Guardian RCC20+16X

Controller for Reciprocating Compressors.

Operation and Set-up Manual

GUARDIAN
Tel. +44 (0) 1270 760599
Fax. +44 (0) 1270 766804
Email: sales@Guardian-controls.com
www.Guardian-controls.com

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General

Guardian Guardian Rcc20+16x Controller is a self-contained unit requiring a single electrical supply to control and monitor reciprocating compressor. 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 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.

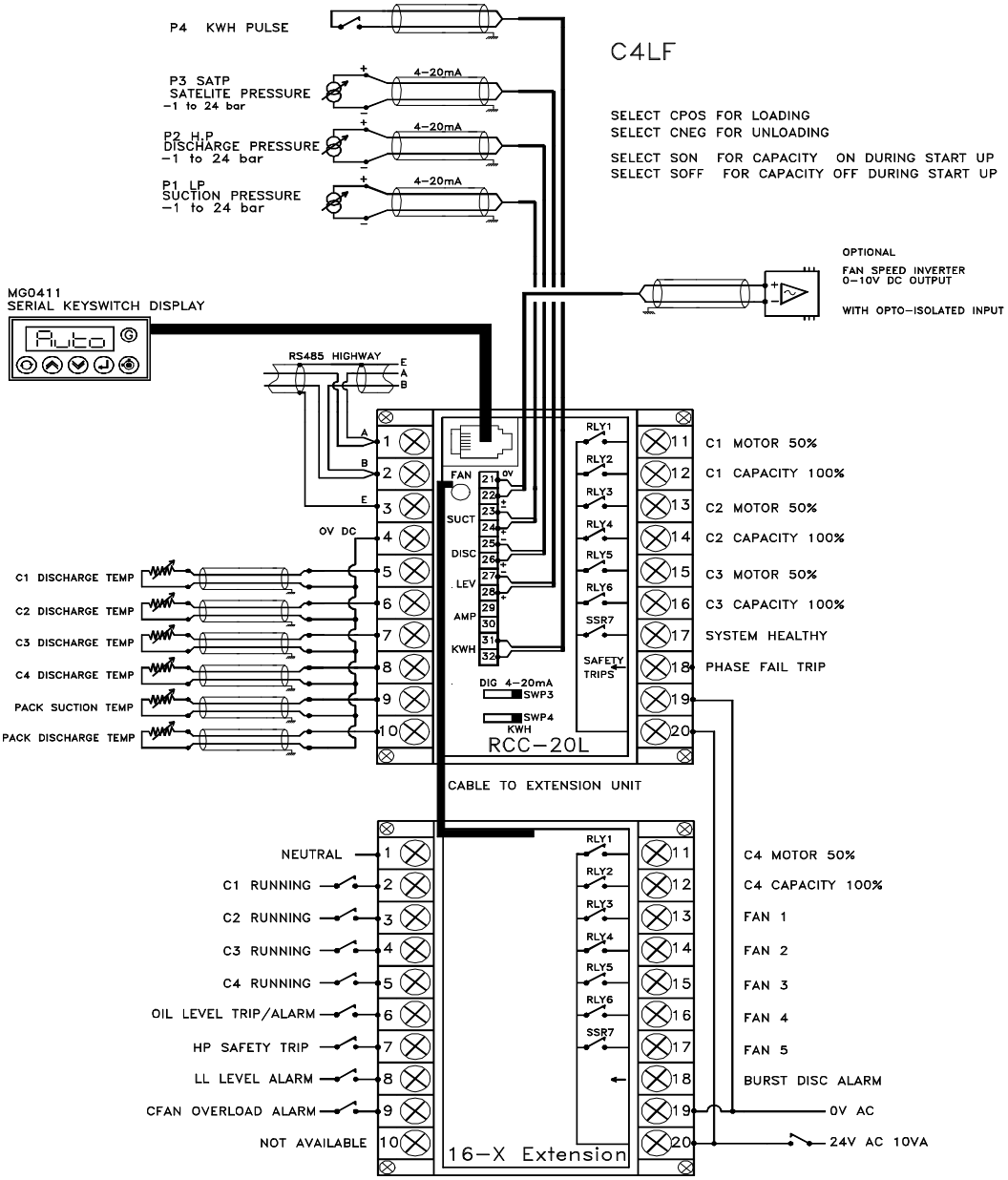
Termination and Layout

RCC-20X 'C4LF' Input/Output Signals

C4LF 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**		
C1 Discharge	4/5	Compressor 1 discharge temperature	Degrees C. 0 to 150
C2 Discharge	4/6	Compressor 2 discharge temperature	Degrees C. 0 to 150
C3 Discharge	4/7	Compressor 3 discharge temperature	Degrees C. 0 to 150
C4 Discharge	4/8	Compressor 4 discharge temperature	Degrees C. 0 to 150
Pack Suction	4/9	Suction temperature	Degrees C. -40 to 40
Pack Discharge	4/10	Dicharge temperature	Degrees C. 0 to 150
Mains Input		**230vac / 24vac**	
Phase fail	**18**	**230vac / 24vac**	
Relay Outputs 230/24v AC 3 amp. Maximum Accumulative Current 10 amp.			
RLY1		Compressor 1 Motor	
RLY2		Compressor 1 Capacity	
RLY3		Compressor 2 Motor	
RLY4		Compressor 2 Capacity	
RLY5		Compressor 3 Motor	
RLY6		Compressor 3 Capacity	
SSR7		System Healthy	

C4LF Extention Unit			
Digital Inputs	**Terminal**		Model dependant (Rcc20/Rcc20L)
C1 Running	2	Compressor 1 running	**230vac / 24vac**
C2 Running	3	Compressor 2 running	**230vac / 24vac**
C3 Running	4	Compressor 3 running	**230vac / 24vac**
C4 Running	5	Compressor 4 running	**230vac / 24vac**
Oil Level	6	Pack oil level alarm/trip	
HP safety trip	7	High pressure safety trip	
LL level alarm	8	Liquid level low alarm	
CFAN OVERLOAD	9	Condenser fan overload alarm	
Burst disc alarm	**18**		**230vac / 24vac**
Relay Outputs 230/24v AC 3 amp. Maximum Accumulative Current 10 amp.			
RLY1		Compressor 4 Motor	
RLY2		Compressor 4 Capacity	
RLY3		Condenser Fan 1	
RLY4		Condenser Fan 2	
RLY5		Condenser Fan 3	
RLY6		Condenser Fan 4	
SSR7		Condenser Fan 5	

RCC-20X C4LF Termination Wiring.



Controller function.

This description is for the C4LF, which controls compressors and condenser fans. The compressor control for the C3L2 is identical.

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 31).
2. Stage up delay has elapsed. (See Page 32).
3. Compressor not at tripped status. (See Page 17)
4. Starts per hour timer, (anti-recycle timer), has elapsed.(See Page 32)
5. Delay after stop has elapsed. (See Page 32).
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 31).
2. Capacity loading delay has elapsed. (See page 32).
3. Next capacity loading output is used according to polarity selected.(See Page 31)
4. Capacity loading delay is reset.

Compressor decrease capacity.

1. Suction pressure is below the control set-point minus dead band. (See Page 31).
2. Capacity loading delay has elapsed. (See page 32).
3. Next capacity output is used according to polarity selected.(See Page 31)
4. Capacity loading delay is reset.

Compressor Stop.

1. Suction pressure is below the control set-point minus dead band. (See Page 31).
2. Maximum number of unloaded compressors has been reached(See Page 31)
3. Stage down delay has elapsed.(See Page 32)
4. Compressor with the longest run hours and shortest re-cycle delay is stopped.
5. Stage down delay is reset.

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 37).
2. Stage delay has elapsed. (See Page 37).
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 31).
2. Stage delay has elapsed. (See Page 37).
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.

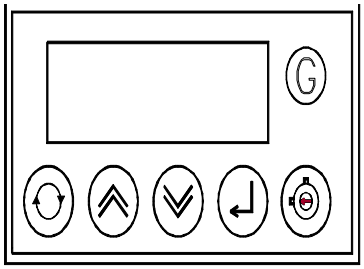
Prior to switching on the GUARDIAN controller check that the hardware unit is the correct type for the incoming mains voltage

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** may be used to toggle display case control status from OFF to FANS only and back to AUTO)

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

@:@	SEt=	?	PP00	/:/	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

@:@	Unit	?				
@:@	A001	/:/	A180	?	A180	
@	d005	?	d005			
@:@	End=	?	=-26			

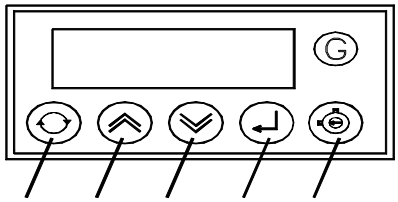
RS485 Communications

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 39

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=11	Compressor motors running status
triP	==11	Motor trip status
LEul	==35	Liquid level % if fitted
=St=	=-36	Suction temperature if ‘STSH’
=Et=	=-38	Equivalent Suction temperature if ‘STSH’
=SH=	===4	Suction superheat temperature if ‘STSH’
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

Suct =2.3	Suction pressure (-1 to 24barG)

is during AUTO or restart sometimes replaced by

8888	During restart
C4LF	Unit model configuration selected
u1.1A	(Software version)
-OFF	If unit selected OFF
HAnd	If unit selected hand control
=PC= FAiL	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

Suct =oc= FAiL	Suction pressure open circuit
diSc =oc= FAiL	Discharge pressure open circuit
Suct 10.5 triP	Suction pressure high trip
diSc 18.6 triP	Discharge pressure high trip

=SH= -0.5 triP	Superheat low trip

Digital Trips

Individual compressor trips:-

C-1 SFtY	Compressor one tripped. This is a result of the run signal not being present for 3 successive compressor starts. 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.

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.

Suct -0.8b =Lo	Suction Pressure Low alarm
Suct 10.8b Hi=	Suction Pressure High alarm
LoAd =120 Hi==	Motor Load High alarm
LeuL ==15 ==Lo	Liquid level Low alarm
=SH= ===1 ==Lo	Superheat Low alarm

Digital Alarms

Digital alarm messages include:-

Lo-A Leu=	Digital input Low level liquid alarm
bdis Alr=	Burst disc alarm.
PhAs Alr=	Phase fail alarm(Stops all compressors).
Fan= Alr=	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.

=PC= FAIL	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	AUTO pack control mode with compressor control on suction pressure
oFF=	-OFF = pack control stopped (standby operation)
hAnd	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.

@:@ HAnd ?
@:@ CAP= ==50 /:/ ==75 ?

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:-

diSc	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)
triP	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.

DiSc 10.8b ==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 triP	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 AUTO fan control mode with compressor control on discharge pressure
OFF=	Fan control stopped
hAnd	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.

@:@ HAnd ?
@:@ CAP= ==50 / : / ==75 ?

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

diFF trip ? =2.4b

RESET

Change suction control setpoint and differential

@:@ SEt= ? PP00 /:/ PP05 ?

@:@ cprs ?

@:@ c2.0b /:/ c2.5b ? c2.5b

@ cd01 /:/ cd02 ? cd02

@:@ End= ? =2.6b

Check Unit Model

@:@ SEt= ? PP00 /:/ PP05 ?

@:@ Unit ? 3PAC This unit model is '3PAC'

@:@ End= ? =2.6b

Select Stub, Case No and Address

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

@:@ SEt= ? PP00 /:/ PP05 ?

@:@ unit ?

@:@ Sn01 /:/ Sn60 ? Sn60

@ Cn01 ? Cn01

@ A001 /:/ A180 ? A180

@:@ End= ? =2.6b

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.

Compressors	**Condenser Fans**	**Settings Level 2**	
CSEt	FSEt	CSEt	Press ?
PP00	PP00	PP00	Set passcode PP05, PP09 or PP11 by using the < and / pushbuttons
PP05 ?	PP05 ?	PP11	Press ?

PP11 menu page 30

PP05 Condenser menu page 24

PP05 Compressor menu page 24

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	Unit model setup RCC-20
CPRS	CPrS	Compressor pressure control setup
Delay	dELY	Compressor delay timers
Suction	Suct	Suction pressure alarm levels
Levels	LEuL	Superheat and Liquid Alarm levels
Trip	triP	Trip inputs and control
Size	CusE	Compressor use
Load	LOAd	Amps high alarm
Test	tESt	Force relays on/off
End	End=	Return to suction pressure display

Condenser Fans

Cond	Cond	Condenser configuration
Fans	FAnS	Fan control settings
Delay	dELY	Fan control delays
Fanp	FAnP	Fan pressure Alarm Limits
Loop	LooP	Fan inverter Speed Control settings

End	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 **Error! Bookmark not defined.** 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.	C4Lf	Controller input/output control configuration. Four compressor with one stage 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.	AnnP 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 Sys5 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.

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 repersents, 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 2 4	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.

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.

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.

(CP r S 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 C4LF 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.	CAu5	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.	CAd5	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).

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.

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.	H15.0	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.

(LEuL as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	noSt StsH	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.	LL40	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)

(t r i p as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	n t c 3 n t c 1	Select type of trip input. Not supported for this configuration. Must be set to this for correct operation.
2.	C n o A C o f f	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)

(C u s E as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	1 C n F 1 C E n 1 C d i	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. This menu is then repeated for each compressor.

MENU: Load (PP05 Pass code level)

(L o A d as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	H 1 5 0	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.	1oFF 1 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.	1111	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 rot 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.	FAu5	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.	FAd5	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.	Fd1.5	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.	H15.0	Discharge pressure High alarm, (bar). If the Discharge pressure rises above this limit a discharge 'Hi' alarm is displayed on the Sd9.
2.	t18.0	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.	St30	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.

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			C4LF	C3L2	C4LF
	Control selection for CMC12 units			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

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
Suct	Suction pressure low alarm limit	bar	***L***	L-1.0	L-1.0	L 5.0
	Suction pressure high alarm limit	bar	***H***	15.0	0.0	20.0
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	Number of trips inputs/compressor			ntc1	ntc3	OILr
	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)		***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
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

r t c =	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

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

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