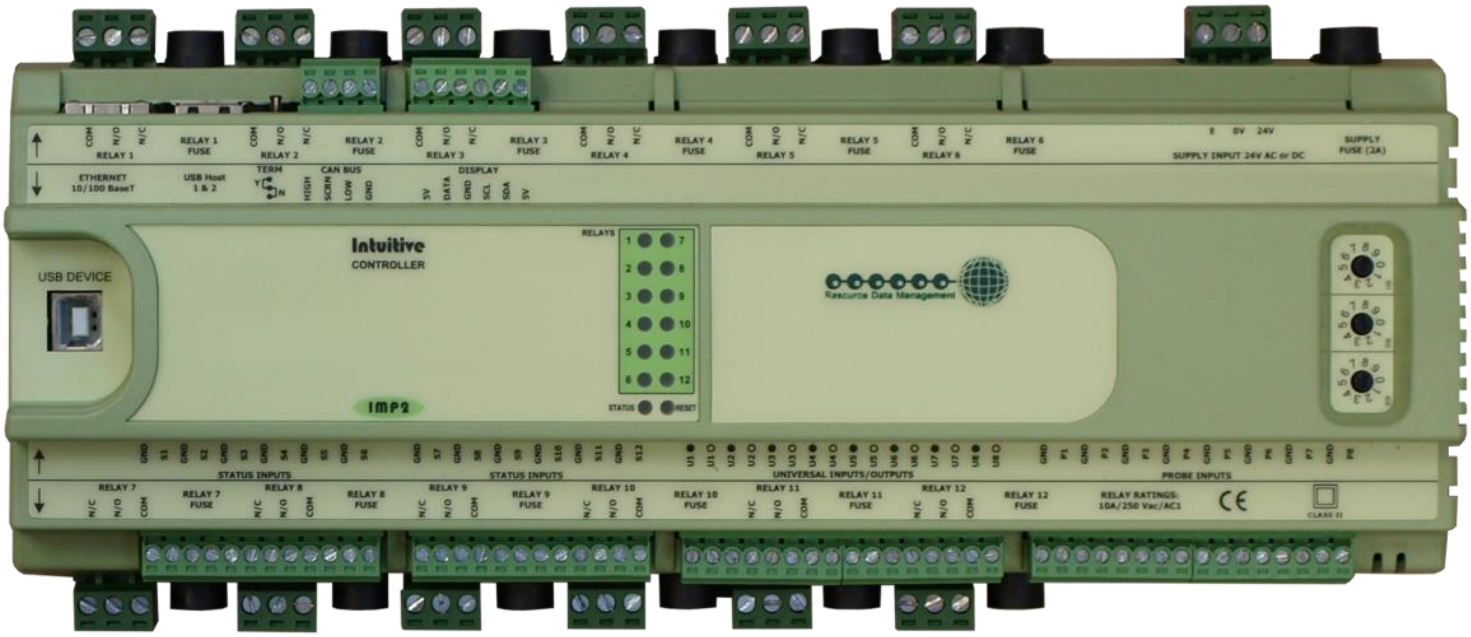
Resource
Data Management

Intuitive Transcritical Superpack

Commissioning/User Guide

Revision 3.8



PR0650-STCO2

Contents

The Intuitive Range

From Resource Data Management

This documentation refers to the Intuitive Transcritical Superpack Controller Firmware version V3.8 or above.

Description

The Intuitive Transcritical Superpack Controller is a versatile controller with up to 5 individual control sections, HT Pack, LT Pack, Gas Cooler and Receiver control and HT and LT Oil injection control. Based on the Superpack platform there are several main controller hardware variants (See table below) and up to 10 expansion boards (IO expansion, Mini IO expansion or stepper expansion) can be added depending on how many inputs and outputs are required.

Each pack section has 16 digital outputs that are configurable for compressors, loaders, trim compressors, a digital scroll compressor or gas dump relay. Sixteen status inputs can be assigned for pack section inputs or general alarms. There are four analogue inputs (4-20mA, 0-5Vdc, 0.5-4.5Vdc, 0.5-9.5Vdc , 1-2Vdc, 1-6Vdc or 0-10Vdc) for pressure transducers, one for suction pressure, one for discharge pressure and two for general monitoring (if required). Eight temperature probe inputs are available for suction temperature, discharge temperature and general monitoring (if required). One analogue output is available to control a variable speed drive (0-20mA, 4-20mA, 0-5Vdc or 0-10Vdc).

The Gas Cooler and Receiver control section has six analogue inputs (4-20mA, 0-5Vdc, 0.5-4.5Vdc, 0.5-9.5Vdc, 1-2Vdc, 1-6Vdc or 0-10Vdc) one for gas cooler pressure, one for receiver pressure, two for general pressure monitoring (if required) one for liquid level and one voltage input for a heat reclaim sensor. There are eight probe inputs to measure gas cooler temperature, gas cooler ambient, gas cooler air on and gas cooler air off temperatures, one probe to control liquid injection, one probe for heat recovery and two temperature probe inputs for general temperature monitoring. There are 13 digital outputs that can be used as gas cooler inverter enable, gas fan inverter enable, receiver inverter enable, auxiliary inverter output enable, transcritical relay, liquid injection, superheat low relay, superheat high relay, heat recovery bypass relay, heat recovery valve, offline relay, run relay and alarm relay. There are five analogue outputs (these can be set to either 0-5Vdc, 0-10Vdc, 4-20mA, 1-2Vdc, 1-6Vdc or 0-20mA) to control the gas cooler valve, a gas cooler fan inverter drive, a receiver valve, a heat recovery valve and an auxiliary compressor inverter drive. There are also three stepper valve outputs available which can be used control the receiver valve, gas cooler valve and heat recovery valve. There are 8 status inputs that can be used for extra capacity enable and receiver high and low alarm inputs.

Each oil injection control section has twenty status inputs available, sixteen for oil enable inputs, one oil separator input, one oil low input, one oil high input and one reset input.

Note: The HT, LT and one of the monitor pressures (input 3 on the main plant controller board) are also available to be broadcast over the Data Manager network for use by an RDM Mercury Switch (PR0018-PHI).

The “Fuzzy” based control algorithm will give enhanced control whilst maintaining the starts per hour requirement. The algorithm also reduces the number of input parameters required for control; only a target pressure is needed.

The “staged” type allows the user to manually program the output stages to the desired switching sequence.

The Intuitive Plant controller has an embedded 7thernet port to allow connection to a Data Manager system without the need for a communications module. A USB port allows for a direct PC connection, due to the number of parameters available it is recommended to use PC for commissioning the controller.

All relays have volt-free contacts and can be mixed between low and high voltage sources. Each controller or expansion requires a 24Vac or 24Vdc supply (a 2A PSU is available from RDM: - PR0625)

Intuitive / Plant Controller Descriptions	Part Number
Intuitive Transcritical Superpack Controller (No Internal Display)	PR0650-STCO2
Intuitive Transcritical Superpack Controller (No Internal Display) and one solid state relay (for digital scroll)	PR0650-STCO2-E1
Intuitive Transcritical Superpack Controller (No Internal Display) and two solid state relays (for digital scroll)	PR0650-STCO2-E2
Intuitive Transcritical Superpack Controller (No Internal Display) two stepper outputs	PR0652-STCO2
Intuitive Transcritical Superpack Controller (No Internal Display) two stepper outputs and one solid state relay (for digital scroll)	PR0652-STCO2-E1
Intuitive Transcritical Superpack Controller (No Internal Display) two stepper outputs and two solid state relays (for digital scroll)	PR0652-STCO2-E2
Intuitive Stepper expansion board with 8 probe inputs, 8 status inputs, 8 universal Ios, 4 relays and 6 stepper motor outputs.	PR0660
Intuitive IO expansion board with 8 status inputs, 8 universal Ios and 12 relays	PR0661
Intuitive Mini IO expansion with 4 Universal Inputs and 5 relays.	PR0663

Configuration

The controller has 2 configuration options: -

Types

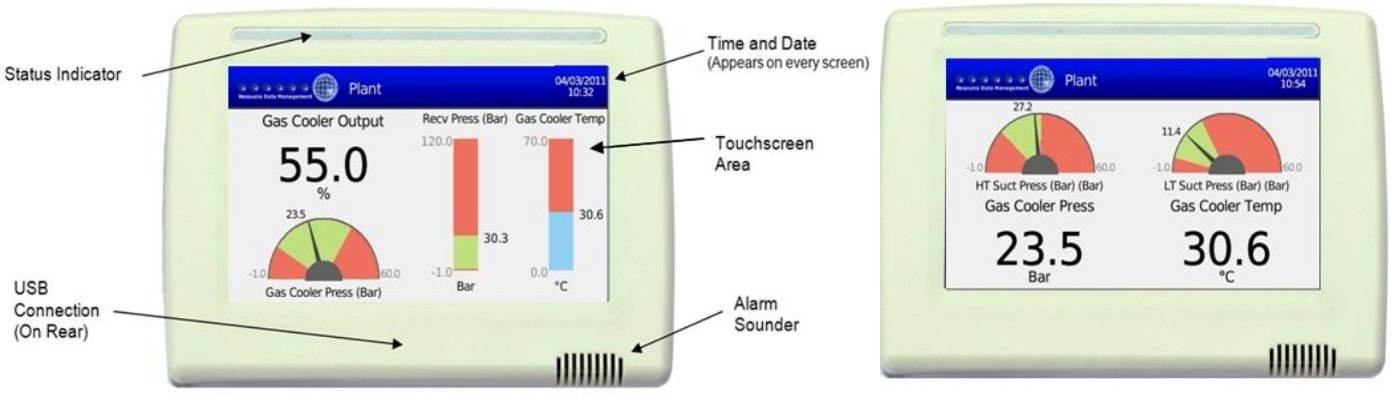
Display value	Type	Control Type
1	Dual Pack	Fuzzy
2	Dual Pack	Staged

The controller is delivered pre-configured as a Dual Pack Fuzzy (Type 1) See Type Change

Plant Controller Colour Touch Display (PR0615)

The Plant Controller Colour Touch Display can be used as an interface for viewing inputs, outputs, parameters and alarm information. This display also allows the user to view the current control state and make changes to parameters.

The custom screen, shown below, can be used to show any Input, output or the control state using a selection of graphic interfaces. This allows the user to highlight the key values or processes to quickly and easily view the desired information.



The Display has a built in alarm sounder and a status indicator bar. The status indicator bar is blue with no alarms and changes to red when in an alarm condition.

When an alarm condition occurs the alarm description is listed on the display, the status bar changes to flashing red and the sounder will be activated. When the accept button is pressed on the display the sounder will be muted and the status indicator bar at the top of the display will become static red. When the alarm condition clears the status indicator bar will return to static blue

Individual alarms can also be disabled at the touch screen display so that specific alarms will not sound or be displayed on the display, in this situation alarms will still be sent to the Data Manager.

See RDM web site "Plant Controller Touch Screen Display" for more information.

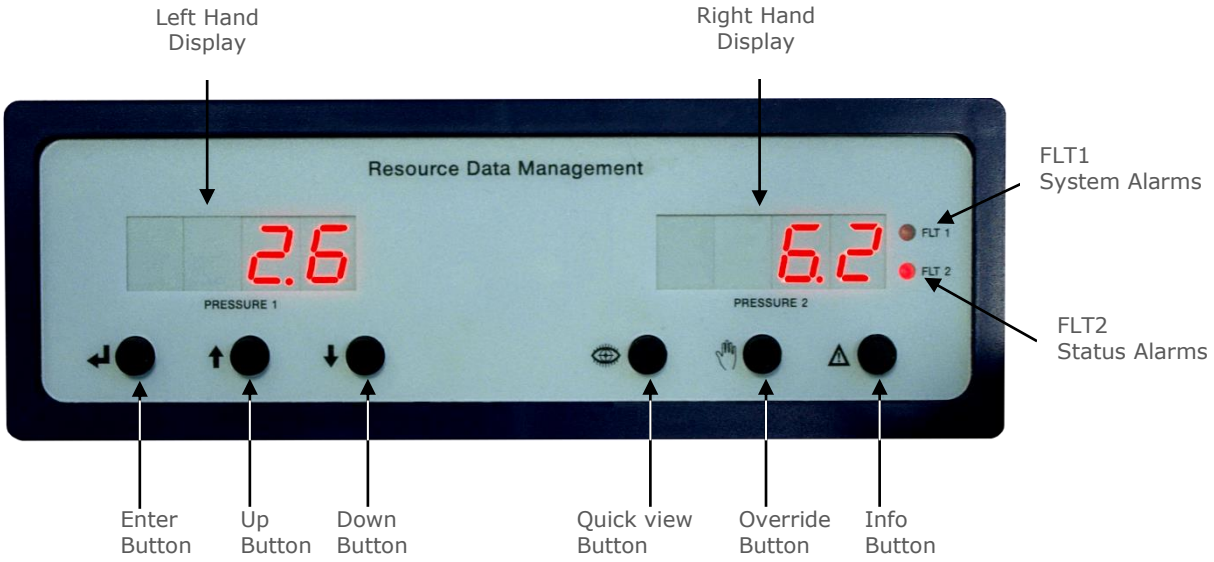
Opposite is a typical screen showing a list of Inputs, the touch display allows you to scroll up and down the list by placing your finger on the display and sliding it upward or downward motion.

You can view outputs by touching the "Outputs" box.

Likewise you can view "States", "Params" and "Alarms" by touching the required box.

Remote Display (PR0620)

The remote display PR0620 is a simpler user interface which can be used in conjunction with the Touchscreen display. **Note** the controller doesn't have an internal display option, only the remote display(s) can be used.



Left Hand Display

The 4 character display shows the pressure or temperature and scrolls round however many sections are used
In set-up mode, displays the set-up menu items
In quick view mode, indicates the target pressure
In Override mode, indicates and allows the relays to be forced on

Right Hand Display

The 4 character display shows which section pressure or temperature being displayed in left hand display "PgAS" (gas cooler pressure), "Sec 1" etc
In set-up mode, display is blank
In Override mode, display is blank

Front Panel Remote Display Buttons

Enter Button: - Used along with down button to enter menu items.

Up Button: - Used to scroll up.

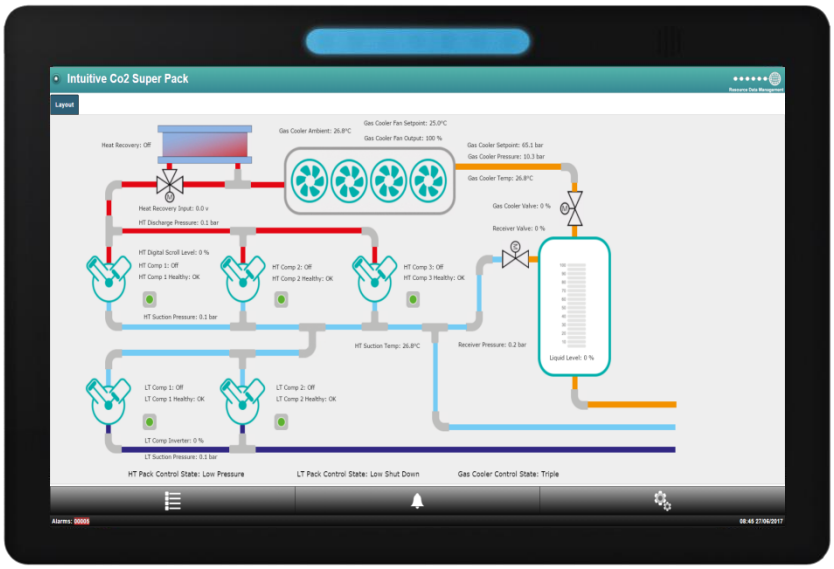
Down Button: - Used to scroll down.

Quick View Button: - Used to view the target pressures and temperatures (See Quickview section).

Override Button: - Used with the "Enter" button, to go into the override mode or to view current variable output values (See Override section).

Info Button: - Used to view the current alarms. (See Info section).

Touch XL



The TouchXL when connected to the CO2 Superpack, is used as a display, mimicking the view of the standard web interface to the controller. It is used to interact with the application software and alarm indication.

As default, the TouchXL will show an overview list of current values such as pressures, temperatures and fault inputs. An optional graphical layout can be loaded onto the CO2 Superpack controller which will appear on the TouchXL. Layouts can be generated using the RDM Layout Editor software which is available separately.

The TouchXL has the benefit of being able to connect to the Intuitive device via USB (USB host 1 or 2) to micro USB or standard Ethernet connections over IP.

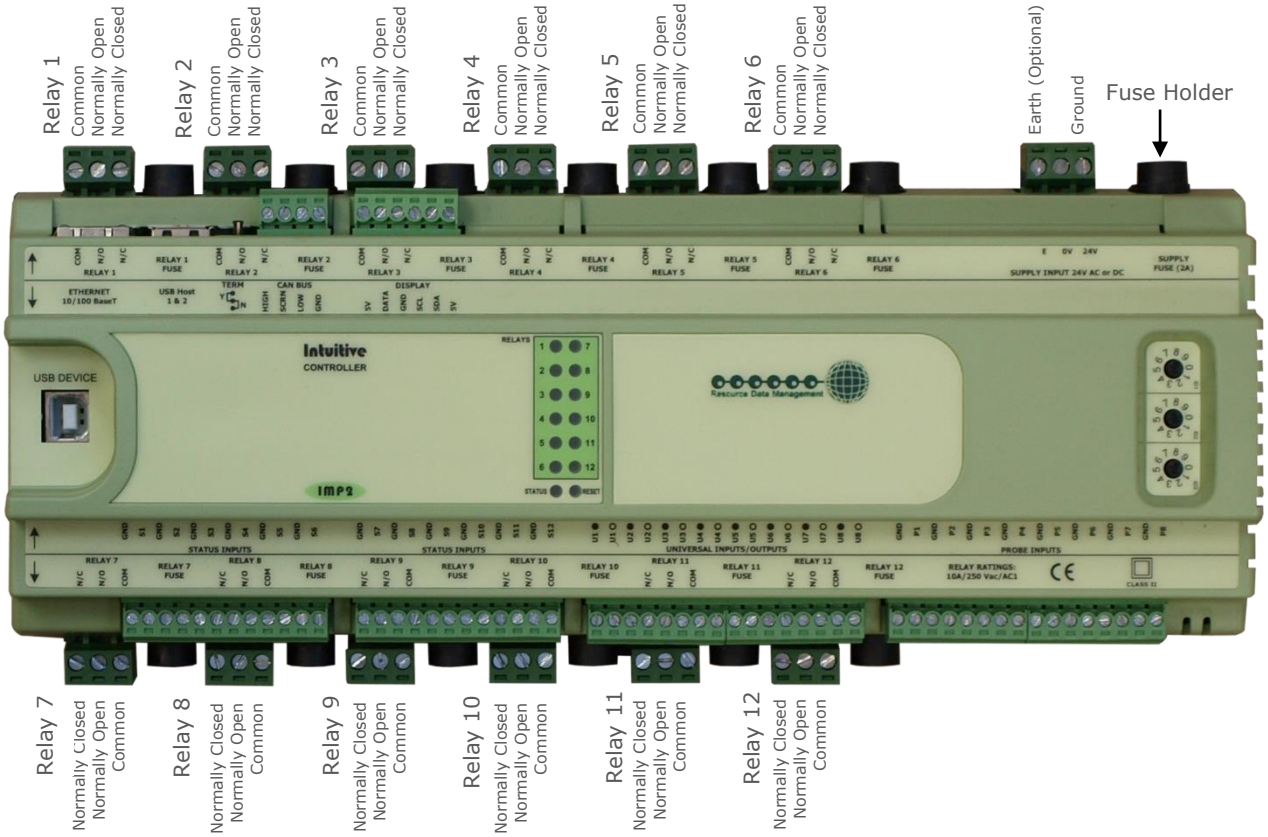
When connecting using the USB method, the communication of the two devices is automatic and the Touch XL will automatically configure itself for use.

Connecting over Ethernet comms requires the configuration of the TouchXL to be setup to 'look at' the Intuitive CO2 Superpack device. This can be carried out in the 'Network Configuration' page within the TouchXL service menus (only accessible directly on the touch screen). Please consult the specific documentation for more details.

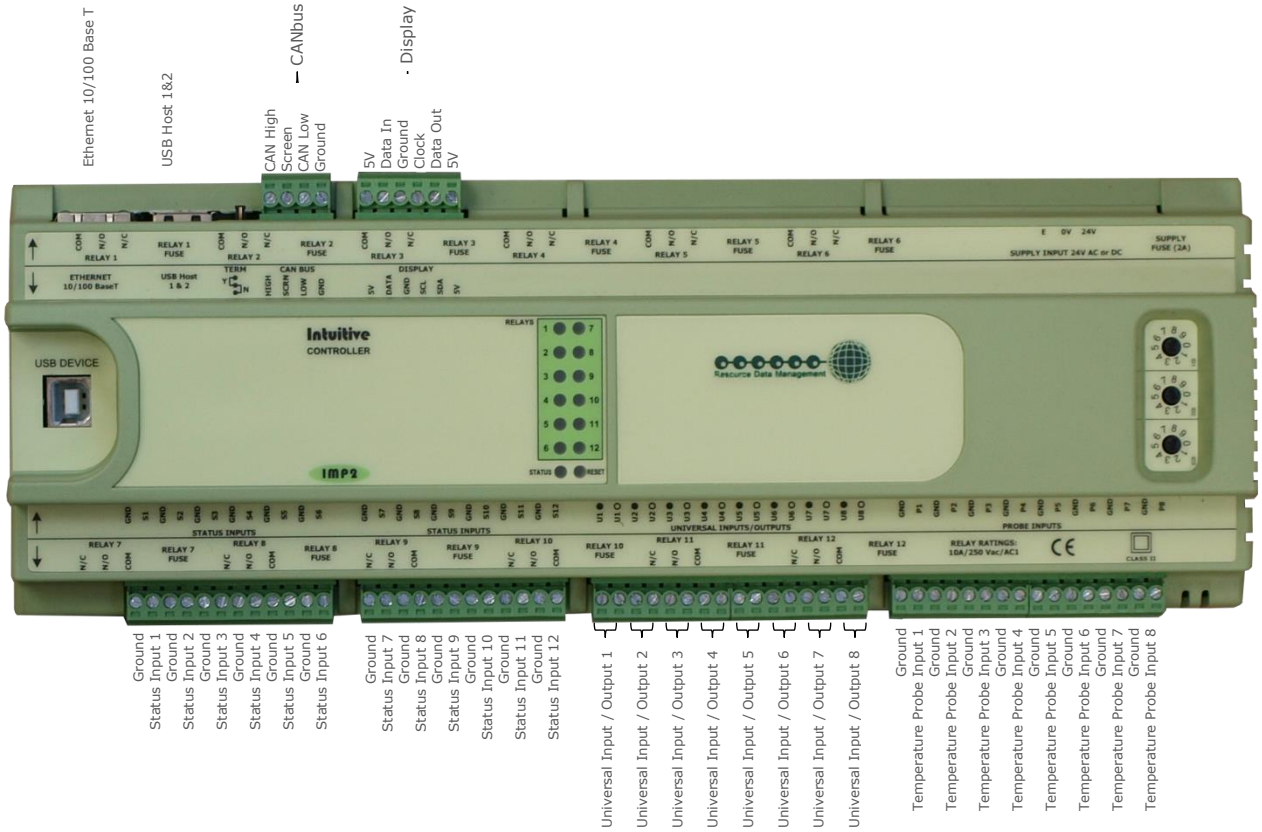
Note: The TouchXL display is only compatible with Intuitive CO2 Superpack software V3.5 and above.

Intuitive Plant Controller I/O Connections (PR0650)

Bottom Row Connections

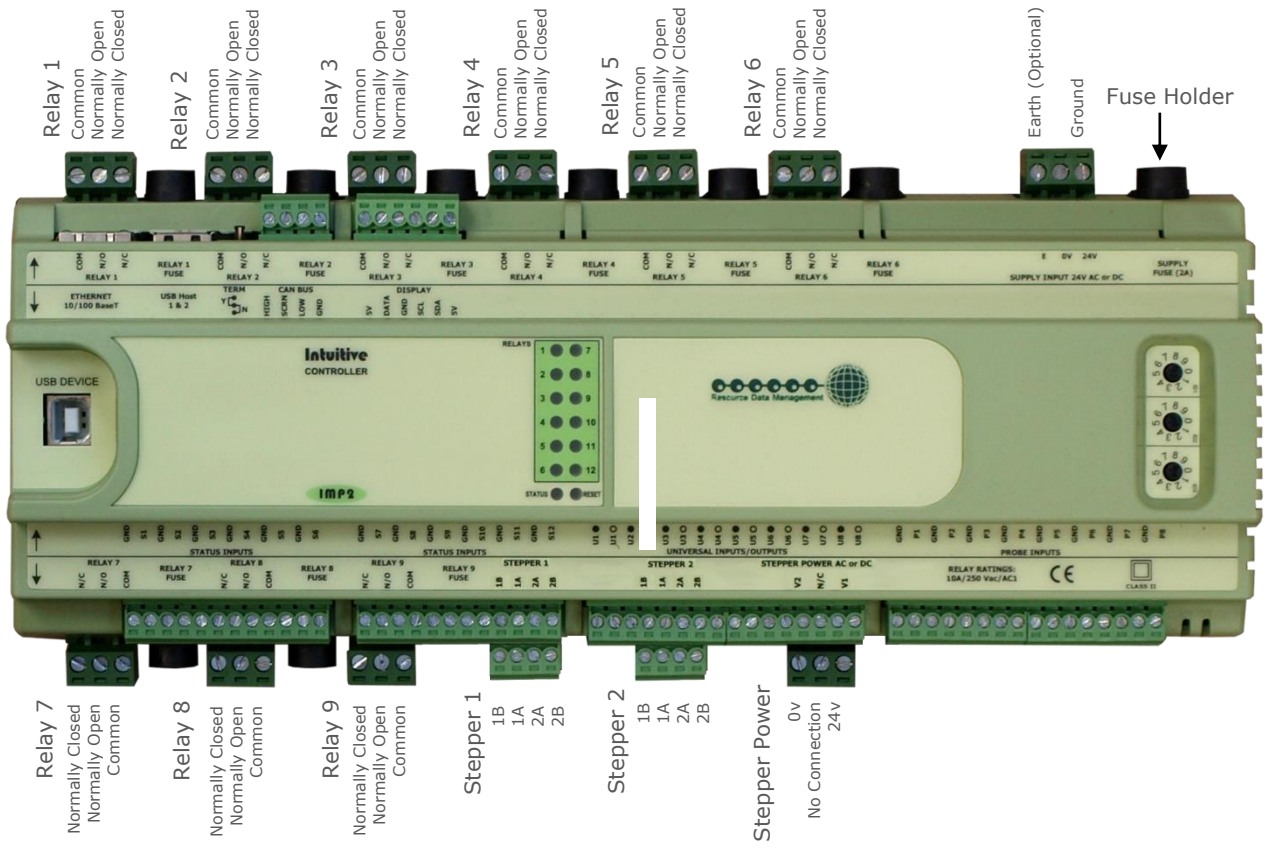


Top Row Connections

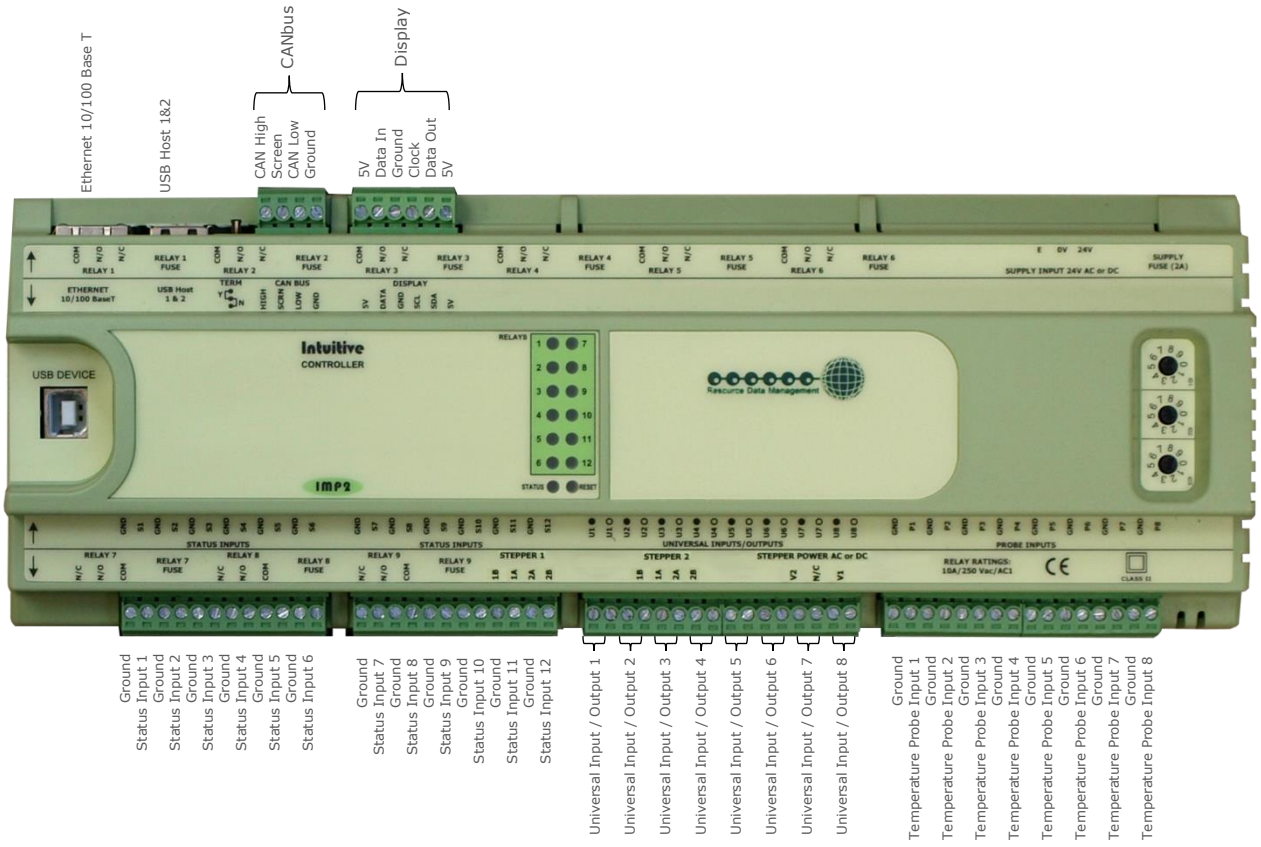


Intuitive Plant Controller with Two Stepper Outputs I/O Connections (PR0652)

Bottom Row Connections

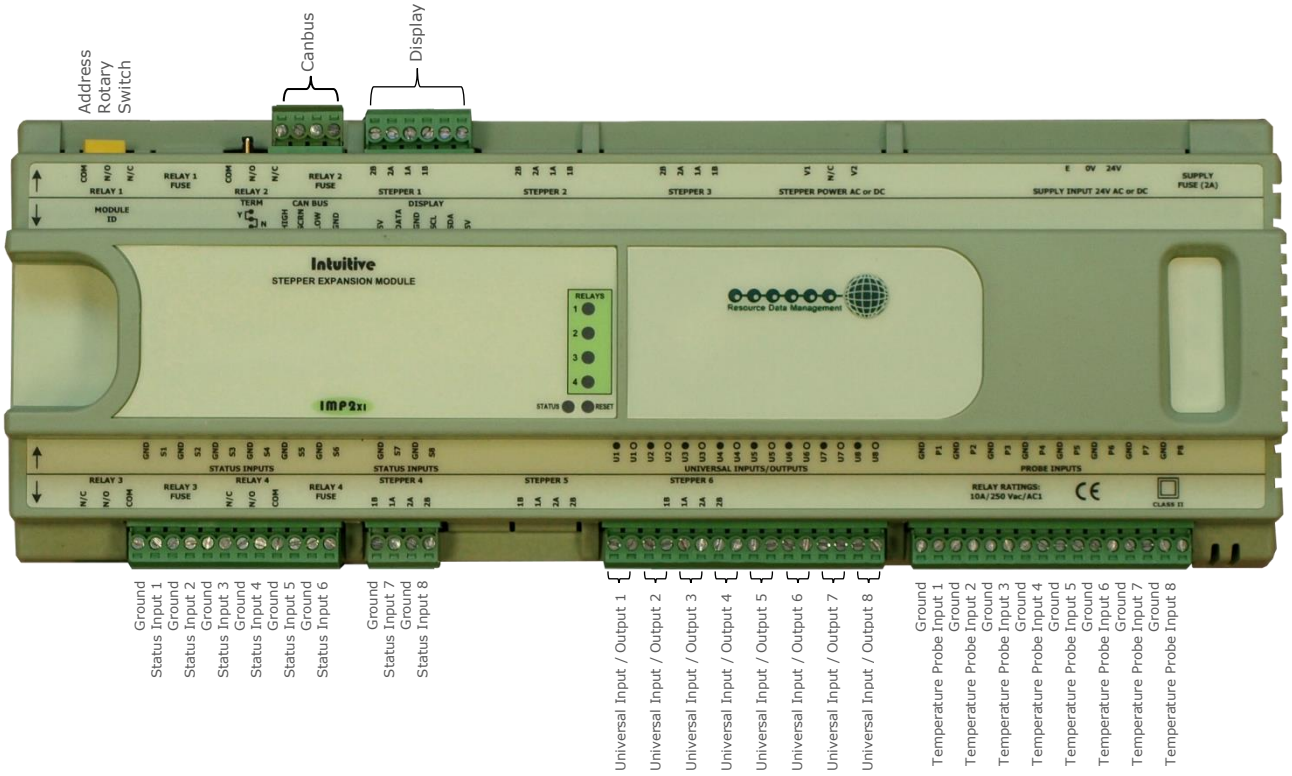


Top Row Connections

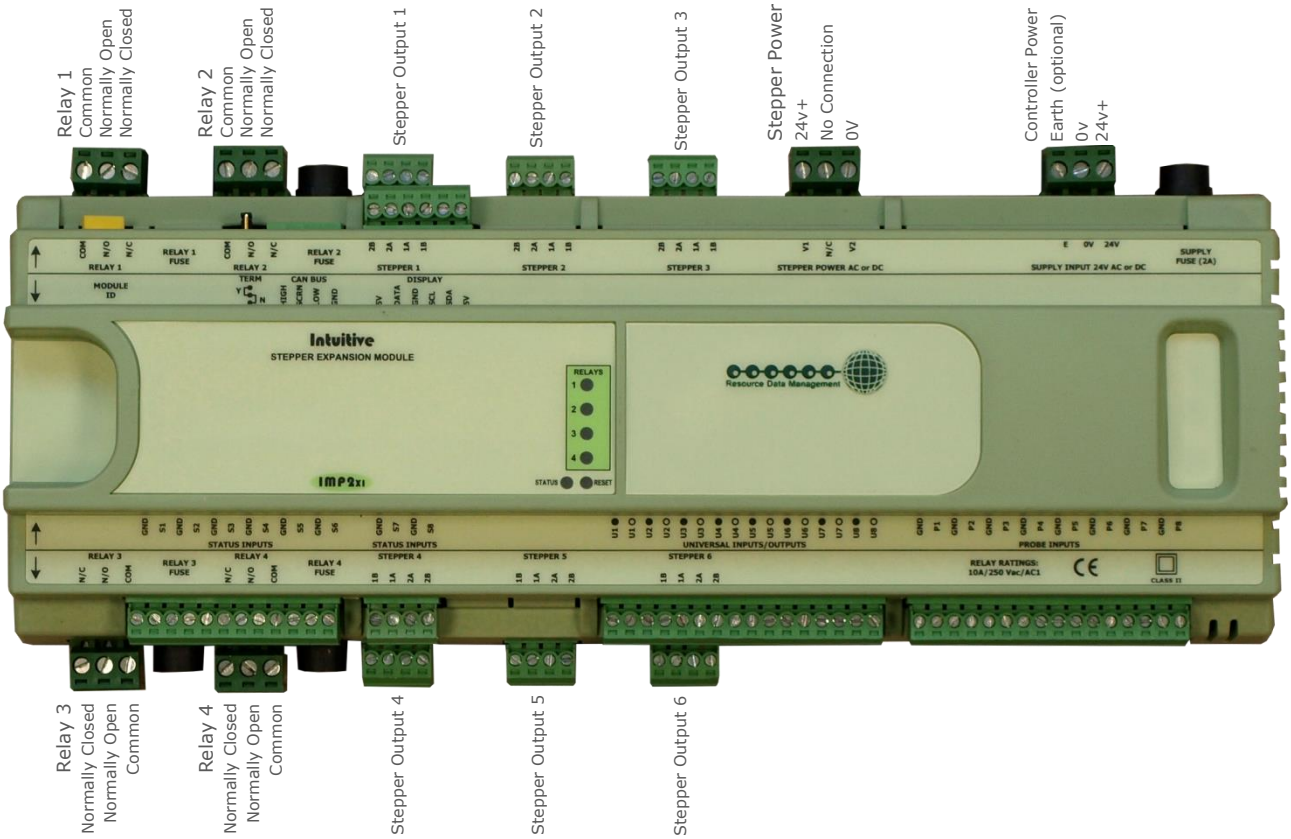


Intuitive Stepper Expansion Module (PR0660)

Top connectors

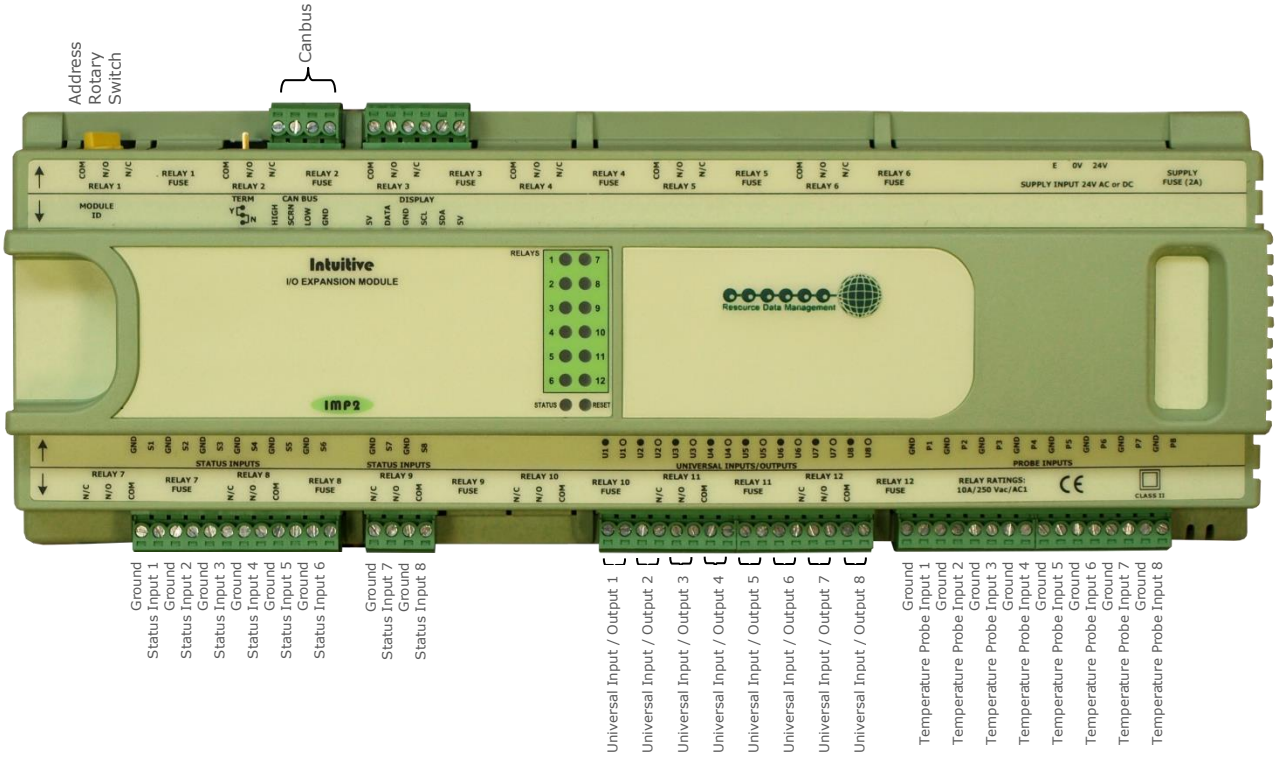


Bottom Connectors

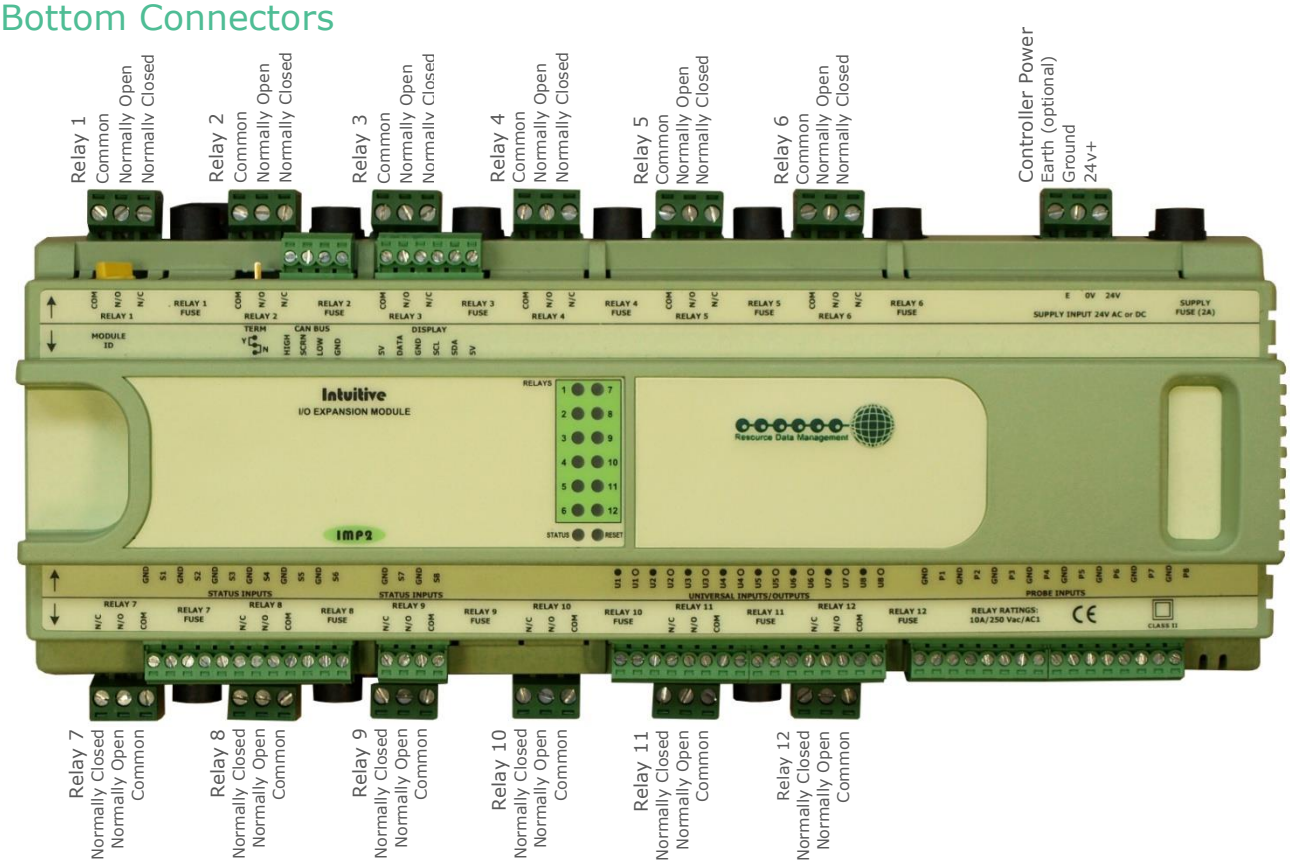


Intuitive Plant IO Expansion Module (PR0661)

Top connectors



Bottom Connectors

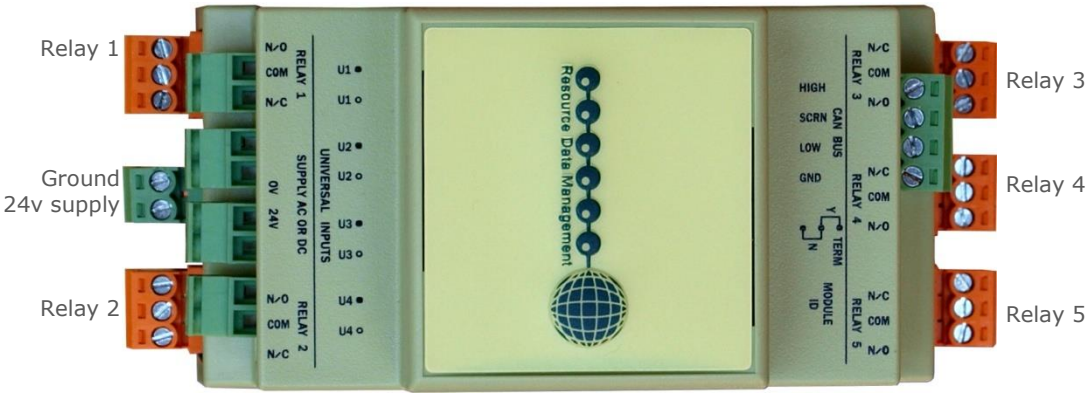


Note: If an AC supply is used to power the main control board or expansion board, the same AC supply cannot be used to power the Stepper valve(s), however a DC supply can be used to power both the control board(s) and the Stepper valve(s).

Intuitive Mini IO Expansion Module (PR0663)

Top connectors

Bottom connectors



Intuitive CO2 Super Plant Pack Controller, Universal Analogue Input / Output Connections

	0 or 4 -20mA or 0 – 10V Input
U1-U8 ●	0 or 4-20mA loop input or variable dc voltage ground.
U1-U8 ○	12v transducer feed or variable dc voltage input.

Input/s & Outputs

All Types	Description	Comments
Status Inputs 1-12 (Main) or 1 – 8 (Expansion)	0V return or 24 Vac	Note 1
Analogue Inputs 1-8	Probe input	Note 2
Universal IO 1-8 Universal Input Only 1-4 on Mini IO Expansion	Analogue Input/Output	4-20mA, 0-5Vdc, 0.5-4.5Vdc, 0.5-9.5Vdc , 1-2Vdc, 1-6Vdc or 0-10Vdc. 4-20mA or 0-10V / 5V output (Mini IO expansion only has Inputs, outputs not available).
Stepper Valve 1-6 (Stepper expansion) or 1-2 (On Main PR0652 two stepper variant)	Bi Polar Stepper Valve Driver	12-24vdc, 825mA / 8W maximum.
Relay 1-12 Relay 1-9 (On Main PR0652 two stepper variant) Relay 1-5 (On Mini IO Expansion)	N/O, N/C and Common	Volt Free. If SSR is fitted then only the Common and N/C are connected
Status LED	Healthy LED	When powered up the LED will flash off/on every 0.5 seconds

Note 1: 24 Vac must have the same 24 Vac return as the supply voltage. If using the Plant controller 24V power supply only the 24Vac signal from the supply is required for the status input.

Note 2: Several probe types are available, see Probe Type

Setting up the controller

Set-up access to the controller can be achieved several ways

- Through the front mounted buttons on the remote display
- Direct access by PC via a USB connection
- TouchXL via a USB connection
- Direct access by a PC via an Ethernet Connection
- Through the RDM Data Manager.

*Note: Due to the high number of data points within the Superpack controller it is not advisable to network the controller to a Data Manager with firmware V2.0.8 or earlier. Doing so will not affect the operation of the Superpack controller but it will have an adverse affect on the Data Managers operation and therefore a Data Manager firmware update is required.

Set-up Mode

Set-up through front buttons

The following tables only apply if using a remote pressure display (PR0620) which has 6 pushbuttons on the front, this enables settings to be changed without the use of a PC however this method is not advisable for full commissioning.

To enter set-up mode, hold the Enter and Down buttons together for approximately 3 seconds until the message "Ent" appears on the display. Now press the Enter button again to enter the function menu, dEty will be displayed. Scroll up or down to go through the list. Alternatively use either a PC connection for configurations or load a configuration from a memory-stick

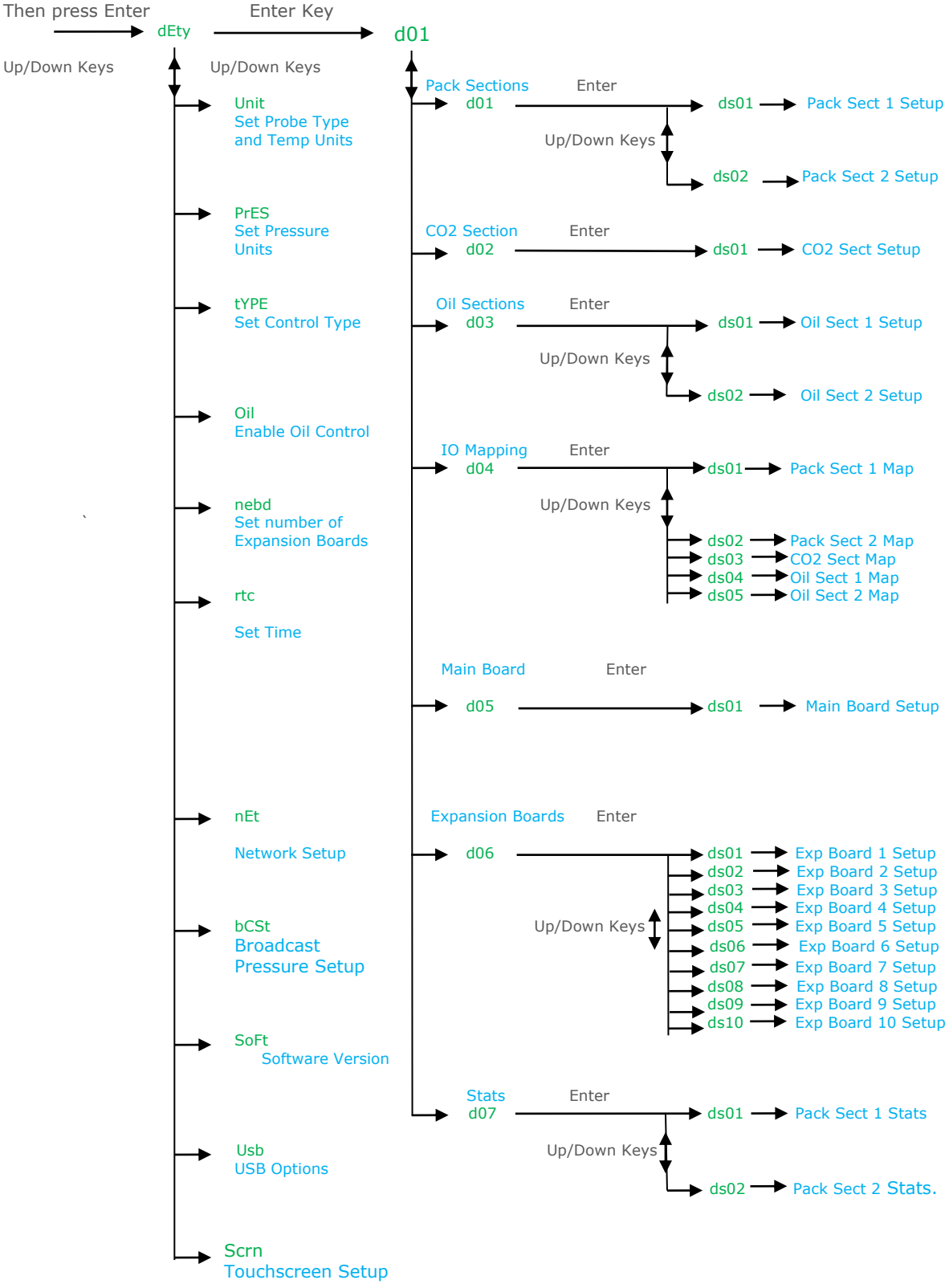
Set-up Menus

LH Display	LH Display	LH Display	Option	Explained in Paragraph
dEty →	If Selected			
	d-0x (d-01 to d-06) x = Device Number →	dS0x (dS01 0o dS03) x = Section Number	Select Device/Section to view/change	Device Number
		IO	View Input/Output States	View Input/Output States
		ParA	Set/view Parameters	Set/view parameters
←	ESC ←	ESC		
Unit			Set/View Probe Type & Units	Set/View Units
Pres			Set/View Pressure Units	Set/View Pressure Unit
TyPE			Set/View Controller Type	Set/view product type
Oil			Enable Oil Control Section	Set/view Oil Control
Nebd			Set number of expansion boards	Set/view expansions
rtc			Set/view Clock	Real Time Clock
nEt			Set/view network configuration	Network Configuration
bCSt			Broadcast (Pressures)	Broadcast
SoFt			View software version	
Usb			Save/Load onto USB device	USB
Scrn			Viewed on touch display	Touch Display Screens
ESC			Exit set-up mode	

Display (PR0620) Menu Structure

Hold Enter and Down Keys for 3 seconds Then press Enter

Text, as it appears on the display, is shown in green. Parameter description is shown in blue.



Device Number

There are 6 sections that can be viewed / set up in dEty

d-01 (Pack Sections)	Pack Sections 1 & 2 I/O and set parameters (dS01 to dS02)
d-02 (CO2 Section)	CO2 Section I/O and set parameters (dS01)
d-03 (Oil Sections)	Oil Sections 1 & 2 I/O and set parameters (dS01 to dS02)
d-04 (IO Mapping)	I/O Mapping of all of the above sections (dS01 to ds05)
d-05 (Main Board)	Main Board I/O and set parameters (dS01)
d-06 (Expansion Boards)	Expansion Boards I/ O and set parameters (dS01 to dS10)
d-07 (Stats)	Pack sections 1 & 2 stats (ds01 to ds02)

Set/View Probe Types & Units

This operation is only available at the controller display or via a PC connection to the Plant controller. It cannot be set remotely via the Data manager front end system. Probe type changes apply to all probes on a controller and cannot be set individually to different types.

This option allows the user to set the probe types and units.

Unit Number	Probe Type	Units
0	Probes not used	°C
1	PT1000	°C
2	PT1000	°F
3	NTC2K	°C
4	NTC2K	°F
5	NTC470R	°C
6	NTC470R	°F
7	NTC700R	°C
8	NTC700R	°F
9	NTC3K	°C
10	NTC3K	°F
11	NTC2K25	°C

Unit Number	Probe Type	Units
12	NTC2K25	°F
13	NTC100K	°C
14	NTC100K	°F
15	NTC5K	°C
16	NTC5K	°F
17	NTC6K	°C
18	NTC6K	°F
19	NTC10K	°C
20	NTC10K	°F
21	NTC10K (2)	°C
22	NTC10K (2)	°F

Temperature probe range -60 degrees Celsius to +128 degrees Celsius.

Set/View Pressure Units

This operation is only available at the controller display or via a PC connection to the Plant controller. It cannot be set remotely via the Data manager front end system. This allows the pressure units to be set to Bar or Psi.

Type. Set/view controller type

1. From the function menu scroll to "type", press enter
2. Use the up/down buttons to scroll through the type values. (See configuration on page 4)
3. Press enter.

The controller will reset with the selected type now programmed.

Type Change

NOTE : When changing controller types from one type to another always check the parameters and the controller configuration to ensure they are appropriate for the application selected.

Enable Oil Control Section

1. From the function menu scroll to "Oil", press enter
2. Set to value 1 to enable Oil Control or 0 to disable it.

Set/view number of expansion boards to be used.

1. From the function menu scroll to "nebd", press enter
2. Select the number of expansion boards required (0 to 10), this will need to be set to a minimum of 1 if using a stepper expansion board (PR0660)

rtc. Real time clock

(This will automatically synchronise on network systems)

1. Use the up or down buttons to scroll through the display until the display reads "rtc"
2. Press enter. The display will show "t-1". Press enter again
3. Scroll hours up or down (0 – 23) press enter
4. Use up button to select "t-2", press enter
5. Scroll minutes up or down (0 – 59) press enter
6. Repeat for t-3 (seconds 0 – 59)
7. Repeat for t-4 (Days up to 31)
8. Repeat for t-5 (months up to 12)
9. Repeat for t-6 (Year up to 99)
10. Use up button to display "ESC", press enter to display "rtc"

Time clock is now set

Network Configuration

There are two network connection options

- IP-L (Rotary switches set to "000")
- IP-r (Rotary switches set to "***" where * is a number between 0 and 9)

IP-L allows you to fix an IP address into the controller, which you would use when you are connecting the controllers onto a customer's local area network. This would allow the customer to view each controller using Internet Explorer

IP-r (normally used mode) allows you to give each controller on the system a unique network ID. This ID is then allocated a dynamic IP address by the system DHCP server (such as the RDM Data Manager)

IP-L

To configure the Plant Controller for IP-L, set all three rotary switches to zero. The unit should then be connected to the network.

1. nEt. From the function menu you can now select nEt
    - Press enter and the display will show "IP-L", press enter
    - You can now set the address using the table below

Display	Option
IP-1	IP Address byte 1
IP-2	IP Address byte 2
IP-3	IP Address byte 3
IP-4	IP Address byte 4
nL	Network Mask Length
gt-1	Gateway Address byte 1
gt-2	Gateway Address byte 2
gt-3	Gateway Address byte 3
gt-4	Gateway Address byte 4
ESC	Exit network menu. **Note:** this option **must** be selected to save any changes made in this menu

IP-r

To configure the communication module for IP-r, set the three rotary switches to give each controller a unique identifier (other than 000). The module should then be connected to the controller and the network via the Ethernet port. The Data Manager will use DHCP to allocate the controller an IP address.

- From the function menu select nEt
- Press enter and the display will show "IP-r", press enter
- You can now view the address given by the DHCP server

IP1: Shows the first IP address value (10 in the example below)
IP2: Shows the second IP address value (1 in the example below)
IP3: Shows the third IP address value (2 in the example below)
IP4: Shows the forth IP address value (86 in the example below)
Example: 10.1.2.86

Broadcast

0 = No broadcast. 1 = Broadcast Pressures. 2 = Broadcast CO2 Load Cycling (Receiver). 3 = Broadcast CO2 Load Cycling (Gas Cooler)

Set for 1. Broadcasts Pressure.

This allows pressure readings on the variable analogue Inputs to be broadcast over a Data Manager IP network for use with a Mercury Switch or Mercury IP Module. This remote pressure is used by the Mercury Switch or IP Module to calculate the Evaporator temperature.

At the device receiving the pressure there will be an option to select Press1, Press2 and Press3, these would normally be Suction section 1, Suction Section 2 and Discharge respectively.

Set for 2. Broadcasts CO2 commands

Allows the pack controller to send commands to the Data Manager which in turns sends "CO2 Case Off" commands to any cases set up on system to do CO2 load shedding

At the device receiving the pressure or in the Data Manager Load Cycling page there will be an option to select Press1, Press2 and Press3, these will normally be Suction section 1, Suction Section 2 and **Receiver** respectively.

Set for 3. Broadcasts CO2 commands

Allows the pack controller to send commands to the Data Manager which in turns sends "CO2 Case Off" commands to any cases set up on system to do CO2 load shedding

At the device receiving the pressure or in the Data Manager Load Cycling page there will be an option to select Press1, Press2 and Press3, these will normally be Suction section 1, Suction Section 2 and **Gas Cooler** respectively.

Note: See CO2 Load shedding documentation and RDM Data Manager user guide for further information on CO2 Load Shedding

USB Operation

The following operations can be performed using a memory-stick plugged into the USB port: -

1. Export event log U-01
2. Not used in this version U-02
3. Save configuration U-03
4. Load configuration U-04
5. Upgrade the software U-05

The above requires the user to enter the USB menu via the display and press enter at the appropriate display option.

For example to save the current configuration insert a USB Memory stick into one of the USB Host ports, go to the USB software menu option, press enter, then the use the up key to scroll to U-03. Now press enter, the screen will flash "USB" until the operation has completed.

The file is transferred to the memory-stick in .zip format. The USB memory stick must be formatted as FAT32.

Touch Display Screen

Determines what information appears on Touch Display Screen

Set to option 0 Allows display items to be manually selected (see display tab)
Set to option 1 Displays Pack Sections 1& 2 info.
Set to option 2 Displays CO2 Section Info.
Set to option 3 Displays Oil Sections 1&2 info.
Set to option 4 Displays I/O Mapping info.
Set to option 5 Displays Main Board info.
Set to option 6 Displays Expansion Boards 1 to 10 info.
Set to option 7 Displays Section 1, 2, 3 Stats

ParA. Set/view parameters

1. From the function menu scroll to dEty
2. Pressing Enter while dEty is displayed will enter the parameter menu. See: Set up Menus

Setting up a PC connection

Due to the number of parameters available, it is recommended that this controller is set-up using a direct connection to a PC.

If your PC has never been used to program an RDM plant controller log on to the RDM web site and go to Support -> Software.

Download the following folder: - Plant Controller USB drivers for Windows XP/2000/Windows7/8/10. Contained within this folder are installation instructions and the drivers required to connect to the Mercury Plant controller. A USB cable is required which connects to a Type A USB connector (PC) at one end and a Type B USB connector at the other end (Plant USB Device port).

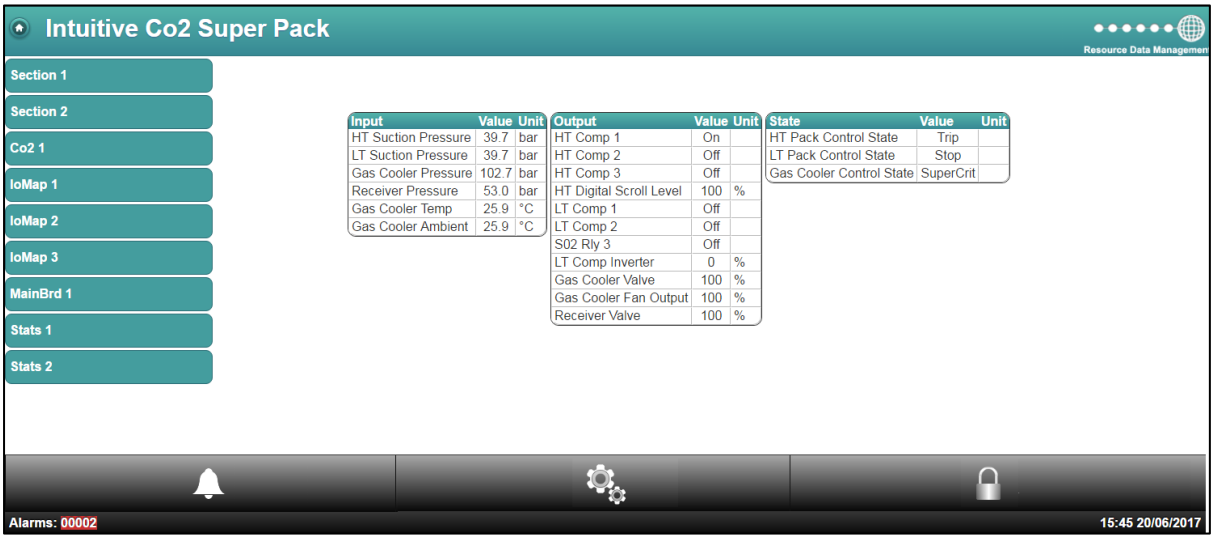
Open a web browser, such as Internet Explorer, Chrome or Firefox and surf to the address 10.255.255.254, this is the fixed address for USB connection to any RDM plant controller and never changes.

This will take you to the controller's home page

Home page

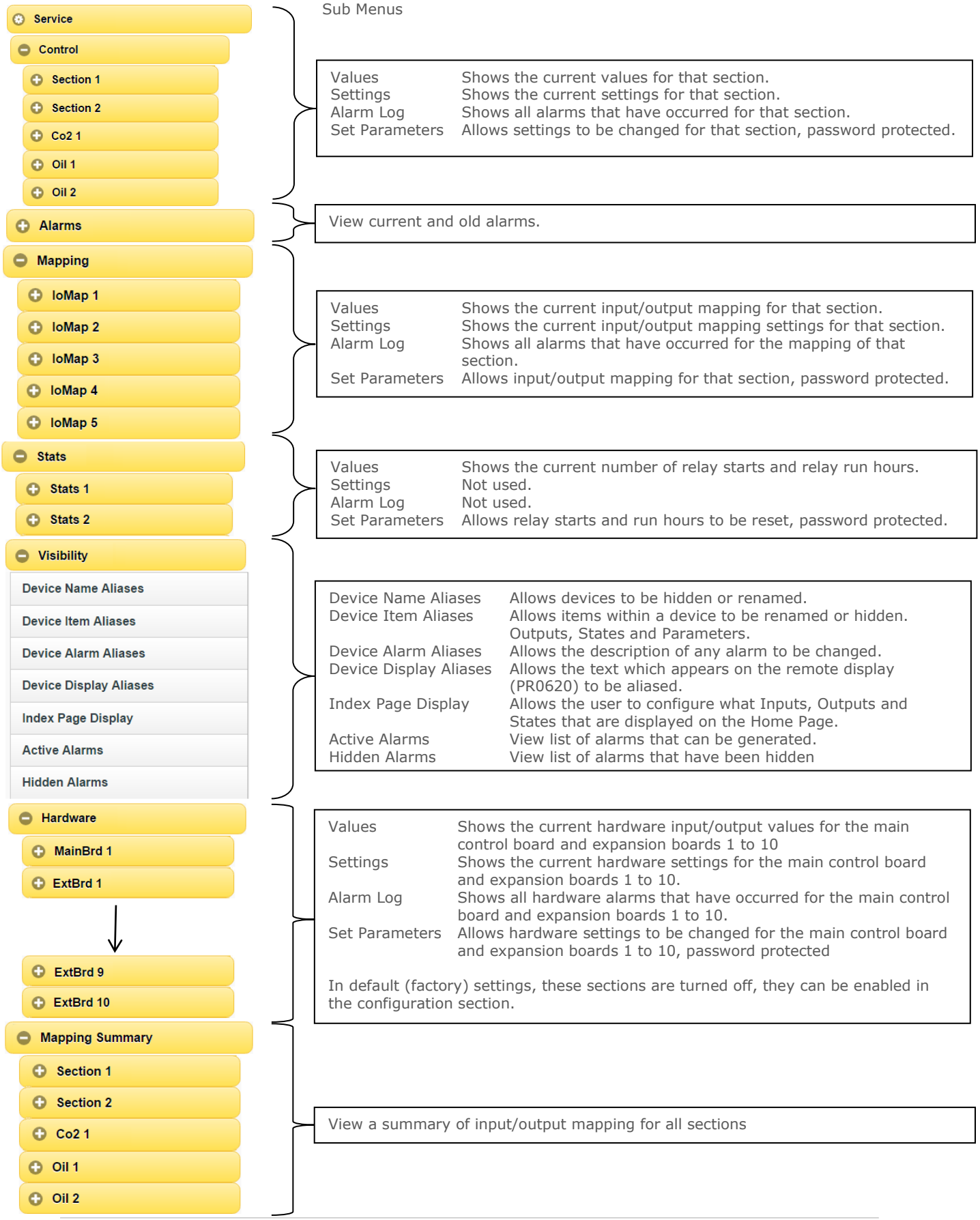
Log in using an appropriate username and password (factory default is username: “install”, password:”1234”) setup operations can then be used via the PC by clicking on the appropriate link.

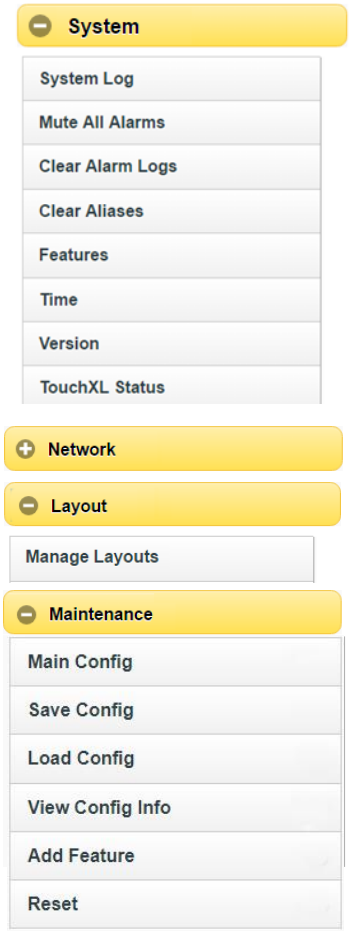
By default the Oil control sections will be set to unused and the number of expansion boards set to 0, selecting the Configuration menu will allow the oil sections to be enabled and the number of expansion boards specified.



Main Menu Overview (PC Connection)

This example shows the oil sections enabled and 10 expansion boards in use and all devices un-hidden.





System Log	View system log
Mute All Alarms	Silences all alarms
Clear Alarm Logs	Removes the alarm log
Clear Aliases	Clears all aliases that have been assigned IO. Additionally clears the visibility of sections and IO's and will reset the visibility on the display to default.
Features	Shows current features enabled.
Time	Set the Time or synchronise with the PC
Version	Shows the controller and expansion board's software version
TouchXL Status	Shows IP Address, MAC address, name, connection status details.

Shows current set up: - Rotary switches, IP address, Netmask & Default gateway.

Allows the user to upload, configure, download, remove and preview layouts on the controller.

Main Config	Shows the current configuration of the controller.
Save Config	Saves the current Configuration
Load Config	Allows the user to upload a previously saved configuration, NOTE: file needs to be named "Setup.xml"
View Config Info	Shows details on the last loaded config including any unmatched items dues to differences in firmware.
Add Feature	Shows the system key to allow features to be enabled remotely.
Reset	Allows the user to reset the controller.

Sections 1 & 2 Pack (d-01)

Not all parameters apply to all controllers types, for example P-140 is stage 1 size so will not appear on a controller if it is set up as a staged pack controller. In the right hand columns, the controller type will be shown, if that parameter applies to that type, if it does not apply it will be greyed out.

Note:
Pack sections 1 &2 have the same parameter numbers

No.	Section Parameters	Range	Step	Units	Default	
					All Pack Fuzzy Default Settings	All Pack Staged Default Settings
P-01	Span 1 *	-3.4 – 180	0.1	Bar	60.0	60.0
P-02	Span 2 *	-3.4 – 180	0.1	Bar	160.0	160.
P-03	Span 3 *	-3.4 – 180	0.1	Bar	60.0	60.0
P-04	Span 4	-3.4 – 180	0.1	Bar	60.0	60.0
P-05	Offset 1	-3.4 – 180	0.1	Bar	0.0	0.0
P-06	Offset 2	-3.4 – 180	0.1	Bar	0.0	0.0
P-07	Offset 3	-3.4 – 180	0.1	Bar	0.0	0.0
P-08	Offset 4	-3.4 – 180	0.1	Bar	0.0	0.0
P-09	Day Target Pressure	-3.4 – 180	0.1	Bar	28.0	28.0
P-10	Night Target Pressure	-3.4 – 180	0.1	Bar	29.0	29.0
P-11	Target Pressure Diff Above P-9/10	-3.4 – 180	0.1	Bar	0.5	0.5
P-12	Target Pressure Diff Below P-9/10	-3.4 – 180	0.1	Bar	0.5	0.5
P-13	Ext. Target Pressure	-3.4 – 180	0.1	Bar	28.0	28.0
P-15	Optimise Limit	-3.4 – 150	0.1	Bar	0.5	0.5
P-16	Response On Speed	1 – 60	1	---	20.0	20.0
P-17	Response Off Speed	1 – 60	1	---	20.0	20.0
P-22	Inverter Starts Per Hour	0 – 60	1	---	0	0
P-23	Compressor Starts per Hour	0 – 60	1	---	0	0
P-24	Run Smallest	0 = Off, 1 = On	1	-	0	0
P-25	Always Run Last	0 = Off, 1 = On	1	-	0	0
P-26	Comp Unload	0 = Off, 1 = On	1	-	0	
P-27	Equal Run	0 = Off, 1 = On	1	-	0	
P-28	Run Proof	0 = Off, 1 = On	1	-	0	0
P-29	Gas Dump	0 = Off, 1 = On	1	-	0	0
P-30	Gas Diff	-3.4 – 180	0.1	Bar	0.5	0
P-31	Inverter	0 = Off, 1 = On	1	-	0	0
P-32	INV Bypass	0 = Disabled 1 = 1 + no retry 2 = 1 + 1 retry 3 = 1 + 2 retries 4 = 1 + 3 retries 5 = 1 + 4 retries	1	-	0	0
P-33	INV Minimum	0 – 100	1	%	0	0
P-34	INV Maximum	0 – 100	1	%	100	100
P-35	PWM Control	0 = Off, 1 = On	1	-	0	0
P-36	PWM Cycle Time	00:10 – 00:30	00:01	min:sec	00:20	00:2
P-37	Inverter Fail	0 – 100	1	%	25	25
P-41	Stage On Delay	00:00 – 01:00	00:01	min:sec	00:00	
P-42	Stage Off Delay	00:00 – 01:00	00:01	min:sec	00:00	
P-50	Alarm Delay	00:00 – 99:00	01:00	min:sec	05:00	05:0
P-51	HP Alarm	-3.4 – 180	0.1	Bar	4.1	4.1
P-52	LP Alarm	-3.4 – 180	0.1	Bar	0.6	0.6
P-53	LP Shut-down	-3.4 – 180	0.1	Bar	0.4	0.4

No.	Section Parameters	Range	Step	Units	Default	No.
P-54	Low Pressure Alarm Delay	00:00 – 99:00	01:00	min:sec	00:00	00:0
P-55	Pressure Fail	0 = Off, 1 = On, 2 = Variable	1	-	2	2
P-73	Night Set On Time	00:00 – 23:59	00:01	min:sec	20:00	20:0
P-74	Night Set Off Time	00:00 – 23:59	00:01	min:sec	08:00	08:0
P-80	Discharge Trip Pressure	-3.4 – 150	0.1	Bar	103.0	13.0
P-81	Discharge Stop Pressure	-3.4 – 150	0.1	Bar	107.0	107.
P-82	Discharge Offset	-3.4 – 150	0.1	Bar	2.0	2.0
P-83	Discharge Trip Temperature	-60 – 256	0.1	°C	90.0	90.0
P-84	Discharge Stop Temperature	-60 – 256	0.1	°C	95.0	95.0
P-85	Discharge Temperature Differential	-60 – 256	0.1	°C	10.0	10.0
P-86	Do Discharge Trip	0 = Off, 1 = Pressure, 2 = Temperature, 3 = Pressure & Temperature	1		1	1
P.100	Status Fault Delay	00:00 – 60:00	00:01	min:sec	00:10	00:1
P.101	General Fault Delay	00:00 – 60:00	00:01	min:sec	00:10	00:1
P-102	Standby Delay	00:00 – 60:00	00:01	min:sec	00:10	00:1
P.103 ↓ P.118	Status Fault 1 ↓ Status Fault 16	0 = Unused 1 = Comp N/O 2 = Comp N/C 3 = Gen N/O 4 = Gen N/C 5 = Standby N/O 6 = Standby N/C 7 = Run N/O 8 = Run N/C 9 = INV N/O 10 = INV N/C 11=Proof N/O 12=Proof N/C	1	---	0	0
P.120 ↓ P.135	Stage 1 ↓ Stage 16	0 = None 1 = Unused 2 = Inv 3 = Comp 4 = Loader 5 = Trim 6 = SSR	1		0	
P.140 ↓ P.155	Stage 1 size ↓ Stage 16 Size	0.0 – 60.0	0.1		0	
P.160 ↓ P.175	Stage 1 Relay 1 ↓ Stage 1 Relay 16	0 = Off 1 = On	1			0
P.180 ↓ P.195	Stage 2 Relay 1 ↓ Stage 2 Relay 16	0 = Off 1 = On	1			0
P.200 ↓ P.215	Stage 3 Relay 1 ↓ Stage 3 Relay 16	0 = Off 1 = On	1			0
P.220 ↓ P.235	Stage 4 Relay 1 ↓ Stage 4 Relay 16	0 = Off 1 = On	1			0

No.	Section Parameters	Range	Step	Units	Default	No.
P.240 ↓ P.255	Stage 5 Relay 1 ↓ Stage 5 Relay 16	0 = Off 1 = On	1			0
P.260 ↓ P.275	Stage 6 Relay 1 ↓ Stage 6 Relay 16	0 = Off 1 = On	1			0
P.280 ↓ P.295	Stage 7 Relay 1 ↓ Stage 7 Relay 16	0 = Off 1 = On	1			0
P.300 ↓ P.315	Stage 8 Relay 1 ↓ Stage 8 Relay 16	0 = Off 1 = On	1			0
P.320 ↓ P.335	Stage 9 Relay 1 ↓ Stage 9 Relay 16	0 = Off 1 = On	1			0
P.340 ↓ P.355	Stage 10 Relay 1 ↓ Stage 10 Relay 16	0 = Off 1 = On	1			0
P.360 ↓ P.375	Stage 11 Relay 1 ↓ Stage 11 Relay 16	0 = Off 1 = On	1			0
P.380 ↓ P.395	Stage 12 Relay 1 ↓ Stage 12 Relay 16	0 = Off 1 = On	1			0
P.400 ↓ P.415	Stage 13 Relay 1 ↓ Stage 13 Relay 16	0 = Off 1 = On	1			0
P.420 ↓ P.435	Stage 14 Relay 1 ↓ Stage 14 Relay 16	0 = Off 1 = On	1			0
P.440 ↓ P.455	Stage 15 Relay 1 ↓ Stage 15 Relay 16	0 = Off 1 = On	1			0
P.460 ↓ P.475	Stage 16 Relay 1 ↓ Stage 16 Relay 16	0 = Off 1 = On	1			0
dFLt	Restore Default Settings (Panel Mount Display Only)					

* Span and Offset allows for the full range of the transducer to be used by the controller.
Span is the full range of the transducer
Offset is the value below zero.

Example: PR0162 transducer with range: -1 bar to 65 bar
Span would be 66 bar (957 psi)
Offset would be -1 bar (14.5 psi)

The controller expects the pressure transducer used to read zero bar when open to air at sea level (1 bar atmospheric pressure disregarded), if the transducer does not read zero then the offset parameter can be adjusted accordingly.

Run smallest = on: - When all compressors are off (because the target pressure has been satisfied) the controller, when the pressure rises, will always turn on the smallest compressor after the variable output has reached 100%. If the ASC timer is running for the smallest compressor, the controller will **NOT bring on any other available compressors, the variable output will remain at 100% and the controller will wait until the ASC Timer has elapsed and then turn on the smallest.

Please note that this is true for **any** pressure condition.

Section 3 CO2 (d-02)

No.	Section Parameters	Range	Step	Units	Default
P-01	G01 Span 1	-3.4 – 180	0.1	Bar	160.0
P-02	G01 Span 2	-3.4 – 180	0.1	Bar	60.0
P-03	G01 Span 3	-3.4 – 180	0.1	Bar	60.0
P-04	G01 Span 4	-3.4 – 180	0.1	Bar	60.0
P-05	G01 Offset 1	-3.4 – 180	0.1	Bar	0.0
P-06	G01 Offset 2	-3.4 – 180	0.1	Bar	0.0
P-07	G01 Offset 3	-3.4 – 180	0.1	Bar	0.0
P-08	G01 Offset 4	-3.4 – 180	0.1	Bar	0.0
P-20	G01 Max Gas Press	-3.4 – 180	0.1	Bar	90.0
P-21	G01 Min Gas Press	-3.4 – 180	0.1	Bar	15.0
P-22	G01 Max Gas SP	-3.4 – 180	0.1	Bar	85.0
P-23	G01 Min Gas SP	-3.4 – 180	0.1	Bar	40.0
P-24	G01 Extra Gas SP	-3.4 – 180	0.1	Bar	2.0
P-25	G01 Gas Trgt Above	-3.4 – 180	0.1	Bar	0.5
P-26	G01 Gas Trgt Below	-3.4 – 180	0.1	Bar	0.5
P-27	G01 Gas Resp On	1 – 60	1	---	5
P-28	G01 Gas Resp Off	1 – 60	1	---	5
P-29	G01 Gas Fuzzy Weight	1 – 10	0.1	---	1
P-40	G01 Min Gas Inv	0 – 100	1	%	0
P-41	G01 Max Gas Inv	0 – 100	1	%	100
P-42	G01 Gas Temp Fail Cooler	0 – 100	1	%	55
P-43	G01 Gas Temp Fail Fan	0 – 100	1	%	60
P-50	G01 Gas HP Reset	00:00 – 05:00	00:01	min:sec	01:00
P-51	G01 Gas Trans.Ref	0 = Auto, 1 = Manual	1	---	Auto
P-52	G01 Gas Gradient	0 – 100	0.1	---	2.4
P-53	G01 Gas Offset	0 – 100	0.1	---	6.4
P-54	G01 Gas SubTrs Offset	-10 – 10	0.1	°C	0.0
P-55	G01 Gas SP Weight	0 – 100	1	%	0
P-60	G01 Sub Cooling	-10 – 10	0.1	°C	3.0
P-70	G01 Cooler InterLock	0 = Off, 1 = On	1	---	Off
P-71	G01 Cooler Valve in Standby	0 = Off, 1 = On	1	---	On
P-72	G01 Max Gas Fan/Step Reset	-3.4 – 180	1	Bar	65
P-80	G01 Gas Alm Dly	00:00 – 60:00	00:01	min:sec	01:00
P-81	G01 Gas Shut Dly	00:00 – 60:00	00:01	min:sec	00:30
P-82	G01 Gas Alm Offset	-3.4 – 180	0.1	Bar	5.0
P-83	G01 Gas Temp OT	-60 – 256	0.1	°C	40.0
P-100	G01 Fan Ctrl	0 = Fixed, 1 = Ambient 2 = Ambient / Pressure 3 = Fixed Pressure	1	---	Ambient
P-101	G01 Fan Trgt	-60 – 256	0.1	°C	15.0
P-102	G01 Fan Offset Tz	-10 – 10	0.1	°C	3.0
P-103	G01 Fan Offset Tc	-10 – 10	0.1	°C	3.0
P-104	G01 Fan Resp On	1 – 60	1	---	5
P-105	G01 Fan Resp Off	1 – 60	1	---	5
P-106	G01 Fan Max Trgt	-60 – 256	0.1	°C	25.0
P-107	G01 Fan Min Trgt	-60 – 256	0.1	°C	5.0
P-108	G01 Fan Ngt SetBack	0 = Off, 1 = On, 2 = Local, 3 = Remote	1	---	Off
P-109	G01 Fan Ngt Reduct	0 – 100	1	%	30
P-110	G01 Fan Ngt SetOn	00:01 – 23:59	00:01	hr:min	20:00
P-111	G01 Fan Ngt SetOff	00:01 – 23:59	00:01	hr:min	08:00
P-112	G01 Fan Ngt Temp Limit	-60 – 256	0.1	°C	28.0
P-113	G01 Fan Day Reduct	0 – 100	1	%	0
P-114	G01 Fan Day Temp Limit	-60 – 256	0.1	°C	28.0
P-201	G01 Recv Target	-3.4 – 180	0.1	Bar	38.0
P-202	G01 Recv Trgt Above	-3.4 – 180	0.1	Bar	0.5
P-203	G01 Recv Trgt Below	-3.4 – 180	0.1	Bar	0.5
P-204	G01 Recv Resp On	1 – 60	1	---	5
P-205	G01 Recv Resp Off	1 – 60	1	---	5
P-206	G01 Recv Fuzzy Weight	1 – 10	1	---	1
P-207	G01 Recv InterLock	0 = Off, 1 = On, 2 = GC, 3 = GCFan	1	---	On
P-220	G01 Recv Alm Dly	00:00 – 60:00	00:01	min:sec	02:00

No.	Section Parameters	Range	Step	Units	Default
P-221	G01 Recv Min Press	-3.4 – 180	0.1	Bar	33.0
P-222	G01 Recv Max Press	-3.4 – 180	0.1	Bar	47.0
P-223	G01 Recv Fail	0 – 100	1	%	30
P-250	G01 Liq Level	0 = Off, 1 = On	1	---	Off
P-251	G01 High LiqLevel	0 – 100	1	%	80
P-252	G01 Low LiqLevel	0 – 100	1	%	20
P-253	G01 LiqLevel Dly	00:00 – 99:00	00:01	min:sec	05:00
P-300	G01 Aux Comp Trgt	-3.4 – 180	0.1	Bar	34.0
P-301	G01 Aux Resp On	1 – 60	1	---	5
P-302	G01 Aux Resp Off	1 – 60	1	---	5
P-350	G01 Do Liq Inj	0 = Off, 1 = On	1	---	Off
P-351	G01 Liq Inj SP	-60 – 256	0.1	°C	115.0
P-352	G01 Liq Inj Diff	-10 – 10	0.1	°C	5.0
P-353	G01 Liq Inj OT	-60 – 256	0.1	°C	128.0
P-400	G01 Do SH	0 = Off, 1 = On	1	---	Off
P-401	G01 SH Lo Trgt	-60 – 256	0.1	°C	8.0
P-402	G01 SH Lo Diff	-60 – 256	0.1	°C	2.0
P-403	G01 SH Lo Alm	-60 – 256	0.1	°C	5.0
P-411	G01 SH Hi Trgt	-60 – 256	0.1	°C	30.0
P-412	G01 SH Hi Diff	-60 – 256	0.1	°C	3.0
P-413	G01 SH Hi Alm	-60 – 256	0.1	°C	50.0
P-420	G01 SH Dly	00:00 – 99:00	00:01	min:sec	02:00
P-500	G01 Co2 Status Dly	00:00 – 60:00	00:01	min:sec	00:10
P-520 ↓ P-535	G01 Co2 Status 1 ↓ G01 Co2 Status 16	0 = Unused, 1 = ExCap N/O 2 = ExCap N/C, 3 = RcvLon N/O, 4 = RcvLon N/C, 5 = RcvHi N/O, 6 = RcvHi N/C, 7 = Heat Rec. N/O 8 = Heat Rec. N/C	1	---	Unused
P-540	G01 Sect Interlock	0 = Off, 1 = On	1	---	Off
P-600	G01 Heat Recovery	0 = Off, 1 = Type 1, 2 = Type 2, 3 = Type 3	1	---	Off
P-601	G01 Heat Rec. Start	1.0 – 3.0	0.1	V	2.0
P-602	G01 Heat Rec. End	4.0 – 8.0	0.1	V	8.0
P-603	G01 Hrec GasRef at Start	-3.4 – 180	0.1	Bar	50.0
P-604	G01 Hrec GasRef at End	-3.4 – 180	0.1	Bar	80.0
P-605	G01 Hrec GasRef above End	-3.4 – 180	0.1	Bar	83.0
P-606	G01 Hrec FanRef at End	-60 – 256	0.1	°C	8.0
P-607	G01 Hrec FanRef at Bypass	-60 – 256	0.1	°C	5.0
P-608	G01 Hrec Bypass	8.5 – 9.9	0.1	V	9.6
P-609	G01 Hrec Bypass Ref.	-60 – 256	0.1	°C	28.0
P-610	G01 Hrec Bypass Diff	-60 – 256	0.1	°C	2.0
P-611	G01 Hrec Bypass Resp On	1 – 60	1	---	5
P-612	G01 Hrec Bypass Resp Off	1 – 60	1	---	5
P-620	G01 Fan Rev	0 = Off, 1 = On, 2 = Local, 3 = Remote	1	---	Off
P-621	G01 Fan Rev Start	00:01 – 23:59	00:01	hrs:min	00:00
P-622	G01 Fan Rev Length	00:00 – 99:00	01:00	min:sec	10:00
P-623	G01 Fan Rev Delay	00:00 – 00:99	01:00	min:sec	01:00
P-624	G01 Fan Rev Fix	0 = Off, 1 = On	1	---	Off
P-625	G01 Fan Rev Variable	0 – 100	1	%	100
P-626	G01 Fan Rev Level	-3.4 – 180	0.1	Bar	45
dFLt	Restore Default Settings (Panel Mount Display Only)				

Oil Sections 1 & 2 (d-03)

Oil sections 1 & 2 have the same parameter numbers (O01 & O02)

No.	Section Parameters	Range	Step	Units	Default
P-01	Oil Enable 1	0 = Off	1	---	Off
P-02	Oil Enable 2	0 = Off	1	---	Off
P-03	Oil Enable 3	0 = Off	1	---	Off
P-04	Oil Enable 4	0 = Off	1	---	Off
P-05	Oil Enable 5	0 = Off	1	---	Off
P-06	Oil Enable 6	0 = Off	1	---	Off
P-07	Oil Enable 7	0 = Off	1	---	Off
P-08	Oil Enable 8	0 = Off	1	---	Off
P-09	Oil Enable 9	0 = Off	1	---	Off
P-10	Oil Enable 10	0 = Off	1	---	Off
P-11	Oil Enable 11	0 = Off	1	---	Off
P-12	Oil Enable 12	0 = Off	1	---	Off
P-13	Oil Enable 13	0 = Off	1	---	Off
P-14	Oil Enable 14	0 = Off	1	---	Off
P-15	Oil Enable 15	0 = Off	1	---	Off
P-16	Oil Enable 16	0 = Off	1	---	Off
P-40	PreDly	00:00 – 01:00	00:01	min:sec	00:05
P-41	Pulses	0 – 30	1	---	30
P-42	PulseOff	00:00 – 01:00	00:01	min:sec	00:30
P-43	PulseOn	00:00 – 01:00	00:01	min:sec	00:30
P-44	LockOut	0 – 6	1	1	3
P-45	Retry	00:00 – 60:00	00:01	min:sec	00:10
P-46	PostDly	00:00 – 00:10	00:01	min:sec	00:10
P-60	Oil Sep Enable	0 = Off, 1 = N/O, 2 = N/C	1	---	Off
P-61	Sep PulseOff	00:00 – 01:00	00:01	min:sec	00:10
P-62	Sep PulseOn	00:00 – 01:00	00:01	min:sec	00:05
P-63	Oil Lo Enable	0 = Off, 1 = N/O, 2 = N/C	1	---	Off
P-64	Oil Hi Enable	0 = Off, 1 = N/O, 2 = N/C	1	---	Off
P-65	LoHi Dly	00:00 – 01:00	00:01	min:sec	00:15
P-66	Oil Reset Enable	0 = Off, 1 = N/O, 2 = N/C	1	---	Off

Pressure, Probe, Status, Inverter, Stepper and Relay Position Parameters (d-04 IOMap)

Controller inputs and outputs are not automatically allocated by the controller, these are manually allocated by the user and provides greater flexibility as to where the expansion modules (if used) are located. For example, if section 2 is set to use 4 compressors then these can be mapped to any relay position on any expansion board. Relays can also be mapped to the main controller if there are relays available which have not been mapped to section 1. The same applies to all other inputs and outputs such as pressure transducers and fault inputs.

All sections 1, 2, 3, 4 & 5 have the same parameter numbers however not all IO may not be applicable to that section, for example the Oil sections do not use a stepper valve although StepPos1 is listed in the mapping table.

The Range covers all possible positions including the maximum amount of expansion modules.

No.	Section Parameters	Range	Step	Units	Default
P-01 ↓ P-04	Pressure Position 1 ↓ Pressure Position 4	0 – 88	1	---	0
P10 ↓ P-17	Probe Position 1 ↓ Probe Position 8	0 – 88	1	---	0
P-20 ↓ P-35	Status Position 1 ↓ Status Position 16	0 – 92	1	---	0
P-40 ↓ P-47	Extra Status Position 1 ↓ Extra Status Position 8	0 – 92			
P-50 ↓ P-53	Inverter Position 1 ↓ Inverter Position 4	0 – 88	1	---	0
P-60 ↓ P-83	Relay Position 1 ↓ Relay Position 24	0 – 132	1	---	0
P-100	Stepper Position 1 (Receiver)	0 – 62	1	---	0
P-101	Stepper Position 2 (Gas Cooler)	0 – 62	1	---	0
P-102	Stepper Position 3 (Heat Recovery)	0 – 62	1	---	0

Note on mapping relays on expansion modules using a local display (PR0615 or PR0620) or a Data Manager

To maintain a standard mapping template for relays, each expansion board can be allocated 12 relay positions, (13 to 24 for example). As the Mini IO expansion module only has 5 physical relays then the next 8 relay positions should be skipped ***if*** there is another expansion module fitted after the Mini IO. If an Intuitive expansion module (12 relays) is being used as well as a Mini IO expansion module (4 relays) then by having the Mini IO as the last expansion module (highest canbus rotary address switch position) then any confusion over relay positioning is avoided.

If two Mini IO expansion modules are in use then the relays on the first module would be allocated positions 13 to 17 (relays 1 to 12 are on the main controller), and the relays on the second module would be allocated positions 25 to 29 (13 to 24 are skipped).

This setup only applies when setting the relay mapping using a local display or a Data Manager panel where relay positions are allocated numbers (as shown in the table above).

When using a PC or Touch XL to set up the controller directly then the drop down menus automatically limit the relays available to the relevant expansion module so the above note can be disregarded.

Universal I/O, Status Inputs, Invert Relays, Probe Offsets Configuration (d-05 Main Board)

No.	Section Parameters	Range	Step	Units	Default
P-01 ↓ P-08	M01 Universal I/O 1 ↓ M01 Universal I/O 8	0 = 4-20mA Input 1 = 0-10V Input 2 = 0-5V Input 3 = 0.5-4.5V Input 4 = 0.5-9.5V Input 5 = 4-20mA Out 6 = 0-20mA Output 7 = 0-10V Output 8 = 0-5V Output	1	---	0/5
P-10	M01 Status Inputs	0V / 24V ac	1	---	0
P-20 ↓ P-31	M01 Invert Relay or SSR select 1 ↓ M01 Invert Relay 12	0 = Off 1 = On 2 = SSR	1	---	0
P-40 ↓ P-47	M01 Offset 1 ↓ M08 Offset 8	-20 to +20	0.1	^{O}C	0.0
P-50	M01 Step Reset	1 – 25	1	Hours	6
P-60	M01 Stepper Type 1	0 = Carel 1 = Sporlan 1 2 = Sporlan 2 3 = Alco 4 = Other	1	---	1
P-61	M01 Stepper Type 2	0 = Carel 1 = Sporlan 1 2 = Sporlan 2 3 = Alco 4 = Other	1	---	1
P-70	M01 Step Max 1	0 – 6400	1	---	2500
P-71	M01 Step Max 2	0 – 6400	1	---	2500
P-80	M01 Step Close 1	0 – 6400	1	---	3500
P-81	M01 Step Close 2	0 – 6400	1	---	3500
P-90	M01 Step Speed 1	0 – 6400	1	Hz	200
P-91	M01 Step Speed 2	0 – 6400	1	Hz	200
P-100	M01 mA Peak 1	0 – 825	1	mA	120
P-101	M01 mA Peak 2	0 – 825	1	mA	120
P-110	M01 Step Half 1	0 = Off, 1 = On	1	---	0
P-111	M01 Step Half 2	0 = Off, 1 = On	1	---	0
P-120	M01 Step mA Hold 1	0 – 825	1	mA	0
P-121	M01 Step mA Hold 2	0 – 825	1	mA	0

Note: Parameters P-50 to P-121 apply only to the PR0652 hardware variant which has two stepper outputs.

When using the PR0650 hardware variant these parameters do not apply, stepper setup is the stepper expansion board PR0660 (See the following page).

Universal I/O, Status Inputs, Invert Relays, Probe Offsets Configuration (d-06 Ext Board)

All expansion boards (ds01 – ds10) have the same parameter numbers

No.	Section Parameters	Range	Step	Units	Default
P-01	Board Type	0 =Unused 1 = IO 2 = Stepper 3 = Mini IO	1	---	0
P-02 ↓ P-09	Universal I/O 1 ↓ Universal I/O 8	0 = 4-20mA Input 1 = 0-10V Input 2 = 0-5V Input 3 = 0.5-4.5V Input 4 = 0.5-9.5V Input 5 = 4-20mA Out 6 = 0-20mA Output 7 = 0-10V Output 8 = 0-5V Output	1	---	0
P-10	Status Inputs	0 = 0V Return 1 = 24V ac	1	---	0
P-20 ↓ P-31	Invert Relay 1 ↓ Invert Relay 12	0 = Off 1 = On	1	---	0
P-40 ↓ P-47	Offset 1 ↓ Offset 8	-20 to +20	0.1	^{O}C	0.0
P-50	Step Reset	0 – 25	1	Hours	6
P-60 ↓ P-65	Step Type 1 ↓ Step Type 6	0 = Carel 1 = Sporlan 1 2 = Sporlan 2 3 = Alco 4 = Other			
P-70 ↓ P-75	Step Max 1 ↓ Step Max 6	0 – 6400	1	---	2500
P-80 ↓ P-85	Step Close 1 ↓ Step Close 6	0 – 6400	1	---	3500
P-90 ↓ P-95	Step Speed 1 ↓ Step Speed 6	0 – 6400	1	Hz	200
P-100 ↓ P-105	Step mA Peak 1 ↓ Step mA Peak 6	0 – 825	1	mA	120
P-110 ↓ P-115	Step Half 1 ↓ Step Half 6	0 = Off, 1 = On	1	---	0
P-120 ↓ P-125	Step mA Hold 1 ↓ Step mA Hold 6	0 – 825	1	mA	0

Compressor Run Hours and Compressor Starts (d-07 Stats)

Note: sections 1 & 2 have the same parameter numbers

No.	Section Parameters	Range	Step	Units	Default
P-01	Reset Stats	0 – 1	1	---	0

Parameter Description:

Section Parameters Description (d-01)

Note: sections 1 & 2 have the same parameter numbers

No.	Parameter	Description
P-01 ↓ P-04	Transducer 1 Span ↓ Transducer 4 Span	Range of the transducers
P-05 ↓ P-08	Transducer 1 Offset ↓ Transducer 4 Offset	Transducer value above or below zero.
P-09	Day Target Pressure	Pressure target, control will try to maintain this pressure during day time. See P-74
P-10	Night Target Pressure	Pressure target, control will try to maintain this pressure during night time. See P-73
P-11	Target Pressure Above P-09/10	Set-point above the target, used to obtain a "dead-band"
P-12	Target Pressure Below P-09/10	Set-point below the target, used to obtain a "dead-band"
P-13	External Target Pressure	Pressure target when Sect1/2/3 Run is off. Control will try to maintain this pressure until Sect1/2/3 Run is on. At this point P-09/10 used. Please see: Status Inputs
P-15	Optimise Limit	This is an offset that is added to the target pressure when using the Data Manager Energy feature Pack Optimisation. For example if target pressure is 2.1 Bar and Optimise Limit set to 0.5 Bar. The remote optimise command will only be able to optimise the current suction set point up to a maximum of 2.6 Bar
P-16	Response On Speed	Allows the user to speed up/slow down the stage on speed (Option: - 1 to 60 with 60 being fastest response)
P-17	Response Off Speed	Allows the user to speed up/slow down the stage off speed (Option: - 1 to 60 with 60 being fastest response)
P-22	Inverter Starts Per Hour	Limits the inverter starts to this many starts per hour, set to 0 if not required.
P-23	Starts per hour	Limits a compressor to this many starts per hour, set to 0 if not required.
P-24	Run smallest	See explanation under the parameter tables for this parameter Run Smallest
P-25	Always run last	Keeps the last stage running except for a Low Shutdown condition. If the last stage is an inverter, the inverter enable will stay energised, but the inverter analogue output may well decrease to 0% if pressure is below the set-point.
P-26	Comp Unload	Selects the order the compressor loaders are switched off See: Compressor Loaders
P-27	Equal run Times	Equalises compressor run times. See: Equal run Times
P-28	Run Proof	See section Run-Proof
P-29	Gas Dump	Enables Gas Dump feature. See: Gas Dump
P-30	Gas Diff	Diff below the set point that the Gas Dump valve is opened. See Gas Dump
P-31	Inverter	Enables the inverter analogue output and associated relay.
P-32	Inv Bypass	Enable for Inverter Bypass feature.

No.	Parameter	Description
P-33	Inverter Min	The minimum percentage the inverter will operate to e.g. if set to 25% the inverter output will never go below this value. This should be set to 10% when using a digital scroll compressor.
P-34	Inverter Max	The maximum percentage the inverter will operate to e.g. if set to 80% the inverter output will never go above this value
P-35	PWM Control	Pulse width modulation control, used to control a digital scroll compressor.
P-36	PWM Cycle Time	The total time for one on/off cycle.
P-37	Inverter Fail	In the event of a pressure transducer failure the inverter output will remain at this value. (if P-55 set to variable)
P-41	Stage On Delay	Once the Inverter reaches 100%, this delay is applied before the next stage is switched on.
P-42	Stage Off Delay	Once the Inverter reaches 0%, this delay is applied before the next stage is switched off.
P-50	Alarm Delay	Delay before HP and LP alarms are signalled
P-51	HP Alarm	HP alarm set-point
P-52	LP Alarm	LP alarm set-point
P-53	LP Shut-down	LP shut-down set-point, all stages go off when this is reached
P-54	Low Alarm Delay	Delay applied before LP Shutdown alarm is generated. Note as soon as the LP Shutdown set point is reached any Compressor/Condenser stages, for the associated section, still operating will go off immediately and does not wait for the LP Shutdown alarm to be created.
P-55	Pressure Fail	The following will occur in the event of pressure transducer fault: – If set to On then all Compressors or Fans will turn On in the event of a transducer failure. If set to Off then all Compressors or Fans will turn Off in the event of a transducer failure. If set to variable:- during the night period all stages will turn off and inverter output will be set to the inverter fail value (P-37), during the day one stage will be switched on.
P-73	Night Set Back On Time	Time for the night set back feature to operate
P-74	Night Set Back Off Time	Time for the night set back feature to go off
P-80	Discharge Trip Pressure	If Discharge Pressure exceeds this setting, compressors will turn off gradually or Inverter will ramp down to try to reduce the discharge pressure before it reaches discharge stop parameter P-81
P-81	Discharge Stop Pressure	If Discharge Pressure exceeds this setting **All** compressors on the assigned pack go off immediately and all fans come on immediately. A Discharge Trip Alarm is generated. **Note:** If using an Inverter on the Compressors the output to the Inverter will go to 0% immediately as well as all compressors going off. The controller will remain in the stop state for a minimum of 1 minute regardless of pressure
P-82	Discharge Offset	The pressure differential below the Discharge Stop Pressure that has to be reached before the discharge trip will reset, this is also subject to a 1 minute delay period.
P-83	Discharge Trip Temperature	If Discharge Temperature exceeds this setting, compressors will turn off gradually or Inverter will ramp down to try to reduce the discharge temperature before it reaches discharge stop parameter P-84
P-84	Discharge Stop Temperature	If Discharge Temperature exceeds this setting **All** compressors on the assigned pack go off immediately and a Discharge Trip Alarm is generated. **Note:** If using an Inverter on the Compressors the output to the Inverter will go to 0% immediately as well as all compressors going off. The controller will remain in the stop state for a minimum of 1 minute regardless of temperature.
P-85	Discharge Temperature Differential	The temperature differential below the Discharge Stop Temperature that has to be reached before the discharge trip will reset, this is also subject to a 1 minute delay period.
P-86	Do Discharge Trip	Off:- Feature is not used Pressure:- Compressors will start switching off when trip pressure level is reached. Pressure & Temperature:- Compressors will start switching off when trip pressure or temperature levels are reached.
P-100	Status fault Delay	Time delay before status faults are activated
P-101	General Alarm Delay	Time delay before general faults are activated
P-102	Standby Delay	Time delay between the standby input being activated and the controller going into standby.

No.	Parameter	Description
P103 ↓ P118	Status Fault 1 ↓ Status Fault 16	Used to select the type of input required See: Status Inputs
P120 ↓ P135	Stage 1 ↓ Stage 16	Select the output device for this stage
P140 ↓ P155	Stage 1 Size ↓ Stage 16 Size	Sets the relative size for each compressor

CO2 Section Parameters Description (d-02)

No.	Section Parameters	Description
P-01 to P-04	Transducers 1-4 Span	Range of the pressure transducer
P-05 to P-08	Transducers 1-4 Offset	Transducer value below or above zero.
P-20	G01 Max Gas Press	Set point at which Gas Cooler HP Open alarm is generated after delay P80
P-21	G01 Min Gas Press	Set point at which Gas Cooler LP Open alarm is generated after delay P80
P-22	G01 Max Gas SP	Upper limit of the calculated Gas cooler Set point
P-23	G01 Min Gas SP	Lower limit of the calculated Gas cooler Set point
P-24	G01 Extra Gas SP	Amount Gas Cooler Set Point is raised by if a status input set to "ExCap" is switched on.
P-25	G01 Gas Trgt Above	Differential above the gas setpoint
P-26	G01 Gas Trgt Below	Differential below the gas setpoint
P-27	G01 Gas Resp On	Adjusts the rate at which the Gas Cooler output increases when above setpoint (Option: - 1 to 60 with 60 being fastest response)
P-28	G01 Gas Resp Off	Adjusts the rate at which the Gas Cooler output decreases when below setpoint (Option: - 1 to 60 with 60 being fastest response)
P-29	G01 Gas Fuzzy Weight	When using an inverter output this setting allows the output value to decrease or increase more quickly. If set to 1 (default) then the output will ramp between 100% and 0% before switching the next stage. If set to 10 and the pressure is far away from setpoint then the inverter will ramp from a lower value (50% for example). This parameter should not be changed from default (1) under normal conditions.
P-40	G01 Min Gas Inv	Minimum value that the Gas Cooler Output will go to
P-41	G01 Max Gas Inv	Maximum value that the Gas Cooler Output will go to
P-42	G01 Gas Temp Fail Cooler	If gas cooler outlet temperature probe fails then the gas cooler output will go to this value.
P-43	G01 Gas Temp Fail Fan	If gas cooler outlet temperature probe fails then the fan output will go to this value.
P-50	G01 Gas HP Reset	Length of time controller stays in HP shutdown if the pressure is exceeded. This time period also applies to LP shutdown.
P-51 P-52 P-53	G01 Gas Trans.Ref G01 Gas Gradient G01 Gas Offset	During "Transcritical Operation", the Gas Cooler set point is calculated as a linear fuction of the "Gas Cooler Outlet" temperature. If Parameter P-51 is set to "Auto", then a pre-defined fuction is used. If Parameter P-51 is set to "Man", then Parameters P-52 and P-53 are used to generate the linear function. (Set Point = Gas Gradient x Gas Temp + Gas Offset)
P-54	G01 Gas SubTrs Offset	Offset to the CO2 critical point (31.1°C)
P-55	G01 Gas Setpoint Weight	Adjusts the weighting of the calculated gas cooler setpoint. The higher the percentage the closer the setpoint will be tracked, however the response of the gas cooler valve may be slower as a result.
P-60	G01 Sub Cooling	Offset to the calculated gas cooler setpoint (in subcritical operation)

P-70	G01 Cooler InterLock	If "Cooler Interlock" is set to "On" then if no Section 1 Stages are running then the Gas Cooler Output is set to its minimum value, as defined by P-40 (default 0%)
P-71	G01 Cooler Valve Standby	If the controller goes into standby mode then the gas cooler valve can be set to turn on or off, default is on.
P-72	G01 Max Gas Fan/Step Reset	Prevents the gas cooler stepper valve from automatically overdriving to 0 (re synching) if the gas cooler pressure is above this value. This setting is also used to prevent fan reversal operation if gas cooler pressure is above this value.
P-80	G01 Gas Alm Dly	Gas cooler HP and LP alarm Delay
P-81	G01 Gas Shut Dly	Gas cooler Shut delay
P-82	G01 Gas Alm Offset	Offset to Parameters P-20 and P-21, Max and Min Gas Press, used as a trigger for "Gas Cooler Shutdown" i.e. If Gas Pressure < (Min – Offset) Shutdown after Delay set by Parameter P-81 If Gas Pressure > (Max + Offset) Shutdown after Delay set by Parameter P-81
P-83	G01 Gas Temp OT	Gas cooler outlet high temperate alarm setting, generates "G01 Gas Cooler OT" alarm after Delay set by P-80
P-100	G01 Fan Ctrl	Selects how the Gas fan target and Gas Cooler target set points are derived. See: Gas Fan Control
P-101	G01 Fan Trgt	Setpoint used if fan control set to fixed or in the event of ambient temperature probe failure.
P-102	G01 Fan Offset Tz	Offset applied to the fan setpoint (only when P-100 set to ambient) when ambient temperature is ^{O}C
P-103	G01 Fan Offset Tc	Offset applied to the fan setpoint (only when P-100 set to ambient) when ambient temperature is at critical temperature (31.1^{O}C default)
P-104	G01 Fan Resp On	Adjusts the rate at which the Gas Fan output increases when above setpoint (1 to 60 with 60 being fastest response)
P-105	G01 Fan Resp Off	Adjusts the rate at which the Gas Fan output decreases when below setpoint (1 to 60 with 60 being fastest response)
P-106	G01 Fan Max Trgt	Stops the floating Gas Fan Set Point going above this level
P-107	G01 Fan Min Trgt	Stops the floating Gas Fan Set Point going below this level
P-108	G01 Fan Ngt SetBack	Turns on the night set back level. There are 4 options: - **Off:** Night Feature is not used. Controller uses what is set in Day Reduction. (P532) **On:** Night Reduction (Parameter P528) is always used **Local:** Uses times in Fan Night Setback On and Fan Night Setback Off parameters (P529/P530) to determine Day / Night **Remote:** Uses GP Timer to determine Day / Night Set up a Gp Timer channel with Output Type set to General. Output mask is the controller name as it appears in the device list. For Output channel number you would count down from 1st output (Relay 1) starting at 0, 1, 2 etc till you get to output for Fan Night Setback. Tick the Invert box so the night setback is on when channel is off.
P-109	G01 Fan Ngt Reduct	Reduces the fan output by this amount when the timer is not in its night zone.
P-110	G01 Fan Ngt SetOn	The time when night setback feature will start operating
P-111	G01 Fan Ngt SetOff	The time when night setback feature will stop operating
P-112	G01 Fan Ngt Temp Limit	Temperature set-point to disable the night set back feature. Night set back is disabled above this level and enabled below it.
P-113	G01 Fan Day Reduct	Reduces the fan output by this amount when the timer is not in its night zone.
P-114	G01 Fan Day Temp Limit	Temperature set-point to disable the day set back feature. Day set back is disabled above this level and enabled below it.
P-201	G01 Recv Target	Set Point at which the Receiver Bypass Valve will open and close.
P-202	G01 Recv Trgt Above	Control differential above receiver target setpoint (P-201)
P-203	G01 Recv Trgt Below	Control differential below receiver target setpoint (P-201)
P-204	G01 Recv Resp On	Adjusts the rate at which the receiver output increases when above target setpoint (Option: - 1 to 60 with 60 being fastest response)
P-205	G01 Recv Resp Off	Adjusts the rate at which the receiver output decreases when below target setpoint (Option: - 1 to 60 with 60 being fastest response)
P-206	G01 Recv Fuzzy Weight	Allows the receiver output value to decrease or increase more quickly. If set to 1 (default) then the output will ramp between 0% and 100%. If set to 10 and the pressure is far away from setpoint then the output will ramp from a higher value (50% for example). This parameter should not be changed from default (1) under normal conditions.

P-207	G01 Recv InterLock	If set to ON, when receiver pressure generates a receiver high pressure alarm, gas cooler output is set to the "Min Gas Inv" parameter value P-40 (default 0%) When receiver pressure generates a receiver low pressure alarm, gas cooler output is set to "Max Gas Inv" Parameter value P-41 (default 100%) If Set to GC, operation is the same as described above but the receiver alarm delay period is ignored. If Set to GCFans, Do not use, for future development.
P-220	G01 Recv Alm Dly	Delay applied before the Receiver Low or High Pressure alarm is generated.
P-221	G01 Recv Min Press	Setting at which Receiver Low Pressure alarm is generated
P-222	G01 Recv Max Press	Setting at which Receiver High Pressure alarm is generated
P-223	G01 Recv Fail	Value the Receiver Bypass Valve will go to it the Receiver Transducer fails
P-250	G01 Liq Level	Enable for Liquid Level feature
P-251	G01 High LiqLevel	Settings at which High Low Liquid Level alarms are generated
P-252	G01 Low LiqLevel	Settings at which Low Liquid Level alarms are generated
P-253	G01 LiqLevel Dly	Liquid level alarm delay period
P-300	G01 Aux Comp Trgt	Pressure at which the Auxiliary Compressor will turn on
P-301	G01 Aux Resp On	Adjusts the rate at which the auxiliary compressor output increases when above target setpoint (Option: - 1 to 60 with 60 being fastest response)
P-302	G01 Aux Resp Off	Adjusts the rate at which the auxiliary compressor output decreases when below target setpoint (Option: - 1 to 60 with 60 being fastest response)
P-350	G01 Do Liq Inj	Enables the liquid injection feature
P-351	G01 Liq Inj SP	Temperature at which Liquid Injection relay comes On. (Superheat high must be on for this to operate, see P-400)
P-352	G01 Liq Inj Diff	Temperature diff below the liquid injection setpoint that the Liquid Injection Relay goes Off
P-353	G01 Liq Inj OT	Temperature at which a Liquid Injection Over Temperature Alarm is generated. This has a fixed 1 minute delay.
P-400	G01 Do SH	Enables the Superheat feature which switches Superheat High and Superheat Low relays when high or low conditions are met.
P-401	G01 SH Lo Trgt	If the superheat falls below this value the Superheat Low Relay will come On
P-402	G01 SH Lo Diff	The diff above P401 that the "Superheat Low Relay" will go Off
P-403	G01 SH Lo Alm	Superheat Low Alarm Set Point
P-411	G01 SH Hi Trgt	If the superheat rises above this value the Superheat High Relay will come On
P-412	G01 SH Hi Diff	The diff below P411 that the Superheat High Relay will go Off
P-413	G01 SH Hi Alm	Superheat High Alarm Set Point
P-420	G01 SH Dly	Delay for Superheat High and Low alarms
P-500	G01 Co2 Status Dly	Time delay applied to the status inputs
P-520 – P535	G01 Co2 Status 1 – 16	Defines the use of each status input, 0 = Unused, 1 = Extra Capacity N/O 2 = Extra Capacity N/C 3 = Receiver Low N/O 4 = Receiver Low N/C 5 = Receiver High N/O 6 = Receiver High N/C 7 = Heat Recovery N/O 8 = Heat Recovery N/C
P-540	G01 Sect Interlock	Interlock between Section 1 and Section 2, when enabled if no Section 1 stages are running then no Section 2 stages will be allowed to run.
P-600	G01 Heat Recovery	Mode 1: Uses 0-10v Heat Recovery Sensor to vary the Gas Cooler Setpoint Mode 2: Uses status input to enable and varies analogue valve output around setpoint Mode 3: Uses status input to enable and cycles relay output around setpoint and diff
P-601	G01 Heat Rec. Start	Selects the voltage input level from the heat recovery sensor (0-10v) that heat recovery will start. (Mode 1 only)
P-602	G01 Heat Rec. End	Selects the voltage input level from the heat recovery sensor (0-10v) that heat recovery will end. (Mode 1 only)
P-603	G01 Hrec GasRef at Start	The gas cooler setpoint at the start of heat recovery (Mode 1 only)
P-604	G01 Hrec GasRef at End	The gas cooler setpoint at the end of heat recovery (Mode 1 only), in modes 2 & 3 this is the gas cooler target when in heat recovery.
P-605	G01 Hrec GasRef above End	The gas cooler setpoint that is used when the input voltage is above the end voltage level (Mode 1 only), in modes 2 & 3 this is the gas cooler high pressure alarm limit.
P-606	G01 Hrec FanRef at End	The fan temperature setpoint used at the end of heat recovery (Mode 1 only)
P-607	G01 Hrec FanRef at Bypass	The fan temperature setpoint used at the bypass level (Mode 1 only)
P-608	G01 Hrec Bypass	Selects the voltage input level from the heat recovery sensor (0-10v) that heat recovery

		will go into bypass mode. (Mode 1 only)
P-609	G01 Hrec Bypass Ref.	Heat recovery target setpoint temperature (Modes 1 & 2 only)
P-610	G01 Hrec Bypass Diff.	Differential above setpoint (Mode 3 only)
P-611	G01 Hrec Resp. On	Sets the speed of heat recovery valve opening (Mode 2 only)
P-612	G01 Hrec Resp. Off	Sets the speed of heat recovery valve closing (Mode 2 only)
P-620	G01 Fan Rev	This feature allows a relay to be allocated as a fan reverse signal, this will reverse the gas cooler fans at a preset time for a preset period to assist clearing debris that may have accumulated in the fans. (Gas cooler pressure must be below P-72 value.) 0 = Off, feature not used 1 = On, allows fans to be forced manually into reverse 2 = Local, uses the controller's internal GP timer to switch the fans into reverse. 3 = Remote, uses the Data Manager's GP timer to switch the fans into reverse.
P-621	G01 Fan Rev Start	Set the local time of day when fans are switched into reverse (only applies if P-620 set to local)
P-622	G01 Fan Rev Length	Sets the length of time fans will run in reverse
P-623	G01 Fan Rev Delay	Sets a delay period between fans stopping and being switched into reverse.
P-624	G01 Fan Rev Fix	If set to On then the fans will run in reverse at a fixed speed (set in P-625), if set to Off then the fans will run at their normal control speed.
P-625	G01 Fan Rev Variable	Sets the fixed reverse fan speed if P-624 set to On.
P-626	G01 Fen Rev Level	Fan reverse will not operate if the pressure is below this value, this is to prevent over condensing. If the pressure drops below this value during a fan reverse cycle then normal forward operation will be resumed, another reverse fan cycle cannot be activated for a minimum of one hour.
dFLt	Restore Default Settings	Only available when using plant display PR0620

Oil Section Parameters Description (d-03)

Parameter numbers are the same for both sections (ds01 & ds02)

No.	Section Parameters	Description
P-01 ↓ P-16	Oil Enable 1 ↓ Oil Enable 16	Used to enable oil fault input on compressor 1 ↓ Used to enable oil fault input on compressor 1
P-40	PreDly	Delay before pulsing Oil relay
P-41	Oil Pulses	Number of times Oil Injection Relays will pulse on and off
P-42	Pulse Off Time	Length of time Oil Injection Relay is pulsed off
P-43	Pulse On Time	Length of time Oil Injection Relay is pulsed on
P-44	LockOut	Number of times Oil Injection will retry before disabling compressor
P-45	Retry	Length of time compressor will go off between retries
P-46	PostDly	Delay after pulsing oil relay
P-60	Oil Sep Enable	Used to enable an oil separator input to allow it to be pulsed on and off.
P-61	Sep PulseOff	Length of time Oil Separator Relay is pulsed off
P-62	Sep PulseOn	Length of time Oil Separator Relay is pulsed on
P-63	Oil Lo Enable	Allocates a status input as a low oil level alarm input, typically the oil separator, for monitoring only.
P-64	Oil Hi Enable	Allocates a status input as a high oil level alarm input, typically the oil separator, for monitoring only.
P-65	LoHi Dly	Oil level alarm delay period
P-66	Oil Reset Enable	Allocates a status input as a reset input to reset oil lockouts

I/O Mapping of Pressure Transducers, Temperature Probes, Inverters, Steppers and Relay Positions (d-04 IOMap)

Parameter numbers are the same for all 5 sections (ds01 to ds05) although some parameters are not used for a particular section, for example the Oil control sections do not require a stepper valve allocation.

Number	Parameter	Description
P-01 ↓ P-04	Pressure Position 1 ↓ Pressure Position 4	Position of pressure transducer inputs (not used in the oil sections)
P-10 ↓ P-17	Probe Position 1 ↓ Probe Position 8	Position of temperature probe inputs (not used in the oil sections)
P-20 ↓ P-35	Status Position 1 ↓ Status Position 16	Position of oil status inputs, these should match the compressor numbers in pack sections 1 & 2.
P-40 ↓ P-47	Extra Status Position 1 ↓ Extra Status Position 8	Position of additional oil status inputs (if used), these are as follows: Oil Separator Input Oil Low Input Oil High Input Oil Reset Input (this should be a momentary switched input)
P-50 ↓ P-53	Inverter or Valve Variable Output Position 1 ↓ Inverter or Valve Variable Output Position 4	Position of variable mA or dc voltage outputs to drive inverters or valves (not used in the oil sections)
P-60 ↓ P-83	Relay Position 1 ↓ Relay Position 24	Position of oil injection relay outputs These correspond to the status inputs 1 -16, the relay will pulse when the relevant status input is activated.
P-100	Stepper Position 1	Position of stepper valve output 1 on main board (not used in the oil sections)
P-101	Stepper Position 2	Position of stepper valve output 2 on main board (not used in the oil sections)

Main Board Setup Configuration Description

Universal I/O Type, Status Input Type, Invert Relays, SSR Select, Stepper Valve Settings and Probe Offsets (d-05 Main Board)

Number	Parameter	Description
P-01 – P-08	M01 Universal I/O 1-8	Select the type of universal input or output, such as 4-20mA in or 0-10vdc out.
P-10	M01 Status Inputs	Select whether 0V return or 24V ac
P-20 – P-31	M01 Invert Relay 1 or SSR Select	Used to invert relay operation or set relay to solid state relay (SSR) if fitted
P-40 – P-47	M01 Offset 1	Offset probe readings by this amount, this allows calibration due to resistance drop over long cable lengths.
P-50	M01 Step Reset Time	After a set amount of stepper valve operation hours (default 6) the valve will automatically close fully to recalibrate it's position.
P-60	M01 Stepper Type 1	Selects the type of stepper valve to be driven
P-61	M01 Stepper Type 2	Selects the type of stepper valve to be driven
P-70	M01 Step Max 1	The number of steps to open the valve fully if valve type is set to "other"
P-71	M01 Step Max 2	The number of steps to open the valve fully if valve type is set to "other"
P-80	M01 Step Close 1	The number of steps to close the valve fully if valve type is set to "other", this is normally higher than the maximum open steps to ensure the valve is fully shut.
P-81	M01 Step Close 2	The number of steps to close the valve fully if valve type is set to "other", this is normally higher than the maximum open steps to ensure the valve is fully shut.
P-90	M01 Step Speed 1	The step speed in Hz if the valve type is set to "other"
P-91	M01 Step Speed 2	The step speed in Hz if the valve type is set to "other"
P-100	M01 mA Peak 1	The maximum current that can be delivered to the valve if the valve type is set to "other"
P-101	M01 mA Peak 2	The maximum current that can be delivered to the valve if the valve type is set to "other"
P-110	M01 Step Half 1	Allows the valve to be opened or closed in half step increments if valve type is set to "other"
P-111	M01 Step Half 2	Allows the valve to be opened or closed in half step increments if valve type is set to "other"
P-120	M01 Step mA Hold 1	The holding current that will be applied to the valve to stop it drifting if valve type is set to "other"
P-121	M01 Step mA Hold 1	The holding current that will be applied to the valve to stop it drifting if valve type is set to "other"

Note: Parameters P-50 to P-121 apply only to the PR0652 hardware variant which has two stepper outputs.

When using the PR0650 hardware variant these parameters do not apply, stepper setup is the stepper expansion board PR0660 (See the following page).

Expansion Board Setup Configuration Description

Universal I/O Type, Status Input Type, Invert Relays, Probe Offsets and Stepper Valve Settings (d-06 Expansion Boards)

Parameter numbers are the same for all 10 expansion boards (ds01 to ds10)

Number	Parameter	Description
P-01	Board Type	Selects the type of expansion board being used, IO board, Mini IO board or Stepper board.
P-02 – P-09	Universal I/O 1-8	Select the type of universal input or output, for example 4-20mA in for a pressure transducer or 0-10vdc out for an inverter drive.
P-10	Status Inputs	Select whether 0V return or 24V ac
P-20 – P-31	Invert Relay 1–12	Used to invert relay operation
P-40 – P-47	Offset 1-8	Offset probe readings by this amount, this allows calibration due to resistance drop over long cable lengths.
P-50	Step Reset	After a set amount of stepper valve operation hours (default 6) the valve will automatically close fully to recalibrate it's position.
P-60 – P-65	Step Type 1–6	Selects the type of stepper valve to be driven.
P-70 – P-75	Step Max 1–6	The number of steps to open the valve fully if valve type is set to "other"
P-80 – P-85	Step Close 1–6	The number of steps to close the valve fully if valve type is set to "other", this is normally higher than the maximum open steps to ensure the valve is fully shut.
P-90 – P-95	Step Speed 1-6	The step speed in Hz if the valve type is set to "other"
P-100 – P-105	Step mA Peak	The maximum current that can be delivered to the valve if the valve type is set to "other"
P-110 – P-115	Step Half 1-6	Allows the valve to be opened or closed in half step increments if valve type is set to "other"
P-120 – P-125	Step mA Hold 1-6	The holding current that will be applied to the valve to stop it drifting if valve type is set to "other"

Compressor Run Hours and Compressor Starts Description (d-07 Stats)

Parameter numbers are the same for both pack sections (ds01 &ds02)

Number	Parameter	Description
P-01	Reset Stats	Reset stats by changing from Reset 1 to Reset 2 or vice versa

Getting Started

There are 5 separate sections, sections 1 & 2 are pack control sections, section 3 is the CO2 control section and sections 4 & 5 are the oil control sections for packs 1 & 2, each section is set up by clicking on the appropriate tab to expand it and selecting "set parameters" to set all the values required.

Pack Sections (Section 1 & Section 2)

Each of the two pack sections has 4 transducer inputs available, 16 status inputs and 16 stage outputs although it should be noted that these are "virtual" inputs and outputs and at this stage are not mapped to physical relays or pressure or fault inputs.

Mapping these settings to the controller's hardware will be done at a later stage.

The minimum requirement is that one transducer span and offset is set to match the suction control pressure transducer. (S01 Span 1 and S01 Offset 1), the other transducers can be used for discharge pressure (recommended) or general monitoring if required.

If an inverter drive is being used then S01 Inv should be set to on and S01 stage 1 set to Inv, this will make the first stage output an inverter enable signal. If no inverter is being used then S01 stage 1 will be set to Comp for compressor. All other stages are then set up accordingly, compressor, loader and so on.

Compressor sizes then need to be entered to enable the controller to calculate the best combination of stages to use. If all compressors are the same size then the sizes can all be set to 1 for simplicity.

If a compressor size is left at 0 then the compressor will not run.

This is the minimum set up requirement for this section to operate, other settings such as status inputs (compressor faults for example), night setback, and alarm settings will need entered as and if required.

All these settings are the same for pack section 2.

CO2 Section (Section 3)

This section contains all the settings relating to gas cooler control, gas fan control, receiver control, liquid injection control (optional), auxiliary compressor control (optional) and heat reclaim control (optional).

The minimum requirements are a gas cooler pressure transducer is set up (G01 Span 1 and G01 Offset 1), a receiver pressure transducer (G01 Span 2 and G01 Offset 2), and a gas cooler outlet temperature probe (G01 Probe 1) and gas cooler ambient temperature probe (G01 Probe 2) are connected.

Oil Control Sections (Sections 4&5)

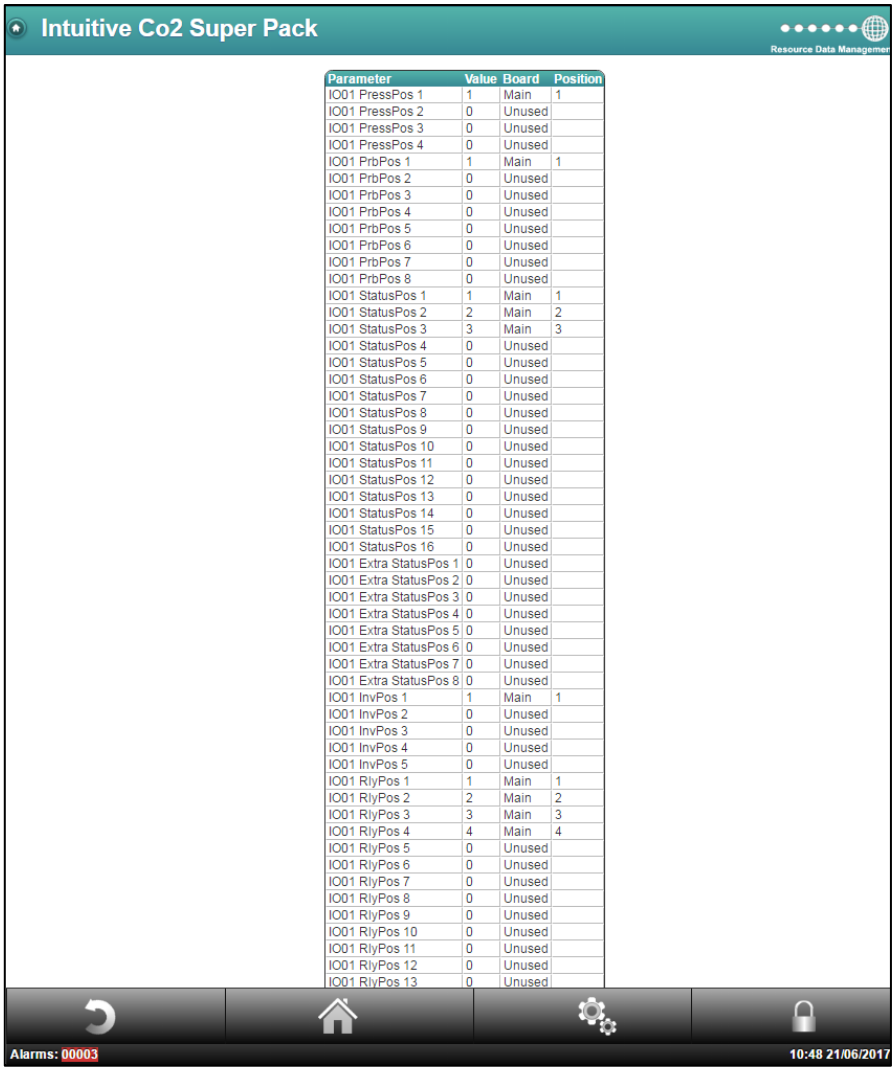
Oil control for each of the pack sections is optional and is switched off as default, set up procedure is the same method as sections 1 to 3.

Once all the sections that are required are setup then all the inputs and outputs can be mapped to physical connections on the main control board or on any of the 10 expansion boards, the controller will not operate until this is done.

IoMap 1 to 5

In the Superpack range of controllers, inputs and outputs, such as relays and probe inputs, are not allocated automatically. These are allocated manually by the user using the IO map sections, although this requires more setting up it does mean greater flexibility. IO map sections 1 & 2 are for pack sections 1 & 2, IO map section 3 is for the CO2 section and IO map sections 4 & 5 are for the oil sections.

In the example below:



Parameter	Value	Board	Position
IO01 PressPos 1	1	Main	1
IO01 PressPos 2	0	Unused	
IO01 PressPos 3	0	Unused	
IO01 PressPos 4	0	Unused	
IO01 PrbPos 1	1	Main	1
IO01 PrbPos 2	0	Unused	
IO01 PrbPos 3	0	Unused	
IO01 PrbPos 4	0	Unused	
IO01 PrbPos 5	0	Unused	
IO01 PrbPos 6	0	Unused	
IO01 PrbPos 7	0	Unused	
IO01 PrbPos 8	0	Unused	
IO01 StatusPos 1	1	Main	1
IO01 StatusPos 2	2	Main	2
IO01 StatusPos 3	3	Main	3
IO01 StatusPos 4	0	Unused	
IO01 StatusPos 5	0	Unused	
IO01 StatusPos 6	0	Unused	
IO01 StatusPos 7	0	Unused	
IO01 StatusPos 8	0	Unused	
IO01 StatusPos 9	0	Unused	
IO01 StatusPos 10	0	Unused	
IO01 StatusPos 11	0	Unused	
IO01 StatusPos 12	0	Unused	
IO01 StatusPos 13	0	Unused	
IO01 StatusPos 14	0	Unused	
IO01 StatusPos 15	0	Unused	
IO01 StatusPos 16	0	Unused	
IO01 Extra StatusPos 1	0	Unused	
IO01 Extra StatusPos 2	0	Unused	
IO01 Extra StatusPos 3	0	Unused	
IO01 Extra StatusPos 4	0	Unused	
IO01 Extra StatusPos 5	0	Unused	
IO01 Extra StatusPos 6	0	Unused	
IO01 Extra StatusPos 7	0	Unused	
IO01 Extra StatusPos 8	0	Unused	
IO01 InvPos 1	1	Main	1
IO01 InvPos 2	0	Unused	
IO01 InvPos 3	0	Unused	
IO01 InvPos 4	0	Unused	
IO01 InvPos 5	0	Unused	
IO01 RlyPos 1	1	Main	1
IO01 RlyPos 2	2	Main	2
IO01 RlyPos 3	3	Main	3
IO01 RlyPos 4	4	Main	4
IO01 RlyPos 5	0	Unused	
IO01 RlyPos 6	0	Unused	
IO01 RlyPos 7	0	Unused	
IO01 RlyPos 8	0	Unused	
IO01 RlyPos 9	0	Unused	
IO01 RlyPos 10	0	Unused	
IO01 RlyPos 11	0	Unused	
IO01 RlyPos 12	0	Unused	
IO01 RlyPos 13	0	Unused	

Section 1 Pressure Position 1 (suction transducer) is mapped to main board 1 Universal Input 1

Section 1 Probe Position 1 is mapped to Main board probe input 1

Section 1 Status Positions 1, 2 & 3 are mapped to Main board status inputs 1, 2 & 3

Section 1 Inverter Position 1 is mapped to Main board Universal IO 1

Section 1 Relay Positions 1 to 4 are mapped to Main board relays 1 to 4

The values listed under the Board and Position columns to the right of the parameter column are the physical locations that the "virtual" locations are mapped to.

The values listed under the parameter column are "virtual" values, for example IO01 RlyPos1 is not one of the physical relays on the main board or one of the expansion boards but is simply stage 1 as set up under Section 1 Parameters (S01 Stage 1 set to "Comp" for example). These "virtual" relays are allocated as follows:

Sections 1&2 (Pack) IO Positioning

Virtual Position	Description
Analogue Input 1	Suction Pressure
Analogue Input 2	Discharge Pressure
Analogue Input 3	Pressure 1
Analogue Input 4	Pressure 2
Temperature Input 1	Suction Temperature
Temperature Input 2	Discharge Temperature
Temperature Input 3-8	Temperature 3-8
Status Inputs 1-16	Status Inputs 1-16
Analogue Output 1	Inverter Output
Digital Output 1-16	Compressor stages 1-16
Digital Output 17	Inverter Bypass
Digital Output 18	Gas dump (If the inverter bypass function is not used then the gas dump relay will move up to position 17)
Digital Output 20	Standby (de energises when section in standby, energised when running)
Digital Output 22	Offline
Digital Output 23	Run
Digital Output 24	Alarm

Section 3 (CO2) IO Positioning

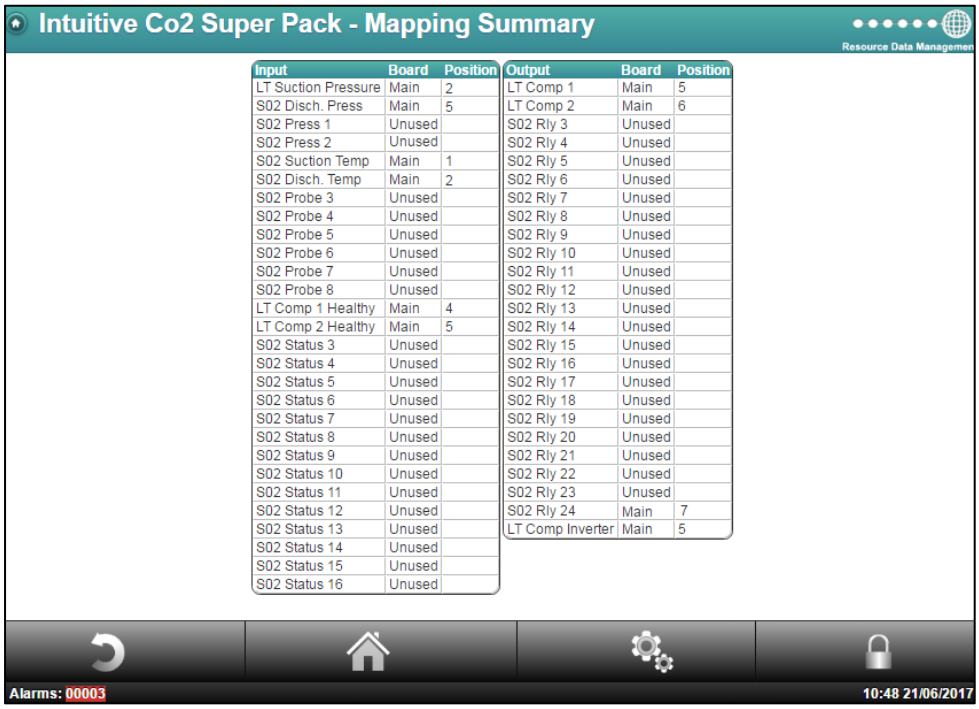
Virtual Position	Description
Analogue Input 1	Cooler Pressure
Analogue Input 2	Receiver Pressure
Analogue Input 3	Liquid Level
Analogue Input 4	Heat Recovery Sensor
Temperature Input 1	Cooler Temperature
Temperature Input 2	Ambient Temperature
Temperature Input 3	Cooler Air On Temperature
Temperature Input 4	Cooler Air Off Temperature
Temperature Input 5	Liquid Injection Temperature
Temperature Input 6	Bypass Temperature
Temperature Input 7/8	Temperatures 7/8
Status Inputs 1-16	Status Inputs 1-16
Analogue Output 1	Cooler Inverter Output
Analogue Output 2	Fan Inverter Output
Analogue Output 3	Receiver Inverter Output
Analogue Output 4	Auxiliary Compressor Inverter Output
Analogue Output 5	Heat Recovery Output
Stepper Output 1	Receiver/Bypass valve (only available on Main Board hardware variant PR0752 or stepper expansion board)
Stepper Output 2	Gas cooler valve (only available on Main Board hardware variant PR0752 or stepper expansion board)
Stepper Output 3	Heat Recovery valve (only available on Main Board hardware variant PR0752 or stepper expansion board)
Digital Output 1	Cooler Inverter Enable
Digital Output 2	Fan Inverter Enable
Digital Output 3	Receiver Inverter Enable
Digital Output 4	Auxilliary Inverter Enable
Digital Output 5	Transcritical Relay
Digital Output 6	Liquid Injection Relay
Digital Output 7	Superheat Low Relay

Virtual Position	Description
Digital Output 8	Superheat High Relay
Digital Output 9	Heat Recovery Valve
Digital Output 10	Heat Recovery Bypass Valve
Digital Output 11	Fan Reverse Relay
Digital Output 12	Heat Recovery Inverter Enable
Digital Output 22	Offline
Digital Output 23	Run
Digital Output 24	Alarm

Sections 4&5 (Oil) IO Positioning

Virtual Position	Description
Status Inputs 1-16	Status Inputs 1-16
Status Inputs 17	Oil Separator
Status Inputs 18	Oil Low
Status Inputs 19	Oil High
Status Inputs 20	Oil Reset
Status Output 1-16	Oil Injection Relays 1-16

Mapping Overview



Input	Board	Position
LT Suction Pressure	Main	2
S02 Disch. Press	Main	5
S02 Press 1	Unused	
S02 Press 2	Unused	
S02 Suction Temp	Main	1
S02 Disch. Temp	Main	2
S02 Probe 3	Unused	
S02 Probe 4	Unused	
S02 Probe 5	Unused	
S02 Probe 6	Unused	
S02 Probe 7	Unused	
S02 Probe 8	Unused	
LT Comp 1 Healthy	Main	4
LT Comp 2 Healthy	Main	5
S02 Status 3	Unused	
S02 Status 4	Unused	
S02 Status 5	Unused	
S02 Status 6	Unused	
S02 Status 7	Unused	
S02 Status 8	Unused	
S02 Status 9	Unused	
S02 Status 10	Unused	
S02 Status 11	Unused	
S02 Status 12	Unused	
S02 Status 13	Unused	
S02 Status 14	Unused	
S02 Status 15	Unused	
S02 Status 16	Unused	

Output	Board	Position
LT Comp 1	Main	5
LT Comp 2	Main	6
S02 Rly 3	Unused	
S02 Rly 4	Unused	
S02 Rly 5	Unused	
S02 Rly 6	Unused	
S02 Rly 7	Unused	
S02 Rly 8	Unused	
S02 Rly 9	Unused	
S02 Rly 10	Unused	
S02 Rly 11	Unused	
S02 Rly 12	Unused	
S02 Rly 13	Unused	
S02 Rly 14	Unused	
S02 Rly 15	Unused	
S02 Rly 16	Unused	
S02 Rly 17	Unused	
S02 Rly 18	Unused	
S02 Rly 19	Unused	
S02 Rly 20	Unused	
S02 Rly 21	Unused	
S02 Rly 22	Unused	
S02 Rly 23	Unused	
S02 Rly 24	Main	7
LT Comp Inverter	Main	5

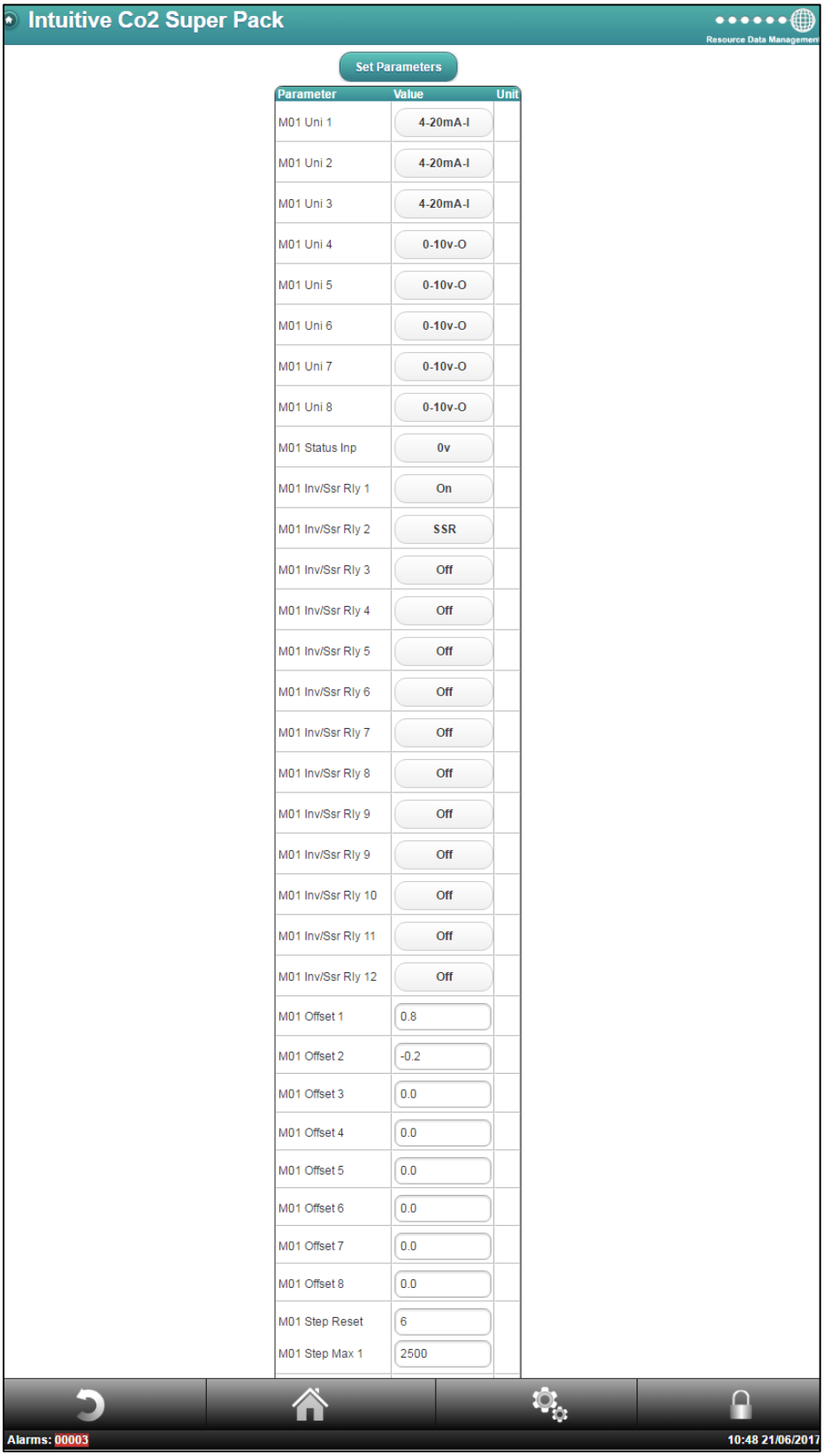
Clicking on the Mapping tab allows an overview of the mapping of each section to be displayed, this is a useful confirmation that mapping is set up correctly and can help with fault finding at a later date.

In this example the suction control transducer for section 2 is mapped to Main board, universal IO connection 2.

Virtual relay positions 1&2 (compressors) are mapped to physical relays 5&6 on the main controller and virtual relay 24 (always the alarm relay) is mapped to physical relay 7 on the main board.

Once the mapping has been completed then the hardware can be set up for the main board and any expansion boards fitted.

Hardware Setup



Main Board

The main board hardware settings have to be set to match the devices connected to it.

M01 Uni 1 to 8 are universal inputs & outputs, in the example on the left Uni1-Uni3 are set to 4-20mA In to read 4-20mA pressure transducers.

Uni 4 to Uni 8 are set to 0-10v Out to provide a signal to control the speed of an inverter drive or variable position valve.

Status Inputs are set to 0v, this applies to all status inputs on that board and requires a volt free contact to activate an input (as opposed to a 24vac signal).

Relay 1 Inv/SSR is set to On which means that the relay function is inverted (energise to switch off).

Relay 2 is set to SSR which means that a solid state relay is fitted in relay position 2 to drive a digital scroll compressor solenoid valve.

Temperature probe 1 has an offset of 0.8 degrees applied to account for an increased resistance due to a long cable run for example.

The two sets of stepper settings after these settings on the main board are only available with hardware option PR0652 which has two stepper driver outputs built in. If the main board is the PR0650 hardware option then a stepper expansion board needs to be used to drive stepper valves.

Extension Board

Extension board hardware set up is the same as the main board except that the first option is "Board" which selects between a stepper expansion board, a Mini IO board or an IO expansion board. There are also settings for 6 stepper valves instead of the two on the main board.

Setup is now complete

System

Link	Operation
System Log	Displays the changes made to the controller in chronological order
Network	Setup: - IP Address Netmask Default Gateway
Time	Set the Time or synchronise with the PC
Reset	Restart the controller
Clear Alarm Log	Clears the controller alarm log completely (Yes/No choice)
Clear Aliases	Clears any item aliases set up and reverts them back to default
Version	Shows the controller and expansion boards software version

Aliases

To simplify the appearance of the controller when being viewed with a PC, devices, items, alarms and display values can be hidden or renamed using the Aliases section.

Link	Operation
Device	Allows devices to be hidden or renamed such as section 1, IOMap 1, MainBrd1, ExtBrd1 and Stats1, for example Section 1 can be renamed to "HT Pack" or hidden if not used.
Items	Allows items within a device to be renamed or hidden such as S01 Press 1, this can be renamed to "HT Suction Press" for example or hidden if not used. There are four subsections or classes, Inputs, Outputs, States and Parameters.
Alarms	Allows the description of any alarm to be changed, for example S01 High Pressure can be renamed to "HT Suction High Pressure" or hidden if not used.
Display	Allows the text which appears on the remote display (PR0620) to be aliased, for example "HP SEC1" can be changed to "HP SUCt". Characters that can be used are limited by the 8 segment LED display, for example S, A and L can be used but X, Y and Z cannot.

To set an alias back to factory setting leave the required filed blank and then set aliases.

Display

To simplify the appearance of the controller when being viewed with a Touchscreen Display (PR0615), the inputs, outputs, states and parameters to be shown on the display can be manually selected. The Screen Dev parameter has to be set to 0 to utilise this feature (see configuration – main menu)

Link	Operation
Device	Selects the device to be displayed such as "Section 1", "CO2 1" and "Oil 1".
Class	Selects the type of item to be displayed for that section, options are "Inputs", "Outputs", "States" or "Parameters". Once selected click on "Set Item Display" to choose which values will be shown on the Touchscreen.

Configuration

Link	Operation
Configuration	Set the controller configuration (see next page)
Save Configuration	Saves the current Configuration
Load Configuration	Allows the user to upload a previously saved configuration, NOTE: file needs to be named "Setup.xml"
Add Feature	Enables additional Features such as Bacnet

Important Note:

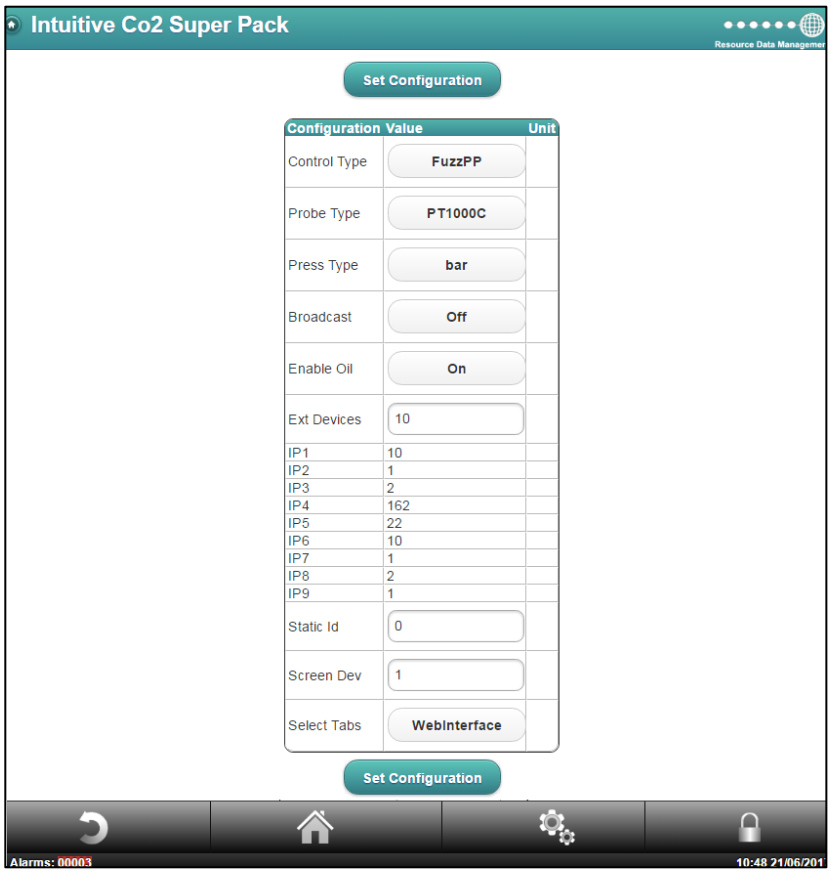
If transferring a saved configuration from a controller with firmware version V2.9 or earlier to a controller with firmware version V3.0 or higher, the universal IO settings (such as 4-20mA in) will revert to default settings (0-10v in), these will need to be changed and saved manually. Once this configuration has been saved it can be transferred between any controllers with V3.0 or higher firmware installed without any further manual intervention.

As new features and settings are added to the controller in subsequent firmware versions (such as the "Ext Devices" parameter), if a configuration from a controller that does not have the feature is transferred onto a controller that does, then as the saved value is not know then it will be set to a default value on the newer controller.

A brief check of functionality should be done when transferring configurations from older firmware versions to newer versions.

Logout: Logs you out of viewing values and setting parameters

Current alarm: Displays the number of current alarms on the system



Control Type.

FuzzyPP: compressor staging on and off times are adjusted automatically depending on pressure compared to target setpoint and rate of change (PID control). PP indicates dual temperature pack control.
StagePP: compressor staging is configured manually by setting fixed stage on and off delays and differential above and below target setpoint.

Probe Type.
Selects thermistor temperature probe type and temperature units degrees C or F, defaults to PT1000 Centigrade.

Press Type.
Selects between bar and psi

Broadcast.
Press: allows pressure to be transmitted over the network for use in evaporator superheat control.
Load: allows evaporator shutdown signals to be sent over the network.
See: Broadcast

Enable Oil: Enables compressor oil control feature.

Ext Devices: Sets the number of Canbus expansion devices being used.

IP1-IP9.
Shows the current IP address details of the controller or allows a static IP address to be entered if rotary address switches are set to 000.
See: Network Configuration

Static Id.
When using a static IP address a static 3 digit id number can be entered. This is used by a Mercury evaporator controller to identify which pack controller is transmitting suction pressure.

Screen Dev.
Select which type of information is shown on the PR0615 Touchscreen Display. See: Touch Display Screen

Language.
Selects the language used, this is dependent on the correct language file being installed.

Network.
Selects the network type, XML (IP), Bacnet or both.

BACnet DevIns(x1000)
BACnet DevIns
When using a Bacnet enabled front end system, the controller is given a unique address or Bacnet Device Instance. As a large number can be entered here the value is entered in two separate fields. In the above example the Device Instance number is 2272300 so the first 4 digits are entered under BACnet DevIns(x1000) and the last 3 digits are entered under BACnet DevIns.

Pack Sections 1 & 2 Additional Information.

Status Inputs

Section Inputs can be set up as: -

0	Unused	Input is not used
1	Compressor or Condenser Normally Open	When selected "Make" to generate Compressor or Condenser Fault
2	Compressor or Condenser Normally Closed	When selected "Break" to generate Compressor or Condenser Fault
3	General Normally Open	When selected "Make" to generate General Fault
4	General Normally Closed	When selected "Break" to generate General Fault
5	Standby Normally Open	When selected "Make" to place Section 1 into standby and generate Standby alarm.
6	Standby Normally Closed	When selected "Break" to place Section 1 into standby and generate Standby alarm.
7	Run Normally Open	When selected "Break" to use Sect 1 Ext Target (P-13) OR "Rem Ext ½" See Note : Ext Target
8	Run Normally Closed	When selected "Make" input to use Sect 1 Ext Target (P-13) OR "Rem Ext ½" See Note: Ext Target
9	INV N/O	When selected "Break" to signal Inverter Run. Used when using Inverter Bypass relay. See Note : INV Bypass
10	INV N/C	When selected "Make" to signal Inverter Run. Used when using Inverter Bypass relay. See Note : INV Bypass
11	Proof N/O	When the global Run Proof option is being used, this input is "Make" to reset a compressor trip caused by fault input (options 1 or 2 above)
12	Proof N/C	When the global Run Proof option is being used, this input is "Break" to reset a compressor trip caused by fault input (options 1 or 2 above)

For the above any alarms will be generated after the Status Fault Delay (P.100) has timed out.

NOTE: These are "Virtual" status inputs so the order in which they are allocated is not important as they will be mapped to actual physical inputs later in the setup. Stages should only be set to unused and the end of allocating, for example Input 1=Comp N/O, Input 2=Comp N/O, Input 3=Comp N/O, Input 4=Standby N/C, Inputs 5 onwards=Unused. Do not set a stage input to Unused followed by used input (such as Comp N/O).

External Target

Pack Controller

To use Sect 1 or 2 Ext Target (P-13) instead of Section 1 or 2 Target Pressure (P-09) a status Input must be set to "Run ½ N/O or N/C".

- When the input is activated the Target Pressure will change from (P-09/10) to (P-13)
- When the input is de-activated the Target Pressure will revert back to (P-09/10)

Section Stages

Pack

#	Stage	Description	
0	None	Use this option to end the number of stages in the controller	
1	Unused	Use this option to skip a relay output within a stage	
2	Inverter	Use this option to assign a relay to an Inverter	
3	Comp	Use this option to assign a relay output to a compressor	See note 5
4	Loader	Use this option to assign a relay output to a compressor loader	See note 9
5	Trim	Use this option to set a relay to a trim compressor	See note 6
6	SSR	Use this option to set a relay to a digital scroll solenoid valve	See Using a Digital Scroll

Note 5: At least 1 output must be assigned to a compressor. Loader outputs will not energise without a compressor being on. When assigning stages a Loader should follow the Compressor to which it is attached.

Note 6: This option can be used to provide additional capacity if the inverter capacity is too small. The "Trim" relay will always come on first before the Inverter enable relay and will use the starts per hour parameter. Once the trim stage is on the inverter enable relay would be energised and the inverter analogue output would begin to ramp up. The trim relay would remain on until all other stages are off and the inverter enable relay has been turned off.

Note 9: Relays can be configured as loaders, selected after a compressor stage or a compressor running on an Inverter

Stage Sizes

Stage sizes will determine the order in which compressors or loaders are switched on and off. This is a relative number between 0 and 60, reflecting the size of the compressor (usually horse power)

The default stage size is 0; stage sizes must be entered for correct operation.

Using a Digital Scroll Compressor

A digital scroll compressor requires an Inverter relay allocated to it to switch on the compressor and a solid state relay (SSR) to energise the capacity solenoid, the SSR output is switched **off** to fully load the compressor and **on** to fully unload the compressor**.** The compressor is loaded and unloaded in 20 second cycles as default (P-36 cycle time) so if the compressor is required to run at 50% capacity then the SSR output will be on for 10 seconds and off for 10 seconds. Similarly if the compressor is required to run at 75% capacity the SSR will be off for 15 seconds and on for 5 seconds.

The following procedure is an example of how the controller should be set up to run a digital scroll compressor:

- When ordering, the controller must be specified with a solid state relay fitted in relay position 1 (PR0650-SUPCO2-E1 for example) or if two digital scrolls are being controlled then a solid state relay is required in relay positions 1&2 (PR0650-SUPCO2-E2 for example). Only one digital scroll compressor can be controlled on each compressor section.
- Under the Main Board set up page set relay 1 to SSR and relay 2 to SSR if fitted.
- Under the section parameters set Inverter to on (P-31) and set inverter minimum to 10% (P-33) or refer to compressor manufacturer's specification for a minimum capacity (to provide compressor cooling).
- Set PWM Control to on (P-35) and set PWM Cycle time to 20 seconds (P-36) or refer to compressor manufacturer's specification.
- Set stage 1 to SSR and stage 2 to Inverter (P-120 & P-121)
  Under the stage IO map, map the SSR to the position the SSR is fitted on the controller (relay position 1 or 2) and the inverter relay to any other relay which is being used to switch the compressor on.
- The Discharge Stop and Trip parameters need to be set according to manufacturer's specification (P-83, P-84, P-85 & P-86).
- If the controller is set to staged control then stage 1 should be set to relays 1 & 2 ON (SSR & INV). When there is a demand for the digital scroll to run the enable relay (INV) will switch on and the capacity solenoid (SSR) will be modulated on and off as required.

Run-Proof

This is a "global" parameter if set to on the Status fault inputs are used to prove that compressors are running. Configure the status inputs, using either Compressor Normally Closed or Compressor Normally Open, that correspond with each relay output. When the relay output is energised and the run proof signal isn't returned within the specified time period, then the compressor relay will go off and be taken out of the control strategy until the run proof has been reset. The run-proof feature uses the status fault delay (P.100) and all run proof signals must be returned within this delay period. Run proofs are used with compressor (Comp) stages only. When the status input is set to Compressor Normally Closed then the input must become open circuit for the compressor run to be confirmed and vice versa. If using an Inverter (Inv) stage then the Inverter bypass function should be used. See "Inverter Bypass"

Note: If using "Run Proofs" and Compressor Loaders.

If you have a compressor with loaders you need to set up status inputs for the compressor body and the loaders and map the inputs accordingly. For example, if relay 1 is a compressor and relays 2 & 3 are the associated loaders then status inputs 1, 2 & 3 would be set as compressors, if inputs 1, 2 & 3 are then mapped to physical input 1 on the controller then when the compressor fault input is activated the associated loaders will be switched off as well as the compressor body.

To reset the run proof for any stage, after maintenance, and return a compressor back into the control strategy, the proof status input should be activated momentarily. If a proof status input is not set up then resetting the controller will have the same effect.

Gas Dump

Gas Dump Enable (P-29). The Gas dump relay will come on when the Suction Pressure drops below the Set Point (P-09/10) plus the Gas Diff (P-30) and all but the last compressor has turned off.

When an Inverter output is configured the Gas dump relay will come on only when the Inverter is active, i.e. above 0% and all other Compressors configured in that section are off.

The Gas dump relay will go off again when: -

The pressure rises above the Set Point (P-09/10)
Or
When the last stage compressor goes off, or Inverter Enable is turned off.

Compressor Loaders

Parameter (P-26) determines the order the compressor loaders are switched off providing the option to turn off one compressor and its loaders before turning off the next or to switch off all the loaders first leaving compressors running unloaded.

If (P-26) set for 0 (Off) then a compressor loaders and compressor body will be switched off before another loader is switched off.

If (P-26) set for 1 (On) then all loaders will be switched off before a compressor body will be switched off leaving any compressors running unloaded before switching a compressor body off.

Example 1

Pack set up: 2 compressors with 2 Loaders each
Sect 1 stage 1 = Comp. Sect 1 stage 2 = Loader. Sect 1 stage 3 = Loader.
Sect 1 stage 4 = Comp. Sect 1 stage 5 = Loader. Sect 1 stage 6 = Loader.
Parameter (P-26) = 0 (Off)

Switching On sequence: Pressure above set point + diff
First compressor comes on. Compressor loader 1 comes on. Compressor loader 2 comes on.
Second compressor comes on. Compressor loader 1 comes on. Compressor loader 2 comes on.
Switching Off sequence: Pressure below set point – diff
One compressor loader 2 goes off. Compressor loader 1 goes off. Compressor body goes off.
Next compressor loader 2 goes off. Compressor loader 1 goes off. Compressor body goes off.

This configuration switches off one compressor and its loaders before switching off the next compressor loader.
Thus leaving one compressor fully loaded till first one is completely off.

Example 2

Pack set up: 2 compressors with 2 Loaders each
Sect 1 stage 1 = Comp. Sect 1 stage 2 = Loader. Sect 1 stage 3 = Loader.
Sect 1 stage 4 = Comp. Sect 1 stage 5 = Loader. Sect 1 stage 6 = Loader.
Parameter (P-26) = 1 (On)

Switching On sequence: Pressure above set point + diff
First compressor comes on. First compressor loader 1 comes on. First compressor loader 2 comes on.
Second compressor comes on. Second compressor loader 1 comes on. Second compressor loader 2 comes on.

Switching Off sequence: Pressure below set point – diff
One compressor loader 2 goes off. Compressor loader 1 goes off.
Next compressor loader 2 goes off. Compressor loader 1 goes off.
One compressor body goes off. Next compressor goes off.

This configuration switches off all loaders before switching off a compressor
Thus leaving both compressors running unloaded before switching one completely off.

NOTE: If using an Inverter with loaders
The Inverter and its loader/s will always be the last to go off.

Equal Run Times

With parameters (P-27) Set to 1 (On) the controller will bring on the compressors in a way that the running times are as near equal as possible.

If the pressure is above set point the next compressor that comes on will be the compressor that has been running for the least amount of time.

If the pressure is below set point the next compressor to go off will be the one that has been running the longest.

This configuration will try to make each compressors run hours equal.

Inverter Bypass

Inverter Bypass Parameter (P-32) is used to set however many retries are required if the Inverter run signal is not returned in the allocated time after the inverter enable has been turned on.

(P-32) set for 1 to 5 is the number of times enable comes on including initial inverter enable turned on.
0 = Feature disabled.
1 = Inverter enable will come on once with no retries
2 = Initial turn on and 1 retry
3 = Initial turn on and 2 retries
4 = Initial turn on and 3 retries
5 = Initial turn on and 4 retries

Firstly assign the desired inverter run input using the Status Fault inputs. This input can be set as either normally closed (INV N/C) or normally open (INV N/O). When the inverter enable relay is called for by the control strategy then the inverter run signal has to be returned to the appropriate input within 2 seconds.

If the run signal is received then the control strategy will continue as normally and the variable output will begin to ramp up.

If the signal is not returned within the allotted time then the following will occur.

(P-32) set for 1 the inverter enable will stay off and bypass relay will come on.

(P-32) set for 2 to 5 the inverter enable relay will be turned off for a further 15 seconds.

This process will occur a further 1 to 4 retries depending on (P-32) if the inverter run signal is not received in any test instance. After the retries the inverter will be taken out of the control logic, until the fault is cleared using the reset process, and the pack will operate as a standard digital pack without the use of the inverter output. At this point the Bypass relay will become like another staged relay and will cycle on and off when called for.

An "INV Bypass" alarm will be generated.

Note if the inverter run signal is not returned within the allotted time in the first instance but is successful in the second, third or fourth attempt (Depending on (P-32) then any future inverter run tests must still complete all tests.

To reset the Inverter Bypass after maintenance, and return the inverter back into the control strategy, the proof status input should be activated momentarily. If a proof status input is not set up then resetting the controller will have the same effect.

The status inputs should be mapped to the relay used as the Inverter Enable relay for a given section i.e. if relay 1 is the first Inverter relay then status Input 1 would become the inverter run input for Section 1. If the second Inverter relay is 5 then status Input 5 would become the inverter run input for Section 2.

Relay Run Hours and Relay Starts

The total run hours and the total number of starts for each relay can be viewed via a Laptop/PC (See Stats) or from the Data Manager front end outputs. This feature informs the user of the total number of hours a given relay has been on. Therefore if a compressor is assigned to a relay the total run hours for the compressor can be viewed. It also gives the total number of starts for a given relay. Therefore gives the total number of starts for that compressor.

To reset the run hours and relay starts connect to the controller using pc/Lap Top. Log in and select "Stats" and "Set Parameters" Change the value from "Reset 1" to "Reset 2" or if value is at "Reset 2" change it to "Reset 1" It makes no difference which value is shown, just the operation of changing it from one to the other will reset the run hours and relay starts.

Likewise this can be done from the front end by selecting "Set Parameters" and carrying out the same operation

This applies to all relays including the Alarm relay.

Operation (Fuzzy)

Once the controller has been set-up and configured, normal operation will resume. If the appropriate Type has been selected the controller will operate using a "fuzzy logic" based control algorithm. The controller will determine the stages to bring on and off using the fuzzy logic rules and adhering to the starts/hr criteria. The response time for devices switching on and off can be varied by adjusting the response on and response off parameters (1 is the slowest response, 60 is the quickest). The fuzzy logic will attempt to optimise the compressor starts and keep them at a minimum. Before a compressor or fan is switched on, Relay 1 will energise and the variable output will ramp to 100%, when it reaches this point, the fixed device (compressor, loader or fan); will switch on and the variable output will begin its cycle again starting from 0%. When demand is satisfied, and all compressor relays are off, the variable output ramps down 0%, if demand is still satisfied, the enable relay de-energises.

Operation (Staged)

Staged operation requires the output relays to be "mapped" to a particular stage. Each stage (there are 16 stages) has to have at least 1 relay assigned for the controller to operate correctly. More than one relay can be assigned to stages in a given section and the same relay can be used in multiple stages. Note a relay cannot be assigned in both Section 1 and Section 2 or 3. As the pressure rises above the target setpoint, plus the target above value, the controller will enter Stage 1 after the stage on delay has expired. At this point any relay assigned in Stage 1 will come on and the stage on delay timer will be reset. If the pressure remains above the setpoint, plus the target above value, and the stage on delay has expired for a second time the controller will enter stage 2. At this point any relay assigned in Stage 2 will come on. Note if a relay has been assigned in Stage 1 but not used in Stage 2 then it will go off at this point. The reverse occurs when the pressure falls below the setpoint plus the target below value. The controller will step down the stages using the stage off delay (P-42) until all stages are off.

When using a variable output as the pressure rises above target setpoint, plus target above, the variable speed output will ramp up from 0% to 100% without following the stage on delay. If the pressure stays above the target setpoint and the variable output is at 100% and the stage on delay has timed out then the controller will enter Stage 1. At this point the variable output will reset to 0% and start ramping up again towards 100%. If the pressure stays above the target setpoint and the variable output is at 100% and the stage on delay has timed out then the controller will enter Stage 2. As the pressure drops below the setpoint, minus the target below, the variable output will ramp from 100% down to 0%, once the stage off delay expires the controller will stage down. Note if the variable output reaches 100% and the stage on delay has not expired the output will remain at 100% until the stage on delay has expired.

For example if set to Pack and pack has 4 Compressors the following could be set: -

Sect1 Stg1 : Rly 1 =On, **Sect1 Stg2** : Rly 1 and Rly 2 = On, **Sect1 Stg 3 :** Rly 1 ,Rly 2 and Rly 3 = On. **Sect1 Stg 4 :** Rly 1, Rly 2, Rly 3 and Rly 4 = On. This would stage relay 1 through to four on after the appropriate stage delay if the pressure is above the target setpoint and differentials.

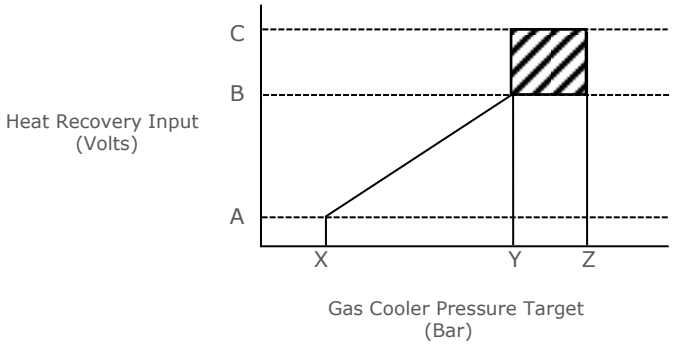
There is a High pressure limit, over which the night set-back feature will be turned off. As the pressure reduces under this limit the night set-back feature is switched on again.

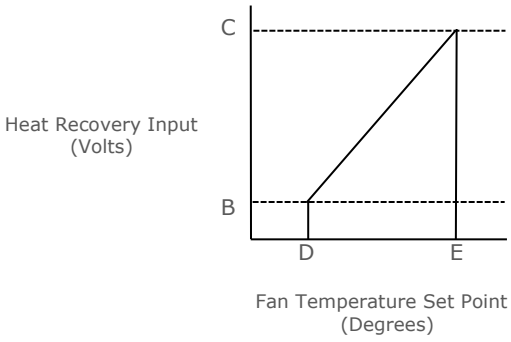
Heat Recovery

Heat recovery (P600) can be set to Off, Mode 1, Mode 2 or Mode 3

Mode 1

In mode 1, a variable 0-10v input signal is used to determine the change in gas cooler setpoint and fan temperature setpoint and switches heat recovery and bypass relays accordingly.





Where:
A = P601 (Heat Recovery Start)
B = P602 (Heat Recovery End)
C = P608 (Heat Recovery Bypass)

X = P603 (Heat Recovery Ref at Start)
Y = P604 (Heat Recovery Ref at End)
Z = P605 (Heat Recovery above End)

B = P602 (Heat Recovery End)
C = P608 (Heat Recovery Bypass)

D = P606 (Heat Recovery Ref at End)
E = P607 (Heat Recovery Ref at Bypass)

If the voltage on (Heat Recovery Sensor) rises above P601 setting then the Gas Cooler Target will go to P603 setting or calculated (Gas Cooler SP) whichever is highest
As the voltage on the input rises between P601 setting and P602 setting the Gas Cooler Target will rise linearly to P604 setting or calculated (Gas Cooler SP) whichever is highest
When the voltage on the input is between P602 and P608 the Gas Cooler Target will go to P605 setting or calculated (Gas Cooler SP) whichever is highest, at the same time the Fan Temperature Set Point will rise between P606 setting and P607 setting in place of the calculated Fan Temperature Set Point,
Once the Heat Recovery Input reaches the P608 Heat Recovery at Bypass setting and is still rising, Bypass comes on and bypasses cooler

Mode 2

In mode 2, a status input signal is used to enable heat recovery, gas cooler setpoint is changed and an analogue 3 way heat recovery valve output (voltage, milliamps or stepper) is varied in relation to the heat recovery temperature probe measured against the Heat Recovery Bypass setpoint.
When heat recovery is enabled (status input Hrec N/O or N/C), heat recovery valve will be switched on (relay) and Gas cooler target will be set to Hrec Gas Ref at End (P604, default 80 bar)
If Bypass Temp is less than Hrec Bypass Ref Value (P609), 3 way valve will start opening.
If Bypass Temp is greater than Hrec Bypass Ref Value (P609) 3 way valve will start closing.
If Gas Cooler Pressure is greater than Gas Bypass HP setting for longer than Gas Alm Dly:
1. Heat Recovery Valve will stay ON
2. Gas cooler target will return to Normal
3. Heat Reclaim 3 way Valve will close to 0%.
4. Gas Bypass HP Alarm Generated.

If Gas Cooler Pressure drops below Gas cooler target, Heat Recovery will resume.

Mode 3

In mode 3, a status input signal is used to enable heat recovery, gas cooler setpoint is changed and the heat recovery bypass valve relay is cycled on and off in relation to the heat recovery temperature probe measured against the Heat Recovery Bypass setpoint.
When heat recovery is enabled (status input Hrec N/O or N/C), heat recovery valve will be switched on and Gas cooler target will be set to Hrec Gas Ref at End (P604, default 80 bar)
If Bypass Temp is less than Hrec Bypass Ref Value (P609), valve will switch on.
If Bypass Temp is greater than Hrec Bypass Ref Value (P609) plus diff value (P610), valve will switch off

If Gas Cooler Pressure is greater than Gas Bypass HP setting for longer than Gas Alm Dly:
1. Heat Recovery Valve will stay ON
2. Gas cooler target will return to Normal
3. Heat recovery bypass valve will be switched ON
4. Gas Bypass HP Alarm Generated.

If Gas Cooler Pressure drops below Gas cooler target, Heat Recovery will resume.

HT/LT Interlock

The LT Pack cannot run unless there is an HT Compressor running or HT Variable Speed Drive enabled and at some percentage open.

Therefore if the last HT compressor goes off due to HT pressure being maintained, then any LT compressors running at that time will go off with the last HT compressor or when the HT Variable speed drive goes to 0%

HT Pack Fail

If the HT Pack Transducer fails. Both HT and LT compressors will go off. The Gas Cooler State will go to "Pack Fault" and everything will shut down.

Expansion Board off line

A relay can be selected to act as watchdog for expansion boards going off line.

If an expansion board goes off line the outputs on the expansion board will remain in whatever state they are in when board stops communicating. A relay can be used to act as a switch to switch power off if required so the outputs will go to a known state.

The relay will be energised during normal running and will de-energise when expansion board is off line.

Note: There is a fixed 1 minute delay before the Off Line Alarm occurs.

Superheat

Parameter P400 enables superheat and allocates outputs for superheat low and superheat high monitoring

The Superheat is calculated from the Evaporator Temperature (Calculated from the HT Suction Pressure) and the Suction Line Probe Temperature.

If the Superheat falls below Superheat Low Target Parameter (P401) then the Superheat Low Relay will come on.

When the Superheat rises above the Superheat Low Target (P401) by the diff parameter (P401) the Superheat Low Relay goes off.

If the Superheat rises above Superheat High Target Parameter (P411) then the Superheat High Relay will come on.

When the Superheat falls below the Superheat High Target (P411) by the diff parameter (P412) the Superheat Low Relay goes off.

If either of the HT Suction Pressure Transducer or the Suction Temperature Probe fails, any of the superheat high or low relays that are on will go off and a superheat fault alarm will be generated.

Oil Faults

When an Oil Fault Input comes on the Oil state will go to a "Pre-Delay" State and wait for period of time in parameter (P40).

Then the corresponding Oil Fault Relay will pulse on and off or the length of time in parameters (P42 and P43) The Oil State will show Pulse On and Pulse Off

This will be repeated for the number of pulses set in parameter (P41)

Then the Oil State will go to an "Oil Lock-Out" state for the time in parameter Oil Retry (P45) and the corresponding compressor will be turned off for this period.

The Oil State will then go to the "Pre-Delay" state again the above will be repeated for the number of times in parameter Oil Lock Out (P44)

After the above sequence if the fault has not cleared the corresponding compressor will be taken out of commission and an Oil Fault alarm will be generated. The Oil State for that input will show Lock Out

Note: The oil reset input needs to be activated (momentarily) to re-instate the compressor once the fault has been rectified.

If at any time during the above sequence the Oil Fault Input goes off the sequence will stop and the Oil State will return to Off

Gas Cooler states with pressure rising and falling

Gas Cooler Pressure

High	HP Shutdown	:	Gas cooler Pressure above Max Gas Pressure (P-20) plus Gas Alarm Offset (P-82)
	Supercritical	:	Gas Cooler Pressure above Maximum Gas Pressure (P-20) but less than offset (P-82)
	Transcritical	:	Gas Cooler Temperature above 31.1 Degrees (offset may be applied (P-53))
	Subcritical	:	Gas Cooler Pressure Normal (Between min and max gas setpoints (P22& P23))
	Triple	:	Gas Cooler Pressure below Minimum Gas Pressure (P21)
Low	LP Shutdown	:	Gas Cooler Pressure below 10 Bar (Fixed setting)

Shutdown (HP)

As the Gas Cooler Pressure rises above Max Gas Pressure (P-20) plus the Gas Alarm Offset (P-82) for a period longer than the Gas Shut Delay (P-81) The Control State will go to "Shutdown"
HT and LT Packs will go off immediately and Pack Control States will go to "Cooler Flt"
Gas Cooler Output Valve will close.
Gas Cooler Fans will go Off.
Transcritical Relay will be Off
A "Gas Cooler HP Shutdown" Alarm will be generated.

Supercritical

As the Gas Cooler Pressure rises above Max Gas Press (P-20) but stays below the Max Gas Press plus the Gas Alarm Offset (P-82)
The Control State will go to "Supercritical"
HT and LT Packs will operate as normal.
Gas Cooler output will be Open.
Gas Cooler Fan will be On.
Transcritical Relay will be On
A "Gas Cooler HP Open" alarm will be generated.
Receiver Output and Aux Comp operate as normal

Transcritical

If the Gas Cooler Temperature goes above 31.1 Degrees C (offset may be applied (P-53))
The Transcritical Relay will come on.
The Gas Cooler Control State will go to "Transcritical"
HT and LT Packs and Gas Cooler Fans operate as normal
Gas Cooler output will be Open.
Gas Cooler Fan will be On.
Receiver Output and Aux Comp operate as normal

Subcritical

As the Gas Cooler pressure (Which gives the Gas cooler Calculated Temperature) is between the parameter Min Gas Press setting P21 and 73 Bar.
The Transcritical Relay will be Off.
The control state will be "Subcritical"
HT and LT Packs and Gas Cooler Fans operate as normal Packs, with compressors going on and off with suction pressures and Gas Cooler Fan going On and Off with Gas Cooler pressure going above and below Gas Fan Target (P101 Fixed) or (Calculated from Gas Cooler Temp. Floating). Gas Cooler Output Valve goes on and off as Gas Cooler pressure rises above Gas Cooler SP
Receiver Output and Aux Comp operate as normal

Triple

As the Gas Cooler Pressure falls below "Min Gas Press" setting (P21) for Gas Alarm Delay (P80)
HT and LT Packs will operate as normal.
The Gas Cooler Fan will be Off
The Transcritical relay will be Off
A "Gas Cooler LP Open" alarm will be generated.
Note : The Gas Cooler Output will Open.
Receiver Output and Aux Comp operate as normal

Shutdown (LP)

As the Gas Cooler Pressure falls below the "Gas Alarm Offset" setting P82 below "Min Gas Press" setting P21 for Gas Shut Delay P81. The Control State will go to "Shutdown"
HT and LT Packs will go off immediately and Pack Control States will go to "Cooler Flt"
The Gas Cooler Fan will be Off
Gas Cooler will close.
A "Gas Cooler LP Shutdown" Alarm will be generated.
Receiver Output and Aux Comp go off
Note : The Transcritical relay will come On

Pack Fault

If the HT Pack Transducer fails the following occurs:

All compressors will go off
All Gas Cooler Outputs that are on will go off and any that are off will stay off

Gas Cooler Valve

The Gas Cooler Valve is used to feed liquid into the Liquid Receiver. The temperature of the gas cooler output is used to determine whether the system is in subcritical or transcritical state.

Gas Cooler Pressure Setpoint

The Gas Cooler Temperature is measured in the Gas Cooler Return Line and added to the Sub Cooling value (Default 3 ^{O}C) and then converted to a pressure. During subcritical operation this value is used as the Gas Cooler setpoint, if the Gas Cooler Pressure rises above this setpoint the Gas Cooler Valve will open.

During transcritical operation, the Gas Cooler set point is calculated as a linear function of the Gas Cooler Outlet temperature.

If Parameter P-51 is set to "Auto", then a pre-defined fuction is used.
If Parameter P-51 is set to "Man", then Parameters P-52 and P-53 are used to generate the linear function,

(Set Point = Gas Gradient x Gas Temp + Gas Offset).
If P-100 (Gas Fan Control Type) is set to Ambient / Pressure then the Ambient temperature probe is used instead of the Gas Cooler Return Line probe.

Gas Cooler Calculated Temperature

The Gas Cooler Pressure is measured in the Gas Cooler Line and converted to a temperature.

Extra Refrigeration Capacity

This function provides the ability increase the system's refrigeration capacity by increasing the pressure in the gas cooler
The function is activated by setting one of the status input parameters (P520-P535) to Extra Capacity N/O or Extra Capacity N/C.
When that input is activated, the Gas Cooler Pressure Setpoint is increased by the amount set in parameter (P24)
See : Gas Cooler Pressure Setpoint

Cooler Interlock

With Cooler Interlock (P540) set to on, if all compressors go off then the gas cooler output valve goes off with the last compressor.

Receiver/Separator Bypass Valve

Receiver/Separator Bypass Valve can be either a Stepper Valve or a Variable Speed Drive

As the Receiver Pressure rises above the "Receiver Target" setting (P201) the "Receiver Bypass Valve" will open.

Receiver Interlock

With "Receiver Interlock" (P207) set to on

To prevent the Receiver Pressure from getting too low, a minimum value is set "Min Gas Pressure" (P21)

If Receiver Pressure drops below this set point, after the alarm delay period (P220), the Gas Cooler Output Valve will open to "Min Gas Inverter" value (P40)

To prevent the Receiver Pressure from getting too high a maximum value is set "Max Gas Pressure" (P20)

If Receiver Pressure rises above this set point, after the alarm delay period (P220), the Gas Cooler Output Valve will close to "Max Gas Inverter" value (P41)

With "Receiver Interlock" (P207) set to GC, operation is the same as above but the gas cooler valve is set to min. And max. Settings immediately without using the alarm delay.

Gas Fan Control

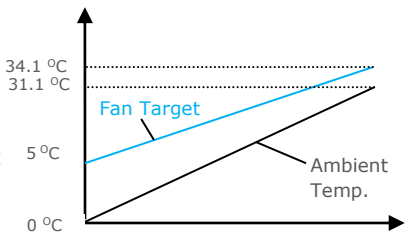
Fixed

If P100 is set for Fixed (0), the Gas Fans will come on when the Gas Cooler temperature probe rises above the temperature target derived from P101 and go off when the Gas Cooler temperature falls below the target (Using fuzzy logic and response on and off speed using parameters P104 & P105)

Note : Parameters P102 & P103 (Gas Fan Offsets) have no effect when Fixed is selected

Ambient

If P100 is set for Ambient (1) or Ambient / Pressure (2), the Target for the Gas Fan SP is calculated using the Ambient Probe plus any offsets set in parameters P102 & P103 (Zero offset and Critical offset).
In the example on the right, Tz is set to 5 ^{O}C and Tc is set to 3 ^{O}C, when the ambient temperature is 0 ^{O}C the fan target is 5^{O}C (diff = 5), when the ambient reaches 31.1 ^{O}C thefan target is 34.1 ^{O}C (diff = 3). The fan target varies on a linear scale between these two points.



Fixed Pressure

If P-100 is set for Fixed Pressure then the Target for the Gas Fan setpoint is calculated from the Gas Fan Setpoint (P-101) in ^{O}C converted to pressure.

Note If the control state goes to Transcritical the Gas Cooler Fans will run

Auxiliary Compressor

The Auxiliary Compressor is used to try to reduce the pressure in the Liquid Receiver before it reaches a point where it will open the Receiver Bypass Valve

As the receiver pressure rises above "Aux Comp Target" (P300) The Auxiliary Compressor Inverter Enable Relay will come on and the Aux Compressor Variable Output will ramp up

The auxiliary Compressor does this by removing any vapour in the top of the Receiver and discharging it into the HT Discharge line.

Liquid Injection

With the parameter "Do SH" (P400) set to "On", the superheat value is calculated as suction temperature measured from the temperature probe minus suction temperature calculated from the suction pressure (Using a CO2 pressure to temperature conversion table).

If the superheat value is greater than SH Lo Trgt (P401) + SH Lo Diff (P402) then the superheat low output is off.

If the superheat value falls below the SH Lo Trgt (P401) then the superheat low output is on and a superheat low alarm is generated.

If the superheat value is below SH Hi Trgt (P411) – SH Hi Diff (P412) then the superheat high output is off.

If the superheat value is greater than SH Hi Trgt (P411) then the superheat high output is on and a superheat high alarm is generated.

If the superheat value cannot be calculated (due to a probe failure for example) then a superheat fault alarm is generated.

Superheat alarms are subject to the superheat alarm delay period (P420)

With the parameter Do Liq Inj (P350) set to on, if the superheat high output is on and the liquid temperature probe is greater than the Liq Inj SP (P351) then the liquid Injection relay switches on.

If the liquid temperature is below Liq Inj SP (P351) – Liq Inj Diff (P351) or the superheat high output switches off then the liquid Injection relay switches off.

If the liquid temperature probe fails then a liquid Injection fault alarm will be generated.

If the liquid temperature rises above the Liq Inj OT setting (P353) then a liquid injection over temperature alarm will be generated.

Viewing Inputs and Outputs via the pressure display (PR0620)

Apart from setting up the controller, you can also view the status of the inputs and outputs.

1. From the function menu, select "IO", press enter
2. You can now scroll through the IO tables as set out below. The tables you view will depend on the controller type configuration.

Input/Output table d01 (Applies ds01 & ds02 Pack Sections)

Parameter numbers are the same for both sections

Number	IO	Range	Units
I-01	Suction Pressure	-3.4 to 180	Bar
I-02	Discharge Pressure	-3.4 to 180	Bar
I-03	Pressure Input 3	-3.4 to 180	Bar
I-10	Suction Temperature	-60 to +256	^{O}C
I-11	Discharge Temperature	-60 to +256	^{O}C
I-12 ↓ I-17	Probe Input 3 ↓ Probe Input 8	-60 to +256	^{O}C
I-30 ↓ I-45	Status Input 1 ↓ Status Input 16	0 = OK 1 = Alarm 2 = Unused	---
I-50	Run	0 = Off, 1 = On 2 = Unused	---
I-51	Proof Reset	0 = Off, 1 = On	---
I-22	Heat	-0 = Off, 1 = On 2 = Unused	---
O-01 ↓ O-24	Relay 1 ↓ Relay 24	0 = Off, 1 = On	---
O-30	Variable Output	0 – 100	%
O-41	Optimisation Level	-3.4 to 180	Bar
O-70	Bypass	0 = Off, 1 = On	---
O-80	Gas Dump	0 = Off, 1 = On	---
S-01 ↓ S-03	Control States	0 = Off 1 = Stabilise 2 = Initial 3 = Cooler Fault 4 = Normal 5 = High Pressure 6 = Low Pressure 7 = Low Shut-down 8 = Transducer Fail 9 = Standby 10 = Trip 11 = Stop 12 = Transducer Fail	

Input/Output table d-02 CO2 Section

Number	IO	Range	Units
I-01	Cooler Pressure	-3.4 to 180	Bar
I-02	Receiver Pressure	-3.4 to 180	Bar
I-10	Cooler Temperature	-60 to +256	°C
I-11	Cooler Ambient Temperature	-60 to +256	°C
I-12	Cooler Air On Temperature	-60 to +256	°C
I-13	Cooler Air Off Temperature	-60 to +256	°C
I-14	Liquid Injection Temperature	-60 to +256	°C
I-15	Heat Recovery Temperature	-60 to +256	°C
I-16	Probe Input 7	-60 to +256	°C
I-17	Probe Input 8	-60 to +256	°C
I-30	Liquid Level Input	0 -100	%
I-60 ↓ I-75	Status Input 1 ↓ Status Input 16	0 = OK 1 = Alarm 2 = Unused	---
I-90	Heat Recovery Sensor	0 – 10	V
O-01	Gas Cooler Setpoint	-3.4 to 180	Bar
O-05	Gas Cooler Calculated Temperature	-60 to +256	°C
O-20	Cooler Inverter	0 = Off, 1 = On	---
O-21	Cooler Output	0 -100	%
O-22	Capacity Input	0 = Off, 1 = On, 2 = Unused	---
O-40	Fan Setpoint	-60 to +256	°C
O-60	Fan Inverter	0 = Off, 1 = On	---
O-61	Fan Inverter Output	0 -100	%
O-70	Fan Night Setback	0 = Off, 1 = On	---
O-71	Fan Day Setback	0 = Off, 1 = On	---
O-90	Receiver Inverter	0 = Off, 1 = On	---
O-91	Receiver Output	0 -100	%
O-110	Auxiliary Compressor Inverter	0 = Off, 1 = On	---
O-111	Auxiliary Compressor Output	0 -100	%
O-120	Transcritical Relay	0 = Off, 1 = On	---
O-121	Liquid Injection	0 = Off, 1 = On	---
O-122	Superheat	-60 to +256	°C
O-123	Superheat Low	0 = Off, 1 = On	---
O-124	Superheat High	0 = Off, 1 = On	---
O-130	Heat Recovery Valve	0 = Off, 1 = On	---
O-131	Heat Recovery Bypass	0 = Off, 1 = On	---
O-140	Stepper 1	0 -100	%
O-141	Stepper 2	0 -100	%
O-142	Stepper 3	0 -100	%
O-150	Offline Relay	0 = Off, 1 = On	---
O-151	Run Relay	0 = Off, 1 = On	---
O-152	Alarm Relay	0 = Off, 1 = On	---

Override

Pressing the "override" button during normal operation displays the variable output value. Repeated presses will scroll through section 1 then section 2 and section 3 variable output values

The override function also allows the user to switch output stages on or off. Press the override and enter button together for 69pprox. 3 seconds until "t-01" is displayed. ("t-01" = main board) ("t-02" = ext board 1) ("t-03" = ext board 2) to ("t-11" = ext board 10)

Press enter to go to "Main Board" "t-01" overrides

"r-01" will be displayed Use the "up" or "down" button to display the relays (r-01 to r-12), analogue outputs (A-01 to A-08) and stepper outputs (S-01 to S-06)

For (r-01 to r-12) Press "Enter" and select "1" to turn the relay on and "0" to turn the relay off.

For A-01 to A-08 and S-01 to S-06 Press "Enter" and use up and down buttons to select the desired output for A-01 to A-08 or S-01 to S-06, Press the "Enter" button when the desired output percentage is reached. Each output can be set between 0% to 100%

Note: A-01 to A-08 must be set for variable outputs and S-01 to S-06 set up as stepper outputs.

Override will last for 30 seconds then the output will return to normal operation.

Info Button

Pressing the "info" button during normal operation displays the number of current alarms. Repeated presses will scroll through section 1 then section 2 and section 3 number of current alarms

Standby Mode

Once in standby all configured stages are turned off and a standby alarm is generated for the given section. There is a settable delay before a section enters standby. Once this delay expires the controller enters standby and a standby alarm is also generated for the relevant section.

Section 1 & 2 can be placed into standby independently using two separate status inputs both sections can be placed into standby at the same time from a single status input by mapping the same status input to each section.

Display Messages

The following messages can appear on the display during normal operation.

Display	System status
HP	High Pressure alarm (Pack or Condenser)
LP	Low Pressure alarm (Pack or Condenser)
Sd	Low Pressure Shut-down (Pack or Condenser)
Lh 1 to Lh 3	Liquid Level High Level alarm
LL 1 to LL 3	Liquid Level Low Alarm
LF 1 to LF 3	Liquid Level Fault
Inv 1 to Inv 3	Inverter Fault
trAn Ft	Pressure Transducer Fault
St 1 to St 16	Stage 1 to 16 Fault (Comp or Cond)
gn 1 to gn 16	General Fault
Stby	Controller in Standby
triP	Discharge Pressure Trip / Stop
br 1 to br 10	Board Offline Alarm
rCL1 to rCL3	Relay Mapping Clash
gSFt PgAS	Gas Sensor Fault
gPFt tgAS	Gas Probe Fault
gOt	Gas Cooler OT
gHPS	Gas Cooler HP Shutdown
gLPS	Gas Cooler Low Pressure Shutdown
AbFt tAbE	Ambient Probe Fault
rSFt PrEC	Receiver Sensor Fault
rcHP	Receiver High Pressure
rcLP	Receiver Low Pressure
rLOL	Receiver Low Level
rHIL	Receiver High Level
LLFt	Liquid Level Fault
LLHi	Liquid Level High
LLLo	Liquid Level Low
ShFt	Superheat Fault
ShOt	Superheat High
ShUt	Superheat Low
LiFt	Liquid Injection Fault
LiOt	Liquid Injection OT
HrFt	Heat Reclaim Sensor Fault
SCPU	Stepper CPU Fault
Oil1 to Oil9	Oil Fault
OilO	Oil Low Level
Oili	Oil High Level
	Gas Bypass HP

Network Alarms

The table below shows the text and associated type number that is sent to the system "front end". The type number is normally used to provide different alarm actions.

Alarm text	Type #
High Pressure Alarms	8
Low Pressure Alarms	9
Low Pressure Shutdown	10
Transducer Faults	6
Discharge Trip	8
General Faults	20
Compressor faults	3
Inverter Fault	3
Discharge Pressure Fault	6
Discharge Temperature Fault	6
Configuration Error	20
Controller in standby	20
Gas Probe Fault	6
Gas Sensor Fault	6
Gas Cooler HP Shut Down	8
Gas Cooler LP Shut Down	9
Gas Cooler HP Open	8
Gas Cooler LP Open	9
Gas Cooler OT	4
Receiver Sensor Fault	6
Receiver High Pressure	8
Receiver Low Pressure	9
Receiver Low Level	13
Receiver High Level	13
Liquid Level Fault	6
Liquid Level High	4
Liquid Level Low	5
Liquid Injection Probe	6
Liquid Injection OT	4
Ambient Probe Fault	6
Superheat Fault	2
Discharge Sensor Fault	6
Discharge High Pressure	8
Superheat Low	8
Superheat High	9
Heat Reclaim Sensor	6
Oil Fault	18
Oil Low Level	6
Oil High Level	6
Board Offline	7
Relay Mapping Clash	7

Specification

Power requirements (for each Main Controller or expansion module):

Supply Voltage Range:	24 Vac ±10% or 24 Vdc ±10%
Supply Frequency:	50 – 60 Hz ±10%
Maximum supply current:	<1 Amp
Typical supply current:	0.3 Amp
Class 2 Insulation:	**No** protective Earth is required. A functional earth can be connected if the equipment is located in an electrically noisy environment.

Note : The use of centre tapped to earth transformers is not allowed.
This is to prevent damage to the transformer and/or controller.

The host equipment must provide adequate protection against contact to hazardous live parts.

RDM advise the use of a suitable external over-current protection device on the Mercury Plant Controller.

Warranty may be invalidated due to excess current being unlimited if there are no fuses/circuit breakers installed

General

Operating temperature range:	$+5^0$C to $+50^0$C
Operating Humidity:	80% maximum
Storage temperature range:	-20^0C to $+65^0$C
Environmental:	Indoor use at altitudes up to 2000m, Pollution Degree 1, Installation Category II. Voltage fluctuations not to exceed ±10% of nominal voltage
Dimensions:	Intuitive Plant Controller 280mm (L) x 122mm (W) x 67mm (H)
Weight:	Intuitive Plant Controller 750 Grams
Safety:	EN61010
EMC:	EN61326; 1997 +Amdt. A1; 1998
Ventilation:	There is no requirement for forced cooling ventilation

Inputs

Probe Input type	See Set/change Units for probe types
Status Input type	The preferred option is a 0 volt return through a volt free relay or 24 Vac referenced to the supply voltage. If a 24Vac signal is being sourced from the Plant controller power supply then **do not** ground the Status Input common rail, this is grounded internally.
Comms:	Ethernet / Bacnet
4-20mA	4-20mA current loop, use the 12 Vdc output to feed the device.
Analogue Outputs	0-10 Volts DC or 4-20mA. (Selected in properties box of the output block) **Note 1**: The 4-20mA output will not operate correctly if the target device input impedance is >75Ω **Note 2**: The 0-10V output will not operate correctly if the target device input impedance is < 10KΩ A 50mA fuse is recommended for this output. **Note 3**: On the intuitive variant, when using the universal 0-10V output to drive an inductive load such as a relay coil, a back e.m.f. protection diode must be fitted. The cathode should connect to the output terminal and the Anode to GND/Return terminal. The maximum load current that can be supplied from these outputs is 38mA. The mercury plant cannot be used to drive a relay coil.

Stepper Outputs

Bipolar Stepper Motor, 12-24vdc chopper drive, 8W Maximum

Relay Ratings, Intuitive Plant Controller

Mechanical Relay
10A/250 Vac/AC1 (Resistive load)
10A/30 Vdc (Resistive load)
5A/250 Vac cosφ=0.4

Solid State Relay (SSR)
1A/250 Vac (AC only, will not switch DC)

Fuse Ratings, Intuitive Plant Controller

Relay Fuses 10A Antisurge HRC, 32 x 6.3mm (1A if SSR is fitted)
Supply Fuse 2A Antisurge HRC, 32 x 6.3mm

Comms:	Ethernet
Interboard Comms	CANBUS

Software, Software drivers, software features and function licences.

RDM product Software Licences and drivers are non-transferable. They are purchased with hardware or separately and once added are for use on that hardware only. If hardware is returned and deemed out of warranty all software driver licences terminate with the hardware.

CANbus cable specification

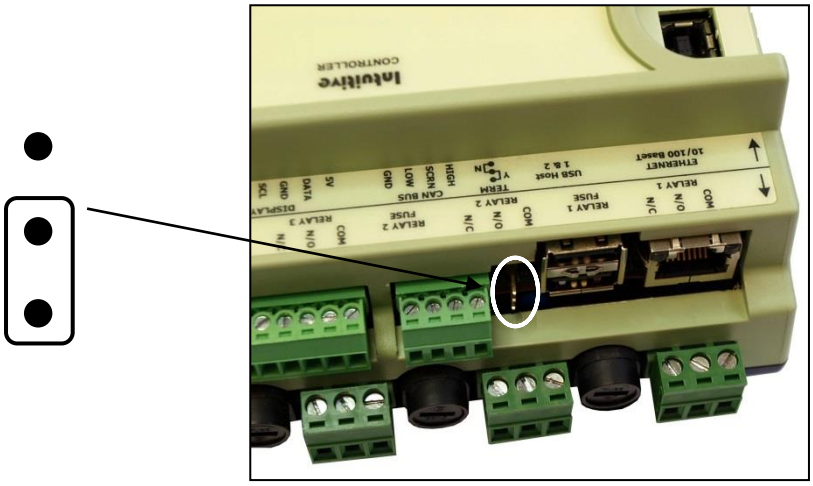
CANbus communication cable **must** be of a standard to meet ISO11898 or equivalent and the screen cable **must** be connected.

Note: end of line termination resistors must be fitted on the CANbus network, on the Intuitive controller and expansion boards this is done by a termination link. The network should be wired in a daisy chain configuration. Only one Intuitive controller should be connected to a single CANbus network. The maximum allowable network cable length is 500M in total from one end of the network to the other providing a CANbus network cable which meets ISO11898 or equivalent is used.

A maximum of 10 expansion boards can be connected to a single Intuitive or Plant controller. When connecting an expansion board to an Intuitive or Plant controller or another Expansion board the following should be observed.

Plant Controller/Expansion Board		**Expansion Board**
CAN High	Connects to	CAN High
Screen	Connects to	Screen
CAN Low	Connects to	CAN Low
Ground	Connects to	Ground

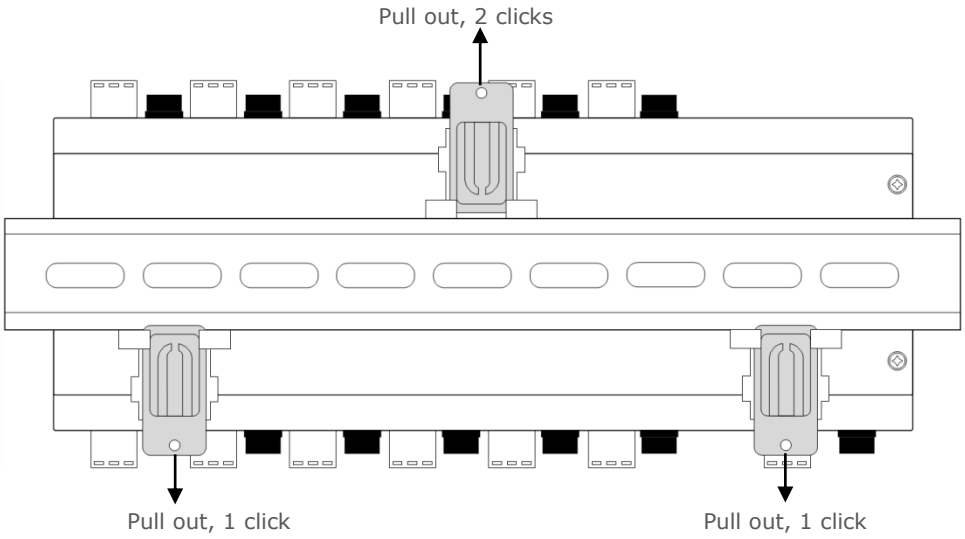
End of line termination resistor



The end of line termination resistor link should be fitted to the middle and bottom pins on the Main control board and on the last expansion board on the CANbus network. All other expansion boards should have the link removed or fitted to the middle and

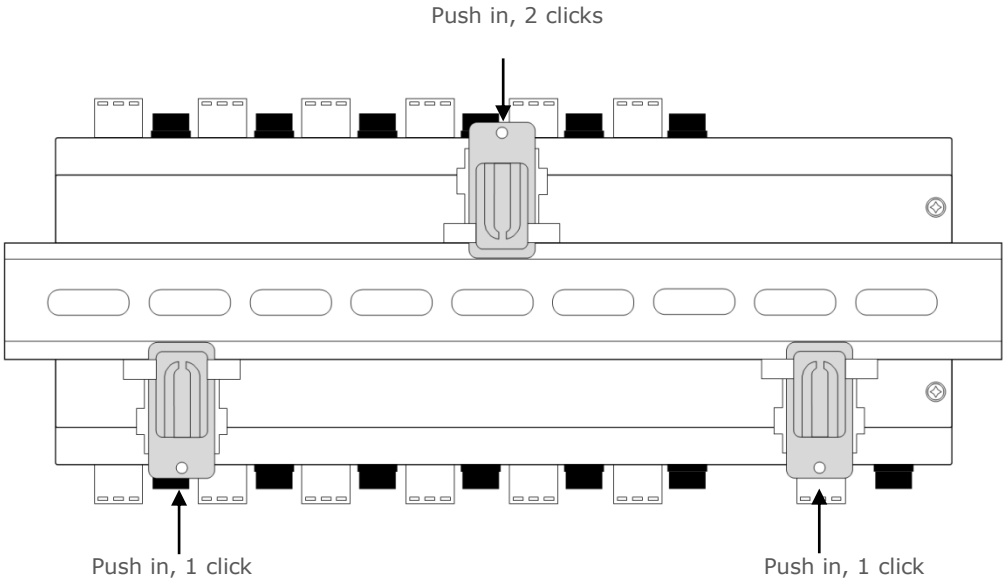
Installation:

Mounting on to a DIN rail, Intuitive Plant Controller



The Intuitive plant controller has three DIN rail mounting feet which can slide in and out to three different positions, sliding into each position is accompanied by a "click" which locks the foot into that position.

To install the controller onto a DIN mounting rail, from the fully pushed in position slide the top mounting foot out by 2 clicks so that the foot is clear of the DIN rail channel. Slide the bottom two feet out by one click so that they are protruding slightly into the DIN rail channel. The controller can now be inserted onto the DIN rail by inserting the bottom lip of the DIN rail behind the two bottom mounting feet



The controller can now be pushed flat onto the DIN rail and the top foot pushed in 2 clicks to hold the controller in place. Finally, push the bottom two feet in by one click to secure the controller.

The mounting feet also have M3 holes for direct mounting where DIN rail is not being used.

Clearances:

The controller requires 40mm clearance top and bottom to allow fuse access and removal and USB cable connection, otherwise 10mm is required, side clearance is 15mm. Clearance at the front and rear is dependent on the site wiring.
There is no requirement for forced cooling ventilation

Cleaning:

Do not wet the controller when cleaning. Clean the front by wiping with a slightly damped lint free cloth.

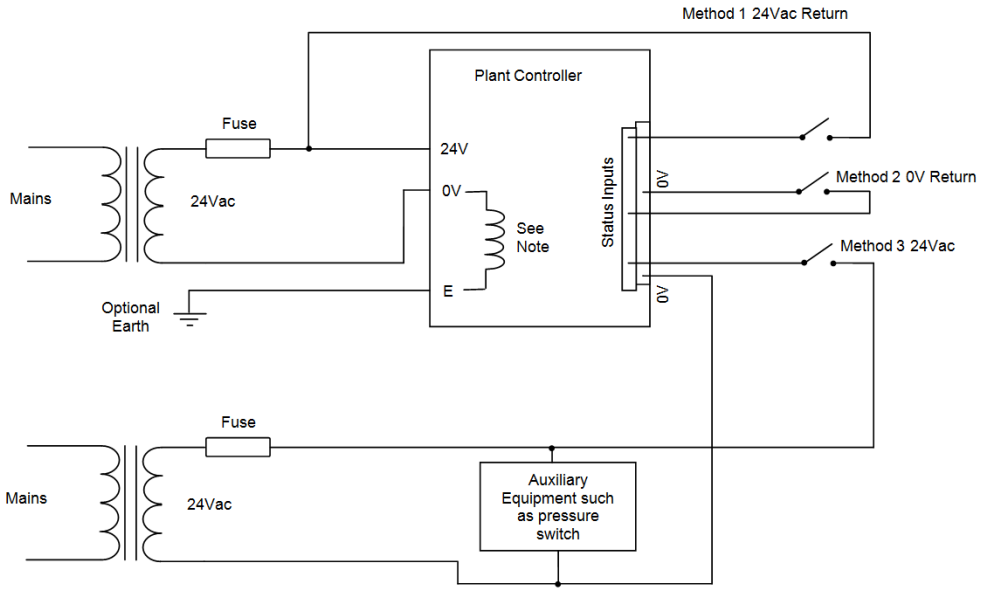
Please note: The specifications of the product detailed on this set up guide may change without notice. RDM Ltd shall not be liable for errors or for incidental or consequential damages, directly or indirectly, in connection with the furnishing, performance or misuse of this product or document.

Appendix 2 – Supply & Status Input Wiring

Appendix four applies to the current version of the Plant controller hardware.

- Method 1. Uses the 24Vac of the transformer supplying the input voltage; which is returned via a switch (or relay) to the status input signal line. No 0V is required at the status connector.
- Method 2. Uses a 0V return (from the status connector) to the status signal input.
- Method 3. Uses a 24Vac signal derived from another transformer (supplying an auxiliary piece of kit) to feed the status input signal line. Note the auxiliary transformer must be referenced to the Plant Controller supply transformer.

All transformers that have a connection to the Plant Controller must have their primaries connected to the same phase. Transformer should have fuse fitted in line with 24V input as per diagram.



The use of centre tapped to earth transformers is not allowed. This is to prevent damage to the transformer and/or controller

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Revision History

Revision	Date	Changes
2.0	22/05/2015	First Issue
2.0a	01/07/2015	Description of liquid line changed to gas cooler return line, receiver interlock GC setting added.
2.1	06/07/2015	Heat Recovery modes 1, 2 & 3 added.
2.1a	07/07/2015	Heat recovery description amended
2.2	18/08/2015	P-72 Max Gas Fan/Step Reset parameter added and Standby Relay Added
2.2a	22/09/2015	V1 and V2 stepper power connections reversed to match other products
2.2b	26/01/2016	Naming of Status/Digital Inputs standardised to Status Inputs.
2.4	10/03/2016	Uni IO defaulted to 0-10v, Oil section and number of expansions configurable in display, save screen config function added, manual override of stepper and uni IO added, fan reverse low level parameter added. Touchscreen Display visibility menu added.
2.5	16/05/2016	Operation of heat reclaim valve in mode 2 changed, valve now closes on HP alarm instead of opening.
2.6	19/05/2016	Improvement in item aliasing to make it more compatible with the Data Manager.
2.7	20/05/2016	Addition of Mini IO expansion hardware and associated settings.
2.8	11/07/2016	Bacnet Support Added
2.9	26/07/2016	Fixed 30 second startup delay added.
2.9a	12/08/2016	Description of gas cooler HP shutdown and supercritical states clarified on page 48
2.9b	08/09/2016	Fan target offsets Tz and Tc added
3.0	26/09/2016	P-72 Max Gas Step Reset changed to Max Fan/Step Reset. Description of P-50 Gas HP Reset changed, this delay also applies to LP shutdown.
3.1	05/10/2016	Note about pressure transducers amended on page 22.
3.1a	30/11/2016	Page 49, description of calculated gas cooler setpoint calculation updated and example of ambient fan setpoint graph updated.
3.1b	20/12/2016	Update to specification page
3.1c	06/02/2017	Parameter description amended.
3.1d	14/02/2017	Added ECA approval
3.2	10/02/2017	Gas Fan control options Ambient / Pressure and Pressure Fixed added to P-100. PR0652 stepper connections changed to match current hardware label.
3.3	10/03/2017	PR0652 Hardware now zeros gas valves when going in and coming out of standby.
3.3a	04/05/2017	Note added about Uni IO settings not being transferred between pre and post V3.0 firmware.
3.4	01/07/2017	View Config Info menu added
3.5	17/07/2017	New Cgi Interface, 1-2 and 1-6Vdc inputs added, TouchXL support.
3.6	14/11/2017	P-55 Gas SP weighting parameter added. Note added regarding using a digital scroll compressor when set to staged.
3.7	06/01/2018	Default valve specific stepper settings updated.
3.8	29/01/2018	Revision level brought in line with V2 hardware platform.

Group Offices

RDM Group Head Office

80 Johnstone Avenue
Hillington Industrial Estate
Glasgow
G52 4NZ
United Kingdom

+44 (0)141 810 2828
support@resourcedm.com

RDM Inc

100 North Sixth Street
Suite 630B
Minneapolis, MN
55403
United States

+1 612 354 3923
usasupport@resourcedm.com

RDM Asia

Sky Park at One City
Jalan USJ 25/1
47650 Subang Jaya
Selangor
Malaysia

+60 3 5022 3188
info@rdmasia.com.my

Visit www.resourcedm.com/support for more information on RDM solutions, additional product documentation and software downloads.

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