GUARDIAN

RCC4PAC

Reciprocating compressor controller
Operation and Set-up Manual

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General

The Guardian Guardian RCC4PAC Reciprocating Compressor Controller provides suction pressure set point control and alarm monitoring for up to 4 compressors.

The controller communicates with the GUARDIAN Autograph Terminal and the Woodley System 5 which provide remote central alarm monitoring, data recording and graphs.

Local pressure displays and modification of all alarm and control settings is available when the unit is connected to the optional GUARDIAN SKD-9 Key switch display.

Termination and Layout

GENERAL SPECIFICATION

Power 110 / 230 Vac 50 Hz 10VA
Operation 0 to 55ºC
Approx. dimensions Width 70 x length 100 x height off rail 110mm.

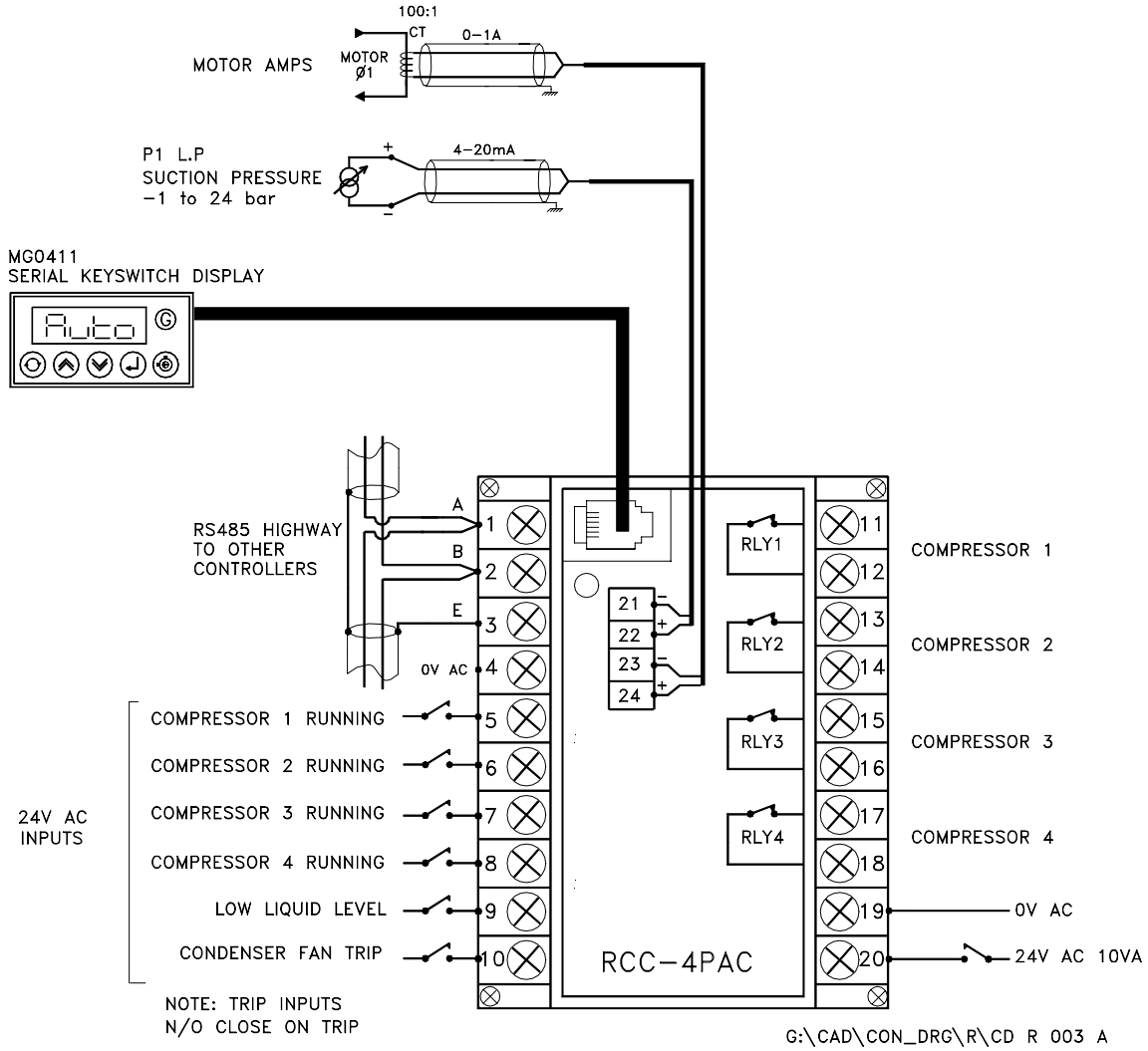
The RCC4pac controller is housed in a DIN rail mounting enclosure with 20 screw clamp connectors.

RCC4PAC Input/Output Signals

4PAC		
Analogue Inputs		
Motor Amps	Motor 01	0-1 amp
P1	Suction Pressure	4 to 20ma 1 to 24 bar g
Digital Inputs 230 /24 Vac		
Input 1	Compressor 1 Run Input	
Input 2	Compressor 2 Run Input	
Input 3	Compressor 3 Run Input	
Input 4	Compressor 4 Run Input	
Input 5	Liquid Low Level Alarm Input	
Input 6	Condenser Fan Fault Input	
R1 to R4	Compressor 1 to 4	

RCC4PAC Termination Wiring

Compressor Control



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 for a guide to using the Sd9 to access and navigate the menus).

Commissioning the controller?

MENU: UNIT

(Unit as displayed on Sd9).

Menu item	Sd9 Display	Menu item description
1.	4PAC	Controller input/output configuration
2.	Sn01	System number, used for RS485 communications.
3.	A003	Address, used for RS485 communications.
4.	 Agt Sys5 Sys6	Communications protocols. Guardian Agt/Consultant. Woodley Mk5 responding with pack and compressor data. Woodley Mk5 responding with pack data.(Takes less address space)

Setting pressure control?

MENU: Compressors.

(CP r s as displayed on Sd9)

Pass-code level PP05.

This set of parameters configures the way the controller responds to changes in pressure.

Menu ref.	Sd9 Display	Menu item descriptions
1.	c 2.9	Control pressure setpoint in bar. This is the pressure the controller will maintain.
2.	db0.2	Control deadband in bar. Defines a zone where no control action is taken. This is used +/- about the setpoint. Above setpoint + deadband compressors will be turned on. Below setpoint – deadband compressors will be turned off. These control actions are also influenced by timers explained in menu **dely**.
3.	Fb0.6	Fast response band in bar. Defines a zone +/- about the setpoint where the stage delay timers are shortened to improve control response.
4.	CAu1	Control Algorithm up. When the pressure is above the setpoint + fast response band, this value is used to reduce the time required to start a compressor(see Su. The larger this value is the shorter the time required.
5.	Cad5	Control Algorithm down. When the pressure is below the setpoint – fast response band, this value is used to reduce the time required to stop a compressor. The lager this value is the shorter the time required.

Setting compressor response times?

MENU: DELAYS.

(dELY As displayed on Sd9)
Pass-code level PP05
This set of parameters configures the timers associated with starting and stopping the compressors.

Menu item	Sd9 Display	Menu item description
1.	SH10	Starts per Hour. e.g. 4 = 1 start every 15mins commencing from start output, if the compressor stops before this 15min period then it will not restart until the 15mins have elapsed.
2.	su0.4	Stage-up delay in tenths of minutes. (0.1 = 6 seconds). This timer starts when the suction pressure rises above the setpoint + deadband(see Cprs menu.). When it has timed out a compressor is started. This timer is affected by the fast response band and up algorithm value.
3.	Sd0.3	Stage-down delay in tenths of minutes. (0.1 = 6 seconds). This timer starts when the suction pressure falls below the setpoint - deadband(see Cprs menu.). When it has timed out a compressor is stopped. This timer is affected by the fast response band and the down algorithm value.
4.	SP20	Start Period delay in seconds. The time allowed for the compressor run signal to be made and before testing for a fault condition.

Setting Suction pressure alarms?

MENU: SUCTION.
(SuCt As displayed on Sd9)
Pass-code level PP05

Menu item	Sd9 Display	Menu item description
1.	L-0.1	Low alarm in bar. When the suction pressure drops below this limit all compressors are stopped. This alarm is auto resetting.
2.	H7.4	High alarm in bar. This is and indication only alarm.

Setting Fault input polarity?

MENU: TRIP.
(trip As displayed on Sd9)
Pass-code level PP05

Menu item	Sd9 Display	Menu item description
1.	CnoA Coff	Case action when pack is tripped. No action. Cases go to off mode when all compressors are tripped. This is achieved via the RS485 comms.
2.	tPos tneg	Input polarity. Applied to all inputs. Fault Inputs are normally open. Fault Inputs are normally closed.

Adding/removing compressors?

MENU: COMPRESSSOR USE.
(CusE As displayed on Sd9)
Pass-code level PP05

Menu item	Sd9 Display	Menu item description
1.	1CnF 1CEn 1Cdi	Compressor Use. Compressor not fitted. Compressor enabled. Compressor disabled. Prevents alarms and control actions.
2.	2CEn	As item 1
3.	3CEn	As item 1
4.	4CEn	As item 1

Setting Load alarms?

MENU: LOAD.

(LoAd As displayed on Sd9)
Pass-code level PP05

Menu item	Sd9 Display	Menu item description
1.	H 86	High alarm in % load. Indication only.
2.	L 10	Low alarm in % load. Must be set to –1 if current is not being measured.

Checking compressor start?

MENU: TEST.

(tEst As displayed on Sd9)
Pass-code level PP05

Menu item	Sd9 Display	Menu item description
1.	1oFF 1 on	Force compressor relay output. This state is changed by pressing the 'Enter' key on the Skd9. Compressor off. Compressor on.
2.	2oFF	As item 1
3.	3oFF	As item 1
4.	4oFF	As item 1
5.	- - - -	Input States. A vertical line indicates that the input is on. Inputs are displayed from left to right, inputs 1 to 6.

Setting the time?

MENU: REAL TIME CLOCK
(r t C As displayed on Sd9)
Pass-code level PP11

Menu item	Sd9 Display	Menu item description
1.	r h 1 1	Hours now.
2.	r t 3 0	Minutes now.

Setting pressure transducer scaling?

MENU: SCALING.
(sCAL As displayed on Sd9)
Pass-code level PP11

Menu item	Sd9 Display	Menu item description
1.	L - 0 1	Scaling low limit in bar gauge. Pressure represented by 4mA. (This figure is usually printed on the transducer body).
2.	H 2 4	Scaling high limit in bar gauge. Pressure represented by 20mA. (This figure is usually printed on the transducer body).

Reset compressor run hours?

MENU: CLEAR RUN HOURS.
(C l r H As displayed on Sd9)
Pass-code level PP11

Menu item	Sd9 Display	Menu item description
1.	S u r E	Confirm reset of run hours by pressing ‘Enter’.

Getting Started

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.

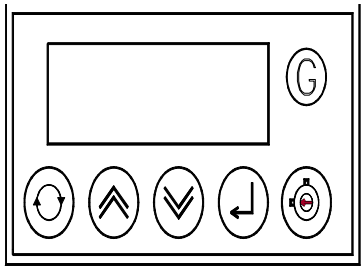
Prior to switching on the GUARDIAN controller check that the hardware unit is the correct type for the incoming mains voltage

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'.**

suct 1.7b

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

suct =oc= FAIL
=

means the display alternately flashes between the value identifier 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'.**

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 20

SD9 DISPLAY INDICATIONS

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 pressures are followed by ‘b’ to denote 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 run output on
deLy	=1==	Compressor anti-short cycle delay timing
Crun	1===	Compressor run signal received
triP	11==	Motor trip status
CSEt		Request compressor parameter change

Default Displays

The default suction pressure display

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

is during AUTO or restart sometimes replaced by

8888	During restart
4PAC	Unit model configuration selected
u1.0A	(Software version)
-OFF	If unit selected OFF
HAnd	If unit selected hand control
=PC= FAiL	if RS485 comms watchdog fail

TRIPS AND ALARMS

COMPRESSOR SAFETY TRIPS

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 (6PAC or 8PAC)
Suct 10.5 triP	Suction pressure high trip

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 -0.8 ==Lo	Suction Pressure Low alarm
Suct 10.8 Hi==	Suction Pressure High alarm
LoAd =120 Hi==	Motor Load High alarm - also unloads pack

Digital Alarms

Digital alarm messages include:-

Lo-A Leu=	Digital input Low level liquid alarm 30 min time delay
Cond trip	Digital input Condenser Fan trip.
C-1 triP	Compressor 1 Tripped. The run input was not present for 3 successive starts.

PC-FAIL ALARM

If the RCC12 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 floodback.

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

A GLOBAL RS485 **TIME** synchronisation command is sent to all case controllers twice per day if **Agt/SYS5/Locl/nonE** protocol selected is **'LocL'**

USEFUL BUTTON SEQUENCES

The following button sequences should prove useful during normal service operation

USEFUL BUTTON SEQUENCES
The following button sequences should prove useful during normal service operation

Reset ALARM or TRIP

C-1 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 ? 4PAC This unit model is '4PAC'
@:@ 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

COMMUNICATIONS

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

Communication commands and replies are checked for parity and block length and automatically re-transmit if errors are detected.

GUARDIAN controllers are inactive until they are addressed.

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Setup / commissioning Parameters

PP05 Normal Menu Compressor Settings

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Unit	Model for			4PAC	4PAC	4PAC
	System number		***Sn***	Sn01	Sn01	S255
	Monitor Address		***A***	A 01	A 01	A255
	Monitor Comms Protocol			Agt	Agt	nonE
CPrS	Pack suction control setpoint	bar	***c***	c 0.0	c-0.6	c5.0
	Control deadband	bar	***db***	db0.1	db0.1	db1.0
	Fast response deadband	bar	***Fb***	Fb0.1	Fb0.1	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	SH15
	Stage up delay	mins	***Su***	Su0.2	Su0.2	Su9.9
	Stage down delay	mins	***Sd***	Sd0.2	Sd0.1	Sd9.9
	Start Period delay	secs	***SP***	SP30	SP15	SP60
Suct	Suction pressure low alarm limit		***L***	L-1.0	L-1.0	L 5.0
	Suction pressure high alarm limit	bar	***H***	15.0	0.0	20.0
triP	GLOBAL RS485 command action			CnoA	CoFF	CnoA
	Input polarity.			tPos	tpos	tneg

	unit	ACTUAL	Default	Min.	Max.

			settings	setting	setting	setting
CusE	Use 1st compressor		***1C***	En	nf	di
	Use 2nd compressor		***2C***	En	nf	di
	Use 3rd compressor		***3C***	En	nf	di
	Use 4th compressor		***4C***	En	nf	di

LOAd	High total current AMPS alarm level	Amp	***H***	H100	H100	H250
	Low total current AMPS alarm level	Amp	***L***	L 00	L -01	L 99

PP11 Menu - Settings Level 2

Compressors

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
rtc=	Real time hours	Hrs	***rh***	rh00	rh00	rh23
	Real time minutes	mins	***rt***	rt00	rt00	rt59

SCAL						
	Pressure Transducer 1 4ma bar guage	bar	***L***	L-01	-13	242
	Pressure Transducer 1 20ma bar guage	bar	***H***	H24	-13	242

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