RCC20X (C5L2)

Controller for Reciprocating Compressors.

Operation and Set-up Manual

General

Guardian Rcc20X (C5L2) Controller is a self-contained unit requiring a single electrical supply to control and monitor up to 5 reciprocating compressors, each with motor and 2 loading valves. It provides inputs for pressures, temperatures and plant faults, and mains outputs for compressor motor and capacity control. Local digital temperature and alarm display is provided by the Guardian SKD9 key-switch display unit, which also gives access to all control and configuration parameters. Full RS-485 communications enables the controller to be integrated into a Guardian Consultant network to provide data logging and alarming.

CONTENTS

Termination and Layout

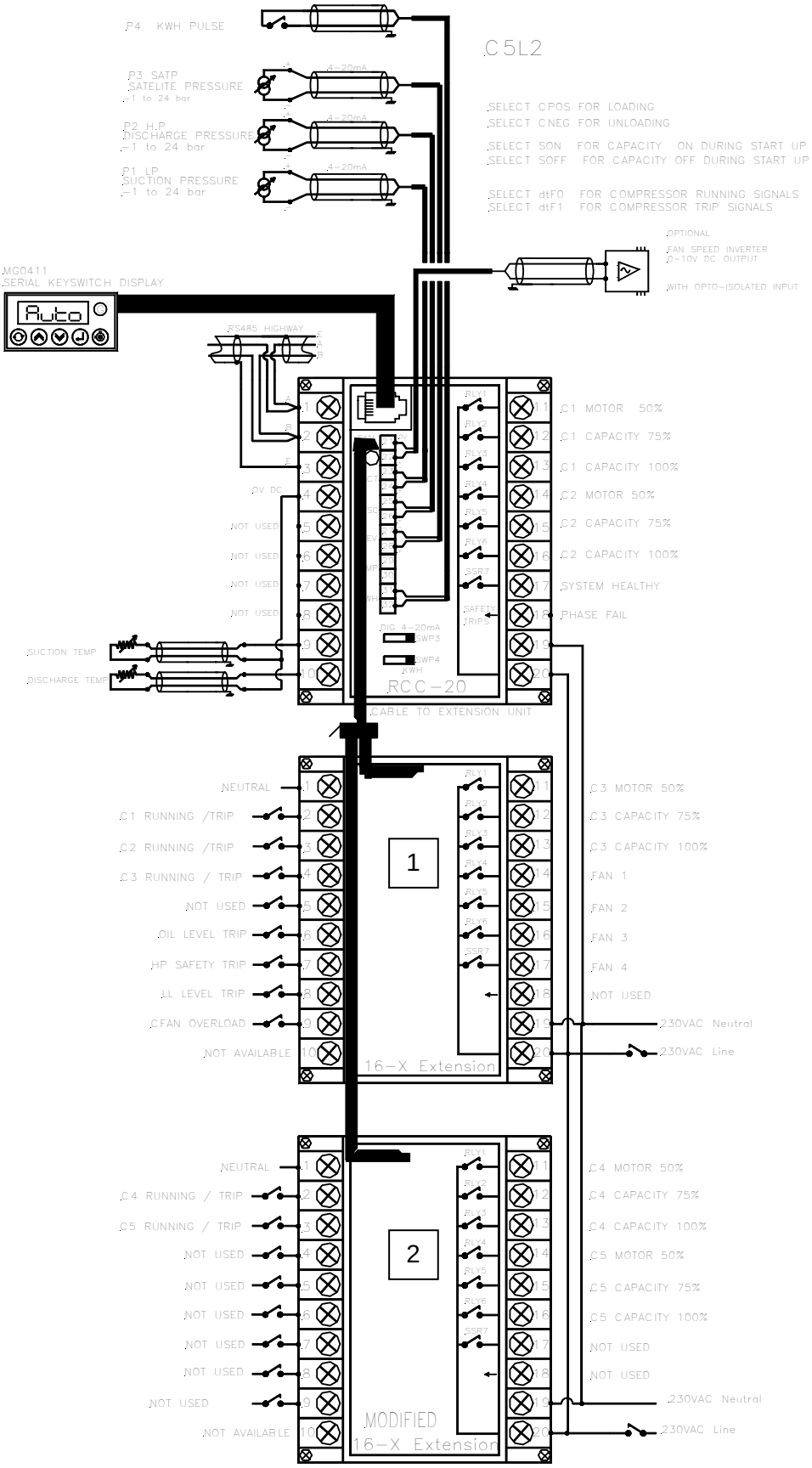
RCC-20X 'C5L2' Input/Output Signals

C5L2 Main Unit			
Analogue Inputs	**Terminal**		
P1 LP	23-/24+	Suction Pressure	-1 to 24 bar
P2 HP	25-/26+	Discharge Pressure	-1 to 24 bar
P3 SATP	27-/28+	Satellite Pressure	-1 to 24 bar
P4 KWH	31/32	Kilo-Watt Hour	Pulse
Analogue Inputs	**Terminal**		
Not used	4/5		
Not used	4/6		
Not used	4/7		
Not used	4/8		
Pack Suction	4/9	Suction temperature	Degrees C.0 to 150
Pack Discharge	4/10	Discharge temperature	Degrees C.0 to 150
Mains Input		**230vac / 24vac**	
Phase fail	**18**	**230vac / 24vac**	
Relay Outputs 230VAC 3 amp. Maximum Accumulative Current 10 amp.			
RLY1	11	Compressor 1 Motor (50%)	**230vac**
RLY2	12	Compressor 1 Capacity (75%)	**230vac**
RLY3	13	Compressor 1 Capacity (100%)	**230vac**
RLY4	14	Compressor 2 Motor (50%)	**230vac**
RLY5	15	Compressor 2 Capacity (75%)	**230vac**
RLY6	16	Compressor 2 Capacity (100%)	**230vac**
SSR7	17	System Healthy	**230vac**
AC Supply	19	Neutral	**230vac**
	20	Line	**230vac**

C5L2 Extention Unit 1			
Digital Inputs	**Terminal**		
Common Neutral	1		
C1 Running /Trip	2	Compressor 1 input	**230vac**
C2 Running /Trip	3	Compressor 2 input	**230vac**
C3 Running/ Trip	4	Compressor 3 input	**230vac**
Not Used	5		**230vac**
Oil Level	6	Pack oil level alarm/trip	**230vac**
HP safety trip	7	High pressure safety trip	**230vac**
LL level alarm	8	Liquid level low alarm	**230vac**
CFAN OVERLOAD	9	Condenser fan overload alarm	**230vac**
Not used	18		**230vac**
Relay Outputs 230 V AC 3 amp. Maximum Accumulative Current 10 amp.			
RLY1	11	Compressor 3 Motor (50%)	**230vac**
RLY2	12	Compressor 3 Capacity (75%)	**230vac**
RLY3	13	Compressor 3 Capacity (100%)	**230vac**
RLY4	14	Condenser Fan 1	**230vac**
RLY5	15	Condenser Fan 2	**230vac**
RLY6	16	Condenser Fan 3	**230vac**
SSR7	17	Condenser Fan 4	**230vac**
AC Supply	19	Neutral	**230vac**
	20	Line	**230vac**

C5L2 Extention Unit 2			
Digital Inputs	**Terminal**		
Common Neutral	**1**		
C4 Running	2	Compressor 4 running	**230vac**
C5 Running	3	Compressor 5 running	**230vac**
Not Used	4		
Not Used	5		
Not Used	6		
Not Used	7		
Not Used	8		
Not Used	9		
Not Used	**18**		
Relay Outputs 230 AC 3 amp. Maximum Accumulative Current 10 amp.			
RLY1	11	Compressor 4 Motor (50%)	**230vac**
RLY2	12	Compressor 4 Capacity (75%)	**230vac**
RLY3	13	Compressor 4 Capacity (100%)	**230vac**
RLY4	14	Compressor 5 Motor (50%)	**230vac**
RLY5	15	Compressor 5 Capacity (75%)	**230vac**
RLY6	16	Compressor 5 Capacity (100%)	**230vac**
SSR7	17	Not Used	**230vac**
AC Supply	19	Neutral	**230vac**
	20	Line	**230vac**

RCC-20X C5L2 Termination Wiring.



Controller function.

This description is for the C5L2, which controls compressors and condenser fans.

Compressor control.

Compressors are staged on and off in response to changes in the measured suction pressure. Which compressor is started or stopped depends on the following :-

Compressor Start.

1. Suction pressure is above the control set-point plus dead band. (See Page 22).
2. Stage up delay has elapsed. (See Page 24).
3. Compressor not at tripped status. (See Page 14)
4. Starts per hour timer, (anti-recycle timer), has elapsed.(See Page 24)
5. Delay after stop has elapsed. (See Page 24).
6. Compressor with the lowest run hours is then selected to start.
7. Stage up delay is reset.

Compressor increase capacity.

1. Suction pressure is above the control set-point plus dead band. (See Page 22).
2. Capacity loading delay has elapsed. (See page 24).
3. Next capacity loading output is used according to polarity selected.(See Page 22)
4. Capacity loading delay is reset.

Compressor decrease capacity.

1. Suction pressure is below the control set-point minus dead band. (See Page 22).
2. Capacity loading delay has elapsed. (See page 24).
3. Next capacity output is used according to polarity selected.(See Page 22)
4. Capacity loading delay is reset.

Compressor Stop.

1. Suction pressure is below the control set-point minus dead band. (See Page 22).
2. Maximum number of unloaded compressors has been reached(See Page 22)
3. Stage down delay has elapsed.(See Page 24)
4. Compressor with the longest run hours and shortest re-cycle delay is stopped.
5. Stage down delay is reset.

Compressor Standby

Any compressor .in the pack may be designated as the standby compressor 'Sb'.
The standby compressor only runs if one of the other compressors in the pack has tripped.

Compressor Enabled, Disabled, Not fitted

Any compressor .in the pack may be designated as disabled or not fitted.
Only 'Enabled' compressors run.

Condenser control.

This is description is for ‘Linear’ fan control.

Fans Start.

1. Discharge pressure is above control set-point plus dead band. (See Page 28).
2. Stage delay has elapsed. (See Page 28).
3. Fan is started in numerical order.
4. Stage delay is reset.

Fans Stop.

1. Discharge pressure is below control set-point minus dead band. (See Page 22).
2. Stage delay has elapsed. (See Page 28).
3. Fan is stopped in last on first off order.
4. Stage delay is reset.

Getting Started

Guardian Controllers provide refrigeration engineers with

- **ULTIMATE FLEXIBILITY**
- **ASSURED MONITORING**
- **RELIABLE ALARMS**

This manual provides refrigeration designers, installers, service mechanics and supermarket personnel with the necessary information to achieve the above objectives.

All users require to know a few basic facts about this controller before successfully starting to perform their design, commissioning, maintenance or operating functions.

a) All GUARDIAN controllers need to be set up with a unit model selection and other basic settings for setpoints, timers and addresses. All these settings need to be done using the SKD.9 Keyswitch Display, so the understanding of the button operation of this unit is essential.
b) The shorthand used in the following chapters for concisely expressing button pressing and selection sequences to do all this set-up needs to be understood.
c) Mains power input voltage and hardware switch and link option selections (if any are required) must correspond to the selected unit model configuration.
d) Since each controller can be configured in a number of different ways to perform flexible refrigeration control then an understanding of how to find out what unit model is currently selected, what it does and how it is connected, is also necessary.

Hardware configuration checks.

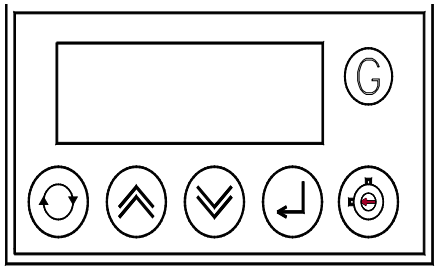
Prior to switching on the GUARDIAN controller check that the hardware unit is the correct type for the incoming mains voltage

When satisfied that the correct type of controller is available then the following checks should be made prior to controller installation or replacement

a) Ensure mains supply is wired correctly to the appropriate TERMINAL WIRING drawing for the model selected.
b) Ensure that any transducer selector switches specified on the TERMINAL WIRING diagram are in the correct state.
c) Ensure any shorting link selector pins specified on the TERMINAL WIRING diagram are correctly fitted.
d) Ensure that probes are wired to the terminal WIRING DIAGRAM and the correct type of thermistor or pressure transducer probes are fitted.
e) The SKD.9 Keypad/display unit is fitted correctly in its 6-way telephone socket.
f) The RS485 highway connections (if required) are wired to the correct terminals and the screen drain wire is continuous to earth.

SKD.9 Display unit operation.

GUARDIAN controllers require a SKD.9 Keyswitch Display unit to be plugged into the telephone jack socket in the controller before any settings can be changed.
The SKD.9 is connected to the GUARDIAN controller via a 6-core telephone cable.
The SKD.9 Keyswitch/Display comprises a plastic enclosure housing a PCB with four membrane pushbuttons, four LED displays and a 2-position Keyswitch.



SKD.9 buttons have the following functions when pressed:-

◉ **'next' button** displays next value or menu selection in sequence.

'raise' button raises a menu settings value or menu item selection.

'lower' button decreases a menu settings value or item selection.

'accept' or 'enter' button accepts any alarm and is used for entering a menu selection or settings value data entry **.**

The two position **keyswitch** is not used Button operation shorthand.

To assist in easy set-up of control setpoints, delays, timers and other configuration settings, the sequence of button presses and subsequent displays will be shown in this handbook as below:
ii) A button symbol means press that button
iii) A display box shows the result of the last button press on the SKD.9 display.

EXAMPLES

◉ AUTO ◉ -OFF ↵ -OFF is shorthand for

Press **'next'** button which then displays AUTO
Press **'next'** button which then displays OFF
Then press **'enter'** button which changes the control mode to OFF and displays -OFF

◉»◉ AUTO ↵

Press **'next'** repeatedly until **Auto** is displayed then press **'enter'.**

RET■ ■-17

means the display alternates between the value identifier tag and the latest value.

RET■ ■oc■ FAIL

means the display alternately flashes between the value identifier tag (return air temperature), the measured value (open circuit) and the alarm or trip message.

Configure unit address.

Enter Passcode PP05 for normal changes

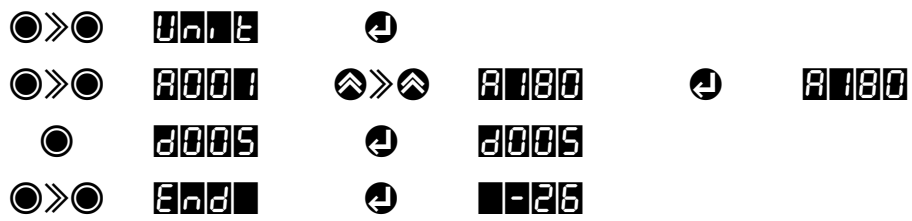
Before any permanent change of controller settings are made then the correct entry of the appropriate passcode is necessary.
Most normal system settings require entry of passcode PP05

Press **'next'** repeatedly until **SEt** is displayed then press **'enter'**. **PP00** is displayed.
Press **'raise'** repeatedly until **PP05** is displayed and then press **'enter'.**

Select Address

e.g. set-up unit for address 180.5

Enter Passcode as button sequence as above



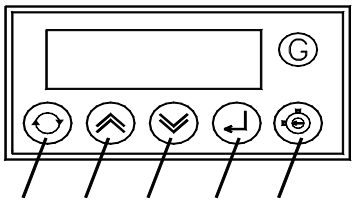
RS485 Communications

When the correct highway address has been entered as above then the controller can communicate with the Guardian CONSULTANT PC for central alarm monitoring and temperature display. Control setpoints, defrost times and alarm limits may then be sent to the controller from the PC rather than using the SKD9 Keyswitch display. For further details see page 31

OPERATION

The SKD.9 Keyswitch display provides a display at the compressors of pack pressures, number of compressors running or tripped etc.

Display of other measured values by pressing 'next' button, the values displayed depend on the unit model selected.
Passcode protected setup of controller setpoints, timers and limits.



SD9 DISPLAY INDICATIONS

Compressor Displays

The following displays are available by repeatedly pressing .Value displays are alternated with an identification Tag (ie 'Suct') which is displayed for a quarter time:-
All pressure are in bar gauge

Tag	Value	
Suct	2.3b	Suction pressure (-1 to 24barG)
LoAd	125	Total pack amps
CAP	100	Total Pack Capacity % (0 to 100 %) (capacity raise/lower operative in HAnd control mode)
S-uP	3.5	Stage up timer count
S-dn	0.3	Stage down timer count
	Auto	Pack Auto control mode (press 'accept')
	OFF	Pack OFF control mode (press 'accept')
	hAnd	HANd control mode (press 'accept') (enables raise/lower buttons)
CPrS	1 1 1	Compressor motors running status
dELY	1 1	Motor Timeout Delay status
Crun	1 1	Motor Running / trip Input status

trIP 11	Motor trip status
LEvl 35	Liquid level % if fitted
SUct -36	Suction temperature if ‘STSH’
Et -38	Equivalent Suction temperature if ‘STSH’
SH 4	Suction superheat temperature if ‘STSH’
LOOP 74	Compressor VSD Loop output speed 0-100% if Fan speed SPd selected
CSEt	Request compressor parameter change
FAnS	Press 'accept' to display discharge

CONDENSER FAN DISPLAYS MAY ALSO BE SELECTED BY PRESSING 'Lower' with 'Suct' on display

COMPRESSOR SETTINGS MAY ALSO BE SELECTED BY PRESSING 'Raise' with 'Suct' on display

Default Displays

The default suction pressure display

Suction pressure (-1 to 24barG)

is during AUTO or restart sometimes replaced by

During restart

Unit model configuration selected

(Software version)

If unit selected OFF

If unit selected hand control

if RS485 comms watchdog fail

TRIPS AND ALARMS

PACK AND COMPRESSOR SAFETY TRIPS

Pack trips always de-energise the system healthy output, stops all motors and de-energises the loading valve and fan relays.
Compressor Motor trips only stop the appropriate compressor.
ALL Trips are RESET locally by pressing the 'enter' button.
The last safety trip input detected is automatically displayed with a flashing alternative **'triP'** message.

The **'next'** button may always be used to view other displays.

Trip messages displayed depend on the unit model and the configuration selected.

Analogue Trips

Suction pressure open circuit

Discharge pressure open circuit

Suction pressure high trip

Discharge pressure high trip

Superheat low trip

Digital Trips

Individual compressor trips:-

Compressor one tripped. This is a result of the run signal not being present after the compressor has been started..
A similar display is used for all other compressors on the controller with just the compressor number changing. It always displays the most recent compressor to have tripped

If a compressor has been selected as Standby CnSb then this will be run after any trip

System Healthy Output

IF a pack Safety trip occurs or suction pressure or discharge pressure signal inputs detect an open circuit FAIL or exceed trip limits then the System Healthy output is removed.

ALARMS

Analogue Alarms

If the suction pressure, amps liquid level or superheat values go outside the high or low alarm limits then the appropriate value is displayed with a flashing alternative '**Hi**' or **'Lo**' alarm message.

Suction Pressure Low alarm

Suction Pressure High alarm

Motor Load High alarm

Liquid level Low alarm

Superheat Low alarm

Digital Alarms

Digital alarm messages include:-

Digital input Low level liquid alarm

Burst disc alarm.

Phase fail alarm(Stops all compressors).

Condenser Fan Overload Alarm.

PC-FAIL ALARM

If the RCC20 unit is in **'Auto'** mode and a valid status request has not been received for 60 seconds via the RS485 highway then a Watchdog timer **'PC/FAIL'** message is displayed.
This alarm is reset if 485 communications are restored or the AGT/SYS5/Locl/nonE is set to **'LocL'** or **'nonE'** in unit settings.

if RS485 comms watchdog fail

MODE CHANGE Compressors

Pressing 'next' until the pack mode selections are on display and then pressing **'enter'** changes the pack mode to the new selection displayed.

AUTO pack control mode with compressor control on suction pressure

-OFF = pack control stopped (standby operation)

hAnd = pack control in local manual operation

Pack Capacity Manual

With the pack mode selected to HANd, the pack capacity can be increased or decreased by pressing **'raise'** or **'lower'** buttons when the pack capacity is on display.

GLOBAL RS485 COMMANDS

IF all compressors are tripped or the unit is in **'OFF'** mode and Trip Settings are **'CoFF'** then a GLOBAL RS485 **'OFF'**command is sent to all case controllers on the same section of RS485 Highway to prevent liquid flood back.

A GLOBAL RS485 **'AUTO'** command is sent on **restart**, when trip **'reset'** is pressed or when control mode is selected **'AUTO'**.

CONDENSER FAN DISPLAY

The following displays are available by repeatedly pressing the 'next' button:-

d.Sc	14.5	Discharge pressure
FAnS	3	Number of fans running (No. of fans running changed by raise/lower buttons if HANd selected)
dELY	13	Fan stage delay timer (secs)
Auto		Auto control mode (press 'accept')
oFF		OFF control mode (press 'accept')
hAnd		Hand control mode (press 'accept') (enables raise/lower buttons)
tr.P	11	Fan trip status
LooP	66	analog output 0-100% if applicable for variable speed Fans
FSEt		Request parameter change for FANS (press accept & raise to PP05)

Return to compressor display
COMPRESSOR DISPLAYS MAY ALSO BE SELECTED BY PRESSING 'Lower' with 'Disc' on display

CONDENSER SETTINGS MAY ALSO BE SELECTED BY PRESSING 'Raise' with 'Disc' on display

HIGH DISCHARGE PRESSURE

If the discharge pressure goes outside the high alarm limit then the pressure value is displayed with a flashing alternative 'Hi' alarm message. The compressors are automatically unloaded to reduce the discharge pressure.

d.Sc	10.86	Hi.	Discharge Pressure High alarm

FAN OVERLOAD TRIPS

Any fan overload trip causes the default display to alternate the failed FAN no. with a 'triP' message.

FAn3	tr.P	fan 3 trip input closed

MODE CHANGE CONDENSERS

Pressing 'next' until the condenser mode selections are on display and then pressing 'enter' changes the condenser mode to the new selection displayed.

Auto AUTO fan control mode with compressor control on discharge pressure

Fan control stopped

Fan control in local manual operation

FAN CAPACITY MANUAL

With the fan mode selected to 'HANd', the condenser capacity can be increased or decreased by pressing 'raise' or 'lower' buttons when the fan capacity is on display.

A maximum of seven fan stages (fans or valves) are sequenced up or down.

USEFUL BUTTON SEQUENCES

The following button sequences should prove useful during normal service operation

Reset ALARM or TRIP

RESET

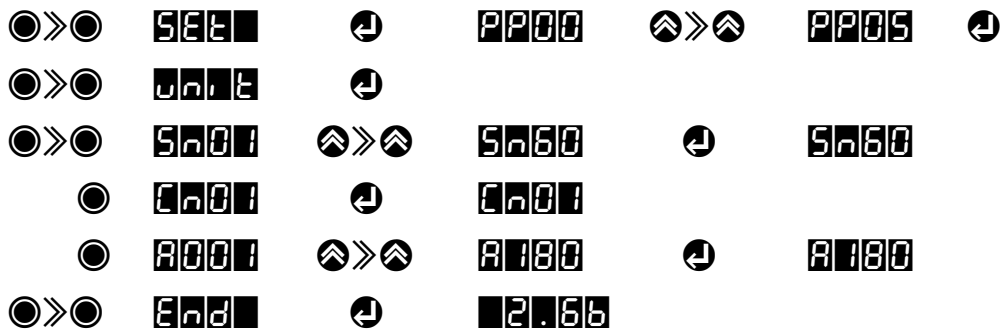
Change suction control setpoint and differential

Check Unit Model

This unit model is '3PAC'

Select Stub, Case No and Address

e.g. setup unit for system 60, case 1, at address 180

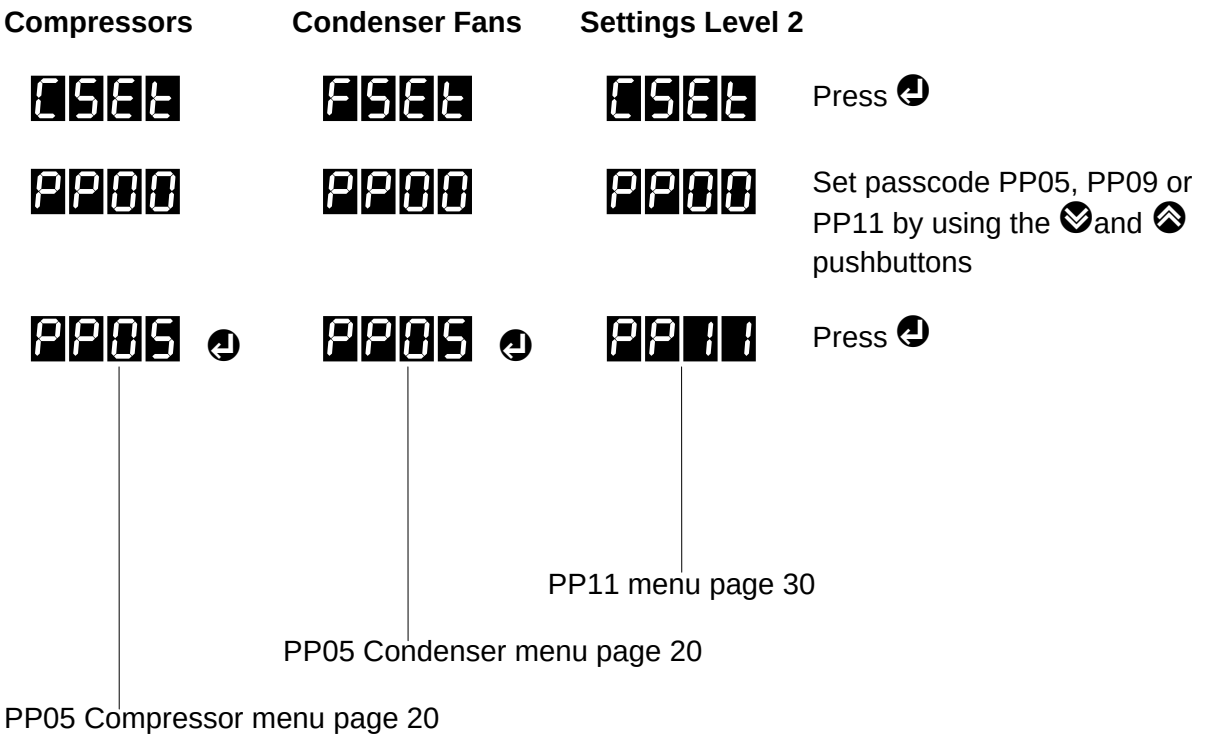


SETUP OPERATION

Setup operation lasts for a maximum of 5 minutes after being activated by pressing, ↵ , with CSEt or FSEt on the display panel.
On entry to Setup passcode PP00 is displayed.

To change any settings passcode PP05, PP09 or PP11 must be first selected using ⌃⌃ and ↵ pushbuttons.

If the correct passcode is not entered then setup values may be displayed but any attempted changes are ignored.



Setup Functions (Normal) passcode 05

PP05 Menu

Press ◉ to sequence through the following PP05 Menu selections:-
Press ↵ to select the displayed menu

Compressors

Unit		Unit model setup RCC-20 Page 21
CPRS		Compressor pressure control setup Page 22
Delay		Compressor delay timers Page 24
Suction		Suction pressure alarm levels Page 25
Levels		Superheat and Liquid Alarm levels Page 25
Trip		Trip inputs and control Page 26
Compressor use		Compressor use Page 26
Load		Amps high alarm Page 26
Test		Force relays on/off Page 27
End		Return to suction pressure display

Condenser Fans

Cond		Condenser configuration Page 27
Fans		Fan control settings Page 28
Delay		Fan control delays Page 29
Fanp		Fan pressure Alarm Limits Page29
Loop		Fan inverter Speed Control settings Page 29
End		Return to condenser pressure display

CONTROL PARAMETER DEFINITIONS.

The following list of parameters may be accessed using the Sd9 display unit. Parameters are grouped under menu headings and may only be changed under pass-code control,(see page 19 for a guide to using the Sd9 to access and navigate the menus).

Press ◉ to sequence through the Setup selections

Press ⏫ or ⏬ to change the settings

Press ↵ to accept the settings

Configure the controller?

Before enabling any connected devices to run make sure the controller has this essential commissioning data entered.

MENU: UNIT (PP05 Pass code level)

(UnIt as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	C5L2	Controller input/output control configuration. Five compressor with two stages of capacity control and up to 5 condenser fan outputs.
2.	Std rCL	Control action required. Standard. Relay outputs used for direct control of compressor. Not supported on this unit.
3.	dLEU dOFF ALEU dISc oILP SAtP	Function/Configuration of input P3. Digital liquid level input. Switch SWP3 must be set to DI-11 Digital Auto/Off mode input. Switch SWP3 must be set to DI-11. Analogue Liquid level. Switch SWP3 must be set to 4-20mA. Discharge pressure. Switch SWP3 must be set to 4-20mA. Oil pressure. Switch SWP3 must be set to 4-20mA. Satellite compressor suction pressure. Switch SWP3 must be set to 4-20mA.
4.	AmnP hUuH dOFF dALr	Function/Configuration of input P4. Pack Current, Amps. Switch SWP4 must be set to Amps. Pack Kilo-Watt Hours input. Switch SWP4 must be set to DI-12. Pack Auto/Off mode input. Switch SWP4 must be set to DI-12. Pack/System alarm input. Switch SWP4 must be set to DI-12.
5.	Sn03	Compressor System number.
6.	A003	Controller address for RS485 communications with Consultant.

7.	 AGt SYSS Locl nonE	Comms protocol in use. Guardian Consultant protocol. Third Party protocol. Not supported. No communications.(Prevents PC/Fail message on SKd-9)
8.	 OiLA OiLt	Oil level action.(digital input terminal 6 on extension unit) Alarm only. Trip all compressors on the pack. Control will be stopped until trip condition has been reset by pressing the 'Enter' key on the SKd-9.

Compressor Control?

MENU: CPrS (PP05 Pass code level)

Suction pressure control settings. These determine what pressure the compressors are started and stopped at. It also has additional unit configuration it a satellite compressor is being used.

(CPrS as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	C 2.0	Suction Pressure control setpoint. (Bar gauge).
2.	db0.2	Suction Pressure control deadband. This is applied +/- the control setpoint. Using value of 2.0 for control setpoint and 0.2 for the deadband, then the controller will want to start compressors when the pressure is above 2.2 and stop compresssor when the pressure is below 1.8.
3.	 noSC SatC	Satellite compressor selection. No Satellite compressor to be used. Satellite compressor required. The compressor selected for satellite control is highest numbered un-used compressor for pack control. This means that a maximum of 3 compressors may only be used for pack control when SatC is selected on a C5L2 configured controller.
4.	 CPoS CnEg	Capacity control output polarity. Capacity control output is closed to increase capacity. Capacity control output is opened to increase capacity.
5.	 SoFF	State of capacity control relay during compressor start. Start with capacity control output open. Start with capacity control output closed.
6.	Un01	Number of compressors to run with reduced capacity control before stopping a compressor motor.
7.	Fb0.5	Fast band. Applied to the suction pressure. When the pressure is above/below the control setpoint by this amount then the stage delays will be shortened by a proportional amount.

8.	CAUS	Compressor Algorithm Up. Applied to stage up timer when suction pressure is above control setpoint plus the Fast band. The larger this number then the greater the stage up delay will be reduced, (a minimum of 6 seconds).
9.	CADS	Compressor Algorithm Down. Applied to stage down timer when suction pressure is below control setpoint minus the Fast band. The larger this number then the greater the stage down delay will be reduced, (a minimum of 6 seconds).
10	dtF0	Set to 1 if Discharge Temperatures C1-C4 are fitted, otherwise set to zero.

MENU: delays (PP05 Pass code level)

Controller delays. These determine when the compressors are started, stopped and how long it has to be off for when stopped. It also includes any other timers used by the controller.

(dELY as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	Sh10	Starts per Hour. This is the anti-recycle timer for the compressors. When set to 10 it will allow a compressor to start every 6 minutes. So, if a compressor starts and runs for 3 minutes and then stops, it must wait 3 minutes before being able to restart.
2.	SU1.5	Stage Up delay, (Adjustable in steps of 0.1 minutes). Time to elapse with the suction pressure above the control setpoint plus the deadband, before a compressor is started.
3.	Sd2.5	Stage Down delay, (Adjustable in steps of 0.1 minutes). Time to elapse with the suction pressure below the control setpoint minus the deadband, before.
4.	dL0.2	Delay for Capacity control steps(Adjustable in steps of 0.1 minutes). Time to elapse with the suction pressure outside the deadband before a capacity control output is switched.
5.	dA1.0	Delay After stop, (Adjustable in steps of 0.1 minutes). Time to elapse after compressor has stopped before it will be available to start.
6.	SP30	Start Period, (Adjustable in seconds). Time allowed to establish running input for compressor. If controller does not see the compressor running input with in this time period it turns the motor output off. If 3 successive compressor starts do not see the running input the compressor is set to tripped status and will not be available to run until reset by pressing 'Enter' on the Sd9 display.
7.	od25	Oil level Delay, (Adjustable in seconds). Time to elapse with oil level input present before alarm/trip status is activated.
8.	Ld30	Liquid level low Delay, (Adjustable in minutes). Time to elapse with liquid level low input present before alarm status is activated.
9	rd30	Rate of change delay to determine suction pressure trend. If pressure falling but still above setpoint then no stage down action If pressure rising but still below setpoint then no stage up action Set to zero to ignore above control

MENU: Suction Pressure Alarms (PP05 Pass code level)

Suction pressure alarm limits.

(SUCt as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	L 0.3	Suction pressure Low alarm, (bar). If the suction pressure falls below this limit all compressors are stopped until the pressure rises above the control setpoint again.
2.	HIS.0	Suction pressure High alarm, (bar). If the suction pressure rises above this limit a suction 'Hi' alarm is displayed on the Sd9 display.

MENU: Level (PP05 Pass code level)

Assorted parameters associated with the refrigerant.

(LEvL as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	noSt SESH	Suction superheat alarm selection. It uses the equivalent temperature of the refrigerant and the actual suction temperature. No Suction superheat trips. Trip on Suction superheat low.
2.	404A r22	Refrigerant type.
3.	A 05	Superheat low Alarm Limit. If the difference between the equivalent temperature and the suction temperature is less than this limit then an alarm is generated.
4.	t 01	Superheat low Trip Limit. If the difference between the equivalent temperature and the suction temperature is less than this limit then all the compressor are stopped and a trip is generated.
5.	LLA0	Analogue Liquid level Low Limit. If the measured liquid level is less than this limit, for the liquid level delay period, then an alarm is generated.

MENU: Pack Trip action (PP05 Pass code level)

(trIP as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	run FLt	Digital trip fail input level definition If compressor digital input is set to run then the compressor will trip if after a time if the signal is not present (ie running input signal). If compressor digital input is set to FLt then the compressor will trip if after a time the signal is present (trip signal)..
2.	CnoA CoFF	Select action in event of pack or all compressors tripped. No action. Send a 'AGT' protocol wild card off command onto the RS485 Highway.

MENU: Compressor Use (PP05 Pass code level)

(CUSE as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	1CnF 1CEn 1Cdi 1CSb	Select if compressor is to be used in pack control Compressor 1 not used for pack control. Compressor 1 enabled for pack control. Compressor 1 disabled. Will not be started. Compressor 1 is on Standby. Will only be started if other compressor trips. This menu is then repeated for each compressor.

MENU: Load (PP05 Pass code level)

(LoAd as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	HiSd	Pack current high alarm limit, (Amps). If measuring pack current then if it rises above this limit a high alarm will be generated.

Test control outputs?

MENU: Test relay outputs (PP05 Pass code level)

(tESt as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	 ioFF i on	Change relay 1 state. By pressing the 'Enter' key on the Sd9 the relay state can be changed. Relay 1 off. Relay 1 on. This menu is then repeated for each output, which is 1 to 7 on the main Rcc20 unit and A to g on the extension unit.
15.	iiii	Input status indication. Each segment can represent two inputs. A vertical on the left or right of the segment indicates that the corresponding input is on.
16.	A100	Test analogue output.(0 to 100%), this gives an output voltage of 0 to 10vdc.

Condenser Control?

Press ◉ to sequence through the Setup selections

Press ⌃ or ⌄ to change the settings

Press ↵ to accept the settings

MENU: Configure Condenser (PP05 Pass code level)

(Cond as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	 Lin not SPd	Condenser type Linear Fan stage up stage down (last on first off). Not supported. Speed control using analogue output to variable speed drive.
15.	Fn04	Number of Fan outputs to be used.
16.	 tPoS tnEG	Trip input polarity. Trips positive. Trip inputs are normally open. Trips negative. Trip inputs are normally closed.

MENU: Fans (PP05 Pass code level)

Discharge pressure control settings. These determine what pressure the condenser fans are started and stopped at.

(FANS as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	F12.0	Discharge Pressure control setpoint. (Bar gauge).
2.	db0.2	Discharge Pressure control deadband. This is applied +/- the control setpoint. Using value of 12.0 for control setpoint and 0.2 for the deadband, then the controller will want to start Fans when the pressure is above 12.2 and stop Fans when the pressure is below 11.8.
7.	FB0.5	Fast band. Applied to the discharge pressure. When the pressure is above/below the control setpoint by this amount then the stage delay will be shortened by a proportional amount.
8.	FAUS	Fans Algorithm Up. Applied to stage delay timer when discharge pressure is above control setpoint plus the Fast band. The larger this number then the greater the stage delay will be reduced, (a minimum of 6 seconds).
9.	FADS	Fans Algorithm Down. Applied to stage delay timer when discharge pressure is below control setpoint minus the Fast band. The larger this number then the greater the stage delay will be reduced, (a minimum of 6 seconds).

MENU: delays (PP05 Pass code level)

Controller delays. These determine when the fans are started or stopped.

(dELY as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	Fdi.S	Stage delay, (Adjustable in steps of 0.1 minutes). Time to elapse with the discharge pressure outside the control dead band before a fan is started or stopped.

MENU: Discharge Pressure Alarms (PP05 Pass code level)

Discharge pressure alarm limits.

(FAnP as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	HI5.0	Discharge pressure High alarm, (bar). If the Discharge pressure rises above this limit a discharge 'Hi' alarm is displayed on the Sd9.
2.	tr18.0	Discharge pressure Trip alarm, (bar). If the discharge pressure rises above this limit a discharge trip is activated and all compressors are stopped. This requires a manual reset via the Sd9.

MENU: Fan Speed control loop (PP05 Pass code level)

Control loop settings for variable speed output.

(LooP as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	P 10.5	Loop Proportional gain. Applied to the error of the discharge pressure from the control setpoint. Large value makes greater changes in speed but can also make control un-stable.
2.	I 0.5	Loop Integral gain. Applied to the error of the discharge pressure from the control setpoint over time, ie the longer the pressure is not at the setpoint the more effect this term has on the speed output. Making this value too large can make the speed response very slow.
3.	d 0.0	Loop Differential gain. Applied to the rate of change error of the discharge pressure from the control setpoint. ie the faster the pressure is moving towards or away from the setpoint the more effect this term has on the speed output. Making this value too large can make the speed response very erratic.
4.	SE30	Start Speed, (0 to 99%). Initial value of variable speed output. Used to overcome motor inertia on start-up.
5.	SP25	Stop Speed,(0 to 99%). Minimum speed that fan may be run at.

Pressure transducer scaling?

For the correct compressor control is it important that the connected transducers, P1 to P4 on the main unit, are scaled correctly. The scaling data is normally found on the body of the transducer, (Pressures), or from the manufacturers data sheet. The controller requires what 4mA represents, eg. -1 bar, and what 20mA, eg. 24bar.

MENU: Scaling (PP11 Pass code level)

(SCAL as displayed on SKd9).
(P1 P2 P3 P4 are sub menus of SCAL and refer to the 4-20mA inputs)

Menu item	Sd9 Display	Menu item description
1.	L-1.0	Input 4mA range.(For pressures this must be in bar gauge.) Value representing 4mA is normally found on transducer body or manufacturers data sheet.
2.	H 24	Input 20mA range. (For pressures this must be in bar gauge.) Value representing 20mA is normally found on transducer body or manufacturers data sheet. These two menu items are repeated for each of the sub menus. If both values are set to zero then the transducer input is ignored.

MENU: Clear Run Hours (PP11 Pass code level)

(CLrH as displayed on SKd9).

By pressing ‘Enter’ on this menu heading the compressor run hour counters will be reset to zero. You will be asked to confirm this action with ‘SurE ‘ being displayed. Pressing ‘Enter’ confirms the request, pressing ‘Next’ abandons the request.

COMMUNICATIONS

Communication facilities are available for interrogation of temperatures, status and modification / display of setpoints, limits and timeclock settings. All communication is via a multi-drop RS485 link which connects all GUARDIAN controller units in series.

Setup / commissioning Parameters

PP05 Normal Menu Compressor Settings

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Unit	Model for RCC-20		***C5L2***	C5L2	C5L2	C5L2
	Not used this model		***Std***	Std.	Std.	r485
	A3 settings			dLEv	dLEv	oilP
	A4 settings			AnnP	AnnP	dAlr
	System number		***Sn***	Sn01	Sn01	S255
	Monitor Address		***A***	A 01	A 01	A255
	Monitor Comms Protocol			Agt	Agt	nonE
	Oil Level digital input action			OilA	OilA	Oilt
CPrS	Pack suction control setpoint	bar	***c***	c 0.0	c -0.6	c 5.0
	Control deadband	bar	***db***	db0.1	db0.1	db1.0
	Satellite compressor selection			noSC	noSC	SAtC
	Setpoint if 'SatC' selected	bar	***c***	c 0.0	c -0.6	c 5.0
	Capacity control valve polarity			Cneg	Cneg	CPoS
	Capacity control valve polarity			Cneg	Cneg	CPoS
	State of capacity control output for compressor start			SoFF	Soff	Son
	Stage up control algorithm		***CAu***	CAu0	CAu0	CAu9
	Number of compressors to run un-loaded.(model dependant)		***un***	Un01	Un01	Un04
	Fast band		***Fb***	Fb0.0	Fb0.0	Fb2.0
	Stage up control algorithm		***CAu***	CAu0	CAu0	CAu9
	Stage down control algorithm		***CAd***	CAd0	CAd0	CAd9
	Discharge temperatures fitted C1-C4		***dtF***	dtF0	dtF0	dtF1

dELY						
	Starts per hour		***SH***	SH12	SH02	SH25
	Stage up delay	mins	***Su***	Su0.2	Su0.2	Su9.9
	Stage down delay	mins	***Sd***	Sd0.2	Sd0.2	Sd9.9
	Capacity control delay	mins	***dL***	dL0.2	dL0.0	dL5.0
	After Stop delay	mins	***dA***	dA1.0	dA0.1	dA9.9
	Start Period	secs	***SP***	SP15	SP15	SP60
	Oil Level Alarm/Trip delay	mins	***od***	od30	od00	od60
	Liquid level alarm delay	Mins	***Ld***	Ld30	Ld00	Ld60
	Rate of change delay on suction press.	secs	***rd***	Rd30	Rd00	Rd99

SuCt						
	Suction pressure low alarm limit	bar	***L***	L-1.0	L-1.0	L 5.0
	Suction pressure high alarm limit	bar	***H***	L-1.0	L-1.0	L 5.0
LEuL	Suction temperature being used			noSt	noSt	StSH
	Refrigerant type			404A	404A	R22
	Superheat low alarm level	°C	***A***	A 05	A-10	A 60
	Superheat low trip level	°C	***t***	t 00	t-10	t 60
	Low liquid alarm level	%	***LL***	LL50	LL00	LL99

trIP						
	compressor inputs run or trip Fault			run	run	Flt
	GLOBAL RS485 command action			CnoA	CoFF	CnoA

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
CuSE	Compressor 1 Use: Not Fitted(nf) Enabled(En),disabled(di) Standby (Sb)		***1C***	En	nF	di
	Compressor 2 Use		***2C***	En	nF	di
	Compressor 3 Use		***3C***	En	nF	di
	Compressor 4 Use		***4C***	En	nF	di
	Compressor 5 Use		***5C***	En	nF	di

LOAd						
	High total current AMPS alarm level	Amp	***H***	H100	H100	H250

PP05 Normal Menu Condenser Settings

Cond	Fan control selection			Lin	Lin	Spd
	Number of fans		***Fn***	Fn00	Fn00	Fn05
	Trip input polarity		***t***	tPoS	tnEg	tPoS
FAnS	Fan control setpoint	bar	***F***	F0.5	F 0.0	F23.0
	Control deadband	bar	***db***	db0.1	db0.1	db5.0
	Fast response deadband	bar	***Fb***	Fb0.1	Fb0.1	Fb5.0
	Fast response Algorithm up	bar	***FAu***	FAu0	FAu0	FAu9
	Fast response Algorithm down	bar	***FAd***	FAd0	FAd0	Fad9
dELY	Fan stage delay	mins	***Fd***	Fd0.1	Fd0.1	Fd3.0
FAnP	Discharge pressure Hi-alarm limit	bar	***H***	H15.0	0.0	23.0
	Discharge pressure Hi-trip limit	bar	***t***	t22.0	0.0	23.0

only if ‘SPd’ selected for ‘Cond’

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
LooP	Fan Speed Loop settings selection					
	Loop proportional term		***P***	P 0.0	P 0.0	P23.0
	Loop integral term		***I***	i 0.0	i 0.0	i23.0
	Loop derivative term		***d***	d 0.0	d 0.0	d23.0
	Start speed %	%	***St***	St00	St00	St99
	Stop speed %	%	***SP***	SP01	SP00	SP99

PP11 Menu - Settings Level 2

Compressors

rtc	Real time hours	Hrs	***rh***	rh00	rh00	rh23
	Real time minutes	mins	***rt***	rt00	rt00	rt59

SCAL						
	Pressure Transducer 1 4ma bar gauge	bar	***L***	L-01	-13	242
	Pressure Transducer 1 20ma bar gauge	bar	***H***	H24	-13	242
	Pressure Transducer 2 4ma bar gauge	bar	***L***	L-01	-13	242
	Pressure Transducer 2 20ma bar gauge	bar	***H***	H24	-13	242
	Pressure Transducer 3 4ma bar gauge	bar	***L***	L-01	-13	242
	Pressure Transducer 3 20ma bar gauge	bar	***H***	H24	-13	242
	Current input 0 current	A	***L***	L00	-13	242
	CT max amps rating	A	***H***	H200	-13	242

CLrH	Clear Compressor run hours to zero		***SurE***	if yes	enter	if not press next

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Factory Setup for CSA Riyadh

PP05 Normal Menu Compressor Settings

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
UnIt	Model for RCC-20		***C5L2***	C5L2	C5L2	C5L2
	Not used this model		***Std***	Std.	Std.	r485
	A3 settings		dLEv	dLEv	dLEv	oilP
	A4 settings		dAlr	AnnP	AnnP	dAlr
	System number		***Sn01***	Sn01	Sn01	S255
	Monitor Address		***A01***	A 01	A 01	A255
	Monitor Comms Protocol		nonE	Agt	Agt	nonE
	Oil Level digital input action		OilA	OilA	OilA	Oilt
CPrS	Pack suction control setpoint	bar	***C 0.6***	c 0.0	c-0.6	c 5.0
	Control deadband	bar	***Db0.1***	db0.1	db0.1	db1.0
	Satellite compressor selection		noSC	noSC	noSC	SAtC
	Capacity control valve polarity		CPoS	Cneg	Cneg	CPoS
	State of capacity control output for compressor start		SoFF	SoFF	SoFF	Son
	Number of compressors with loading		***ncL4***	ncL0	ncL0	NcL5
	Number of compressors to simultaneously run unloaded		Un01	Un01	Un01	Un05
	Fast band		***Fb0.5***	Fb0.0	Fb0.0	Fb2.0
	Stage up control algorithm		***Cau0***	CAu0	CAu0	CAu9
	Stage down control algorithm		***Cad0***	CAd0	CAd0	CAd9
	Discharge temperatures fitted C1-C4		***DtF0***	dtF0	dtF0	dtF1

dELY						
	Starts per hour		***SH06***	SH12	SH02	SH25
	Stage up delay	mins	***Su0.5***	Su0.2	Su0.2	Su9.9
	Stage down delay	mins	***Sd0.5***	Sd0.2	Sd0.2	Sd9.9
	Capacity control delay	mins	***DL0.2***	dL0.2	dL0.0	dL5.0
	After Stop delay	mins	***DA1.0***	dA1.0	dA0.1	dA9.9
	Start Period	secs	***SP30***	SP15	SP15	SP60
	Oil Level Alarm/Trip delay	mins	***Od00***	od30	od00	od60
	Liquid level alarm delay	Mins	***Ld00***	Ld30	Ld00	Ld60
	Rate of change delay on suction press.	secs	***Rd00***	Rd30	Rd00	Rd99

SuCt						
	Suction pressure low alarm limit	bar	***L 0.1***	L-1.0	L-1.0	L 5.0
	Suction pressure high alarm limit	bar	***H 1.4***	L-1.0	L-1.0	L 5.0

LEuL						
	Suction temperature being used		noSt	noSt	noSt	StSH
	Refrigerant type		r22	404A	404A	R22
	Superheat low alarm level	°C	***A 05***	A 05	A-10	A 60
	Superheat low trip level	°C	***T 00***	t 00	t-10	t 60
	Low liquid alarm level	%	***LL 50***	LL50	LL00	LL99

trIP						
	compressor inputs run or trip Fault		run	run	run	Flt

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
CuSE	Compressor 1 Use: Not Fitted(nf) Enabled(En),disabled(di) Standby (Sb)		***1CEn***	En	nF	di
	Compressor 2 Use		***2CEn***	En	nF	di
	Compressor 3 Use		***3CEn***	En	nF	di
	Compressor 4 Use		***4CSb***	En	nF	di
	Compressor 5 Use		***5CnF***	En	nF	di

LOAd						
	High total current AMPS alarm level	Amp	***H100***	H100	H100	H250

PP05 Normal Menu Condenser Settings

CONd	Fan control selection		***Lin***	Lin	Lin	Spd
	Number of fans		***Fn01***	Fn01	Fn00	Fn05
	Trip input polarity		tPoS	tPoS	tnEg	tPoS
FAnS	Fan control setpoint	bar	F0.5	F0.5	F 0.0	F23.0
	Control deadband	bar	db0.1	db0.1	db0.1	db5.0
	Fast response deadband	bar	Fb0.1	Fb0.1	Fb0.1	Fb5.0
	Fast response Algorithm up	bar	FAu0	FAu0	FAu0	FAu9
	Fast response Algorithm down	bar	FAd0	FAd0	FAd0	Fad9
dELY	Fan stage delay	mins	Fd0.0	Fd0.0	Fd0.1	Fd3.0
FAnP	Discharge pressure Hi-alarm limit	bar	***H 0.0***	H15.0	0.0	23.0
	Discharge pressure Hi-trip limit	bar	***t 0.0***	t22.0	0.0	23.0

only if ‘SPd’ selected for ‘Cond’

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
LooP	Fan Speed Loop settings selection					
	Loop proportional term		***P***	P 0.0	P 0.0	P23.0
	Loop integral term		***I***	i 0.0	i 0.0	i23.0
	Loop derivative term		***d***	d 0.0	d 0.0	d23.0
	Start speed %	%	***St***	St00	St00	St99
	Stop speed %	%	***SP***	SP01	SP00	SP99

PP11 Menu - Settings Level 2

Compressors

rtc

Real time hours	Hrs	***rh***	rh00	rh00	rh23
Real time minutes	mins	***rt***	rt00	rt00	rt59

SCAL

Pressure Transducer 1 4ma bar gauge	bar	***L-01***	L-01	-13	242
Pressure Transducer 1 20ma bar gauge	bar	***H 08***	H24	-13	242
Pressure Transducer 2 4ma bar gauge	bar	***L 00***	L-01	-13	242
Pressure Transducer 2 20ma bar gauge	bar	***H 00***	H24	-13	242
Pressure Transducer 3 4ma bar gauge	bar	***L 00***	L-01	-13	242
Pressure Transducer 3 20ma bar gauge	bar	***H 00***	H24	-13	242
Current input 0 current	A	***L 00***	L00	-13	242
CT max amps rating	A	***H 00***	H200	-13	242

CLrH

Clear Compressor run hours to zero		***SurE***	if yes	enter	if not press next