 🔴 |
|---|---|---|---|
| 1 | Shutdown Error | OFF | FF |
| 2 | Startup Init | OFF | OFF ** |
| 3 | Start Inhibit Check | OFF | OFF ** |
| | Start inhibit condition | | SF |
| 4 | Ready to Start | OFF | OFF ** |
| 5 | Blowdown | if (load_request) FF else IF | OFF ** |
| 6 | Standby | IF | OFF ** |
| 7 | Start Motor in Star/Delta | if (load_request) FF else IF | OFF ** |
| 8 | Load Delay | if (load_request) FF else IF | OFF ** |
| 9 | Load | ON | OFF ** |
| 10 | Reload Delay | if (load_request) FF else IF | OFF ** |
| 11 | Standby Run on Time | IF | OFF ** |
| 12 | Stop Run on Time | SF | OFF ** |

🔴 ** SF for Alarm condition

## 4.3 Display




The display is divided in to 4 areas.

| | |
|---|---|
| Top, Left: | Display Field<br>3½ character numeric display used to continuously show delivery pressure in normal operating mode or menu page number in menu mode |
| Top, Right: | Fault Symbol Field<br>Symbolic displays used to indicate common general fault conditions |
| Middle: | Item Field and Value Field<br>3½ character numeric display to the left used to display selected value field item<br>5 character numeric display used to display selected item value or option<br>Unit indicators used to show value field display units as appropriate<br>Symbolic displays used to reinforce meaning of selected item, as appropriate, or indicate status information in normal operational mode 'Information Screen Item' |
| Bottom: | Information Field and Indication Field Value<br>Symbolic displays used to indicate enabled functions<br>2 character numeric display used to indicate selected information field item |

The following symbols are used:

| | | | |
|---|---|---|---|
|  | Dewpoint |  | Motor, motor running |
|  | Pressure schedule or timer clock event |  | On load, loaded |
|  | Amount of time, timer |  | Service |
|  | Filter, differential pressure |  | Time period, timer |

 Pressure set point indication (upper and lower set point indicators displayed independently)

 Condensate drain active (optional function)

 Open or closed contact (digital input state or relay output state)

 Analogue reading

 Power failure autorestart enabled (optional function)

 Pressure schedule enabled

 Remote load or remote pressure regulation active

 Remote start/stop

 Normal Operational Mode Page 00: selected item locked as temporary default display
Menu Mode: page item locked (adjustment inhibited)

The following units can be displayed:

$f^3$ , $kf^3$ ,cfm ,kW ,kWh ,h ,% , $m^3$ , $m^3$/min, s ,r ,p, m, A ,V, spm ,rpm ,mA ,mV, $^0$C , $^0$F ,psi , bar

The following error symbols can be displayed:

| | | | |
|---|---|---|---|
|  | General fault |  | Lubrication oil, oil level |
|  | Emergency stop |  | Dewpoint |
|  | Excess pressure or above set pressure |  | Motor |

 Power failure (displayed when power restored after power failure event interrupted operation)

 High temperature or above set temperature limit

 Service due or service attention required

## 4.4 Display Structure and Menu Navigation

Display Item Structure:

All value, parameter or option selection displays are grouped into menu lists. Items are assigned to a list according to type and classification. Items that can be used to select options or modify functions are assigned to 'menu mode' lists. Items that an operator may require to view during routine operation, detected pressure or temperature values for example, are assigned to the normal operational mode list. Lists are identified by page number, the normal operational display list is page 0. All parameters and options are assigned to menu mode pages 1 or higher. All Page 0 items are view only and cannot be adjusted.

Normal Operational Mode (Page 0):

At controller initialisation, all display elements and LED indicators are switched on for three seconds, the display will then show the software version code for a further 3 seconds before initialisation is complete and the normal operating display (Page 0) is shown. In page 0 'normal operational display mode' the Display Field will show the final delivery pressure continuously and the Item and Value Fields will initially show the Information Item display for 35 seconds before reverting to the default temperature display item. All available Item and Value field option displays (temperatures, pressures, hours counters) can be selected using the Up or Down buttons at any time. The Item display will revert to the default item after 35 seconds if no further selection is made. Pressing the Enter button will lock any selected Item display and inhibit return to the default display. When an Item display is locked the lock key symbol will slow flash. To unlock an Item display press Up or Down to view an alternative Item display or press Reset or Escape. In page 0 Escape will select the Information Item display and Reset will select any active fault code display or the Information Item display if no faults are active. Unless a selected Item display is locked, the display will automatically jump to the Information Item display at key status change events. The timeout period before returning to the default Item display is modified in some instances to enable the full range of a set countdown timer to be shown. No Item values, options or parameters can be adjusted in page 0. If a fault condition occurs the fault code becomes the first list item and the display will automatically jump to display the fault code. More than one active fault code item can exist at any one time.

Access Code:

Access to page list displays higher than page 0 are restricted by access code. To access menu mode pages press UP and DOWN together, an access code entry display is shown and the first code character will flash. Use PLUS or MINUS to adjust the value of the first code character then press ENTER. The next code character will flash; use UP or DOWN to adjust then press ENTER. Repeat for all four code characters. If the code number is less than 1000 then the first code character will be 0(zero). 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 to certain menu mode pages is dependent on authority level determined by the access code used. An invalid code will return the display to normal operational mode; page 0.


The following pages and access levels are used:

| **ACCESS LEVEL = USER** (code = 9) | **ACCESS LEVEL = SERVICE 1** (code = 100) | **ACCESS LEVEL = SERVICE 2** (code =121) |
|---|---|---|
| P00, P01, P02, P03 | P00, P01, P02, P03<br>P04, P05, P06, P07<br>P08, P09, P10 | P00, P01, P02, P03<br>P04, P05, P06, P07<br>P08, P09, P10, P11 |

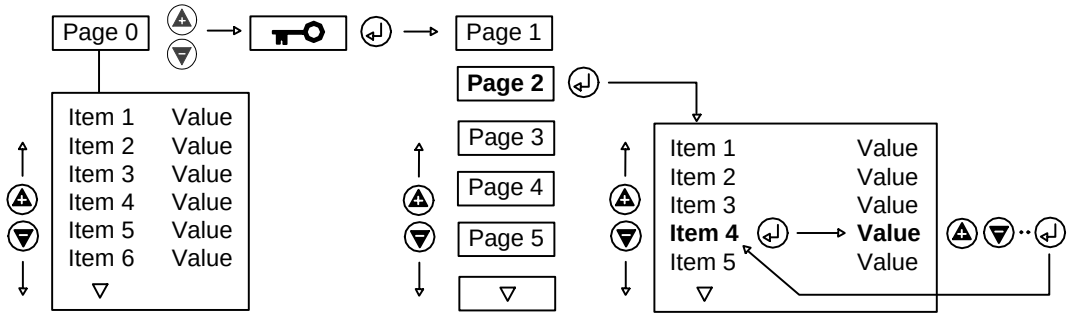
Access Code Timeouts:

When in menu mode, if no key activity is detected for a period of time the display will automatically reset to the normal operational display; Page 0. The timeout period is dependant on the access code used:

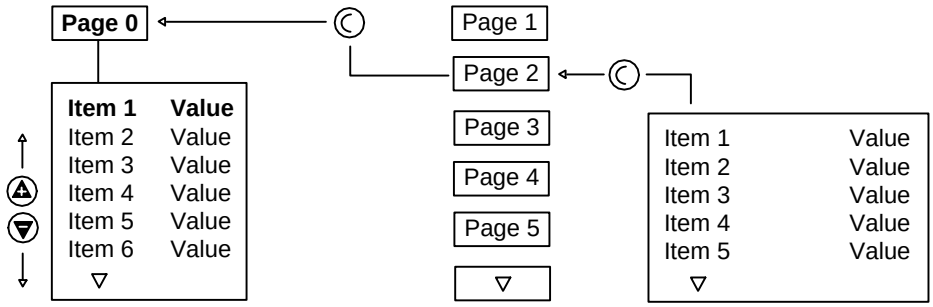
User: *1 minute* Service 1: *10 minutes* Service 2: *1 hour*

Menu Mode Navigation:

In menu mode the Display Field will flash and show the Page number. To select a page press UP or DOWN. For each page the Item and Value field will display the first Item of the page list. To view a page list press ENTER, the Page number will stop flashing and the Item display will flash. Press UP or DOWN to view the selected page list items. To select an Item value for modification press ENTER, the Item display will stop flashing and the Value display will flash. The value or option can now be modified by pressing UP(Plus) or DOWN(Minus). To enter a modified value or option in memory press ENTER; alternatively the modification can be abandoned, and the original setting maintained, by pressing ESCAPE.



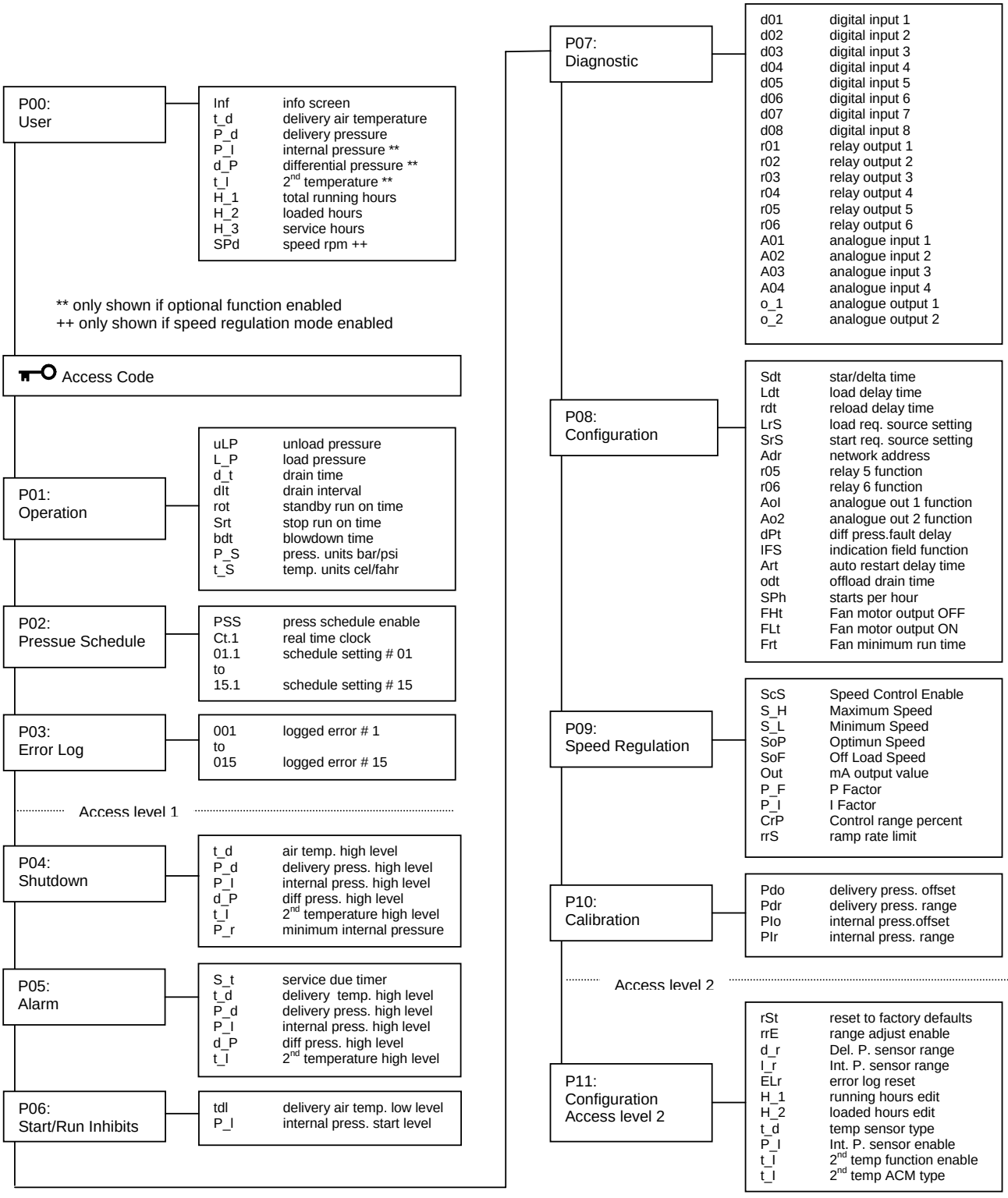

Press ESCAPE at any time in menu mode to step backwards one stage in the navigation process. Pressing ESCAPE when the page number is flashing will exit menu mode and return the display to normal operational mode; page 0.




Press and hold RESET for two seconds at any time to immediately exit menu mode and return to the normal operational mode display. Any value or option adjustment that has not been confirmed and entered into memory will be abandoned and the original setting maintained.

A flashing Key symbol displayed with any Item indicates the Item is locked and cannot be modified. This will occur if the Item is view only (non adjustable) or in instances where the item cannot be adjusted while the compressor is in the operational STARTED state.

### 4.4.1 Menu Structure



## 4.4.2 P00 User Menu

The User menu shows normal operational values and information displays. This is the default display menu; no access code is required.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | information screen | --- | no_edit | --- | --- | --- | **InF** |
| 2 | delivery air temperature | °C/°F | no_edit | --- | --- | --- | **t_d** 55°C |
| 3 | delivery pressure | bar/psi | no_edit | --- | --- | --- | **P_d** 4.5 bar |
| 4 ** | internal pressure | bar/psi | no_edit | --- | --- | --- | ***P_I*** 1.3 bar |
| 5 ** | differential pressure | bar/psi | no_edit | --- | --- | --- | ***d_P*** 0.4 bar |
| 6 | running hours | h | no_edit | 0 | 99999 | --- | **H_1** 1430h |
| 7 | loaded hours | h | no_edit | 0 | 99999 | --- | **H_2** 1275h |
| 8 | service hours | h | no_edit | -9999 | 9999 | --- | **H_3** 570h |
| 9 ## | motor speed | rpm | no_edit | 0 | 7200 | --- | ***SPd*** 3000rpm |
| 10 ## | percent speed | % | no_edit | 0.0 | 100.0 | --- | ***Pct*** 100.0% |

** only shown if internal pressure sensor function activated
## only shown if variable speed regulation mode is activated

If running or loaded hours exceed 99999 the counter will reset to zero.

**Info Item:**
The page 0 'Information Item' provides a basic overview of status using symbols:


Main motor running


Compressor on load


Delivery pressure relative to pressure set points, not displayed when remote pressure control active.


Pressure equal to, or below, load pressure set point


Pressure equal to, or above, unload pressure set point


Pressure between load and unload pressure set points


Condensate drain valve output is energised (if function enabled)


Countdown timer function is occuring (Run-On-Time, Stop Run-On-Time, Blowdown Time). During a countdown time function the remaining time in seconds is displayed.


If the Real Time Clock option is fitted, the current time (hours:minutes) is displayed.

### 4.4.3 P01 Operation Menu

Contains general operation parameters that may be modified by the User from time to time.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | unload pressure | bar/psi | 0.1 | 5.1 | 14.0 | 7.0 | **uIP** 7.0 bar |
| 2 | load pressure | bar/psi | 0.1 | 5.0 | 13.9 | 6.5 | **l_P** 6.5 bar |
| 3 | drain time | s | 1 | 1 | 30 | 5 | **d_t** 5 s |
| 4 | drain interval time | s | 1 | 30 | 3600 | 60 | **dIt** 60 s |
| 5 | standby run on time | s | 1 | 120 | 3600 | 300 | **rot** 300 s |
| 6 | stop run on time | s | 1 | 1 | 60 | 30 | **Srt** 30 s |
| 7 | blowdown time | s | 1 | 1 | 600 | 10 | **bdt** 10 |
| 8 | pressure units | --- | 1 | bar | psi | bar | **P_S** bar / psi |
| 9 | temperature units | --- | 1 | C | F | C | **t_S** $^0$C / $^0$F |

Minimum differential between load and unload set points is 0.2bar

Pressure Settings:
Trip cannot be adjusted above maximum sensor range
Alarm cannot be adjusted above (Shutdown – 0.2bar) or below ('uIP' Unload + 0.2bar)
Unload can not be adjusted above (Alarm – 0.2bar) or below ('P_l' Load + 0.2bar)
Load cannot be adjusted above ('uIP' Unload – 0.2bar) or below 5.0bar

Pressure and Temperature Units:
Selects the units for displayed values. Internally the controller operates using mBar (0.001bar) and mCelsius (0.001°C). The values displayed are calculated from the internal operating values.

## 4.4.4 P02 Pressure Schedule Menu

**Note:** Items only available if the real time clock feature is fitted.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | Pressure schedule enable | --- | --- | --- | --- | --- | **PSS** 0=not active 1=active |
| 2 | Real time clock | --- | --- | --- | --- | --- | **Ct.1** 1 \| 07:00 |
| 3 | Setting 1 | --- | --- | --- | --- | --- | **01.1** 1 \| 06:30 |
| to | | | | | | | |
| 30 | Setting 28 | --- | --- | --- | --- | --- | **28.1** 5 \| 18:30 |

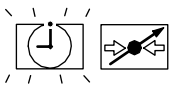
**Pressure Schedule:**
The pressure schedule can be used to change operating pressure set points, or force the compressor in to a standby state, at specified times on specified days of the week. The pressure schedule cycles through the settings on a weekly basis; beginning 00:00 hours on day of the week 1 (Monday) through to 23:59 hours on day of the week 7 (Sunday). Day of week setting '8' can be used to specify that the instruction should be executed at the same time on each day of the working week (days 1 to 5 inclusive; not including weekend days 6 and 7). Day of the week setting '9' can be used to specify that the instruction should be executed on every day of the week (days 1 to 7 inclusive).

The day of the week and the time of day can be specified for each setting together with unload and load pressure set points. The controller will use the specified pressure set points from the set time and day of the week until the next chronological setting modifies the pressure set points, or the pressure schedule is disabled or a remote override is activated.

If zero unload pressure is specified the compressor will unload, run-on and stop into the standby state. The compressor will remain in the standby state until the next setting specifies an operating pressure above zero. There are 28 available settings, some or all of which can be utilised. There are no limits to the number of settings that can be assigned to any particular day of the week. The controller will immediately operate in accordance with the schedule settings when the pressure schedule is activated and the compressor is started.

**Note:** The pressure schedule will not start and stop the compressor; the compressor must be started before pressure schedule functionality will operate.

 When the pressure schedule is activated the 'pressure schedule control' symbol will appear in the lower display 'Information Field' area.

 The pressure schedule has a lower priority than communications pressure control or the remote pressure control digital inputs, both will override the pressure schedule settings. The 'pressure schedule control' symbol will flash, and the 'Remote Pressure Control' symbol appear, during a remote override situation.

 The pressure schedule can be remotely suspended, and normal pressure set point control resumed, by activating the remote load digital input without activating the remote load enable input. This facility can be used to temporarily override the pressure schedule, with a single remote switching contact, during unexpected or non-routine periods. The 'pressure schedule control' symbol will flash during an override situation.

**Pressure Schedule Menu Navigation**
The pressure schedule menu page uses sub items. All page items, except PPS pressure schedule enable, consist of a number of sub-items that are selected sequentially after entering the primary item for adjustment.


*The Pressure Schedule must be deactivated, or the compressor stopped, before any setting adjustments can be made.*

**To Adjust The Real Time Clock:**
Select menu Page 02, and navigate to the Ct.1 Item. The page list item will flash and the display will show the current set day of the week and time in 24hr mode. Press ENTER to select the Item for adjustment; the Item display will stop flashing and the value display hours will flash. Press UP(plus) or DOWN(minus) to adjust the value then press ENTER, the minutes value wil flash. Press UP or DOWN to adjust the value then press ENTER, the next sub item will automatically be displayed (and the Item display will increment from Ct.1 to Ct.2). Note: the day of the week will automatically be adjusted in accordance with the set date. If no adjustment of a sub item is necessary immediately press ENTER to increment to the next sub item. Continue to press ENTER to increment to the next sub item display, making adjustments as necessary, until the end of the sub item list is reached. When the last sub item is entered the value display will stop flashing and the Item display will show the first sub item number and will flash. Press UP or DOWN to navigate to another page list Item or press Escape to navigate to another menu page.

Ct.1 day of the week and 24hr time (1|00:00 to 7|23:59)
Ct.2 year
Ct.3 month (1 to 12)
Ct.4 day of the month (1 to maximum number of days in the set month)

**Pressure Schedule Settings:**

##.1 day of the week and time of day (for example **1| 06:30** = 6:30am every Monday)
##.2 Unload pressure set point
##.3 Load pressure set point

To Enter a New Pressure Schedule Setting:
Select menu Page 02, and navigate to an empty pressure schedule Item (01.1 to 28.1). A zero(0), followed by dashes, in the value display indicates an empty pressure schedule item. Press ENTER to select the Item for adjustment; the Item display will stop flashing and the zero(0) in the value display will flash. Press UP(plus) or DOWN(minus) to adjust the number to the required day of the week (1, Monday to 7, Sunday or 8 for every day of the working week 1 to 5). Press ENTER to set the day value into memory, the dashes will now show 00:00 (time of day, 24hr mode) and start to flash (the Item display will increment from ##.1 to ##.2). Press UP(plus) or DOWN(minus) to adjust the time and press ENTER.

**Note:** If there are other settings in the pressure schedule list the primary Item setting number will automatically change to position the setting in the correct chronological order. The pressure schedule menu will always store settings in chronological order from day of the week 1 (Monday) to day of the week 7 (Sunday), followed by any day of the week 8 or 9 settings.

The Item display will automatically increment to show the next sub item (##.2) and the value display will flash and show the unload pressure set point for the pressure schedule setting. Press UP(plus) or DOWN(minus) to adjust the unload pressure set point and then press ENTER.

**Note:** To force the compressor into a Standby state, adjust the unload pressure set point to 0(zero). In this instance the load pressure set point adjustment (sub item ##.3) will be cleared automatically.

The Item display will automatically increment to show the next sub item (##.3) and the value display will show the load pressure set point. Press UP(plus) or DOWN(minus) to adjust the load pressure set point and then press ENTER, The Item display will flash and return to the first sub item (##.1). Press UP or DOWN to navigate to another Item setting or press Escape to navigate to another menu page.

To Adjust a Pressure Schedule Setting:
Navigate to the pressure schedule Item that requires adjustment and pressure enter. Follow the same procedure as for setting a new pressure schedule setting adjusting sub items as necessary. If a sub item does not require adjustment press ENTER to increment to the next sub item.

To Delete A Pressure Schedule Setting:
Navigate to the pressure schedule Item and Press ENTER. The day of the week number will flash and the Item display will show ##.1; the first sub item. Press DOWN(minus) to adjust the day of the week number to 0(zero) and press ENTER. All remaining sub item settings will be cleared and the setting will be deleted from the pressure schedule list.

**Note:** If there are other settings in the pressure schedule menu list the primary Item setting number will automatically change to position the empty setting in the correct chronological order. Press UP(plus) or DOWN(minus) to view other setting Items.

**Caution:** Unload pressure set point adjustment is limited to 0.2bar below the set delivery pressure Alarm limit. If the delivery pressure Alarm limit is subsequently adjusted, it is possible for pressure schedule settings with higher-pressure set points to result in an excess pressure Alarm or Shutdown Trip fault condition.

### 4.4.5 P03 Error Log Menu

Contains the last 15 fault states in chronological order. The most recent fault (alarm, start inhibit or shutdown) is stored as item 1. Each item consists of two values: the fault code number and the running hours when the fault occurred. The display will automatically alternate between these two values. All items are view only.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | logged error #1 | --- | no_edit | --- | --- | --- | **01** . . . Er: 0010 E <> 12345 ***** |
| 2 to 15 | logged error #2 to error #15 | --- | no_edit | --- | --- | --- | **02 to 15** |

example: last detected error = Emergency Stop shutdown (fault code 0010E) at 12345 running hours

### 4.4.6 P04 Shutdown Menu

Settings that determine the level or condition at which a shutdown fault is generated.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | delivery air temperature high level | °C/°F | 1 | 80 | 130** | 120 | **t_d** 120 $^0$C |
| 2 | delivery pressure high level | bar/psi | 0.1 | 7.0 | 15.9 | 8.0 | **P_d** 8.0 bar |
| 3 | internal pressure high level | bar/psi | 0.1 | 7.1 | 16.0 | 9.0 | **P_I** 9.0 bar |
| 4 | differential pressure high level | bar/psi | 0.1 | Alarm+0.2 | 5.0 | 1.0 | **d_P** 1.0 bar |
| 5 | 2nd temp high level | °C/°F | 1 | | | | **t_I** 120 $^0$C |
| 6 | Minimum Int pressure | bar/psi | 0.1 | 0.0 | 1.0 | 0.0 | **P_r** 0.0 |

** Delivery temperature maximum limit may be higher with alternative temperature sensor types.

Differential Pressure High Level:
Will activate if the condition remains above the set level for longer than the differential pressure fault delay time (see menu 08) AND the delivery temperature is above 50 $^0$C.

Internal Pressure Minimum Level:
Internal pressure is checked after the initial motor start sequence + set load delay time, and at each load request thereafter. If detected pressure is below the set limit a shutdown error is generated. This feature is intended to provide protection against incorrect motor rotation or catastrophic internal pipe/coupling failure.

2nd Temperature High Level:
Only available if 2nd temperature function enabled and hardware ACM fitted.

Minimum Internal Pressure:
Fault shutdown if internal pressure fails to exceed this setting just prior to loading. Intended to detect failure to generate internal pressure due to motor reverse rotation.

### 4.4.7 P05 Alarm Menu

Settings that determine the level or condition at which an alarm fault is generated.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | Service Timer | hours | 100 | 1000 | 10000 | 2000 | **S_t** 2000 h |
| 2 | delivery air temperature high level | °C/°F | 1 | 70 | 120 | 110 | **t_d** 110 $^0$C |
| 3 | delivery pressure high level | bar/psi | 0.1 | 7.0 | 15.9 | 7.6 | **P_d** 8.0 bar |
| 4 | internal pressure high level | bar/psi | 0.1 | 7.1 | 16.0 | 8.6 | **P_I** 9.0 bar |
| 5 | differential pressure high level | bar/psi | 0.1 | 0.2 | 4.8 | 0.8 | **d_P** 0.8 bar |
| 6 | 2nd temp high level | °C/°F | 1 | | | | **t_I** 110 $^0$C |

Service Countdown Timer:
The service countdown timer will count down from the set value in accordance with running hours. When the item is viewed the service hour's value will reflect the current hours remaining until a routine maintenance service is due (zero hours). When zero hours are reached a service due alarm will be displayed. The alarm can only be reset when the service hours is adjusted above zero. The service hours count will continue to count down in negative values until the timer is re-set. This function is intended to promote timely routine maintenance and indicate how many running hours have passed since a service due alarm was displayed. The value can be adjusted back to the required maintenance interval time each time a maintenance service is completed.

Differential Pressure High Level:
Will activate if the condition remains above the set level for longer than the differential pressure fault delay time (see menu P08) AND the delivery temperature is above 50 $^0$C

### 4.4.8 P06 Start and Run Inhibit Menu

Settings that determine the level or condition at which a start or Run inhibit condition exists.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | delivery air temperature low level (R) | °C/°F | 1 | -20 | 10 | 1 | **t_d** 1 $^0$C |
| 2 | internal pressure start level (R) | bar/psi | 0.1 | 0.1 | 2.0 | 0.5 | **P_I** 0.5 bar |

Delivery Air Temperature Low Level: Run Inhibit active if temperature falls below set limit.
Internal Pressure Start Level: Run Inhibit active if pressure is above set limit.

Run inhibits (R) allow the compressor to be started but will prevent a main motor start until the condition clears. When the condition is no longer present, the alarm will self reset and the main motor automatically allowed to start as required (see: internal pressure blowdown timeout shutdown function)
Note: There are no Start inhibits (S) as standard.

### 4.4.9 P07 Diagnostic Menu

This menu allows a technician to check all inputs and test all outputs individually without running the compressor.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | digital input 1 | --- | no_edit | --- | --- | --- | **d01** 0 |
| 2 | digital input 2 | --- | no_edit | --- | --- | --- | **d02** 0 |
| 3 | digital input 3 | --- | no_edit | --- | --- | --- | **d03** 0 |
| 4 | digital input 4 | --- | no_edit | --- | --- | --- | **d04** 0 |
| 5 | digital input 5 | --- | no_edit | --- | --- | --- | **d05** 0 |
| 6 | digital input 6 | --- | no_edit | --- | --- | --- | **d06** 0 |
| 7 | digital input 7 | --- | no_edit | --- | --- | --- | **d07** 0 |
| 8 | digital input 8 | --- | no_edit | --- | --- | --- | **d08** 0 |
| 9 | relay output 1 | --- | 1 | 0 | 1 | 0 | **r01** 0 |
| 10 | relay output 2 | --- | 1 | 0 | 1 | 0 | **r02** 0 |
| 11 | relay output 3 | --- | 1 | 0 | 1 | 0 | **r03** 0 |
| 12 | relay output 4 | --- | 1 | 0 | 1 | 0 | **r04** 0 |
| 13 | relay output 5 | --- | 1 | 0 | 1 | 0 | **r05** 0 |
| 14 | relay output 6 | --- | 1 | 0 | 1 | 0 | **r06** 0 |
| 15 | analogue input 1 | --- | no_edit | --- | --- | --- | **A01** 4.00mA |
| 16 | analogue input 2 | --- | no_edit | --- | --- | --- | **A02** 0.467V |
| 17 | analogue input 3 | --- | no_edit | --- | --- | --- | **A03** 4.00mA |
| 18 | analogue input 4 | --- | no_edit | --- | --- | --- | **A04** 0.000V |
| 19 | analogue output1 | mA | 0.10 | 4.0 | 20.0 | --- | **o_1** 4.00 mA |
| 20 | analogue output2 | mA | 0.10 | 4.0 | 20.0 | --- | **o_2** 20.00 mA |

Digital Inputs: The display will show an open or closed contact symbol representing the actual input state, the display will show if the corresponding input function is active (1) or de-active (0).
Note: Value display number indicates function not input state (example: Emergency Stop = –o–o– '0')

Relay Outputs: Relays can be energised (1) and de-energised (0). The motor starter relay outputs 1 to 3 can only be energised one at a time, the output will de-energise when the selected Item is changed.

Analogue Inputs: Analogue input values will toggle (2second) between associated engineering units set for the input and the actual mV(temperature or voltage inputs) or mA(current loop inputs) detected on the controller connector of the corresponding analogue input. The mV or mA value can be independently checked with a meter.

Analogue Outputs: In standard mode the analogue output will follow the set output function. If the function is between 1 and 13 the output will switch between 0.0mA = OFF and 20.00mA = ON. This is intended to provide a drive for an external 24Vdc coil relay with a switch-on current no greater than 20.00mA. Functions 14 to 17 provide true 4-20mA functions.

Analogue output values can be adjusted (from 4.0mA to 20.0mA) to force the output to a particular mA level for diagnostic or calibration processes. The output will automatically revert to the defined function upon menu exit.

### 4.4.10 P08 Configuration Menu

Settings that determine the basic operating configuration.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | star/delta time | s | 0.2 | 1 | 30 | 10 | **Sdt** 10.0 sec |
| 2 | load delay time | s | 0.2 | 1 | 30 | 1 | **ldt** 1.0 sec |
| 3 | reload delay time | s | 0.2 | 1 | 10 | 1 | **rdt** 1.0 sec |
| 4 | load request source setting | 0=press.sensor<br>1=comm.req. | 1 | 0 | 1 | 0 | **lrS** 0 |
| 5 | start request source setting | 0=keyboard<br>1=comm.req.<br>2=dig.inputs | 1 | 0 | 2 | 0 | **SrS** 0 |
| 6 | network address | --- | 1 | 1 | 99 | 1 | **Adr** 1 |
| 7 | relay 5 function setting | 1 to 13<br>see Output Functions | 1 | 1 | 13 | 7 | **r05** 7 |
| 8 | relay 6 function setting | 1 to 13<br>see Output Functions | 1 | 1 | 13 | 3 | **r06** 3 |

Relay 5 and 6 Output Functions:

| | |
|---|---|
| 1 - Alarm | De-energised for any active Alarm fault (not including Start/Run Inhibit) |
| 2 - Shutdown | De-energised for any active Shutdown fault (not including Start/Run Inhibit) |
| 3 – Group Fault | De-energised for any active Alarm, Star/Run Inhibit or Shutdown fault |
| 4 – Alarm Service | De-Energised for any Alarm fault or Service Due alarm (not including Start/Run Inhibit) |
| 5 – Service | Energised for Service Due alarm only |
| 6 – Heater | Energises if detected temperature falls below set low temperature run inhibit + 2°C<br>De-energises if detected temperature increases above set low temp run inhibit + 3°C<br>Can be used to energise anti-condensate heater contactor or as low temperature warning auxiliary output. |
| 7 – Drain | -When loaded: cycle in accordance with drain open and drain interval time settings. Elapsed interval time is stored in non-permanent memory when not loaded and the remaining interval time applied when loaded operation is resumed.<br>-When not loaded AND in 'started' state (optional; active only if offload drain time set above zero seconds, 0sec = offload drain function disabled).<br>drain interval time = drain interval time x 10.<br>drain open time = offload drain time setting.<br>reset to start of interval time when status change to not loaded, then cycle. |
| 8 – Fan | Energised in all RUNNING states except 'motor start' and 'load delay time'<br>Can be used to energise internal and/or external cooling fan motor contactor |
| 9 – Standby | Energised in 'Standby' and 'Blowdown' states |
| 10 – Running | Energised in all RUNNING state conditions |
| 11 – Loaded | Energised in all LOADED state conditions |
| 12 – Started | Energised in all STARTED state conditions |
| 13 – Fan (temp ctl) | Enabled to operate in all RUNNING states except 'motor start' and 'load delay time'<br>If enabled to operate the output will only energise if delivery temperature exceeds the set 'Fan High' temperature setting. If delivery temperature falls below the set 'Fan Low' temperature setting the output will de-energise. Once energised the output will remain energised for a minimum of the set 'Fan Minimum Run Time' regardless of delivery temperature. Can be used to energise internal and/or external cooling fan motor contactor; the minimum run time is intended as a means of limiting Fan motor starts-per-hour. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | Analogue output 1 function | --- | 1 | 0 | 17(SC) | 14 | **AoI** 14 |
| 10 | Analogue output 2 function | ---- | 1 | 0 | 17 | 15 | **Ao2** 15 |
| 11 | differential pressure fault delay time | s | 1 | 1 | 600 | 10 | **dPt** 10.0 sec |
| 12 | indication field function setting | 0=no indication<br>1=network address<br>2=machine state No.<br>3=average cycle time<br>4=max cycle time<br>5=# starts registered<br>6=press control mode<br>7=active P.Schedule item | 1 | 0 | 7 | 1 | **Ifs** 1 |
| 13 | auto restart delay time | s | 1 | 0 | 120 | 10 | **Art** 10.0 sec |
| 14 | offload drain time | s | 1 | 0 | 30 | 0 | **odt** 0 |
| 15 | starts per hour | --- | 1 | 0 | 20 | 0 | **Sph** 0 |
| 16 | Fan control OFF temp | $^0$C | | | | | **FHt** 85 $^0$C |
| 17 | Fan control ON temp | $^0$C | | | | | **FLt** 75 $^0$C |
| 18 | Fan minimum run time | s | | | | | **Frt** 180 sec |

Analogue Output 1 and 2 Select:
The analogue outputs can be selected for digital on/off functions 1 to 13 or true 4-20mA output signal functions 14 to 17.

| Function | Description |
|---|---|
| 0 | disabled, 0.0mA |
| 1 to 13 | as relay 5 and 6 functions 1 to 13 |
| 14 | AI1, delivery pressure, 4-20mA |
| 15 | AI2, delivery temperature, 4-20mA |
| 16 | AI3, internal pressure, 4-20mA (if ACM fitted and function enabled) |
| 17 | AI4, second temperature, 4-20mA (if ACM fitted and function enabled) |
| SC | In variable speed motor control mode analogue output 1 is fixed for 4-20mA speed control signal and cannot be set for a different function. This function cannot be selected normally. |

For functions 14 to 17 the output will be 4.00mA in the instance of a sensor fault or analogue input function disabled.

**Note:** The digital functions 1 to 13 are intended for controlling an external 24Vdc coil relay with a switch-on current no greater than 20.0mA.

Indication Field Function Setting:
The function of the number shown in the indication display field (bottom right of display) can be selected;
Network Address – the set RS485 network address for the compressor (default)
Machine State Number – the current active status block condition (see machine state diagram)
Average Cycle Time – the average controller software cycle time in mSecs
Maximum Cycle Time – the maximum controller software cycle time in mSec
Starts Registered – The number of motor start events that have occurred in the last one-hour period
Pressure Control Mode – The current pressure control mode (see Pressure Control Source Priority Logic)
P.Schedule Item – The active pressure schedule list item when using P.Schedule function

Information field items are intended for general information or diagnostic purposes, to disable select (0).

Auto Restart Delay:
If an auto restart delay time is specified, the controller will execute an automated restart after a power disruption if the controller was in the Started state when the power disruption occurred. The delay time specifies the warning period after controller initialization before a re-start is executed. The time before restart is indicated on the controller display. No restart will occur if the controller was not in the started state prior to power disruption.

Offload Drain Function:
When not loaded AND in 'started' state (optional; active when offload drain time set above zero seconds, 0sec = offload drain function disabled).

drain interval time = set normal drain interval time x 10.
drain open time = offload drain time setting.

Reset to start of interval time when status change to not loaded, then cycle.

The offload drain timer function is intended to prevent a non-loaded compressor, which is part of a multiple compressor system connected to common air delivery pipework, experiencing condensation build-up that is being generated by other operational compressor(s) in the system.

Starts per hour:
Every time a main motor start event occurs, an entry is made in an array (app_starts_per_hour_countdown_array[x]). The entry is made in the first available location in a FIFO register list. The entry is 3600 seconds, which is counted down from that point in time. For every motor start event to the maximum number of starts per hour allowed, an entry is made. When the first entry expires, the others, which were recorded at a later point in time, will be shifted forward one, and the number of registered motor starts is decremented.
If the number of motor starts registered (motor start events within the last one hour period) equals the number of starts allowed, an adjustment to the run-on-time is made. The new run-on-time is calculated so that the compressor will continue to run offload until the number of registered start events within the last one hour period reduces below the maximum number set, allowing another start event to occur.
The 'starts per hour' function only influences the standby run on time, it will not prevent the motor from being starting. If a new start is performed after the maximum number of starts has already been registered, the oldest one is removed from the list, which causes the time to wait to increase.

To disable the function, and maintain the set run-on-time period regardless of motor start events, adjust the starts per hour setting to 0(zero).

Fan Temperature Control:
Relays 5 or 6, and Analogue outputs 1 and 2, can be selected for temperature controlled fan function 13. In this mode the output will energise if delivery temperature exceeds the set 'FH' temperature setting. If delivery temperature falls below the set 'FL' temperature setting the output will de-energise. Once energised the output will remain energised for a minimum of the set 'Ft' fan motor run-on time regardless of delivery temperature.

### 4.4.11 P09 Speed Regulation Menu

The speed regulation function provides P&I loop control of a variable speed drive (using 4-20mA output 1) in order to maintain a steady target pressure level (load pressure).

Speed regulation is used to maintain delivery pressure at the load pressure set point. If pressure rises to the unload pressure set point the load solenoid output is de-energised and the compressor unloaded. While in the offload state the controller will maintain speed at the set offload speed setting. If pressure remains above the load pressure set point for longer than the set run-on-time the main motor will stop and the controller will enter the standby state. When pressure falls below the load pressure set point the motor is re-started, if in standby state, and the load solenoid output is energised. Full range speed regulation is then applied.

If connected to a CMC sequence controller system, and the system consists of more than one VSR (variable speed regulated) compressor, any VSR compressor assigned as base load will be biased to operate at the set optimum speed setting. Any VSR compressor assigned as top-up will use full range speed regulation. In addition, the target pressure of each VSR compressor is automatically referenced to the sequencer to maintain exact pressure control regardless or pressure differentials between compressors. In this manner up to 12 VSR compressors can be controlled as a single coherent system with full efficiency capacity matched management, sequence rotation and single pressure set point control.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | Speed regulation control mode | --- | 1 | 0 | 2 | 0 | **ScS** 0=disabled<br>1=fixed speed regulation<br>2=variable speed regulation |
| 2 | maximum speed | rpm | 100 | 100 | 10000 | 3000 | **S_H** |
| 3 | minimum speed | rpm | 100 | 0 | 9900 | 1500 | **S_L** |
| 4 | optimum speed | rpm | 100 | 100 | 10000 | 2700 | **SoP** |
| 5 | Offload speed | rpm | 100 | 0 | 9900 | 1800 | **SPd** |
| 6 | rpm actual | rpm | --- | --- | --- | --- | **SPd** View only, for information |
| 7 | output actual | mA | --- | --- | --- | --- | **out** View only, for information |
| 8 | P factor | --- | 1 | 0 | 100 | 40 | **P_F** |
| 9 | I factor | --- | 1 | 0 | 100 | 10 | **I_F** |
| 10 | Control range percent | % | --- | --- | --- | --- | **CrP** View only, for information |
| 11 | Maximum ramp rate | % | 1 | 5 | 100 | 10 | **rrS** |

Speed regulation control mode:
To disable speed regulation control for a fixed speed motor, load/unload compressor; select mode ‘0’.
To operate at fixed speeds select mode ‘1’. The motor will operate at the set optimum speed while loaded, and at the set offload speed when unloaded. The transition in speed is determined by the max ramp rate.
To operate as a full range variable speed regulated compressor select mode ‘2’.

| | |
|---|---|
| Maximum Speed | set for motor speed at 20mA output |
| Minimum Speed | set for motor speed at 4mA output |
| Optimum Speed | optimum efficiency speed while loaded |
| Offload Speed | motor speed when off load |
| P Factor | P&I loop proportional factor |
| I Factor | P&I loop integration factor |
| Max Ramp Rate | maximum allowed rate of change expressed as % of full speed range per second (example: max 3000rpm, min 1500rpm, ramp rate 10% = 150rpm/second maximum) |

Control Range Percent: Shows the percentage of speed range where set minimum speed is represented as 0% and maximum speed is 100%. This value is different from the percent speed show in menu page 0.

Remote Load Digital Input Function:
If enabled for variable speed regulation, the remote load digital input will operate the compressor in speed control regulation mode '1' regardless of mode setting. If set for mode '2' the compressor will revert to mode '2' operation when the remote load enable input is deactivated.

Pressure Schedule:
In variable speed regulation mode, the pressure schedule can be used to modify the target pressure (load pressure), the unload pressure or set to zero pressure to enter standby mode.

### 4.4.12 P10 Calibration Menu

Pressure sensor calibration settings.

Calibration settings for analogue pressure sensors.
When an item is selected the page# display field will show the actual pressure for the item select using the existing calibration values. As calibration values are adjusted the pressure display will reflect the new calibration.

Offset: To calibrate an offset, expose the appropriate sensor to atmosphere and adjust the offset value until the pressure display shows 0.0bar.

Range: To calibrate the range, apply an accurately known pressure to the sensor and adjust the range value until the pressure display matches the applied pressure. The range value can be calibrated with static or changing applied pressure.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | delivery pressure offset | bar/psi | 0.1 | -0.5 | 0.5 | 0.0 | **Pdo** 0.0 bar |
| 2 | delivery pressure range | bar/psi | 0.1 | 15.0 | 17.0 | 16.0 | **Pdr** 16.0 bar |
| 3 | internal pressure offset | bar/psi | 0.1 | -0.5 | 0.5 | 0.0 | **Plo** 0.0 bar |
| 4 | internal pressure range | bar/psi | 0.1 | 15.0 | 17.0 | 16.0 | **Plr** 16.0 bar |

**Caution:** Incorrectly set pressure sensor calibration values will affect performance and set safety levels.

### 4.4.13 P11 Access Level 2 Configuration Menu

Special functions and settings that determine specific configuration; generally set once during commissioning.

| item# | description | units | step | min | max | default | display |
|---|---|---|---|---|---|---|---|
| 1 | reset to factory defaults | --- | --- | --- | --- | --- | **rst** dFLt 7.0 bar |
| 2 | Enable P.sensors range adjust. | --- | 1 | 0 | 1 | 0 | **rrE** 0 |
| 3 | Delivery P.sensor range | bar/psi | 0.1 | 5.0 | 100.0 | 16.0 | **d_r** 16.0 bar |
| 4 | Internal P.senor range | bar/psi | 0.1 | 5.0 | 100.0 | 16.0 | **I_r** 16.0 bar |
| 5 | error log reset | --- | --- | rst=0 | reset | --- | **ELr** rst=0 |
| 6 | running hours edit | hours | 100 | 0 | 99999 | 0 | **H_1** 0h |
| 7 | loaded hours edit | hours | 100 | 0 | 99999 | 0 | **H_2** 0h |
| 8 | delivery air temperature sensor type | 2=PT100/PT1000 3=KTY 4=RTD | 1 | 2 | 4 | 3** | **t_d** 3 |
| 9 | internal press sensor enable | 0=not used 1=used | 1 | 0 | 1 | 0** | **P_I** 0 |
| 10 | 2nd temp sensor enable | 0=not used 1=used | 1 | 0 | 1 | 0** | **t_I** 0 |
| 11 | 2nd temp sensor type | 2=PT100/PT1000 3=KTY 4=RTD | 1 | 2 | 4 | 3** | **t_I** 3 |

****** set differently as default in some standard software variants

⚠ **Reset To Factory Defaults**
**Caution: This function will reset all adjustable settings and configuration parameters to factory default** (see Factory Default Configuration and Pressure tables).

Enable Pressure Sensor Range Adjustment:
If set to 1=ON will allow the range values for the delivery and internal pressure sensors to be adjusted. Range adjustment provides a means of modifying the controller to accept 4-20mA pressure sensors that have range values different to the standard 0 to 16.0 bar default. If set to 1=ON and a 'Reset to Factory Default' is executed the pressure sensor ranges are not reset and will remain as adjusted.

Pressure Sensor Range Adjustments:
The pressure sensor range values must match the range of the pressure sensor used. If a 4-20mA sensor with a range of 0 to 20bar is connected to the delivery pressure analogue input adjust the delivery pressure sensor range value to 20.0bar.

⚠ **Incorrect adjustment of pressure sensor range values will affect accuracy, performance and pressure related safety functions.**

Error log reset:
Error log reset is used to clear all entries in the error log list (menu page 03).
To clear the error log list select the error log reset item then press UP(plus); the value display will show “RST”.
Press ENTER, when the error log is clear the value display will change back to “0” and the cleared.

Running and Loaded Hours Edit:
Note: The recorded hours values can be adjusted using these items.

Delivery Air Temperature Sensor Type:
The appropriate hardware ACM module must be fitted to the R1 before a selection change is made.

| Sensor Type | Setting | ACM |
|---|---|---|
| KTY | 2 | KTY |
| PT100 | 3 | PT100 |
| PT1000 | 3 | PT1000 |
| RTD | 4 | KTY |

Internal Pressure Sensor Enable:
Set to 0(zero) if no internal compressor pressure sensor is to be fitted; internal pressure and differential pressure related functions will be inhibited and associating values will not be displayed on user page 0.

2nd Temperature Sensor Type:
The appropriate hardware ACM module must be fitted to the R1 before the function is enabled and a type selection change is made.

| Sensor Type | Setting | ACM |
|---|---|---|
| KTY | 2 | KTY |
| PT100 | 3 | PT100 |
| PT1000 | 3 | PT1000 |
| RTD | 4 | KTY |

### 4.4.14 Pressure Control Source Priority Logic

Pressure regulation control can be derived from a number of sources, internal or remote. Each potential source has a different priority over other potential sources. The following source priority logic diagrams show the pressure regulation mode and method the controller will use under all potential setup selection, remote connection or failure mode conditions.

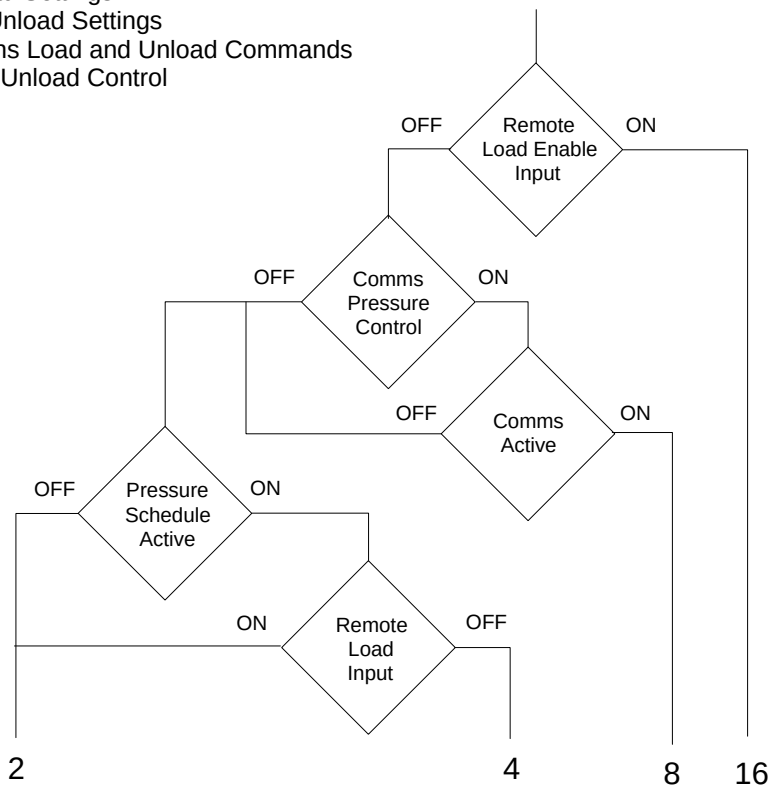
The remote digital load enable input (mode 16) has priority over all other pressure control sources.

If, for example, RS485 network control is selected as the primary source (8), and communications are disrupted, the controller will automatically select a lower priority pressure regulation source (4 or 2) dependant on setup. When network communications are restored, the controller will automatically return to communications pressure regulation control (8).

For diagnostic purposes the pressure regulation source at any particular moment can be established by selecting the Indication field to show pressure source (configuration menu page), the pressure regulation source (and regulation mode) numbers shown below will then be displayed in the Indication field.

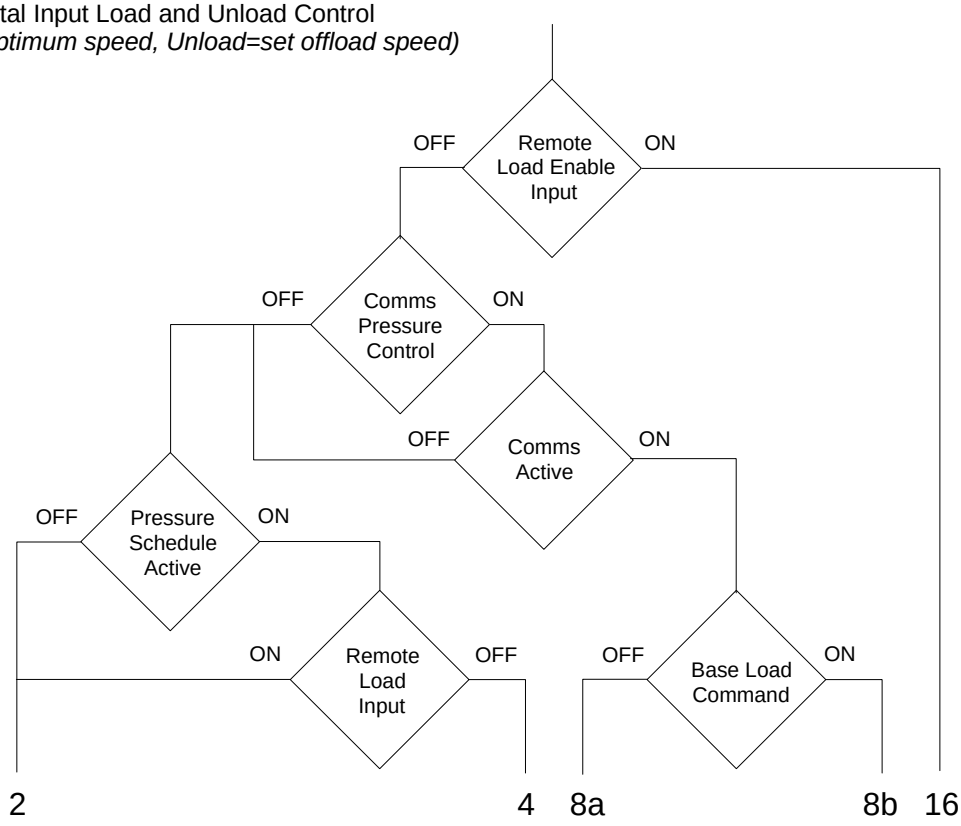
**For Standard Fixed Speed Compressor Mode:**

1 Alarm Limit Unload Override
2 Menu Page 01 Load and Unload Settings
4 Pressure Schedule Load and Unload Settings
8 Remote RS485 Communications Load and Unload Commands
16 Remote Digital Input Load and Unload Control



**For Variable Speed Regulation Mode:**

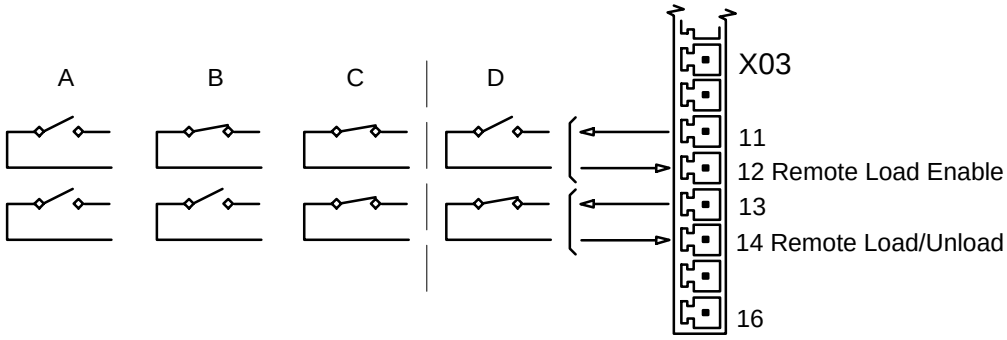
1 Alarm Limit Unload Override
2 Menu Page 01 Load and Unload Settings
4 Pressure Schedule Load and Unload Settings
8a Remote RS485 Communications Load and Unload Commands
8b Remote RS485 Communications Base-Load
*(motor speed=biased to optimum speed)*
16 Remote Digital Input Load and Unload Control
*17 (Load=set optimum speed, Unload=set offload speed)*




**Safety:**
Regardless of pressure regulation source, the set Alarm and Shutdown pressure safety limits remain active and are detected from the delivery pressure sensor and internal pressure sensor (if fitted). If internal pressure sensing is not in use, the delivery pressure sensor must never be detached from the air delivery point of the compressor package.

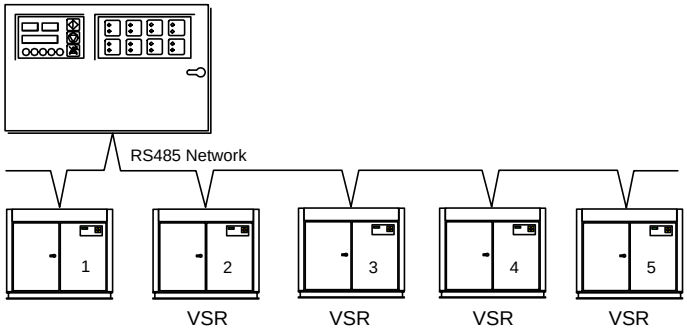
**Alarm Limit Unload Override:**
If delivery pressure exceeds the set Alarm pressure limit, regardless of pressure regulation source, the load solenoid will be immediately de-energised. The load solenoid will remain de-energised while pressure is above the set Alarm limit and for a period of 10 seconds after pressure falls below the Alarm limit. This is a safety feature designed to prevent incorrectly set remote pressure regulation sources causing the compressor to exceed design pressure limits. While in the Alarm Unload Override condition the pressure source number will be incremented by '1' (for example: remote digital load enable and load active (16) AND Alarm unload override active (1) = 17).

### 4.4.15 Remote Digital Load Input Functions:




A Remote load enable not active
B Remote load enable active, compressor unload command
C Remote load enable active, compressor load command
D Remote load enable not active, Pressure Schedule override function

### 4.4.16 RS485 Communications Management Control System:




Integration with a CMC air system management controller is inherent to all R1 controllers.

More than one VSR (variable speed regulated) compressor can be sequence managed by a CMC air system management controller. One VSR compressor, selected depending on control strategy, will be assigned as top-up and will operate with full range speed regulation. Other VSR compressor(s), assigned as base-load units, will operate at the optimum speed set in each controller. If demand exceeds total system capacity at any time all base-load VSR compressors will increase speed above the optimum setting (up to the maximum speed setting) as appropriate to maintain pressure.

The CMC management control system is capable of demand matching any mixture of different output capacity VSR and fixed speed compressors in energy efficiency mode of operation.

### 4.4.17 Reset To Defaults - CONFIGURATION TABLE

| **Factory Defaults** | | | | |
|---|---|---|---|---|
| **No.** | **Item** | **Description** | **Value** | **Unit** |
| | | | | |
| | **P01** | | | |
| 1 | d_t | Drain Open Time | 5 | sec |
| 2 | dIt | Drain Interval Time | 60 | sec |
| 3 | Rot | Standby Run-On Time | 300 | sec |
| 4 | Srt | Stop Run-On Time | 30 | sec |
| 5 | bdt | Blowdown Time | 10 | sec |
| 6 | t_S | Temperature Display Unit | 0 = °C | |
| | **P04** | | | |
| 7 | t_d | Delivery Temperature Shutdown | 120 | °C |
| | **P05** | | | |
| 8 | S_t | Service Timer | 2000 | hours |
| 9 | t_d | Delivery Temperature Alarm | 110 | °C |
| | **P06** | | | |
| 10 | tdL | Delivery Temperature Run Inhibit | 1 | °C |
| | **P08** | | | |
| 11 | Sdt | Star/Delta Time | 10.0 | sec |
| 12 | Ldt | Load Delay Time | 1.0 | sec |
| 13 | rdt | Reload Delay Time | 1.0 | sec |
| 14 | r05 | Relay 5 Function | 7 = drain | |
| 15 | r06 | Relay 6 Function | 3 = group fault | |
| 16 | dPt | Differential Pressure Fault Delay | 10 | sec |
| 17 | Art | Power Failure Auto Restart Time | 10 | sec |
| 18 | odt | Offload Drain Interval Time | 0 = off | sec |
| 19 | SPh | Starts Per Hour | 0 = off | number |
| 20 | FHt | Fan Temperature Control High - ON | 85 | °C |
| 21 | FLt | Fan Temperature Control Low - OFF | 75 | °C |
| 22 | Frt | Fan Temperature Control Minimum Run Time | 180 | sec |
| | **P09** | | | |
| 23 | SCS | Speed Regulation Mode Enable | 0 = off | |
| 24 | S_H | Maximum Speed | 3000 | rpm |
| 25 | S_L | Minimum Speed | 1500 | rpm |
| 26 | SoP | Optimum Speed | 2700 | rpm |
| 27 | SoF | Offload Speed | 1800 | rpm |
| 28 | P_f | P-Factor, Speed Regulation | 40 | number |
| 29 | P_I | I-Factor, Speed Regulation | 10 | number |
| 30 | rrS | Ramp Rate, Speed Regulation | 10 | %/sec |
| | **P11** | | | |
| 31 | t_d | Delivery Temperature Sensor Type | 3 = KTY | |
| 32 | P_I | Internal Pressure Enable | 0 = off | |
| 33 | t_I | 2nd Temperature Enable | 0 = off | |

| | | | | |
|---|---|---|---|---|
| 34 | t_I | 2nd Temperature Sensor Type | 3 = KTY | |
| | **P04** | | | |
| 35 | t_I | 2nd Temperature Shutdown | 120 | °C |
| | **P05** | | | |
| 36 | t_I | 2nd Temperature Alarm | 110 | °C |
| | **P08** | | | |
| 37 | Ao1 | Analogue Output 1 Function | 14 = delivery pressure | |
| 38 | Ao2 | Analogue Output 2 Function | 15 = delivery temp | |

### 4.4.18 Reset To Defaults - PRESSURE TABLE

| **Factory Default** | | | |
|---|---|---|---|
| **No.** | **Item** | **Description** | **bar** |
| | | | |
| | **P01** | | |
| 1 | uLP | Unload Pressure | 7.0 |
| 2 | L_P | Load Pressure | 6.5 |
| | **P04** | | |
| 3 | P_d | Delivery Pressure Shutdown | 8.0 |
| 4 | P_I | Internal Pressure Shutdown | 9.0 |
| 5 | d_P | Differential Pressure Shutdown | 1.0 |
| | **P05** | | |
| 6 | P_d | Delivery Pressure Alarm | 7.6 |
| 7 | P_I | Internal Pressure Alarm | 8.6 |
| 8 | d_P | Differential Pressure Alarm | 0.8 |
| | **P06** | | |
| 9 | P_I | Internal Pressure Run Inhibit | 0.5 |
| | | | |
| 10 | - - | Minimum Load Pressure Setting | 5.0 |
| 11 | - - | Delivery Pressure Shutdown Maximum | 16.0 |
| 12 | - - | Internal Pressure Alarm Minimum | 5.4 |
| 13 | - - | Internal Pressure Shutdown Maximum | 16.0 |
| 14 | - - | Differential Pressure Alarm Minimum | 0.2 |
| 15 | - - | Differential Pressure Shutdown Maximum | 5.0 |
| 16 | - - | Minimum Settings Differential | 0.2 |
| | | | |
| | **P11** | | |
| 17 | d_r | Delivery Pressure Sensor Range | 16.0 |
| 18 | I_r | Internal Pressure Sensor Range | 16.0 |
| | | | |
| | **P04** | | |
| 19 | P_r | Minimum Internal Pressure Shutdown | 0.0 = disabled |
| | | | |
| | **P01** | | |
| 20 | P_S | Bar/psi/kPa DisplayUnit | 0 = bar |

### 4.4.19 Temperature Sensor Adjustment Limits and Default Values

| **KTY Temperature °C** | min | max | default | step |
|---|---|---|---|---|
| Alarm | 70.0 | 131.0 | 110.0 | 0.5 |
| Shutdown | 71.0 | 132.0 | 120.0 | 0.5 |
| Range | -10.0 | 132.0 | - | - |

| **PT100/1000 Temperature °C** | min | max | default | step |
|---|---|---|---|---|
| Alarm | 70.0 | 249.0 | 210.0 | 0.5 |
| Shutdown Trip | 71.0 | 250.0 | 220.0 | 0.5 |
| Range | -50.0 | 250.0 | - | - |

| **RTD Temperature °C** | min | max | default | step |
|---|---|---|---|---|
| Alarm | 70.0 | 149.0 | 110.0 | 0.5 |
| Shutdown | 71.0 | 150.0 | 120.0 | 0.5 |
| Range | -40.0 | 150.0 | - | - |

# 5.0 Fault Messages

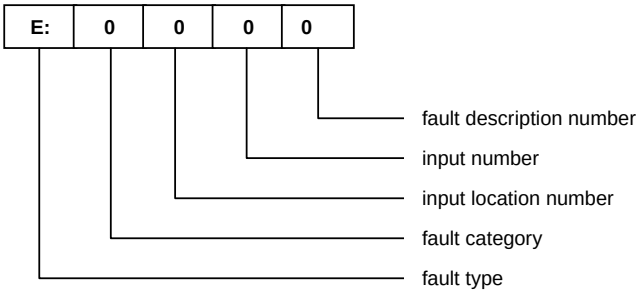
Faults are abnormal operating condition states. Alarms are fault states that indicate normal operating conditions have been exceeded but do not present an immediate hazard or potentially damaging condition. Alarms are intended as a warning only and will not stop the compressor or prevent the compressor from being started and run.

Start inhibits are fault states that prevent the compressor from initially being starting. Start inhibit faults are conditions that may present a hazard or damaging situation if the compressor was to be started. A start inhibit will self reset when the condition being monitored returns to normal operational levels. Start inhibit conditions are only checked during the initial start procedure and will not stop the compressor once started and in the 'started' state. Start inhibit conditions are not checked during an automated motor start from Standby.

Run inhibits are fault states that prevent the compressor from starting and running the main motor. Run inhibit faults are conditions that may present a hazard or damaging situation if the main motor is run. A run inhibit will self reset when the condition being monitored returns to normal operational levels and the compressor will then be allowed to exit the standby condition and run without further manual intervention. Run inhibit conditions are checked prior to a main motor start sequence and will not stop the compressor motor once started. Run inhibit conditions do not prevent the compressor from entering the 'started' state condition.

Shutdown trip errors are fault states that present a hazardous or damaging condition, the compressor is stopped immediately. The Shutdown trip error condition must be resolved, and the fault reset, before the compressor can be re-started.

The different fault state conditions are indicated on the screen with specific codes; the last character indicating the fault type: E = Shutdown Trip Error, A= Alarm, S = Start Inhibit, R = Run Inhibit. Shutdown trip errors are divided into two different categories: immediate shutdown errors and controlled stop errors. Immediate shutdown errors stop the compressor instantly (Emergency Stop button activated for example). Controlled stop errors stop the compressor in a controlled way using a normal Stop command; the motor will continue to run for the set stop run-on-time. Immediate shutdown errors have an error code where the first character is 0 (zero). Controlled stop faults have a "1" as the first character. Alarm faults are also divided into two different categories: alarms and service alarm messages. Alarms start with a "2", service alarm messages with a "4". Start Inhibit fault codes start with a "3".



| fault description number | fault description |
|---|---|
| 9 | high level shutdown trip |
| 8 | high level alarm |
| 7 | high level start inhibit |
| 6 | special function |
| 5 | sensor error |
| 4 | timeout |
| 3 | low level start inhibit |
| 2 | low level alarm |
| 1 | low level shutdown trip |
| 0 | digital input |

| input number | input |
|---|---|
| # | Input number for controller input terminal/location |

| input location number | input location description |
|---|---|
| 0 | digital input on base PCB |
| 1 | analogue input on base PCB |
| 2 | input on optional connector 1 (add on PCB) |
| 3 | input on optional connector 2 (add on PCB) |
| 4 | digital input on base PCB slave unit |
| 5 | analogue input on base PCB slave unit |
| 6 | input on optional connector 1 (add on PCB) slave unit |
| 7 | input on optional connector 2 (add on PCB) slave unit |
| 8 | special functions |
| 9 | special functions slave unit |

| fault category number | fault category description |
|---|---|
| 0 | immediate shutdown trip error |
| 1 | controlled shutdown trip error |
| 2 | alarm |
| 3 | start inhibit |
| 4 | service |

| fault type | fault type description |
|---|---|
| E | shutdown trip error |
| A | alarm (or service message alarm) |
| S | start inhibit |
| R | run inhibit |
| L | load inhibit |

## 5.1 Immediate Stop Shutdown Errors

### 5.1.1 Digital input errors

E:0010 emergency stop
E:0020 oil filter differential pressure switch
E:0040 air/oil separator differential pressure switch
E:0080 motor fault (fault relay contact, overload switch or PTC thermistor)

### 5.1.2 Analogue input errors

E:0115 delivery pressure sensor fault
E:0119 delivery pressure high
E:0125 delivery temperature sensor fault
E:0129 delivery temperature high
E:0131 internal pressure failed to exceed minimum internal pressure setting P_r
E:0135 internal pressure sensor fault
E:0139 internal pressure high
E:0145 2nd temperature sensor error
E:0149 2nd temperature high

### 5.1.3 Special function errors

E:0809 diff pressure high
E:0814 blowdown timeout
E:0821 short circuit condition detected on Digital Inputs terminal X03
E:0831 short circuit condition detected on Analogue Inputs terminal X01
E:0836 main Controller PCB – PLL unlocked error
E:0837 main Controller PCB - SPI error
E:0846 delivery pressure sensor range incorrect for model type
E:0856 internal pressure sensor range incorrect for model type

E:5000 controller – parameter table index corrupt

## 5.2 Controlled Stop Shutdown Errors

E:1804 HMI communication timeout

## 5.3 Alarms

### 5.3.1 Digital input alarms

A:2030 air filter differential pressure switch

### 5.3.2 Analogue input alarms

A:2118 delivery pressure high
A:2128 delivery temperature high
A:2138 internal pressure high
A:2148 2nd temperature high

### 5.3.3 Special function alarms

A:2808 diff pressure high
A:2816 power failure occurred while compressor was in the Started state

A:2826 internal SPI error
A:2836 RTC error or clock feature not detected and pressure schedule function enabled

## 5.4 Start Inhibits

none

## 5.5 Run Inhibits

R:3123 delivery temperature Td below the set low temperature run inhibit level, controller will allow motor start when temperature increases above the set level
R:3137 internal pressure PI higher than the set run inhibit pressure level, controller will allow motor start when pressure decreases below the set level, see blowdown timeout E0814

## 5.6 Load Inhibits

none

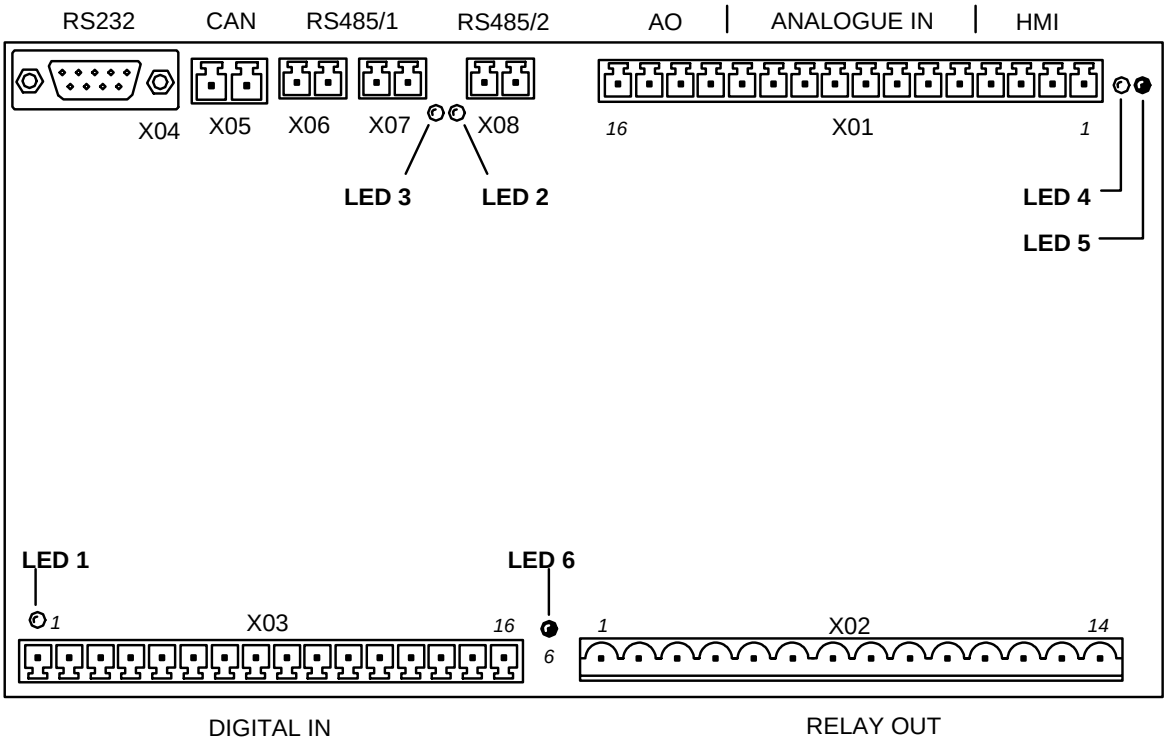
## 5.7 Service Alarms

### 5.7.1 Special function service alarms

A:4804 service hours time expired, service due

## 6.0 R1 Controller - LED indications

On the R1 base PCB; six LED's give diagnostic information about different functions. LED's 1-4 are green and indicate CPU and/or communication activity. LED's 5 and 6 are red and indicate short circuit conditions on the associated input terminal.




LED's 1-4 use different system timers and predefined blink rates to indicate different active functions:

The following rules apply:

LEDx blinks using the 500msec toggle signal:
- the corresponding CPU is running without any communication on any channel

LEDx blinks using the ch.1 active signal:
- the corresponding CPU is communicating on the channel which is defined to be channel 1 for this CPU.

LEDx blinks using the ch.2 active signal:
- the corresponding CPU is communicating on the channel which is defined to be channel 2 for this CPU.

LEDx blinks using the ch.3 active signal:
- the corresponding CPU is communicating on the channel which is defined to be channel 3 for this CPU.

LEDx blinks using the ch.4 active signal:
- the corresponding CPU is communicating on the channel which is defined to be channel 4 for this CPU.

LEDx blinks using the ch.1&2 active signal:

- the corresponding CPU is communicating on both channels and indicates this by alternating the channel 1 and channel 2 blink rate.

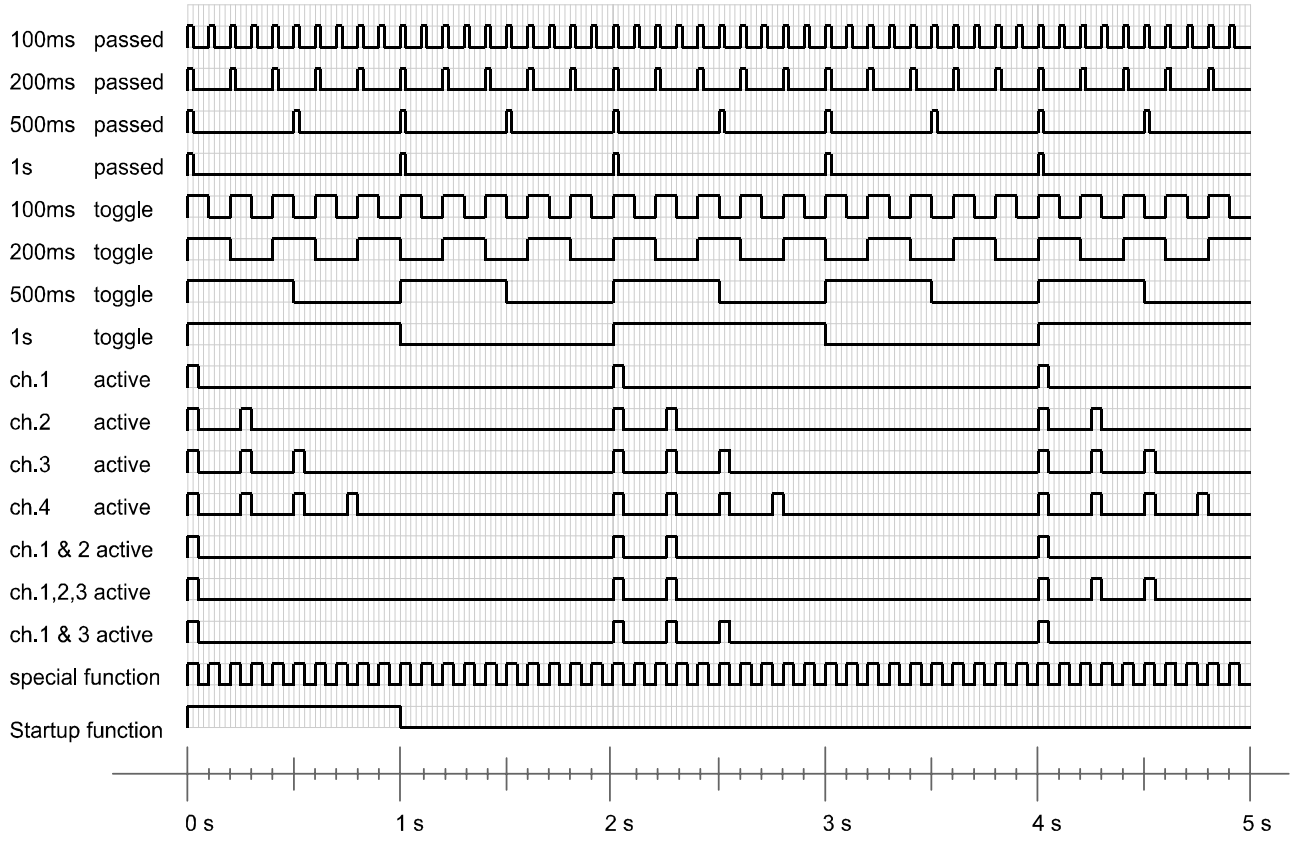
LEDx blinks using any combination of channel active signals:

- the corresponding CPU is communicating with those channels currently being indicated.

LEDx blinks using the special function signal:

- the corresponding CPU is performing a special function. This special function will be defined for every specific case.

## system timer and indication functions



| | |
|---|---|
| - LED1 = 500msec toggle signal: | ST10 CPU is up and running (main processor) |
| - LED1 = channel 1 active signal: | ST10 CPU has communication with the I/O CPU using the SPI I/O channel |
| - LED1 = channel 2 active signal: | ST10 CPU has communication with the I/O CPU using the SPI OPTION1 channel |
| - LED1 = channel 3 active signal: | ST10 CPU has communication with the I/O CPU using the SPI OPTION2 channel |
| - LED1 = channel 4 active signal: | ST10 CPU has communication with the I/O CPU using the SPI EXTENDED OPTION channel |
| - LED1 = special function signal: | ST10 CPU is running in the boot download program |
| - LED1 = startup function signal: | ST10 CPU is starting up and is initialising everything |

| | |
|---|---|
| - LED2 = channel 1 active signal: | ST10 CPU has communication with an external device connected to the RS485(1) channel |
| - LED2 = channel 2 active signal: | ST10 CPU has communication with an external device connected to the CAN channel |
| - LED2 = special function signal: | ST10 CPU is running in TESTLIB mode. |

| | |
|---|---|
| - LED3 = channel 1 active signal: | ST10 CPU has communication with an external device connected to the RS485(2) channel |
| - LED3 = channel 2 active signal: | ST10 CPU has communication with an external device connected to the RS232 channel |

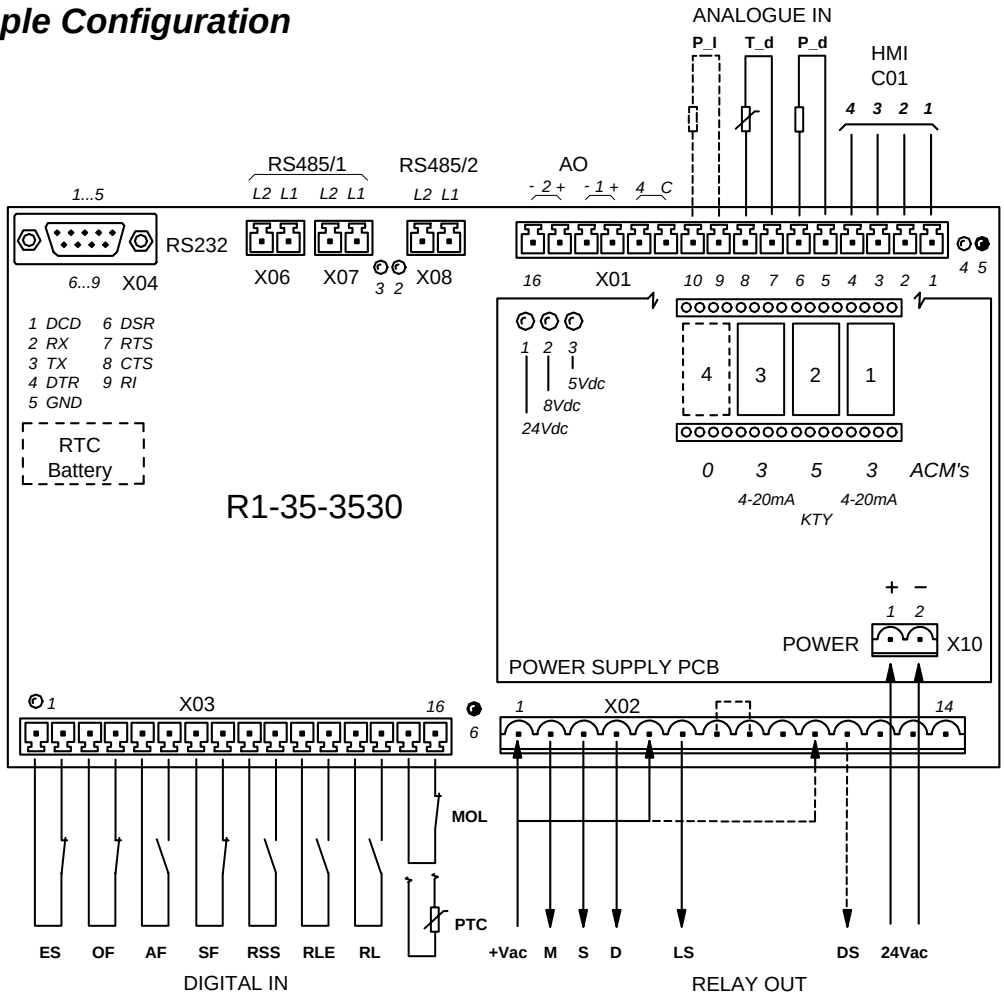
| | |
|---|---|
| - LED4 = 500msec toggle signal: | I/O CPU is up and running (slave processor for relays and analog inputs and outputs) |
| - LED4 = channel 1 active signal: | I/O CPU has communication with the ST10 CPU using the SPI I/O channel |
| - LED4 = channel 2 active signal: | I/O CPU has communication with an external device (e.g. HMI with custom display) connected to the RS485(HMI) channel |
| - LED4 = special function signal: | I/O CPU is performing the calibration function. |
| - LED4 = startup function signal: | I/O CPU is starting up and is initialising everything |

The red indication LED's (LED5-LED6) are located near a connector where digital inputs and analogue sensors can be connected to the power supply. The R1 is protected against short circuits in external cabling. If the current limit is exceeded the protection will shutdown the power and indicate this by the corresponding red LED. After a given amount of time a retry will be performed to check if the overload is still there. If not, the led will go out and power returned. If the overload is still present, the same amount of time is used for the next attempt.

| | |
|---|---|
| - LED5 = off: | no overload in analogue input circuit. |
| - LED5 = on: | overload in analogue input circuit. |

| | |
|---|---|
| - LED6 = off: | no overload in digital input circuit. |
| - LED6 = on: | overload in digital input circuit. |

## *7.0 Example Configuration*




| | |
|---|---|
| ES | Emergency Stop Button |
| OF | Oil Filter High DP |
| AF | Air Filter High DP |
| SF | Air/Oil Separator Element High DP |
| RSS | Remote Start/Stop |
| RLE | Remote Load Enable |
| RL | Remote Load |
| MOL | Motor Overload |
| PTC | Motor PTC (option) |
| M | Main(Line) Motor Contactor |
| S | Star Motor Contactor |
| D | Delta Motor Contactor |
| LS | Load Solenoid |
| DS | Drain Solenoid (option) |
| P_d | Delivery Pressure Sensor (4-20mA) |
| T_d | Delivery Temperature Sensor (KTY) |
| P_I | Internal Pressure Sensor (4-20mA) |