

GUARDIAN IPC20

Industrial plant room controller.

Operation and Set-up Manual

Industrial Plantroom Controller for Refrigerated Coldstores

- Industrial vessel controller
- Glycol pump controller
- Oil cooling and under-floor pump controller
- Alarm, trip and power monitoring
- Local panel operation and setup of timers, limits and configuration
- Remote RS485 monitoring and setup

GUARDIAN IPC-20 Controller is a mains powered, rail-mounted industrial plant room controller to provide flexible control and monitoring for ammonia plant room auxiliary devices such as water and air condensers, pumps, levels and heaters. It is configurable as:-

- **IuC** – For LT vessel or HT inter-cooler with up to 3 pumps.
- **GPC** – Glycol pump controller
- **OcuF**- Oil cooling and under-floor pump controller

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

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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.

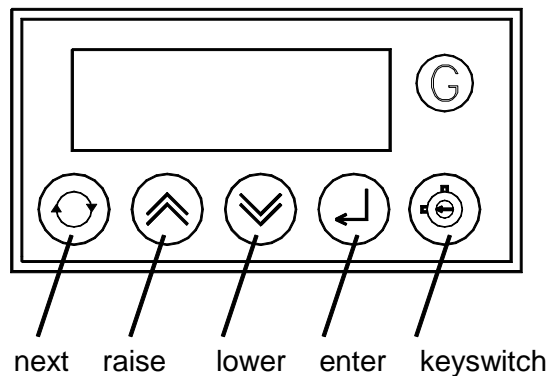
- a) All GUARDIAN controllers need to be set up with a unit model selection and other basic settings for setpoints, timers and addresses. All these settings need to be done using the SKD.9 Keyswitch Display, so the understanding of the button operation of this unit is essential.
- b) The shorthand used in the following chapters for concisely expressing button pressing and selection sequences to do all this setup 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.

SKD.9 KEYSWITCH DISPLAY 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

The Keyswitch is not used on any IPC-14 controllers.

BUTTON OPERATION SHORTHAND

To assist in easy setup 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 4. 8b

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

di Sc =Oc= FAI L

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

HARDWARE CONFIGURATION CHECKS

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

Models with **BLUE** labels and suffix 'L' (**LOW VOLTAGE**) operate at **24vac**

Models with **BLACK** labels and no suffix (**NORMAL 230vac**) operate at **230vac**

230vac MAINS SUPPLY WILL DAMAGE A BLUE LABEL CONTROLLER !!!

A BLACK label controller will not work with a 24vac supply

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.

CONFIGURE UNIT MODEL, SYSTEM No & 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 Unit Model

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

Enter Passcode PP05 as button sequence above

@: @ Uni t ? 9Pc= /: / OCuF ? OCuF

Press 'next' repeatedly until **Unit** is displayed and then press 'enter'

Display shows unit model currently selected which may be wrong.

Press 'raise' repeatedly until correct model is displayed (e.g. OCuF) and then press 'enter' which causes the display to wink briefly and display the new unit model selection (e.g. OCuF)

Select System No and Address

e.g. setup unit for system 60 at address 180

Enter Passcode as button sequence as above

@: @ Uni t

@: @ Sn01 /: / Sn60 ? Sn60

@ A001 /: < A180 ? A180

@: @ End= ? ==26

RS485 Communications

When the correct system number, case/compressor number and highway address have been entered as above then the controller can communicate with the GUARDIAN AutoGraph Terminal 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 SKD.9 Keyswitch display. For further details see page 30

UNIT MODELS

Guardian controllers may be configured in a number of different ways dependent on unit model selection. Each unit model fulfils a different refrigeration temperature monitoring and control requirement. In order to perform the required refrigeration control then each model has different uses for the controller's input output signals. This section gives details of all the model variations available for the controller and the way to connect the wiring to the plant devices and measuring transducers.

Available unit models (IPC-20)

IPC -20 'iuC'	LT vessel or HT inter-cooler controller.
IPC -20 'gPc'	Glycol pump Controller.
IPC -20 'OCuF'	Oil cooling and under-floor Pump Controller.

GENERAL SPECIFICATION

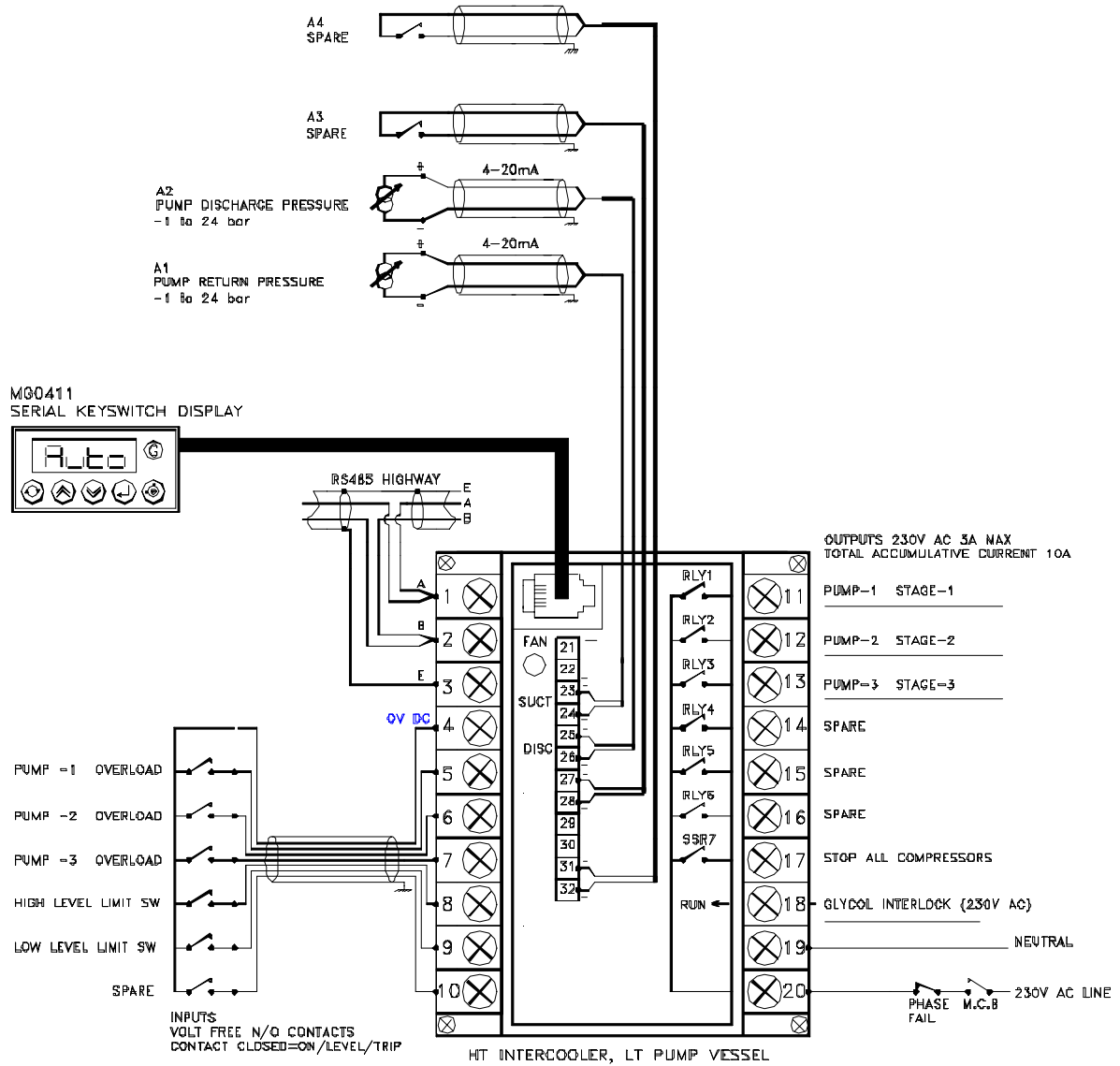
Power	110 / 230 Vac 50 hz 10VA
Operation	0 to 55°C
Approx. dimensions	Width 70 x length 100 x height off rail 110mm.

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

IPC-20 Model 'iuC' Input/Output Signals

IuC		
Analogue Inputs		
Digital Inputs		
Mains Inputs 230Vac		
Relay Outputs 230/24v AC 3 amp. Maximum Accumulative Current 10 amp.		

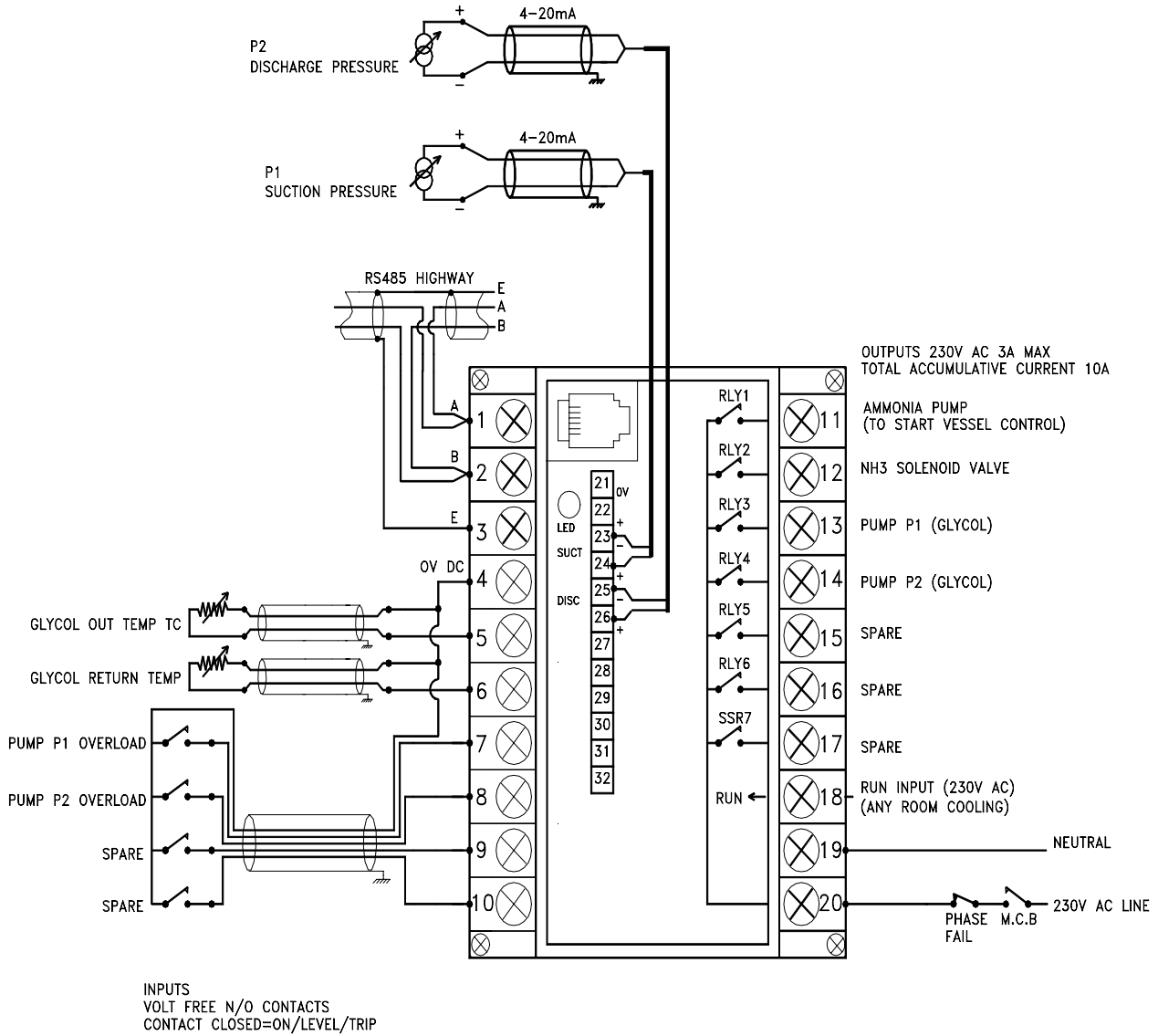
IPC-20 Model 'iuC' Termination Wiring



IPC-20 Model 'gPc' Input/Output Signals

GPc		
Analogue Inputs		
Digital Inputs		
Mains Inputs 230Vac		
Relay Outputs 230/24v AC 3 amp. Maximum Accumulative Current 10 amp.		

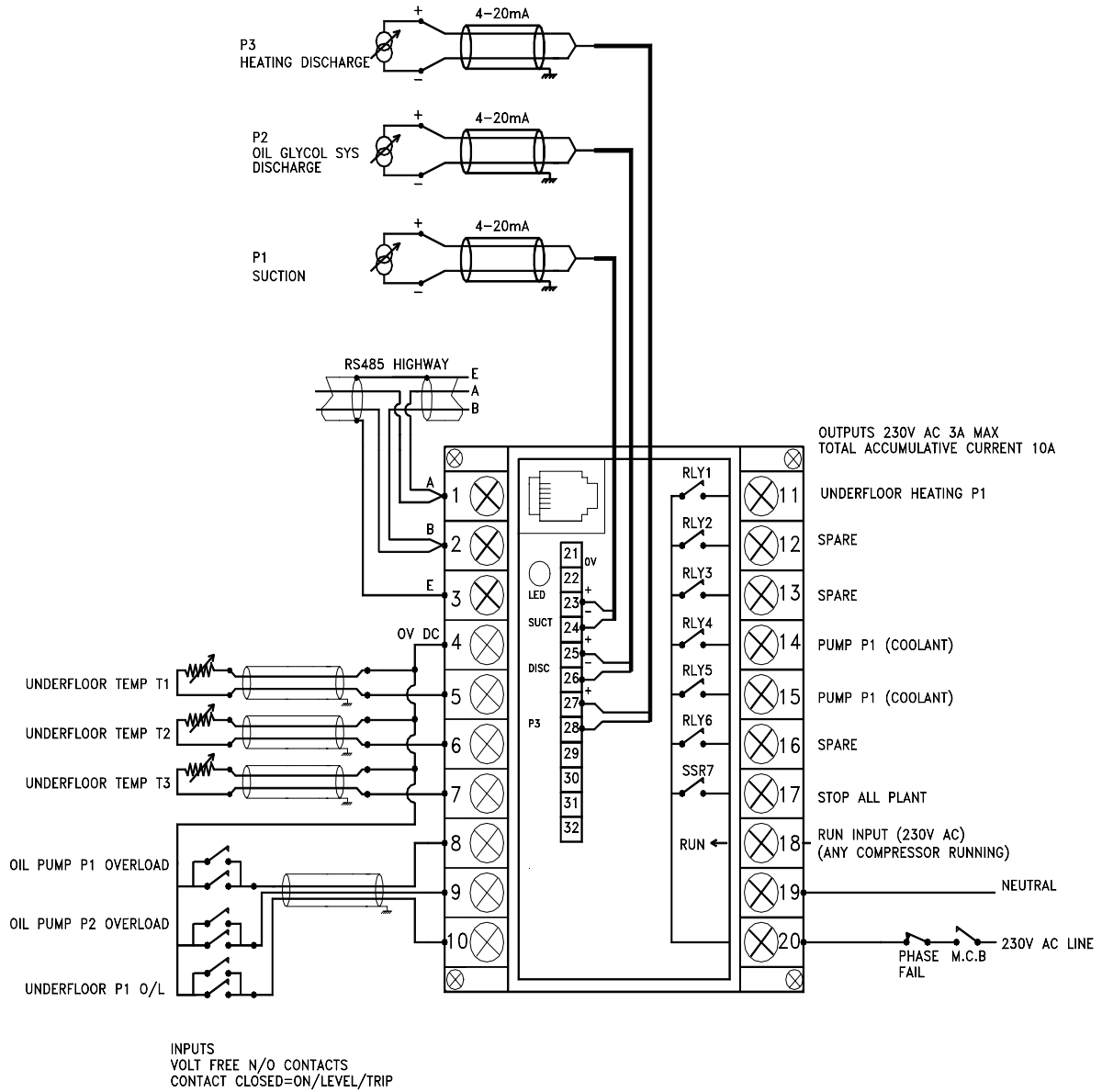
IPC-20 Model 'gPc' Termination Wiring



IPC-20 Model 'oCuF' Input/Output Signals

OCUF		
Analogue Inputs		
Digital Inputs		
Mains Inputs 230Vac		
Relay Outputs 230/24v AC 3 amp. Maximum Accumulative Current 10 amp.		

IPC-20 Model 'oCuF' Termination Wiring



DISPLAY INDICATIONS

INDUSTRIAL VESSEL CONTROLLER (iuC)

When setup as 'iuC', the controller reverts to the default display if no buttons have been pressed for 3 minutes and displays the pump differential pressure.

The default display is replaced by a status message if any of the following conditions occur:-

	8888	After power on restart
	=i uC	Unit Model Selected
	U1.09	Software version displayed after power on or after OFF
	Auto	Restart routine in progress
	OFF=	AFAN selected OFF mode from PC or local display
Suct	FAi l	Suction pressure transducer has failed
di sc	FAi l	Discharge pressure transducer has failed
=Hi =	StoP	Vessel High level trip
=Lo=	Stop	Vessel Low level trip
=P-n	triP	Pump n Overload tripped n= 1 to 3
=P-n	fl o=	Pump n flow failed n=1 to 3
	=2.5	Differential Pressure

DEFAULT DISPLAYS (iuC)

The following displays are available by repeatedly pressing the @ button.

The Value displays are alternated with an identification tag (e.g. diff)

	Tag	Value
Differential Pressure	di Ff	=nn. n displayed in Bar gauge.
Suction Pressure	Suct	=nn. n in Bar gauge.
Discharge Pressure	di Sc	=nn. n in Bar gauge.
Auto Control Mode	Auto	Pressing ? gives Auto
Off Control Mode	OFF=	Pressing ? gives OFF
Hand Control Mode	hAnd	Pressing ? gives HAND
Pump running status	PunP	1==2 A vertical indicates pump running and the fourth segment displays the duty pump.
Pump Trip Status	tri P	==== A vertical indicates tripped.
Control input states	i nPt	grHL where: g= Glycol interlock r = liquid solenoid energised. H = High level switch made.(goes to S after delay) L = Low level switch made.(goes to S after delay)
	Set=	Go to Setup Mode when ? press

DISPLAY INDICATIONS

GLYCOL PUMP CONTROLLER (gPc)

When setup as 'gPc', the controller reverts to the default display if no buttons have been pressed for 3 minutes and displays the Glycol Out temperature T1.

The default display is replaced by a status message if any of the following conditions occur:-

	8888	After power on restart
	gPc=	Unit Model Selected
	U1.09	Software version displayed after power on or after OFF
	Auto	Restart routine in progress
	OFF=	Selected OFF mode from PC or local display
Suct	FAi l	Suction pressure transducer has failed
di sc	FAi l	Discharge pressure transducer has failed
=P-n	tri P	Pump n Overload tripped n= 1 to 3
=P-n	fl o=	Pump n flow failed n=1 to 3
	=2.5	Glycol out temperature.

DEFAULT DISPLAYS (gPc)

The following displays are available by repeatedly pressing the @ button.
The Value displays are alternated with an identification tag (e.g. Out)

	Tag	Value
Glycol Out temperature	Out=	=nn. n In degrees C.
Glycol Return temperature	retn	=nn. n In degrees C.
Differential pressure	di FF	=nn. n In Bar gauge.
Auto Control Mode	Auto	Pressing ? gives Auto
Off Control Mode	OFF=	Pressing ? gives OFF
Hand Control Mode	hAnd	Pressing ? gives HAND
Pump running status	PunP	1 == 2 A vertical indicates pump running and the fourth segment displays the duty pump.
Pump Trip Status	tri P	==== A vertical indicates tripped.
Control input states	i nPt	C=== where: c = liquid solenoid energised.
Suction Pressure	Suct	=nn. n in Bar gauge.
Discharge Pressure	di Sc	=nn. n in Bar gauge.
	Set=	Go to Setup Mode when ? press

DISPLAY INDICATIONS

OIL COOLING AND UNDER-FLOOR PUMP CONTROLLER (OCuF)

When setup as 'OCuF', the controller reverts to the default display if no buttons have been pressed for 3 minutes and displays the oil cooling pump differential pressure.

The default display is replaced by a status message if any of the following conditions occur:-

	8888	After power on restart
	OcuF	Unit Model Selected
	U1.09	Software version displayed after power on or after OFF
	Auto	Restart routine in progress
	OFF=	Selected OFF mode from PC or local display
Suct	Fai l	Suction pressure transducer has failed
di sc	Fai l	Discharge pressure transducer has failed
=C-n	tri P	Cooling Pump n Overload tripped n= 1 to 2
=H-1	tri P	Under-floor heating Pump Overload tripped.
=C-n	fl o=	Oil cooling pump n flow failed n=1 to 2
=H-1	fl o=	Under-floor pump flow failed
	=2.5	Oil cooling pump differential pressure.

DEFAULT DISPLAYS (OCuF)

The following displays are available by repeatedly pressing the @ button.
The Value displays are alternated with an identification tag (e.g. difc)

	Tag	Value
Oil cooling pump differential pressure	Di fc	=nn. n In Bar.
Under-floor heating pump differential	Di fH	=nn. n In Bar.
Suction Pressure	Suct	=nn. n in Bar gauge.
Auto Control Mode	Auto	Pressing ? gives Auto
Off Control Mode	OFF=	Pressing ? gives OFF
Hand Control Mode	HAnd	Pressing ? gives HAND
Oil cooling Pump running status	COOL	1 == 2 A vertical indicates pump running and the fourth segment displays the duty pump.
Oil cooling Pump Trip Status	tri P	==== A vertical indicates tripped.
Under-floor heating Pump running status	HEAt	1 == 2 A vertical indicates pump running and the fourth segment displays the duty pump.
Under-floor heating Pump Trip Status	tri P	==== A vertical indicates tripped.
Control input states	InPt	r === where: r = Any compressor running.
Oil cooling Discharge Pressure	di SC	=nn. n in Bar gauge.
Under-floor heating Discharge Pressure	di SH	=nn. n in Bar gauge.
Under-floor temperature 1	Uft1	=nnn in degrees C.
Under-floor temperature 2	Uft2	=nnn in degrees C.
Under-floor temperature 3	Uft3	=nnn in degrees C.
	Set=	Go to Setup Mode when ? press

Alarm Indications

Alarms are not displayed during Setup operation.
All alarms are reset automatically when the fault has disappeared.

IF no RS485 highway is connected then the PC FAIL message can be removed by selecting setup as follows:-

```
@: @  SEt=   ?   PP00   /: /   PP05   ?  
Uni t   ?   ui C=   @: @   A9t=   /: /   nonE ?  
@: @  End=   ?   ==24
```

USEFUL BUTTON SEQUENCES

The following button sequences should prove useful during normal service operation

Check Unit Model

```
@: @ SEt= ? PP00 /: / PP05 ?
@: @ Uni t ? gpc= This unit model is 'gPc'
@: @ End= ? ==23
```

Select System No and Address

e.g. setup unit for system 60 at address 180

```
@: @ Uni t ?
@: @ Sn01 /: / Sn60 ? Sn60
@ A001 /: < A180 ? A180
@: @ End= ? ==26
```

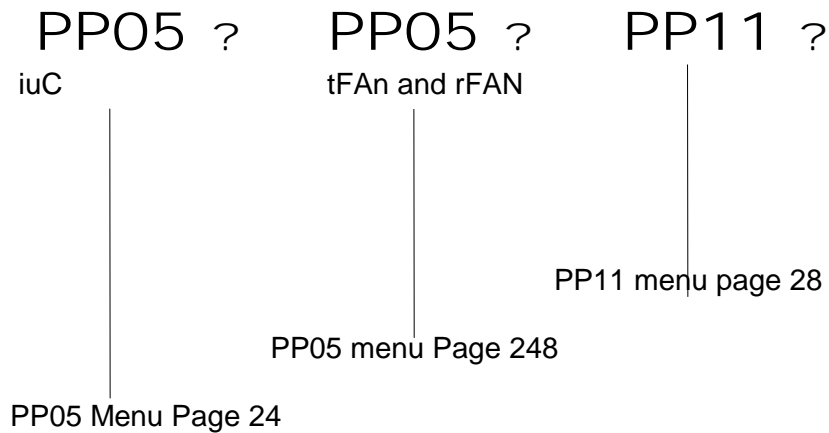
SETUP OPERATION

Setup operation lasts for a maximum of 5 minutes after being activated by pressing **?** with **SEt** on the display panel.

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

SEt / Press **?**

PP00 Set passcode PP05, or PP11 by using the **/** and **<** pushbuttons



PP05 Menu (iuC)

Press @ to sequence through the following PP05 menu selections

Press ? to select the displayed menu

Uni t	IPC-20 Unit Identity Page 25
di fs	Condenser Configuration; Number of condenser stages. Page 25
Suct	Fan Control set point and deadband. Page 26
dELy	Delays between condenser stages Page 26
End/	Return to normal operation

PP05 Menu (CFAn, AFAn)

Press @ to sequence through the following PP05 menu selections

Press ? to select the displayed menu

Uni t	IPC-14 Unit Identity Page 25
Cond	Condenser Configuration; Number of condenser stages. Page 25
FANS	Fan Control set point and deadband. Page 26
HEAt	Heater Control Settings Page 26
dELy	Delays between condenser stages Page 26
FAnP	Pressure alarm and trip limits. Page 27
tEst	Relay Tests Page Error! Bookmark not defined.
End/	Return to normal operation

Unit

Unit

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Model Type Selection

YYYY

YYYY = ivC Vessel Controller
 =VSPE Variable speed pumps evaporator Controller
 =VSPP Variable speed pumps process Controller

Unit Hardware Type

IP20

Type 20 for and ivC,VSPE,VSPP models

System Number

Snnn

nnn = 0 to 255

Monitor Address

Annn

nnn = 0 to 255

Communications Protocol

YYYY

YYYY = A9t Autograph Terminal
 SYS5 Woodley System 5
 LocL Local Highway only
 nonE None
 If LocL or nonE is selected the PC / FAiL message is not displayed

Condenser configuration

Cond

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Number of Stages (including pump)

Fnnn

nn = 01 to 09

Fan control settings

FANS

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Fan Control Setpoint During defrost	Hnn. n	nn.n = 1.0 to 20.0 Bar
Fan Control Setpoint	Lnn. n	nn.n = 1.0 to 20.0 Bar
Control Deadband	dbn. n	n.n = 0.1 to 5.0 Bar plus and minus setpoint
Fast Response Deadband	Fbn. n	n.n = 0.1 to 5.0 Bar plus and minus setpoint
Stage up Control Algorithm	FAun	n = 0 to 9 Higher n gives faster response when pressure is above setpoint + Fb
Stage Down Control Algorithm	FAdn	n = 0 to 9 Higher n gives faster response when pressure is below setpoint - Fb

Heat

HEAt

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Control setpoint for Water heaters	c=nn	nn = -40 to 40 C
---------------------------------------	------	------------------

Delay

DELY

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Stage delay	fdn. n	n.n = 0.1 to 3.0 tenths of minutes.(0.1=6 seconds)
Time delay for second heater stage	Hdnn	nn = 00 to 99 minutes

FAnP

FAnP

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Fan Pressure Alarm

Hnn. n Discharge Pressure Hi-alarm limit
nn.n = 1.0 to 20.0

Fan Pressure Trip

tnn. n Discharge Pressure Hi-trip limit
nn.n = 1.0 to 20.0

tESt

tESt

Press @ to sequence through the relay selections

Repeatedly press ? to switch the relays on and off

Relay R1

1OFF 1/on

Relay R2

2OFF 2/on

etc. to

Relay d

dOFF d/on

All outputs return to automatic control when SETUP is ended

End

End/

Return from Setup to normal operation

PP11 Menu

Press @ to sequence through the following PP11 menu selections

Press ? to select the displayed menu

Communications	conn	Page 28
Real time clock	rtc/	Page 28
Pressure Transducer Scaling	SCAL	Page 29
	End/	Return to normal operation

Communications

conn

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Lowest address to be monitored for defrost status	Lnnn	nnn = 00 to 255
Highest address to be monitored for defrost status	Hnnn	nnn = 00 to 255

rtc

rtc/

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Real clock time hours	rhnn	nn = 0 to 23 hrs
Real clock time minutes	rtnn	nn = 0 to 59 mins

Pressure Transducer Scaling

SCAL

Press ? at each P_n display to further display the L and H values
Press the $/$ or $<$ to change the L settings then press ? to confirm the changes. Press $@$
Press the $/$ or $<$ to change the H settings then press ? to confirm the changes. Press $@$ to sequence to the next P_n

Pressure Transducer 1 =P1=

Pressure at 4 mA L=nn nn = -1 to 24 Bar

Pressure at 20 mA H=nn nn = -1 to 24 Bar

And so on to...

Pressure Transducer 4 =P4=

Pressure at 4 mA L=nn nn = -1 to 24 Bar

Pressure at 20 mA H=nn nn = -1 to 24 Bar

End

End/ Return from Setup to normal operation

COMMUNICATIONS

Communication facilities are available for interrogation of pressures, temperatures, status and modification/display of setpoints, limits and loop settings. All communication is via a multi-drop RS485 link which connects all IPC-20 units in series with all other Guardian units.

Communications commands and replies are checked for parity and block length and automatically retransmit if errors are detected.

Each IPC-20 has a unique unit number address Annn and System Number Snn which is used to select the appropriate unit for interrogation or modification.

Snn is system no. 1-80

Annn is address 1-255

Some communication commands may use 'wildcard' stub number 99 and 'wildcard' case number 9 to access all systems on the highway or all addresses within a system.

IPC-20 units are inactive until they are addressed.

GUARDIAN Autograph Refrigeration Monitor Communication commands available are:-

- a) Transmit Unit Status which replies with command plus humidity, status & air temperature.
- b) Transmit Values which replies with address plus latest signed temperature values, time, trip states, relay states and internal status.
- c) Transmit Set points, which replies with set points and limits

Uuu addresses may not be changed via the link.

- d) Receive set points with new set point values from controller

Setup / Commissioning Parameters

IPC20 iuc Vessel controller

PP05 Normal Menu Settings

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting		
Unit		Model type selection CFAn=Condenser Fan control		iuC	iuC	rfa	
		Hardware type CFAn=iP14		iP20	iP20	iP14	
		Stub number	Sn	Sn 01	Sn 01	Sn 80	
		Case number (normally 1.)	Cn	Cn 01	Cn 01	Cn 04	
		Autograph address number	A	A255	A 00	A255	
		Monitor Comms Protocol		Agt	Agt	none	
diffs		When in iuC Configuration					
		Target Pump diff, below which pump trips	bar	A			
		Target Pump diff, only for 3 pumps	bar	B			
Suct		Pump Inlet Pressure Setpoint below which pump starts	bar	L			
		Pump Inlet Pressure Setpoint above which pump stops	bar	H			
dELy		High level alarm delay	mins	HL	0.5	0.0	3.0
		Low level alarm delay	mins	LL	1	0	99
		Target diff alarm delay time	mins	Pd	0	0	9.9

=End

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