Rack Control

NOTE: throughout the text,
keys referred to are:
▲ increment value key
▼ decrement value key
■ cancel key
▶ select, accept key

1. INTRODUCTION

The Rack controlller is a complete compressor control. Racks of up to 8 compressors and condensers with up to 4 circuits and 12 fans can be controlled.

The controller incorperates sophisticated monitoring of Oil Pressure, HP, LP, Liquid Level, Compressor Temperature and has a limit start timer to protect the compressors.

Versatile control programming and temperature optimising ensure the compressors run efficiently and reliably.

All temperature and pressure readings are available on the display at the touch of a key and programming is in plain English.

2. INSTALLATION

The display-keyboard module is the same as the alarm, defrost, and temperature control etc. except for the software fitted, and is wired the same way. (Refer to Presscon Network - Wiring Specification & Startup for details).

Mounting is accomplished by removing the screws at the top and bottom of the box and removing the lid. The two hole through the circuit board and back of the box can be used to mount the assembly. Do not put excessive force on the circuit board. The 25mm hole can be used to pass wiring through the box.

3. OPERATION

Function	Keys
Cancel (any function)	■
Next Screen	▲ or ▼
Hold Screen	▶
Restart Rack	▶ (5 sec)

The information shown on the screen will vary depending on the way the control is set-up, typically the suction and head pressures and setpoints, number of compressors and fans running and status of any fault monitoring will be shown.

If applicable the following screens will appear in turn.

Presscon
Control No.   1

The description on the top line can be changed in programming. The bottom line shows the card address of this controller.

Net Status   : 2
Last Address : 21

This is a count of the number of communication retries by this controller since this display last appeared. The occassional failure and retry is to be expected but more than a few per minute may indicate a network problem. The count is cleared to zero after this display appears. The Last Address is the card address of the card which had the most recent communication failure.

S: 26 kPa : 75%
H: 1372 kPa : 50%

Suction and Head readings and the percentage of the total capacity of compressors and fans running.

Variable Speed
Compressor   20%

The percentage output of the analogue compressor control output.

** *   26 kPa
Compressors 3/4

3 of the 4 compressors are running (1st, 2nd and 4th) and suction reading is 26 kPa.

Suction   26 kPa
In 30 : Out 25

Cut In at 30 kPa and Cut Out at 25 kPa.

If **Suct Op** is displayed in place of Suction then optimising is active and the Cut In and Out shown are the current values as modified by optimising.

Control Normal

The state of the control input. Control is by switching resistances between a sensor card input set as a temperature input and the G terminal.

Resistance	Control
Open circuit	Normal
220 k	Optimise
100 k	Table 4
47 k	Table 3
22 k	Table 2
10 k	Table 1
6k8	Decrease
4k7	Maximum
2k7	Run Fans
1 k	Hold
0 R	Off

Normal is control by programmed settings. *Optimise* forces the settings to optimise regardless of temperatures. *Table* number forces the control to use the selected table. While this is on the tables will not rotate. *Maximum* forces the control to increase capacity with time delay. *Decrease* forces the control to decrease capacity with time delay. *Run Fans* causes the condensor fans to turn on with time delay. *Hold* forces the control to ignore readings and maintain the current outputs. *Off* causes all compressors and the analogue output to turn off without time delay.

Fault Latched
OVERLOAD

The fault input has tripped and latched the compressors off, and the programmed description of the fault (Overload in this case).

Level	high

Liquid level is 75 % and has exceeded the high alarm level.

Op: -18°C	-16.4 °C
-19.6°C	-22.9°C

Temperature optimising probe readings.

Comp 1 : 79.4°C
Comp 2 : FAULT

Compressor temperatures, Compressor 2 has tripped out on a temperature fault.

Oil 3 : Idle
Oil 4 : 294 kPa

Oil pressure relative to suction pressure. Compressor 3 is not running.

Press > To Reset
Compressor 2

Compressor 2 can be restarted by holding the ▶ key for 5 seconds.

Press > To Reset
Compressor Rack

The entire rack can be restarted by holding the ▶ key 5 seconds.

Head 1	1326 kPa
In 1430 : Out 1400	

Head circuit 1 reading and Cut In and Cut Out.

*****_
5 Fans Running

Status of the condenser fans showing which ones are running.

4. PROGRAMMING

The Rack control is programmed via its 4 keys and screen. The screen will describe the setting to be adjusted and the current value.

The programming method is the same as for other modules, except the menu items vary..

To begin programming, press and hold both the CANCEL(■) and NEXT(▶)

keys for around 10 seconds until the following is displayed;

PROGRAMMING

If an access number has been set it must first be entered;

PROGRAMMING : 10
ACCESS NUMBER

SYSTEM OPTIONS
- - - - - - - - - - - - -

COMPRESSORS
- - - - - - - - - - - - -

CONDENSERS
- - - - - - - - - - - - -

COMP. SAFETY
- - - - - - - - - - - - -

CONFIGURATION
- - - - - - - - - - - - -

Select the group you wish to program with ▲ and ▼, then select with ▶ (start with system options for a new unit).

Note that pressing CANCEL at any time while in programming will return you to normal mode and leave the displayed setting unaltered.

The menus are described in the recommended programming order for setting up a new controller. If you only wish to make an alteration you may skip to a setting and make the desired change. All settings are adjusted with the ▲ and ▼ keys and then stored or with the select key ▶.

Refer to the Rack Configuration Sheet (section 6) for more details.

4.1 SYSTEM OPTIONS

Set fundamental options as follows;

INITIAL : OFF
SYSTEM SETUP

Turn this on the first time you program a unit. Default values will be loaded based on your settings for previous values, speeding up the programming. If values have previously been programmed these may be upset if this option is on.

CONTROL DESCRIPT
L.T. Rack 1

Each control can be given a description which will be displayed on the screen during normal operation. See section 5 for a list of these descriptions.

DISPLAY

Set the scrolling rate of the display quick or slow.

PRESSURE (kPa)
DISPLAY MODE

Pressures can be programmed and displayed in psi or kPa. If this is changed all pressure settings are automatically converted to the new units.

CELSIUS (C)
DISPLAY MODE

Set °C or °F display mode for temperature.

4.2 COMPRESSORS

The following menus define the compressor control strategy. Menus will be skipped if they are not relevant for the system you have defined.

USE PSENS/L FOR
RACK CONTROL

Select from a Phasefale Psens/L, Psens/H, Custom pressure sensor, Temperature probe or no control for the compressor rack. The Psens/L will read 0-100 and the Psens/H 0-500 psi.

RACK	55 kPa
SETPOINT	

The Cut In setting for the compressors.

RACK	10 kPa
DIFFERENTIAL	

The Cut Out for the compressors is the Setpoint less the Differential.

No. OF OPTIMISE
SENSORS 2

The number of temperature sensors used by the optimise logic.

SENSOR 1: -22.0°C
OPTIMISE SETTING

For each sensor, set the temperature at which optimising can begin if it falls below this. If there is more than one sensor then each sensor must be below its setting before optimising can begin.

RACK : 30 kPa
OPTIMISER OFFSET

The maximum value the optimiser can raise the rack setpoint.

OPTIMISE	20 sec
STEP DELAY	

When optimising begins the rack setpoint is raised by 1 kPa or 0.1°C each *Optimise Step Delay*. When the optimising conditions are not met the setpoint is lowered in the same way.

USE CAPACITIES	
TO CONTROL RACK	

Select whether to use Capacities or Stage tables to control the compressors. Capacities uses the size of the compressors to decide which one to switch. Stage tables are programmed tables which give the operator precise control over the switching order of compressors and unloaders.

No. OF	3
COMPRESSORS	

The number of compressors to be controlled.

No. of COMPS	2
WITH IDLE INPUT	

The number of compressors with idle inputs. These inputs are used so the controller knows if the compressor is running. Wiring to a sensor card input set to pressure, the input should be switched to the G terminal when the compressor is idle (not running) and open circuit when running. This input allows the *Limit Start delay* to operate and the compressors to start with unloaders in a specified state (see section below on stage tables) when compressors are switched by other controls. The first four compressors can have this input beginning with compressor 1.

Note : If Oil Safety is used on a compressor then the idle input is via the oil pressure sensor and does not need to be specified here.

UNLOADERS : none	
ON COMPRESSOR 1	

If stage table are used, specify the number of unloaders on each compressor.

INCREASE	60 sec
CAPACITY DELAY	

The time delay between increases of compressor capacity for the rack.

DECREASE 40 sec	
CAPACITY DELAY	

The time delay between decreases of compressor capacity for the rack.

If the reading is more than one differential from the Cut In or Cut Out these delays will be reduced.

SWAP/OVER : OFF	
STAGE TABLES	

Swap/over stage tables is a strategy using two tables. The first table is used for increases of capacity and the second for decreases. The tables are only swapped at the first or last step, or at any step where both tables are identical, otherwise the control remains with the current table until one of the above conditions occurs.

INCREASE	60 sec
UNLOADER DELAY	

The time delay between increases of capacity for the rack when no compressor is switched.

DECREASE	40 sec
UNLOADER DELAY	

The time delay between decreases of capacity for the rack when no compressor is switched.

No. OF TABLES	2

Set the number of tables to use.

ROTATE : 8 Hours	
TABLE PERIOD	

Tables will be rotated after this period.

If *none* is selected then no rotation will occur. The control input can also be used to specify which table is used and no rotation will occur while a specific table is called for by this input.

No. OF STEPS :	7
PER TABLE	

The number of steps in each table. 32 steps are available which must be split between the tables. (i.e. one table can have 32 steps but if there are two tables they can have 16 each).

STEP 2 : TABLE 1	
Cxx1xx3	

For each step in each table program the compressors and unloaders on or off. Step one is the off or lowest stage. An "x" means off. A "C" means the output is a compressor and it is on. A number means an unloader relating to that compressor (i.e. "3" is an unloader on compressor 3).

NOTE : When a compressor is off due to a fault or the idle input, the unloaders for that compressor are switched to their step one value until after the compressor starts.

This allows the compressors to be started at any time in an unloaded state.

EQUAL CAPACITY	
COMPRESSORS	

If Capacity control is used, specify whether compressors are of equal capacity.

COMPRESSOR No. 1	
CAPACITY 5	

If compressors have unequal capacities, specify the size of each compressor. The capacity is a relative value between 1 and 10, which is used to rank the compressors according to their size.

4.3 CONDENSERS

The following menu items set the condenser control strategy.

USE PSENS/H FOR	
COND CONTROL	

Select from Phasefale Psens/L, Psens/H, a Custom pressure sensor, Temperature probe or no control for the compressor rack. The Psens/L will read 0 -100 psi and the Psens/H 0 - 500 psi.

No. OF	2
CIRCUITS	

Up to 4 condenser circuits can be controlled. If more than one circuit is used, any circuit above its setpoint will bring fans on. Fans will switch off when all circuits are below their Cut Out value. As an option fans can be set to respond only to certain circuits, see the fan strategy setting for details. For each circuit set the following :

COND.	1450 kPa
SETPOINT 1	

Fan Cut In value for this circuit.

COND.	50 kPa
DIFFERENTIAL 1	

Fan Cut Out is Setpoint minus Differential.

FANS	1550 kPa
ALL ON PRESS. 1	

If any circuit reaches the Fans All On Pressure then all fans are switched on without time delay.

Faults on the first circuit relate to the compressor rack and are set under the *Compressor Safety* menu, faults on the other circuits can operate relays and are set as follows:

HP	:	ON
FAULT OUTPUT		2

Turn the fault output for this circuit on or off.

| HIGH 1640 kPa |
| PRESSURE FAULT 2 |

HP fault pressure. If this is exceeded the fault output will operate until 15 minutes after the pressure falls below it again. The alarm output will also operate.

| NO. OF 6 |
| FANS |

From 0 to 12 fans can be switched.

| ROTATE |
| LEADING FAN |

Fan control strategy, select whether to Rotate the fans for even wear, Don't Rotate, so the fans always follow a fixed sequence or set the fans to follow a Custom control strategy.

| FAN 1 : YYnn |
| ON CIRCUITS 1234 |

If a custom strategy is used, for each fan, select which circuits the fan will respond to. In the above screen fan 1 will turn on if circuits 1 or 2 need fans but not if circuits 3 or 4 do.

| FAN ON 30 sec |
| DELAY |

The delay between switching fans on.

| FAN OFF 20 sec |
| DELAY |

The delay between switching fans off.

4.4 COMPRESSOR SAFETY

The following items relate to the compressor safety features of the rack controller.

| No. OF COMPS. 2 |
| WITH OIL FAIL |

Set the number of compressors to have oil pressure failure control (up to the first four). Oil safety will turn off the failed compressor but leave the rest running. The failed compressor will need to be restarted via the keyboard or P.I.N. software. The oil pressure sensor should be wired with an idle circuit as shown in the Sensor card instructions. This allows the oil safety control to determine if the compressor is running.

| USE PSENS/H FOR |
| OIL PRESSURE |

Select from Phasefale Psens/L, Psens/H or a Custom pressure sensor.

| OIL SAFETY |
| OFFSET 230 kPa |

Oil pressure relative to suction pressure which must be maintained to avoid an oil pressure fault.

| OIL SAFETY |
| DELAY 90 sec |

The oil fault will occur if the pressure is below its setting for this period and the compressor is not idle.

| No. OF COMPS 3 |
| WITH HEAD TEMP |

Number of compressor head temperature sensors. The first four compressors can have this sensor.

| COMPRESSOR FAULT |
| TEMP. 80.0ºC |

High temperature fault setting for compressor.

| COMPRESSOR RESET |
| TEMP. 50.0ºC |

Temperature at which the compressor will automatically restart.

| COMPRESSOR FAULT |
| DELAY 2 min |

A compressor fault occurs when the fault temperature is exceeded for the fault delay time. Only the offending compressor will be switched off and the alarm output will operate.

| LIQUID : ON |
| LEVEL CONTROL |

Set liquid level control on or off. The liquid level sensor should be linear with a voltage output of 1 V for 0% and 6 V for 100% and the Sensor card input switched to pressure. A suitable sensor is available from Ward Valve.

| LOW LIQUID : 10 % |
| WARNING LEVEL |

When the liquid falls below this level for the liquid level delay, the alarm output operates.

| HIGH LIQUID : 70 % |
| WARNING LEVEL |

When the liquid rises above this level for the liquid level delay, the alarm output operates.

| HIGH LIQUID : 80 % |
| FAULT LEVEL |

When the liquid rises above this level for the liquid level delay, the alarm output operates and the compressors are all switched off until restarted via the keyboard or P.I.N. software.

| LIQUID : 60 sec |

| LEVEL DELAY |

The liquid level delay time.

| RACK : OFF |
| CONTROL INPUT |

Select whether to use a Control Input (as described in section 3).

| RACK : ON |
| FAULT INPUT |

Set the fault input on or off. This input is a Sensor card input set to temperature mode. When a fault occurs the compressors are all switched off. (stage table controls are switched to step one).

| RACK FAULT INPUT |
| AUTOMATIC RESET |

The compressors can be set to automatically restart when the fault goes away or to require a manual restart via the keyboard or P.I.N. software.

| RACK FAULT INPUT |
| FAULT WHEN OPEN |

The fault can be set to occur when the input goes open or closed circuit.

| RACK : 30 sec |
| FAULT DELAY |

The time delay before the fault occurs.

| FAULT DESCRIPT. |
| OVERLOAD |

Description which appears on the display when the fault has occurred.

| HP : ON |
| FAULT CONTROL |

Use circuit one of the condenser control to switch off the compressors on HP fault.

| HIGH 1550 kPa |
| PRESSURE FAULT |

HP fault setting. If condenser circuit one exceeds this pressure the compressors will be switched off without time delay and restarted after a 15 minute delay. The alarm output will also operate.

| LOW 10 kPa |
| PRESSURE FAULT |

When the suction pressure falls below this value the compressors will be switched off without time delay and the alarm output will operate. Compressors will restart automatically in accordance with the setpoint and any time delays if the pressure returns to normal.

| LIMIT 4 min |
| START DELAY TIME |

Each compressor requires at least this time to elapse since its previous start.

4.5 CONFIGURATION

Select the configuration option and the following menu asks you to confirm you wish to enter;

ACCESS TO : OFF
CONFIGURATION

change to ON, and press ▶ to gain access to the configuration options;

SECURITY
- - - - - - - - - - - - - - -

NETWORK CARDS
- - - - - - - - - - - - - - -

SENSORS & RELAYS
- - - - - - - - - - - - - - -

exit
- - - - - - - - - - - - - - -

The exit option returns to normal programming.

4.5.1 SECURITY

CHANGE : 10
ACCESS NUMBER

The access number is a number which must be entered each time programming is entered. Select OFF if this is not required.

ALARM : OFF
OUTPUT RELAY

This is an alarm output relay.

ALARM RELAY
FLASHING

The alarm output relay can be programmed to flash at a 1 second rate or be steady. The active state of the relay is in alarm, check the Relay card instructions to determine the wiring for normally open or normally closed programming.

ANALOG CONTROL
OFF

If used, select the analogue control to be used for Compressor or Condensor control.
The Analogue output can be used to control a variable capacity compressor or variable speed fan. The 0 to 10 V dc output is via a Relay Card ANOUT and GND terminals.

ANALOGUE INC
RATE

The rate at which the output increases when the suction or discharge sensor reading is higher than the Setpoint minus half the Differantial (e.g. setpoint 100 kpa, diff. 20 kpa analogue output increases when suction reading is above 90 kpa).

ANALOGUE DEC
RATE

The rate at which the analogue output decreases when the suction or discharge sensor reading is lower than the Setpoint minus half the Differantial (e.g. setpoint 100 kpa, diff. 20 kpa analogue output decreases when suction reading is below 90 kpa).

SWITCH STEP
CHANGE

The change in analogue output voltage each time a fixed capacity compressor or fan is switched on or off. The output decreases by this amount when a compressor or fan is switched on and increases by this amount when a compressor or fan is switched off.

MAX ANALOGUE
OUTPUT

The maximum voltage the analogue output is premitted to rise to.

CUSTOM 0 kPa
SENSOR AT 1V

CUSTOM 1000 kPa
SENSOR AT 6V

Set the pressures of the custom sensor at 1V and 6V. The custom sensor should be a linear voltage type. If it is a 0 to 5 volt type then calculate the expected pressures at 1 and 6 volts and enter these.

IGNORE : OFF
BINDING WARNINGS

If set to ON, allows you to program cards not yet connected.

RESET : OFF
ADDRESS TABLE

Used to re-start sensor and relay programming from scratch.

4.5.2 NETWORK CARDS

This menu is used to "find" network cards and then assign a card number from 1 to 99 to each network card. Each card must have a unique card number.

CARD COUNT : 7
CHECK CARDS : OFF

A count of the cards found (including this one) is displayed. If ON is selected each card is identified and its card number can be altered.

CARD No. : 1
OF THIS DISPLAY

This display prompts for the card number of this rack controller.

CARD No. of
Defrost : 31

This display shows a card numbered 31 of type DEFROST has been identified.
As a defrost card has a display its display will show;

This controller
selected to bind

to help identify it. Cards that do not have a display will stop flashing their selected indicator and turn it steady on. The following message indicates all the cards on the network have been displayed, if a card did not show up here it may not be communicating correctly and should be investigated.

CARDS FOUND : 7
EXPECTED : 7

After all the cards have been found a summary screen shows the number which were found and the number expected from the card count carried out at the start of the Network Cards menu.

4.5.3 SENSORS & RELAYS

This menu allows you to assign inputs to sensor cards and outputs to relay cards etc. Ensure all other programming has been completed BEFORE accessing this menu.
The "sensors and relays" menu will look at the configuration you have set up and then ask you to identify the source of each input and the location of each output in the system. A maximum of 9 separate cards (total of relay, sensor and clock/modem cards) can be specified under this menu.
Use the table in the Relay card instructions to determine how you wish to program and wire the outputs.

WARNING THIS IS
ALREADY USED

Each channel must use a unique sensor, this message indicates the sensor has already been used. If a card is specified, but cannot be found, the display shows;

WARNING CARD
NOT FOUND

In this case, you will be re-prompted for the sensor location until found. If "IGNORE BINDING WARNINGS" in the SECURITY menu is set to ON, you can proceed through the SENSORS & RELAYS menu but will get a "binding error" at the end. This means that not all points set can be found by the card or more than 9 cards have been addressed. After all required inputs and outputs have been prompted and set, the display responds;

Please wait

while the connections are made to the selected cards. If any card cannot be set, the message;

Binding Error

warns you to retry. If the "Sensors and relays" menu is not completed then communications will not occur properly, this message warns of this;

NETWORK BINDING
INCOMPLETE

Once all connections are made and binding has been completed the following message is displayed ;

end of
programming

the display will then return to normal and begin controlling according to the new settings.

5.   FIXED DESCRIPTION LISTS

The following descriptions are available to describe the function of the rack controller.

Air Conditioning
Ammonia System
Chiller 1
Chiller 2
Compressor
Condenser
Condenser 1
Condenser 2
Condenser 3
Dairy Rack 1
Dairy Rack 2
Dairy Rack 3
Dairy Rack 4
Discharge 1
Discharge 2
Freon System
H.T. Rack 1
H.T. Rack 2
High Alarm 1
High Alarm 2
High Stage 1
High Stage 2
High Temperature
Ice Maker 1
Ice Maker 2
Inter-Cooler 1
Inter-Cooler 2
Interm-Stage 1
Interm-Stage 2
L.T. Rack 1
L.T. Rack 2
L.T. Rack 3
L.T. Rack 4
Low Alarm 1
Low Alarm 2
Low Stage 1
Low Stage 2
Low Stage 3
Low Temperature
M.T. Rack 1
M.T. Rack 2
M.T. Rack 3
M.T. Rack 4
Meat Rack 1
Meat Rack 2
Meat Rack 3
Meat Rack 4
Med Temperature
Multi Condenser
Presscon
Pressure Alarm 1
Pressure Alarm 2
Rack Controller
Rack 1
Rack 2
Rack 3
Rack 4
System 1
System 2
System 3
System 4
System 5
System 6
System A
System B
System C
System D
System E
System F

The following descriptions are available to describe the fault input.

COMPRESSOR
DAY MODE
DISCHARGE
ELECTRICAL
GENERAL
GLYCOL LEVEL
HIGH LIQUID
HIGH PRESSURE
HP/LP
HIGH ACCUMULATOR
HIGH RECEIVER
LIQUID LEVEL
LOW ACCUMULATOR
LOW LIQUID
LOW PRESSURE
MANUAL
MAXIMUM DEMAND
MOTOR
NIGHT MODE
OIL
OIL POT
OIL PRESSURE
OVERLOAD
OVER-RIDE
PHASE LOSS
PRESSURE
SWITCH
TEMPERATURE
TIME CLOCK