

# GUARDIAN RCU-12

## Refrigeration Control Unit for Display Cabinets & Coldstore Coolers

- AKV-10/20<sup>®</sup> expansion valve regulation
- Liquid solenoid valve operation
- Refrigeration temperature monitor
- Control-air temperature alarm monitor
- Fan-fail and coldstore door alarms
- Defrost cycle, heater and fan control
- Local panel display and setup
- Remote RS485 communications

## Operation and Setup Manual

The GUARDIAN RCU-12 Refrigeration Controller is a mains powered, rail-mounted, refrigeration temperature and defrost sequence controller for supermarket display cases, coldrooms and coldstore coolers using AKV-10/20<sup>®</sup> or normal solenoid valves.

Local temperature displays and modification of all defrost times, alarm and control settings is available when the unit is connected to the optional GUARDIAN SKD-9 Serial Keypad Display.

The RCU-12 communicates with a GUARDIAN Consultant and Autograph Terminal which both provide remote central alarm monitoring, data recording and graphs.

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

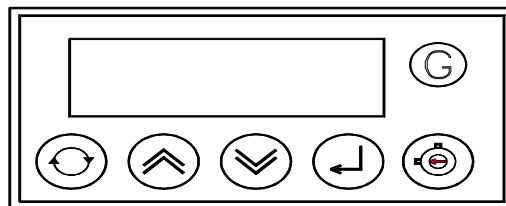
- a) All GUARDIAN controllers need to be set up with a unit model selection and other basic settings for setpoints, timers and addresses. All these settings need to be done using the SKD.9 Keyswitch Display, so the understanding of the button operation of this unit is essential.
- b) The shorthand used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

- |   |                                   |  |
|---|-----------------------------------|--|
| @ | <b>'next' button</b>              | displays next value or menu selection in sequence.                                       |
| / | <b>'raise' button</b>             | raises a menu settings value or menu item selection.                                     |
| < | <b>'lower' button</b>             | decreases a menu settings value or item selection.                                       |
| ? | <b>'accept' or 'enter' button</b> | 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 HVAC or compressor 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 48b

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 ? ru10 /: / rc12 ? rc12

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. ru12) and then press 'enter' which causes the display to wink briefly and display the new unit model selection (e.g. ru12)

### Select System No and Address

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

Enter Passcode as button sequence as above

@: @ Uni t

@: @ Sn01 /: / Sn60 ? Sn60

@ Cn01 ? Cn01

@ 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 SKD9 Keyswitch display.

## 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 RCU12

The RCU12 can be configured for control of a **single display case** or coldroom as

- a) 'rc12' used for electronic expansion valve or liquid solenoid valve control of one display case or coldroom with various types of defrost sequences
- b) 'rc10' used for case/coldstore liquid solenoid valve control
- c) 'intC' used for an integral case with condensate heater control

The RCU12 can be configured for control or monitoring of **multiple display cases** as

- a) 'rnu8' used to alarm monitor six independent case temperatures
- b) 'stub' used for control of up to five multiple cases with a single liquid valve
- c) '4OC' used for independent control of four off cycle case liquid valves
- d) '2DEF' used for independent control of two cases each with defrost and liquid valve

The RCU12 can also be configured as an alarm unit to flash a common alarm beacon and teledialler contacts whenever any alarm is detected for any controller on the RS485 highway system

### GENERAL SPECIFICATION

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

The RCU12 controller is housed in a DIN rail mounting enclosure with 20 screw clamp connectors

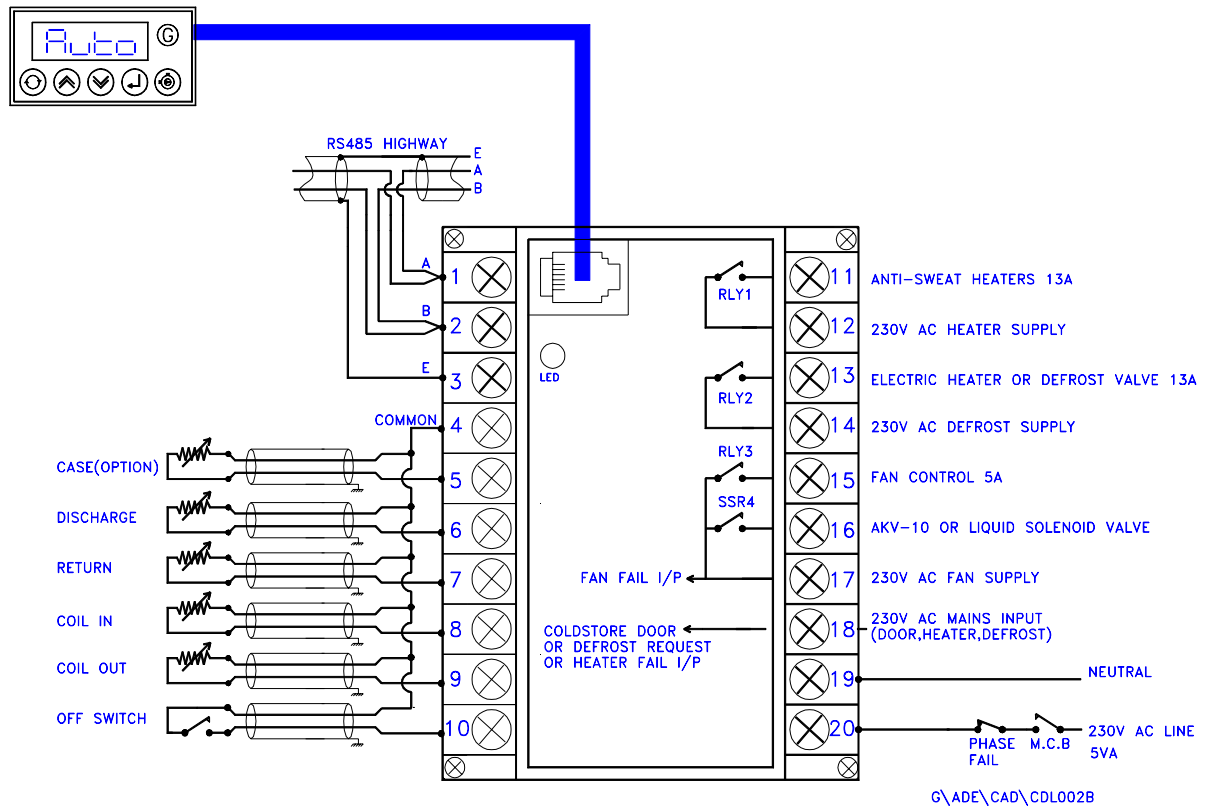
### RCU-12 'ru12' Input/Output Signals

Used for case/coldstore liquid solenoid or Electronic expansion valve control

'ru12'		
<b>Analog Measurements thermistor</b>		-40 to +50°C +0.5°C
T1	Case/ coldstore coil	°C
T2	Discharge air temperature	°C Control probe
T3	Return air temperature	°C
T4	Coil in temperature	°C
T5	Coil out temperature	°C
T6	OFF switch input	
<b>Digital Inputs</b>		
IA	Coldstore door open contact	
IB	Heater mains circuit fail	
IA	Fans A, mains circuit fail	
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Trim Heater control	
R2	Electric defrost/HGV control	
R3	Fan control	
SSR4	AKV-10/AKV-20 valve output or liquid solenoid valve	

### RCU-12 Termination Wiring - 'ru12' model selection

MG0411  
SERIAL KEYSWITCH DISPLAY





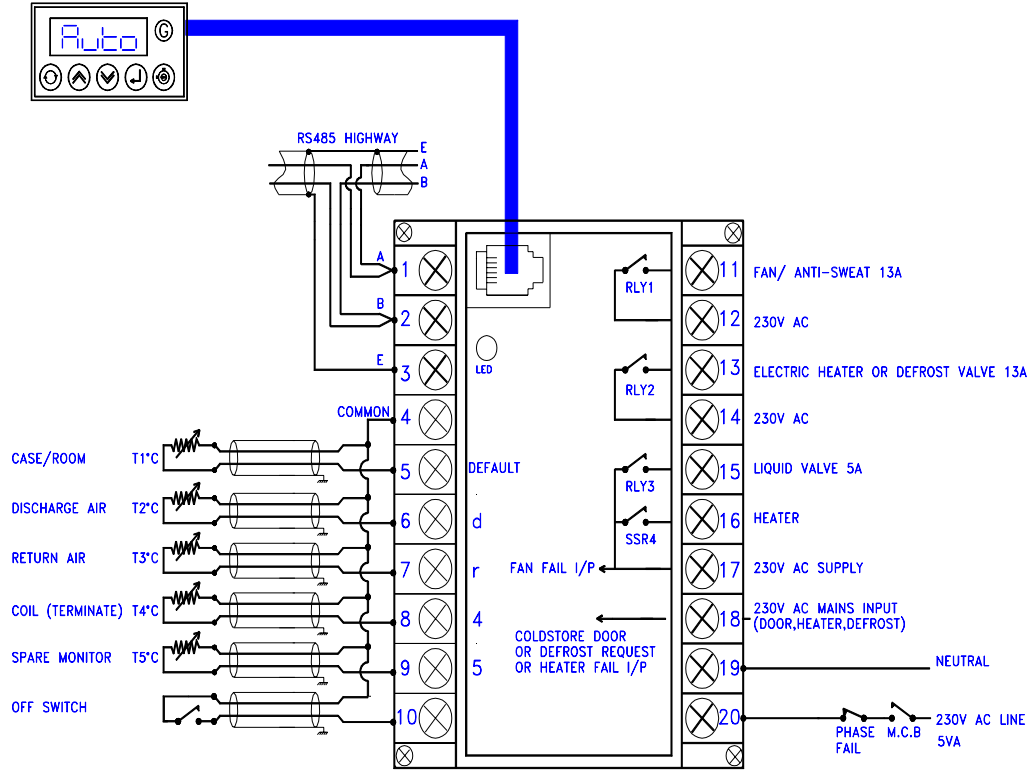
**RCU-12 'rc10' Input/Output Signals**

Used for case/coldstore liquid solenoid valve control

<b>'rc10'</b>		
<b>Analog Measurements thermistor</b>		-40 to +50°C +0.5°C
T1	Case/ coldstore temp	°C
T2	Discharge air temperature	°C Control probe
T3	Return air temperature	°C C/R control probe
T4	Coil in temperature	°C
T6	OFF switch input	
<b>Digital Inputs</b>		
IB	Heater mains circuit fail	
IA	Fans A, mains circuit fail	
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Fan control	
R2	Electric defrost/HGV control	
R3	Liquid solenoid valve output	

**RCU-12 Termination Wiring - 'Rc10' model selection**

MG0411  
SERIAL KEYSWITCH DISPLAY



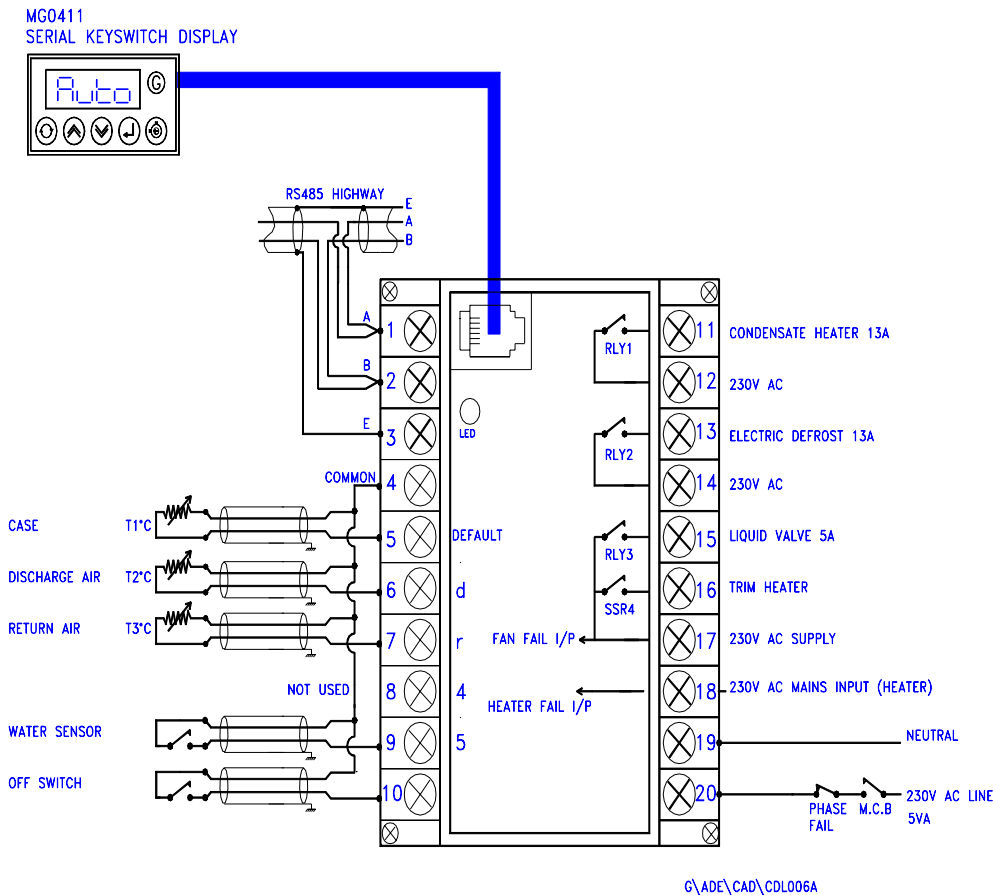
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### RCU-12 'intC' Input/Output Signals

Used for integral case with condensate heater control

'intC'		
<b>Analog Measurements thermistor</b>		-40 to +50°C +0.5°C
T1	Case/ coldstore temp	°C
T2	Discharge air temperature	°C
T3	Return air temperature	°C
		°C
T5	Condensate water sensor	RLY1=On if i/p<31KR
T6	OFF switch input	
<b>Digital Inputs</b>		
IB	Heater mains circuit fail	
IA	Fans A, mains circuit fail	
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Condensate Heater	
R2	Electric defrost/HGV control	
R3	liquid solenoid valve output	
SSR4	Trim Heater control	

### RCU-12 Termination Wiring - 'intC' model selection



## RCU-12 Multi-case Configurations

The RCU.12 provides a number of multi case functions where one Rcu12 controller is cost effectively used to control a number of case sections. 'Stub' and 'ru8' monitor options requires a 'Zone' to be setup with the controller address to provide alarm message names for each of the six temperatures within the controller. All temperature are communicated on the same controller address. See page 53

Multi case options 2DEF and 4OC require several addresses to be allocated on the highway. 2DEF requires 6 address and 4OC requires 12. Each temperature on the controller is communicated as a discharge temperature at a different address. Each section takes two systems ie 6 addresses. The address used is dependent on the probe allocation selection eg for 2.DEF (3030)(4020)(5010) Examples are given on page 52

### RCU12 '2DEF'

electric defrost outputs for different periods at fixed 2.hour spacing from previous terminate defrost on lowest probe in group. No fans or heater outputs control on selectable average of 3,4 or 5 temps on LSV1 remaining temps on LSV2

#### Probe configurations 2-DEF

##### probe configuration selection

		(3030)(4020)(5010)					2-DEF				
		A	3	4	5						
		B	3	2	1						
Snxx	A/T1	A/T1	A/T1			----- T1	R1	----	LSV-A		
	T2	T2	A/T2			----- T2	R2	----	LSV-B		
	T3	T3	A/T3			----- T3	R3	----	DEF-A		
	.	T4	A/T4			----- T4	SSR4	----	DEF-B		
	.	.	A/T5			----- T5					
Snxx+2	B/T1	B/T1	B/T1			----- T6					
	/T2	.	.			RCU12					
	/T3	.	.								

### RCU12 '4oc'

off-cycle defrost (independent periods) at fixed 1 hour spacing from previous section alarm monitor all probes to control setpoint but allow some to have alarm state 'none' and control on selectable average of

1,2 3 or 4-temps on LSV1 1 or 2-temp on LSV2  
1-temp on LSV3 and LSV4 if total temps<=6

which allows valid combinations (4011)(3111)(3021)(2211)(2022)(1111)

#### Probe configurations 4-oc

##### probe configuration selection

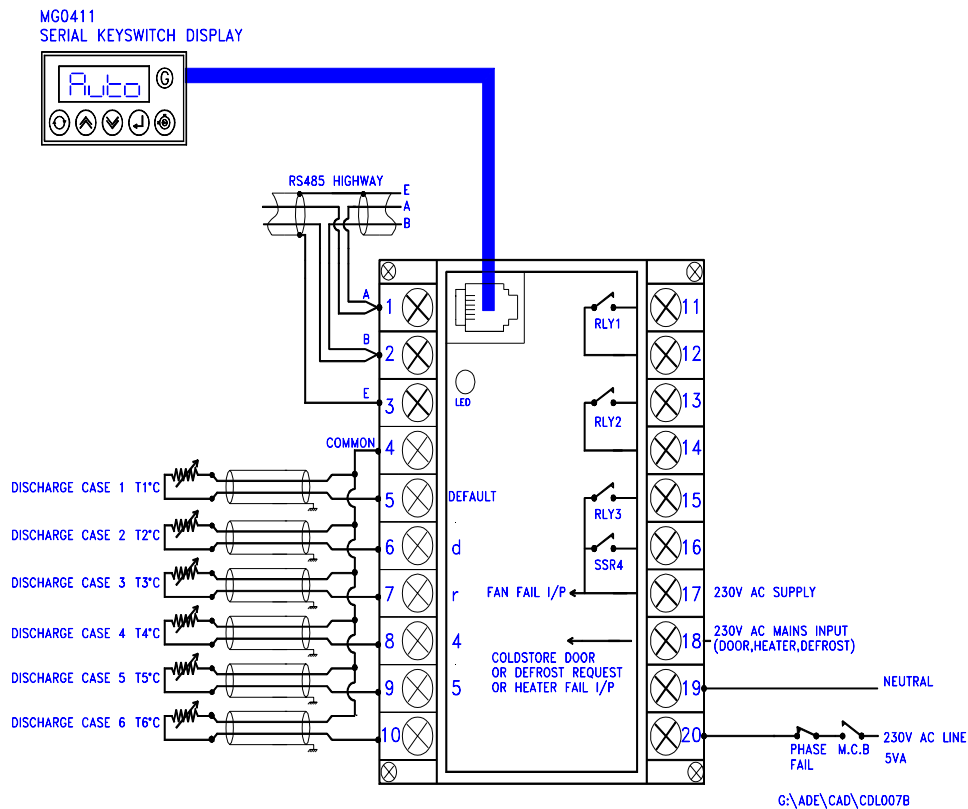
		(4011)(3111)(3021)(2211)(2022)(1111)								4-OC			
		A	4	3	3	2	2	1					
		B	0	1	0	2	0	1					
		C	1	1	2	1	2	1					
		D	1	1	1	1	2	1					
A/T1	A/T1	A/T1	A/T1	A/T1	A/T1	A/T1	----- T1	R1	----	LSV-A			
T2	T2	T2	T2	T2	T2	B/T1	----- T2	R2	----	LSV-B			
T3	T3	T3	B/T3	C/T3	C/T3	C/T1	----- T3	R3	----	LSV-C			
T4	B/T4	C/T4	T4	T4	T4	D/T1	----- T4	SSR4	----	LSV-D			
C/T5	C/T5	T5	C/T5	D/T5			----- T5						
D/T6	D/T6	D/T6	D/T6	T6			----- T6						
							RCU12						

### RCU-12 'ru8' Input/Output Signals

Used as a 6-temperature, 2 input monitor for multiple cases

'ru8'		
<b>Analog Measurements thermistor</b>		-40 to +50°C +0.5°C
T1	Discharge case 1 temp	°C
T2	Discharge case 2 temp	°C
T3	Discharge case 3 temp	°C
T4	Discharge case 4 temp	°C
T5	Discharge case 5 temp	°C
T6	OFF switch input	
<b>Digital Inputs</b>		
IB	Heater mains circuit fail	
IA	Fans A, mains circuit fail	
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Not used	
R2	Not used	
R3	Not used	
SSR4	Not used	

### RCU-12 Termination Wiring - 'ru8' model selection

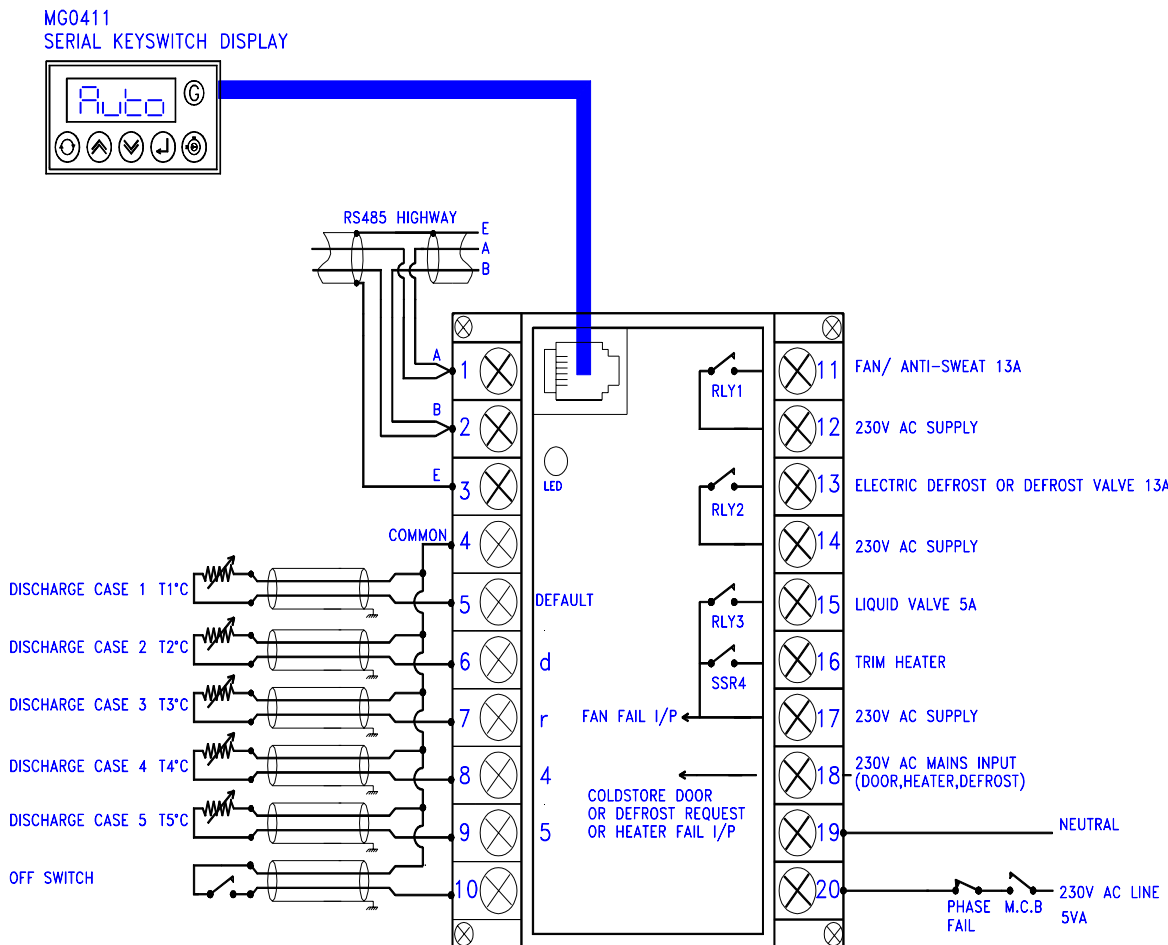


**RCU-12 'stub' Input/Output Signals**

Used for control of multiple cases with a single liquid valve

<b>'stub'</b>		
<b>Analog Measurements thermistor</b>		-40 to +50°C +0.5°C
T1	Discharge case 1 temp	°C
T2	Discharge case 2 temp	°C
T3	Discharge case 3 temp	°C
T4	Discharge case 4 temp	°C
T5	Discharge case 5 temp	°C
T6	OFF switch input	
<b>Digital Inputs</b>		
IB	Heater mains circuit fail	
IA	Fans A, mains circuit fail	
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Fan/Anti sweat	
R2	Electric defrost or defrost valve	
R3	Liquid solenoid valve	
SSR4	Trim heater control	

### RCU-12 Termination Wiring - 'stub' model selection

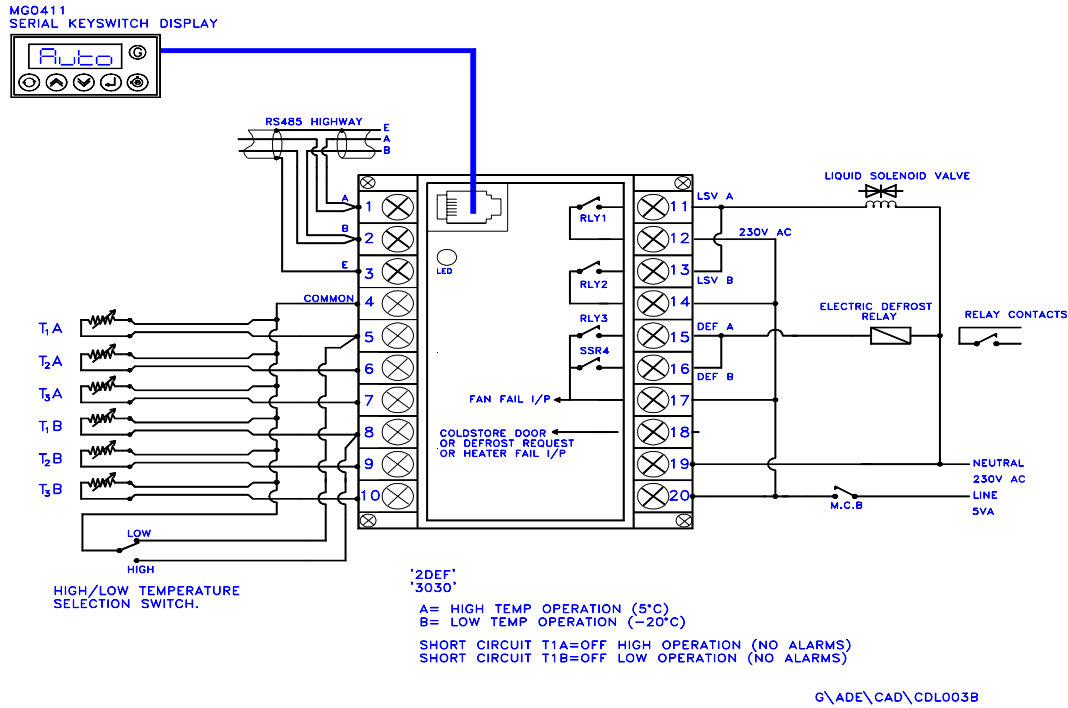


### RCU-12 '2dEF' Input/Output Signals

Used for control of multiple cases with a single liquid valve

'2dEF'		
<b>Analog Measurements thermistor</b>		-40 to +50°C +0.5°C
T1	T1 Case A	°C
T2	T2 Case A	°C
T3	T3 Case A	°C
T4	T1 Case B	°C
T5	T2 Case B	°C
T6	T3 Case B	°C
<b>Digital Inputs</b>		
IB	Heater mains circuit fail	
IA	Fans A, mains circuit fail	
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Liquid solenoid valve Case A	
R2	Liquid solenoid valve Case B	
R3	Defrost relay control Case A	
SSR4	Defrost relay control Case B	

**RCU-12 Termination Wiring - '2dEF' model selection**



**RCU-12 '40C' Input/Output Signals**

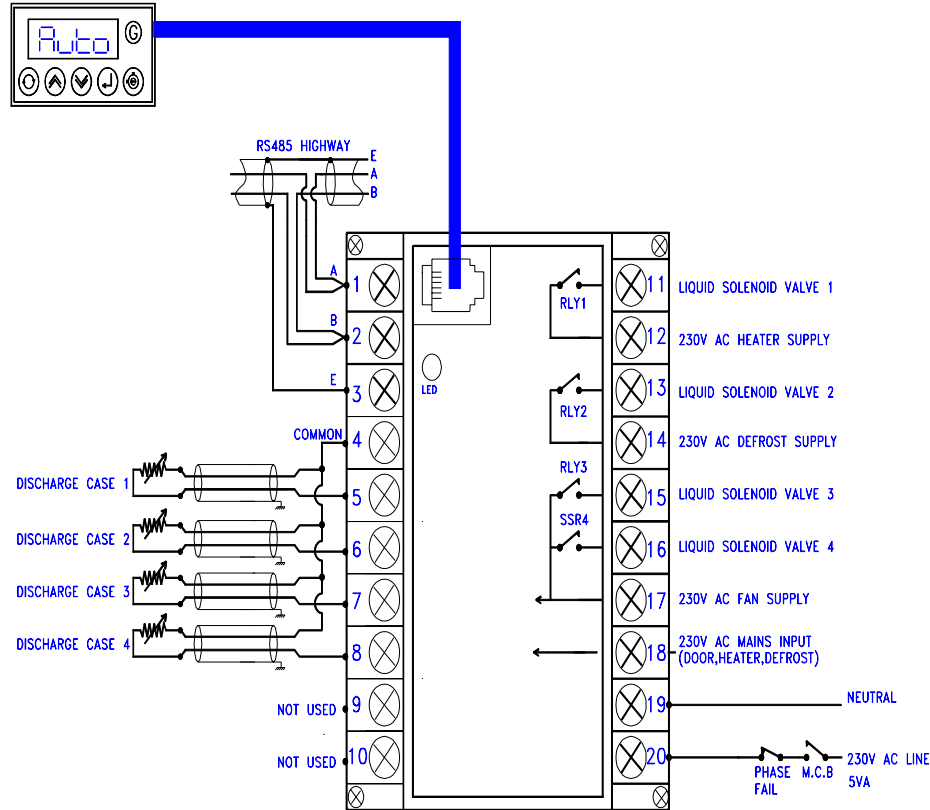
Used for control of multiple cases with a single liquid valve

Analog Measurements thermistor		-40 to +50°C +0.5°C
T1	Discharge case 1	°C
T2	Discharge case 2	°C
T3	Discharge case 3	°C
T4	Discharge case 4	°C
<b>Digital Inputs</b>		
IB		
IA		
<b>Relay Outputs (5 amp 230VAC n/o with suppressors)</b>		
R1	Liquid solenoid valve Case 1	
R2	Liquid solenoid valve Case 2	
R3	Liquid solenoid valve Case 3	
SSR4	Liquid solenoid valve Case 4	



**RCU-12 Termination Wiring - '40C' model selection (configured as a 1111)**

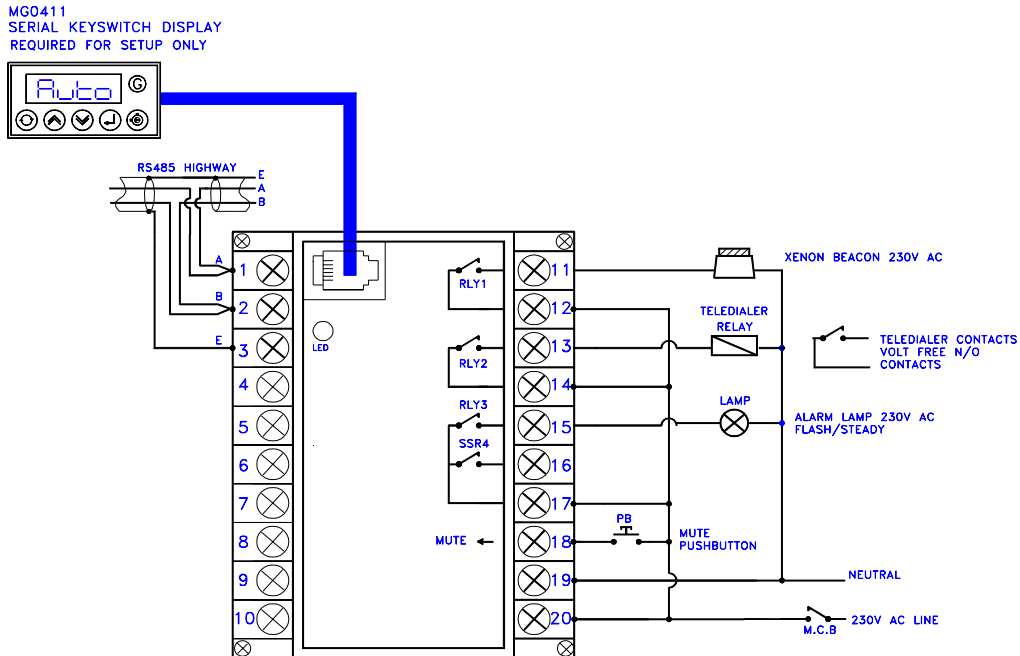
MGO411  
SERIAL KEYSWITCH DISPLAY



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### RCU-12 ALARM UNIT Termination Wiring - 'ru10' 'Alr'

The controller may be selected for use as a common alarm unit with wiring as below and setup as described on page 38

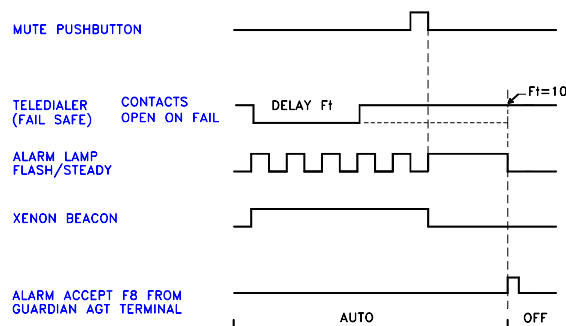


1. Apply power to the RCU-12 unit.
  2. Set up the unit using the Serial keyswitch display as follows;
    - (a). Press up "set" is displayed.
    - (b). Press enter "PP00" is displayed.
    - (c). Press up until "PP05" is displayed.
    - (d). Press next until "Unit" is displayed.
    - (e). Press enter, now using the next, up and down buttons set the following  
 Parameters; rc10  
           Sn80  
           Cn1  
           A249  
           Alr
- Remember to press "enter" after each setting.

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An SKD.9 Display is not normally fitted to an RCU12 setup as an ALARM UNIT since all temperature inputs display open circuit. A SKD.9 is required to set the system number address and select 'Alr.'

#### Alarm unit Timing diagram:



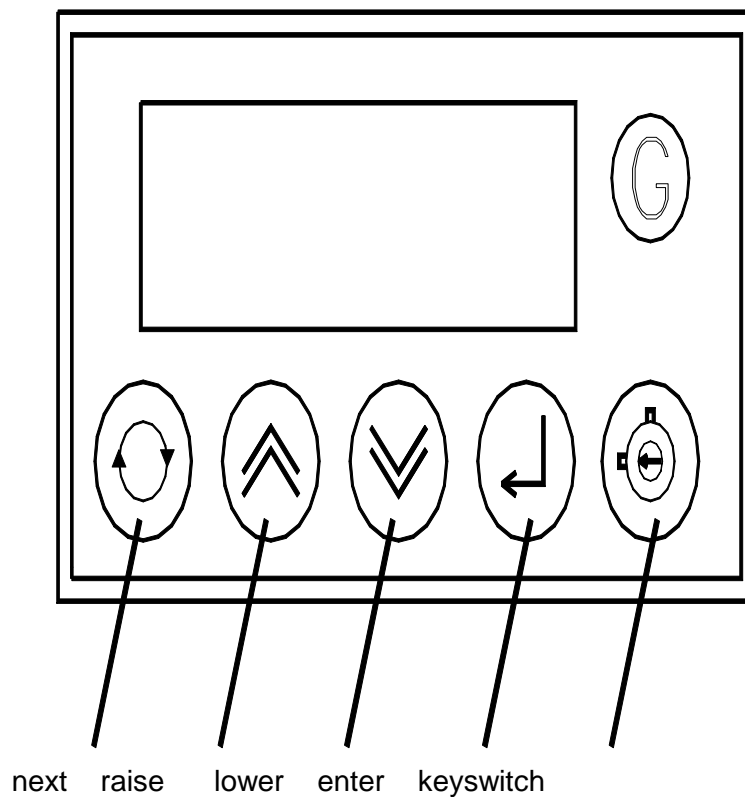
# OPERATION

The SKD.9 Keyswitch display provides a display at the case or coldroom of:

Salesfloor temperature display.

Display of other temperatures and humidity by pressing 'next' @ button, the values displayed depend on the unit model selected.

Passcode protected setup of controller setpoints, timers and limits.



---

## **CASE CLEANING OPERATION**

### **FANS ONLY**

To switch from normal automatic control mode to FANS ONLY prior to case cleaning:-  
Insert security Key into the keyswitch on the display unit.  
Ensure key turned anti-clockwise  
Turn key clockwise.  
FAnS is now displayed and all control relays are switched off except for the fans relay.  
Turn key anti-clockwise.  
Remove key until required for OFF selection.

### **OFF for cleaning**

To switch from FANS mode to OFF prior to case cleaning:-  
  
Insert security Key into the keyswitch on the display unit.  
Ensure key turned anti-clockwise.  
Turn key clockwise.  
The display unit now displays -OFF and all control relays are switched off.  
Turn key anti-clockwise.  
Remove key until required for Auto selection after cleaning is complete.  
The case is now safe for cleaning.

### **AUTO control after cleaning**

To switch from -OFF mode to AUTO after case cleaning:-  
  
Insert security Key into the keyswitch on the display unit.  
Ensure key turned anti-clockwise.  
Turn key clockwise.  
  
The display unit now displays the software version V1.0b followed by AUTO and then after a delay returns to the default temperature display.  
Turn key anti-clockwise.  
Remove key until required for the next case cleaning.

## DISPLAY INDICATIONS

### Status Display

The controller reverts to the default display if no buttons have been pressed for 3 minutes and displays the calculated product temperature CPT which is derived from an adjustable ratio of the discharge and return air.

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

- dEF While defrost is in progress
- Pd= From end of defrost cycle until discharge air temperature is within alarm band after defrost is complete
- FAn Selected for Fans Only prior to cleaning from local display or switch input
- OFF Selected OFF for cleaning from local display or switch input
- =pC= FAI L RS485 communications to controller failure.  
Baud rate set at 9600 and PC is not communicating
- Auto After power on or case OFF waiting for restart delay before opening liquid valve.
- 8888 U3. OA Software version displayed after power on

## Temperature Displays - rc12

Repeated pressing of @ displays in sequence the points listed below.

<b>Identity</b>	<b>Temperature on display</b>	
blank	Case / room/ calculated product temperature	
d===	Delivery air temperature	* note 1 *
r===	Return air	* note 2 *
i===	Evaporator inlet coil	* note 3 *
O===	Evaporator outlet coil	
H===	Evaporator superheat (o-i)	
<b>CdFH</b>	<b>relay outputs</b>	
C	if Cooling in progress	- bar if not
d	if Defrost relay energised	- bar if not
F	if Fan relay energised	- bar if not
H	if Hotgas/trim/pan Heater energised	- bar if not
<b>12AE</b>	<b>mains inputs</b>	
1 /-	state of Fanfail input	( - = off, 1 = on)
2 /-	state of heater/door/defrost input	( - = off, 2 = on)
A / H	Auto/Hold on Expansion valve control	
E /-/S	E/.. pulse on /off to expansion valve	
	S superheat alarm	
SEt= -	go to Setup Mode when Enter pressed.	
Et39	Elapse time (Defrost mode only) where 39= minutes into defrost.	

Temperature Displays -rc10

Repeated pressing of @ displays in sequence points listed below.

<b>Identity</b>	<b>Temperature on display</b>	
blank	Case / room / Calculated Product Temperature	
d===	Delivery air temperature	* note 1 *
r===	Return air	* note 2 *
C===	Evaporator coil	* note 3 *
4===	spare (monitor only)	
5===	Off switch open or short circuit ( oc/sc)	
<b>CDF=</b>	<b>Relay outputs</b>	
C	if Cooling in progress	- bar if not
d	if Defrost relay energised	- bar if not
F	if Fan relay energised	- bar if not
<b>12==</b>	<b>Mains inputs</b>	
1 /-	state of Fanfail input	( - = off, 1 = on)
2 /-	state of heater /door / defrost input	( - = off, 2 = on)
<b>SEt=</b>	-go to Setup Mode when Enter pressed.	
	<b>Elapse time (Defrost mode only)</b>	
<b>Et39</b>	Where 39 = minutes into defrost.	

- \* note 1 \*      Normal Control input
- \* note 2 \*      Control input if coldstore
- \* note 3\*      Coldstore & HGt4 termination inputs

## Temperature Displays - intC

Repeated pressing of @ displays in sequence points listed below.

<b>Identity</b>	<b>Temperature on display</b>
blank	Case / room / Calculated Product Temperature
d===	Delivery air temperature * note 1 *
r===	Return air
5===	Water sensor input oc / not oc
<b>CDF=</b>	<b>Relay outputs</b>
C	if Cooling in progress - bar if not
d	if Defrost relay energised - bar if not
H	if Hotgas/trim/pan Heater energised - bar if not
F	if Fan relay energised - bar if not
<b>12==</b>	<b>Mains inputs</b>
1 /-	state of Fanfail input (- = off, 1 = on)
2 /-	state of heater input (- = off, 2 = on)
SEt=	go to Setup Mode when Enter pressed.
	<b>Elapse time (Defrost mode only)</b>
Et39	Where 39= minutes into defrost.

\* note 1 \* Normal Control & defrost terminate input

- note 2 \* If water sensor is less than 31KR (ie water is present) then the condensate heater is switched ON to evaporate it.

•

A delay of Ft\_Fan\_delay ( 2 minutes) operates before switching on to prevent condensate heater 'chatter'.



## Temperature Displays - rnu8

Repeated pressing of @ displays in sequence points listed below.

<b>Identity</b>	<b>Temperature on display</b>
1 ===	Delivery air case 1 temperature
2 ===	Delivery air case 2 temperature
3 ===	Delivery air case 3 temperature
4 ===	Delivery air case 4 temperature
5 ===	Delivery air case 5 temperature
6 ===	Delivery air case 6 temperature
<b>AB</b> ==	<b>Mains inputs</b>
A / -	state of Fanfail input ( - = off, 1 = on)
B / -	state of heater / door / defrost input ( - = off, 2 = on)
<b>SEt</b> =	go to Setup Mode when Enter pressed.

The ru8 monitor facility allows individual limits and alarm mode to be set for each temperature using PP07 settings (Alarm limits).

All points share a common alarm differential and guardtime.

When used with GUARDIAN Autograph, each 'rnu8' unit is set up as a 'zone' with individual temperature names and alarm setpoints.

Probes 2,4,6 can be used to measure compressor discharge temperatures using a special high temperature thermistor probe MT420 (0.to 120degC) if the unit is setup as 'H246' instead of 'Std.'" Alternatively rnu8 can be configured as "digi". This converts all inputs to digital signals only.

## Temperature Displays - 'stub'

Repeated pressing of @ displays in sequence points listed below.

<b>Identity</b>	<b>Temperature on display</b>	
blank	Average case / room Temperature	
2===	Delivery air case 2 temperature	* note 1 & 2*
3===	Delivery air case 3 temperature	* note 1 & 2*
4===	Delivery air case 4 temperature	* note 1 & 2*
5===	Delivery air case 5 temperature	* note 1 & 2*
<b>CDFH</b>	<b>Relay outputs</b>	
C	if Cooling in progress	- bar if not
d	if Defrost relay energised	- bar if not
F	if Fan relay energised	- bar if not
<b>12==</b>	<b>Mains inputs</b>	
1 / -	state of Fanfail input	( - = off, 1 = on)
2 / -	state of heater / door / defrost input	( - = off, 2 = on)
<b>SEt=</b>	go to Setup Mode when Enter pressed.	
	<b>Elapse time (Defrost mode only)</b>	
<b>Et39</b>	Where 39 = minutes into defrost.	

- \* note 1 \*      Stubs control on average of all probes fitted
- \* note 2 \*      Stubs terminate on lowest probe fitted if HG-T

## Temperature Displays - '2dEF'

Repeated pressing of @ displays in sequence points listed below.

<b>Identity</b>	<b>Temperature on display</b>
1 ===	T1 temperature
2 ===	T2 temperature
3 ===	T3 temperature
4 ===	T4 temperature
5 ===	T5 temperature
6 ===	T6 temperature
11 = 1	<b>Relay outputs on R1 to R4</b>
12 ==	<b>Mains inputs</b>
	input 1 not available
2 / -	state of heater / door / defrost input ( - = off, 2 = on)
SEt =	go to Setup Mode when Enter pressed.
	<b>Elapse time (Defrost mode only)</b>
Et39	Where 39 = minutes into defrost.

- \* note 1 \*      Stubs control on average of all probes fitted
- \* note 2 \*      Stubs terminate on lowest probe fitted if HG-T

### Temperature Displays - '40C'

Repeated pressing of @ displays in sequence points listed below.

<b>Identity</b>	<b>Temperature on display(configured as 1111)</b>
1 ===	Case 1 discharge temperature
2 ===	Case 2 discharge temperature
3 ===	Case 3 discharge temperature
4 ===	Case 4 discharge temperature
1 1 1 1	<b>Relay outputs on R1 to R4</b>
= 2 = =	<b>Mains inputs</b>
1 / -	input 1 not available
2 / -	state of heater / door / defrost input ( - = off, 2 = on)
SEt =	go to Setup Mode when Enter pressed
	<b>Elapse time (Defrost mode only)</b>
Et39	Where 39 = minutes into defrost.

## Alarm Indications

Alarms alternately flash with selected temperature channel during Default and Normal operation. a, b, c, h, Hi, Lo, OC, SC, nF.

Alarms are not displayed during Setup operation.

All alarms are reset automatically when the fault has disappeared.

### *Blown Fuse Alarms*

Blown fuse Alarms are identified on LED display A-D as below:

A=== fan 1 display A

===h trim heater display D  
(IF 'Htr' selected for relay 3)

All alarm trips are inhibited when fans only, case off or during defrost.

### *Control Air alarms (return air if coldstore)*

Discharge (return) Air alarms are indicated on LED displays:

dEL= -- 13 Hi == Hi if discharge air temperature is above the control setpoint plus alarm diff. for longer than the guardtime.

dEL= -- 28 ==LO Lo discharge air temperature is below the setpoint minus alarm differential for longer than the guardtime.

Return air not discharge air alarms are given for coldstores.

Temperature alarms are inhibited during defrost cycles and during case cleaning.

Guardtime count is reset each time the discharge air returns within limits.

Alarm states Hi, Lo are automatically reset when the discharge air returns within limits.

### *Probe Fails*

dEL= =OC= FAI L open circuit probes indicate OC instead of value

dEL= =SC= FAI L short-circuit probes indicate SC instead of value

dEL= =nF= not fitted probes indicate nF (may requires 'nF' setup)

The liquid valve is closed on any failure of the control air probe.

### *PC FAIL*

If GUARDIAN controllers have not received a RS485 command for 5 minutes then the 'PC FAIL' message is displayed indicating a PC communication failure.

=PC= FAI L

If the controller is on a system which does not have a central PC alarm monitor then the PC FAIL message can be removed by selecting baud '**none**' using passcode 11.(see page 4)

PC fail messages are also removed by selecting **ndad** or **nda** under unit settings.

## USEFUL BUTTON SEQUENCES

The following button sequences should prove useful during normal service operation

### Check Unit Model

```
@: @ SEt= ? PP00 /: / PP05 ?
@: @ Uni t ? ru12 This unit model is 'ru12'
@: @ End= ? == 26
```

### Select Stub, Case No and Address

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

```
@: @ SEt= ? PP00 /: / PP05 ?
@: @ Sn01 /: / Sn60 ? Sn60
@ Cn01 ? Cn01
@ A001 /: / A180 ? A180
@: @ End= ? == 26
```

### Cut-in Setpoint for Liquid Valve (c)

To change the cooling cut-in setpoint for the liquid valve the procedure is as follows if the old setpoint is -11 the new setpoint is -05

```
@: @ SEt= ? PP00 /: / PP05 ?
@ CASE ? c- 11 /: / c- 05 ?
@: @ End= ? The unit now controls to the new discharge air
cut-in setpoint -05°C
```

### Case FANS only

To switch to FANS ONLY prior to case cleaning an alternative procedure to using the keyswitch is as follows except for Coldstores which may not be selected for FANS only.

```
@: @ SEt= ? PP00 /: / pp05 ?
@ CASE ? @: @ FAnS ? - FAn
```

When the unit displays -FAn instead of the case temperature, all alarms, liquid valve control and defrost cycles are turned off but the fans are kept running.

FANS mode may be selected remotely via RS485 communication command.

The case is switched OFF by selecting OFF mode.

The case is switched back on by selecting Auto mode.

See also Keyswitch Fans Only selection.

### Case OFF for Cleaning

To switch off a case / coldstore for cleaning an alternative procedure to using the keyswitch is as follows:-

```
@: @  SEt=    ?    PPO0    / : /    pp05    ?
      @    CASE    ?    @: @    OFF=    ?    - OFF
```

When the unit displays - OFF instead of the case temperature, all alarms, liquid valve control, defrost cycles and fan outputs are turned off.

OFF mode may be selected remotely via a switch input or a RS485 communication command.

The case is switched back on by selecting Auto mode.

See also Keyswitch Case OFF for cleaning selection page 20

### Case AUTO Mode

To return a case/coldstore back into Auto after cleaning the procedure is as follows:-

```
@: @  SEt=    ?    PPO0    / : /    pp05    ?
      @    CASE    ?    @: @    Auto    ?    Auto
```

When the unit displays Auto instead of the case temperature, all alarms are allowed and fan outputs are turned on. Time scheduled defrosts are restarted immediately if required.

Liquid valve control is inhibited until the restart delay timer has finished.

The restart delay timer prevents overloading the compressor on restart after a total power fail or compressor fault and is automatically calculated using the stub number of the case.

When the restart delay is complete, the liquid valve returns to automatic control and the case temperature value is displayed.

See also Keyswitch Case AUTO after cleaning selection page 21

### Initiate DEFROST - -

To initiate a manual defrost request the procedure is as follows:-

```
@: @  SEt=    ?    PPO0    / : /    pp05    ?
      @    CASE    ?    @: @    i dEF    ?    - dEF
```

When the unit displays -dEF instead of the case temperature, all alarms and liquid valve control are turned off.

The defrost cycle performed is dependent on the DEFROST TYPE selection ie Off-Cycle, Hotgas Terminate, Hotgas Cycle, GdFr, or Coldstore.

DEF mode may be selected remotely via a RS485 communication command.

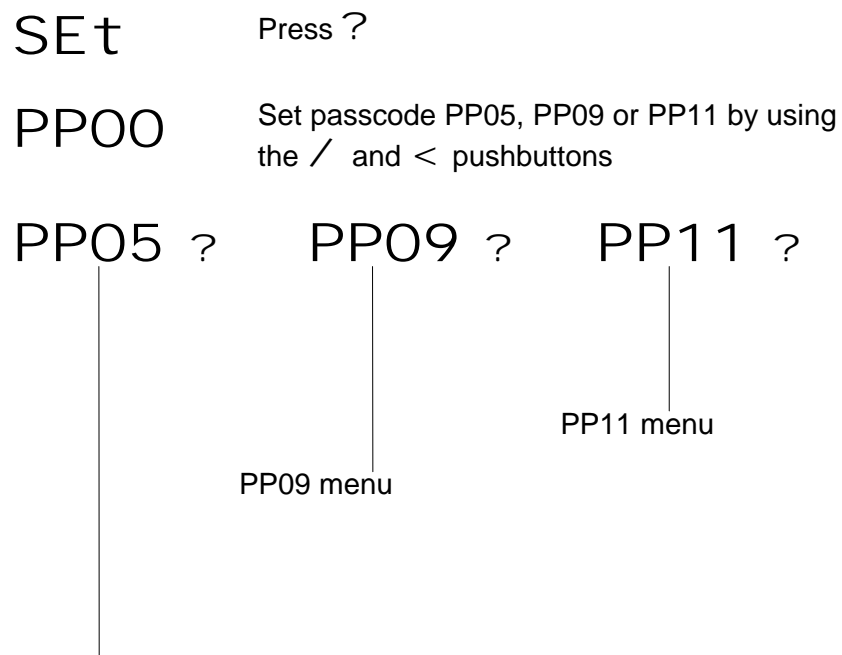
The defrost may be terminated (after draindown delay) by selecting Auto mode.

## SETUP OPERATION

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

During setup operation, alarms, temperature and defrost controls are inhibited.

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



### Setup Functions (level 1) passcode PP05

Press **@** to sequence through the Setup selections

Press **/** or **<** to change the settings

Press **?** to accept the settings

Case	<b>CASE</b>	Change control mode or cooling setpoint Page 33
Defrost	<b>DEFr</b>	Defrost type, times and settings (Commissioning only)
Electronic valve expansion	<b>EEu=</b>	Electronic expansion valve (if rc12 selected) Page 35
Unit	<b>Uni t</b>	Stub and case identity (Commissioning only) Page 36
Test	<b>tESt</b>	Toggle output relays Faulty valve check. Page 37
End	<b>End=</b>	Return to normal operation Page 21



**CASE  
CASE**

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Cut-in setpoint for  
Liquid Valve

**C=nn**      nn = -40 to +40°C

Mode selection

**YYYY**

yyyy = idEF Initiate defrost (only if in Auto) page 20  
 FAnS Fans only prior to cleaning (not allowed for coldstore) page 18  
 OFF Select case OFF for cleaning page 18  
 Auto Return to Automatic control page 19  
 These selections only operate when keyswitch selection for OFF or FAnS are not present.

Cut-in setpoint for  
liquid valve 1

**(2DEF)**  
**1 - nn**      nn = -40 to +40°C

Initiate defrost mode  
for case 1

**dEF1**

Select case 1 off for  
cleaning

**OFF1**

Return case 1 back to  
automatic control

**Aut1**

Cut-in setpoint for  
liquid valve 2

**2 - nn**      nn = -40 to +40°C

Initiate defrost mode  
for case 2

**dEF2**

Select case 2 off for  
cleaning

**OFF2**

Return case 2 back to  
automatic control

**Aut2**

Cut-in setpoint for  
liquid valve 1

**(40C)**  
**1 - nn**      nn = -40 to +40°C

Initiate defrost mode  
for case 1

**dEF1**

Select case 1 off for  
cleaning

**OFF1**

Return case 1 back to  
automatic control

**Aut1**

...etc...

Cut-in setpoint for liquid valve 4	4 - nn	nn = -40 to +40°C
Initiate defrost mode for case 4	dEF4	
Select case 4 off for cleaning	OFF4	
Return case 4 back to automatic control	Aut4	
<b>Defrost Defr</b>	Press @ to sequence through the Setup selections	
	Press / or < to change the settings	
	Press ? to accept the settings	
Defrost type	YYYY	
	YYYY = O-C	Off-cycle defrost
	HG-C	Hotgas Cycle on differential
	HG-t	Hotgas terminate on discharge air
	Stor	Coldstore terminate on probe T4
	HGt4	HGt4 = Hotgas terminate on probe T4
	GdFr	Glassdoor Freezer -fans off in defrost
Number of defrosts per day	dn=n	n = 0 to 6
First defrost time T1 hours	1h=n	n = 0 to 23 hrs
	3DEF and 6OC setup automatically delays the defrost by one hour for each system .	
	i.e. if 1h03 1t30 is set for the unit then the defrost start times will be:	
	Stub system	1      2      3      4      5      6
		0330 0430 0530 0630 0730 0830
Delay 2nd defrost by n hours if dn=2	d2dn	n = 0 to 9 hrs
First defrost time T1 minutes	1t nn	nn = 0 to 59 min
Defrost period	dPnn	nn = 2 to 99 min
Defrost periods 1-4 (4OC ,2dEF)	1Pnn	nn = 2 to 99 min
	4Pnn	nn = 2 to 99 min
Defrost termination temperature (not Off-Cycle cases)	d=nn	nn = 0 to +40 °C
Defrost termination differential (for Hotgas Cycle cases only)	ddnn	nn = 1 to 40 °C

**Electronic Expansion Valve Parameters - (only if rc12 selected)**

<b>EEu</b>		Press @ to sequence through the Setup selections
<b>Eeu</b>		Press / or < to change the settings
		Press ? to accept the settings
Superheat High. Maximum superheat	<b>SHnn</b>	nn = 0 to 40 °C
Superheat Low. Minimum superheat	<b>SLn. n</b>	n.n = 0 to 99 °C
Superheat Alarm Limit at which superheat recovery is actioned.	<b>SAnn</b>	nn = 0 to 40 °C
Stable Band	<b>Sbn. n</b>	n.n = 0 to 99 °C Taken +/- about current superheat setpoint. Oscillations of superheat outside Sb cause increase in superheat towards SH. If superheat remains within Sb then superheat is reduced towards SL ( 0 = function not active)
Stable band Delay time	<b>Sdnn</b>	nn = 0 to 99 mins Time after which Sb setpoint change is applied
Evaporating temperature of pack system	<b>E=nn</b>	nn = -40 to 40 °C If the coil in temperature is reading 5°C above this limit then the controller goes into superheat recovery mode
Defrost Recovery Valve position	<b>dr nn</b>	nn = 0 to 99%
Starting Output	<b>Sonn</b>	nn = 0 to 99% Valve position after power restart or thermostatic cycle of AKV10
Superheat Alarm Time OFF	<b>tFnn</b>	nn = 1 to 15 min Valve is shut for this time after superheat alarm before attempting recovery procedure
Superheat Alarm Time ON	<b>tnnn</b>	nn = 1 to 15 min Valve is open for this time after superheat alarm and TF time above whilst attempting recovery procedure

<b>Unit</b>	Press @ to sequence through the Setup selections
<b>Unit</b>	Press / or < to change the settings
	Press ? to accept the settings
Model type selection	YYYY
	YYYY = ru10 Standard case/coldroom controller Stub Stub model for up to five case sections sharing a common fans, defrost and suction line but with individual discharge air alarms ru8 Model suitable for alarm monitoring on 6 temperature and 2 digital inputs ru12 Model used for AKV-10/other expansion valve control intC Integral case control with drip tray heater 4OC 4 off cycle case liquid solenoid valve controls 2dEF 2 electric defrost case controls
Stub number	Snnn nn = 1 to 80
Case number (normally 3 max.)	Cn=n n = 1 to 4
Autograph address number	Annn nnn = 1 to 255 Guardian unit address automatically calculated is (Sn x 3) + Cn-1 e.g. stub 30 case 2 has address (30 x 3) + 2-1 = 91
Input 2 selection	YYYY
	YYYY = Htr Trim heater fuse fail Hgas Pack hotgas valve control input door Door open alarm
4oc & 2dEF multi- case probe configurations	YYYY
	YYYY = 4011 3021 3111 2022 2211 1111 4020 3030 5010
Product ratio %	Prnn nn = 0 to 99 (see page 27)
	YYYY
	YYYY = ndad No digital alarm display nda No digital alarms required

---

dad Digital alarms displayed

**Test**  
**tEST**

Press @ to sequence through the relay selections

Repeatedly press ? to switch the relays on and off

Heater control relay    10FF    1=on    Relay R1

Defrost relay output    20FF    2=on    Relay R2

Fan relay output    30FF    3=on    Relay R3

Expansion/LS valve  
output    40FF    4=on    Relay SSR4

All outputs return to automatic settings when SETUP is ended

**End**  
**End=**

Return from Setup to normal operation

## Expansion Valve Setup

For coil temperature control 'EET' the only parameter that requires setup is the 'E' term for pack evaporating temperature.

Other parameters at their default values should provide adequate electronic expansion valve control.

If a particular case is not controlling efficiently then other parameters may be adjusted dependent on observed performance using passcode PP11.

Expansion valve sizing should give observed valve open % averages between 40% and 60%. to allow sufficient capacity for peak demands such as defrost recovery and initial starting where refrigerant demand may exceed normal cooling by a factor of 2 and as much as 4 on certain low temperature applications.

During restart or defrost recovery the valve is maintained at preset defrost or startup open positions ( $dr=50\%$  or  $So=50\%$ ) until the coil in temperature is below  $E +5^{\circ}C$  at which point the control mode switches to automatic.

If EET type is selected and the coil in temperature is reading  $5^{\circ}C$  above the E limit then the controller goes into superheat recovery mode.

### Terminology

Under the  $E\epsilon U=$  heading in PPO5 Electronic expansion valve parameters which allows access to all control settings and are most likely to be adjusted for the valve are

$E=$  Evaporating temperature of system.

$Ed$  is the Evaporating temperature differential (the temperature above system setpoint at which protective measures are taken). That is fixed at  $5^{\circ}C$  and will switch to superheat recovery mode where the valve will close for  $tF$  time then open for  $tn$  time to  $SO$  value and maintains this cycle until  $Ed$  is restored to normal and superheat is stabilised.

$SH=$  Superheat high maximum value valve is allowed to control at.

$SL=$  Superheat low minimum value valve is allowed to control at.

$SA=$  Superheat alarm limit closes valve for  $tF$  period.

$Sb=$  Stable band. If the superheat is maintained within this limit the valve will adjust the superheat control towards  $SL$ . If the superheat is not maintained within this limit the valve will adjust the superheat control towards  $SH$ .

$Sd=$  Stable band delay. This is the time period over which superheat stability is asessed.

$dr=$  Defrost recovery valve position. This is the % valve opening held for time  $Ct$ .

$SO=$  Starting output. This is the valve % opening from power on or superheat recovery.

$tF=$  Superheat alarm time off. This is the time duration the valve is closed after a superheat alarm.

$tn=$  Superheat alarm time on. This is the time duration the valve is held open to enable recovery. The valve is opened to the % before the alarm occurred.

Under LOOP heading in PP11 the relevant settings are only accessed from the serial display:-

$bL=$  Bleed position. This is the minimum % opening the valve will operate at below which it is fully closed.

$Ct=$  Coil time. Time period valve is held at  $SO$  or  $dr$  before switching to automatic mode.

### Product Ratio

If probe 1 (case) has no probe wired to it and so is 'oc' then the default temperature value displayed and logged for probe 1 is the PR% ratio of the discharge and return air.

Pr =0      If PR% = 0 then the return air value is displayed

Pr 99      If PR% = 99 then the discharge air value is displayed

Pr 50      If PR% = 50 then the mean of discharge and return air value is displayed

Product Ratio may be used to save the cost of a probe and to display return air as the default temperature for a coldstore.

The Product Ratio PR = 88% is setup as follows using passcode 5 under UNIT selection provided T1 is 'oc':- open circuit.

```
@: @  SEt=    ?    PP00    / : /    pp05    ?
@: @  Uni t    ?
@: @  Pr00    / : /    Pr88    ?    Pr88
```

### addressing

## Alarm Unit

The RCU12 may be configured as a supermarket central alarm indicator and teledialler unit for systems using the Guardian GUARDIAN Autograph Terminal.

The required Unit settings are:-

<b>Sn80</b>	Stub number = 80
<b>Cn=1</b>	Case number = 1
<b>A249</b>	<b>A250</b> Unit address = 249 or 250
<b>Al r =</b>	Alarm selection for relay 3 (only if A = 249 / 250)

Any alarm detected and printed by the Autograph Terminal causes the alarm unit to be selected to AUTO which results in:

TB11 (fans)	Energises remote 230vac flashing beacon in store which stops when MUTE pushbutton is pressed.
TB13 (defrost)	Closes its n/o contacts for 30 seconds to initiate an alarm via the store teledialler
* * *	This output has suppressers to 230vac neutral and requires an auxiliary teledialler alarm relay to provide a volt free teledialler contact.

IF a continuous output is required for the duration of the alarm then set Ft\_Fan\_delay=10 (Ft10) in PP09

TB15 (LSV)	After a 30 second delay, flashes the 230vac alarm lamp every half second until the MUTE pushbutton is pressed when it goes steady until ALARM LIST on the AUTOGRAPH Terminal is ACCEPTED.
------------	---

TB18 (heater fail)	Is used for the MUTE pushbutton input.
--------------------	--

TB12, TB14, TB16/TB17	Should be connected to TB20 - 230Vac line
-----------------------	---

Any new alarms cause the cycle to be repeated with a contact closure for the teledialler and a flashing alarm lamp and beacon.

The flashing or steady alarm lamp is extinguished when Function key F8 - Accept Alarms is pressed at the Autograph Terminal by switching the alarm unit into OFF mode.

The correct unit address 249 must be setup for stub 80 on the Autograph Terminal to make the system function correctly.

The RCU12 alarm unit display output connector may be connected to an Autograph II terminal in order to provide signals to drive the AUTOGRAPH panel ALARM LAMP, BEEPER AND MUTE pushbutton.



## Setup Functions (level 3) passcode PP07

Alarm Monitor settings (normally for ru8 selection)

When rc10,rc12 or intC are selected these settings are automatically returned to the appropriate control limits.

When used as an alarm monitor (ru8) the temperature alarm setpoints and contact alarms may be setup as follows;

Temperature number	<b>n=AL</b>	n = 1 to 6 Press @ to select Temperature (1 to 9) Press ? to display for selected temperature
Alarm type selection	<b>YYYY</b>	YYYY = hi Goes into alarm above SP+Ad after Gt lo Goes into alarm below SP-Ad after Gt hilo Goes into alarm if hi or lo after Gt nonE Never goes into alarm Change by / or < and then press ?
Guardtime	<b>gt nn</b>	nn = 0 to 90 mins Change by / or < and then press ?
Alarm Differential	<b>Ad nn</b>	nn = 2 to 40 °C Change by / or < and then press ?
Digital input d	<b>d-AL</b>	d = A to H Use @ to select digital input (A to H) Press ? to display for selected input
Digital alarm type selection	<b>YYYY</b>	YYYY = on Goes into alarm if input ON after Gt oFF Goes into alarm if input OFF after Gt roFF Future reset facility nonE Never goes into alarm Change by / or < and then press ?
Guardtime for input d	<b>d=nn</b>	nn = 0 to 90 mins Change by / or < and then press ?

Digital guardtimes all have default value of 0 mins

---

## Setup Functions (level 2) passcode PP09

Normally FACTORY settings

Press @ to sequence through the following PP09 menu selections:-

Press ? to select the displayed menu

Real time clock	rtc=	Page 42
System settings	SYSt	Times and alarms Page <b>Error! Bookmark not defined.</b>
End	End=	Return to normal operation Page 21

### Real Time Clock 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

**System Settings**  
**SYSt**

Press @ to sequence through the Setup selections

Press / or < to change the settings

Press ? to accept the settings

Cooling differential for control	cd=n	nn = 0 to 5° C
Defrost Liquid draindown delay time	Lt nn	nn = 0 to 5 min
Defrost Fan delay time	Ft nn	nn = 0 to 10 min
Control air temp. alarm Guardtime	gt nn	nn = 0 to 99 min
Alarm differential control air	Ad nn	nn = 2 to 40 'C
Calculated defrost times - display only		
Defrost T1 time hours	1h nn	nn = 0 to 23 hrs
Defrost T1 time minutes	1t nn	nn = 0 to 59 min
Defrost T2 time hours	2h nn	nn = 0 to 23 hrs
Defrost T2 time minutes	2t nn	nn = 0 to 59 min
	<b>etc.</b>	
Defrost T6 time hours	6h nn	nn = 0 to 23 hrs
Defrost T6 time minutes	6t nn	nn = 0 to 59 min

**End**

End= Return from SETUP to normal operation Page 21

## Setup Functions (level 3) passcode PP11

Normal Factory settings only

Press **@** to sequence through the following PP09 menu selections:-

Press **?** to select the displayed menu

baud	<b>bAud</b>	Serial communications port Page <b>Error! Bookmark not defined.</b>
Loop	<b>LOOP</b>	Control PID Loop Parameters Page 49
End	<b>End=</b>	Return to normal operation Page 21

**baud**  
**bAud**

Press **@** to sequence through the Setup selections

Press **/** or **<** to change the settings

Press **?** to accept the settings

Communications  
baud rate

**YYYY**

YYYY = 9600 Baud rate  
nonE None removes PC FAIL if no PC present

**LOOP**  
**LOOP**

Press **@** to sequence through the Setup selections

Press **/** or **<** to change the settings

Press **?** to accept the settings

Proportional Gain

**P=n. n**    n.n = 0 to 255

Integral Gain

**i n. nn**    n.nn = 0 to 255

Differential Gain

**d=n. n**    n.n = 0 to 255

Bleed Position

**bLnn**    nn = 0 to 99%  
Sets minimum valve position

Loop Period

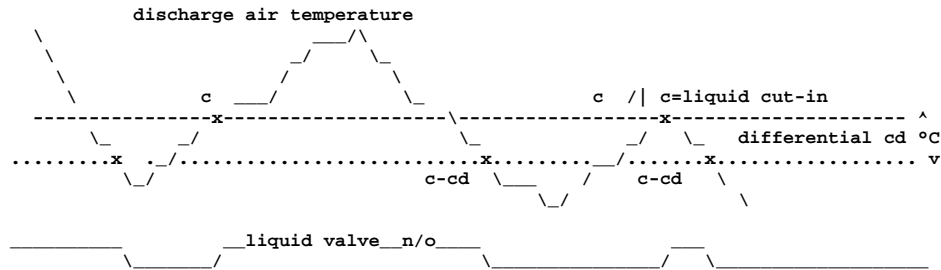
**Pdnn**    nn = 0 to 99 secs

**End**

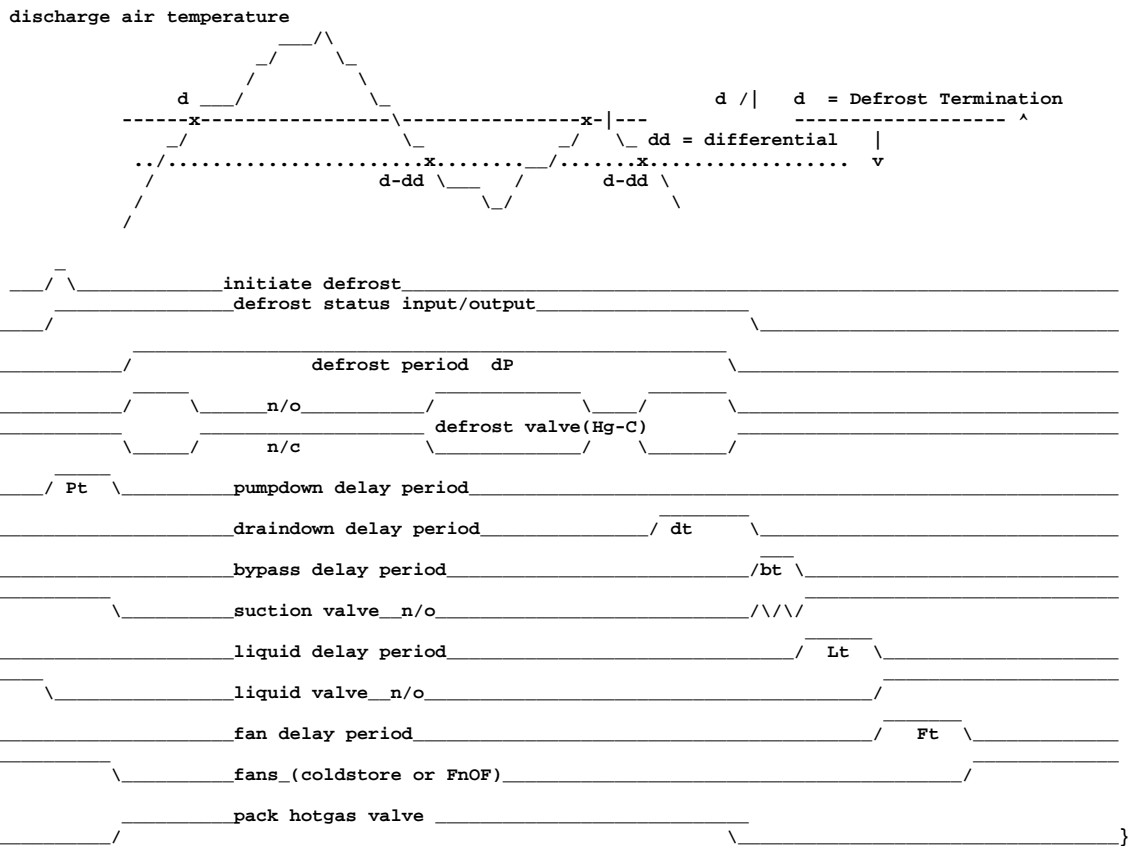
**End=**    Return from SETUP to normal operation    Page 21

## Control

**FIG.1 LIQUID VALVE CONTROL**



**FIG.2 DEFROST CYCLE VALVE CONTROL**



## DEFROST CONTROLS

### Hg-C - Hotgas Cycle

```

request ____/\_____
**** PACK ****
Hotgas valve_/_hot gas_____/_shut_____
Suction valve\_shut_____/_open_____
bypass valve_____/_open_____
**** CASE ****
FANS-1,2,3      run_____
Trim Heaters    on_____
LV              \shut_____/_open_____
HG1  _shut_/_open_____/_open_____
draindown      ..... defrost time-1..... / dt \
liquid delay   _____ / Lt \

```

### Hg-t - Hotgas Terminate

```

request ____/\_____
defrost status  defrost any case in stub _____
input/output_/_stub done_____
PACK
Hotgas valve_/_hot gas_____/_coolant_____
Suction valve\_shut_____/_open_____
bypass valve_____/_open_____
FANS-1,2      run_( if FnOn)
               \ .....stop ( if FnOF)...../
               on_( if trOn)
Trim Heaters  \.....off.( if trOF)...../
LV1          \shut_____/_open_____
HG1  _shut_/_open_____/_open_____
terminate case 1 ..... defrost time-1.....
draindown delay 1 _____ /dt 1 \
liquid delay 1   _____ / Lt1 \
LV2            \shut_____/_open_____
HG2  _shut_/_open_____/_open_____
terminate case 2 ..... defrost time-2.....
draindown delay 2 _____ / dt2 \
liquid delay 2   _____ / Lt2 \

```

### O-C Off-Cycle Defrost

```

request ____/\_____
PACK
3-way valve - not used
                run_____
FANS 1,2
LV1   _____ \      shut_____ /_____ open_____
HG1   __ not used
      ..... defrost time-1.....
Liquid delay 1 _____ / Lt1 \ _____
LV2   _____ \      shut_____ /_____
HG2   __ not used
      ..... defrost time-2....
Liquid delay2 _____ / Lt2 \ _____
  
```

### Stor - Coldstore Defrost

(Similar to Hotgas terminate HG-T except FANS are switched off)  
 Coldstores control the liquid valve on the return air probe and NOT on discharge probe.  
 Coldstores terminate on lowest valid coil probe T4 and T5 and NOT on discharge probe.  
 Coldstore door input is monitored by input c  
 Door closed = contact closed = mains present  
 Door open = contact open = no mains present  
 Coldstores fans are switched off until fan delay is complete

```

request ____/\_____
PACK
Hotgasvalve _____ / hot gas _____ \ _____ open_____
Suction valve _____ \      shut_____ /_____ open_____
bypass valve _____ /_____ open_____ \ _____
LV1   _____ \      shut_____ /_____ open_____
HG1   __ shut _____ / open _____ \ _____
      ..... defrost time-1.....
Pan Heater _____ / on _____ \ _____ off_____
pumpdown ____ / Pt \ _____
terminate on minimum valid input
of coil inputs 8 and /or 9 .....x
draindown delay _____ / dt \ _____
bypass delay _____ / bt \ _____
Liquid delay _____ / Lt \ _____
fan start delay _____ / Ft \ _____
FANS-1 run _____ \ stop _____ / _____
  
```

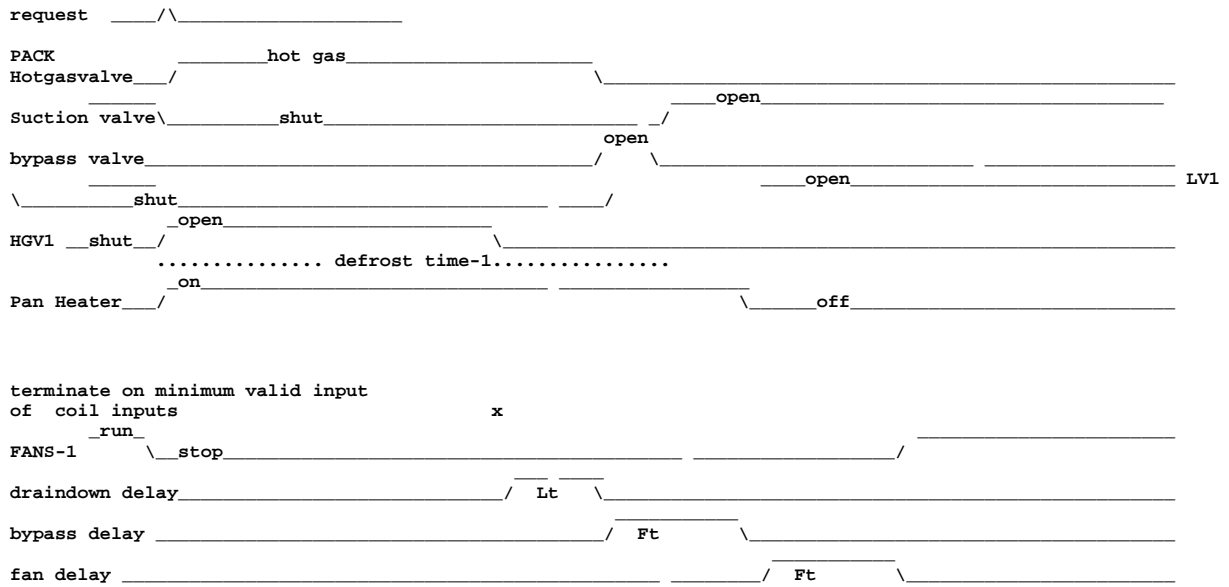
(Probe 9 MUST have 'not fitted' link if not used)

### GdFr - Glass Door Freezer Defrost

(Similar to Hotgas terminate HG -T except FANS are switched off)

Glass door Freezers terminate on lowest valid coil probe T4 and T5 and NOT on discharge probe.

Fans are switched off until fan delay is complete





---

## Communications

Communication facilities are available for interrogation of temperatures, status and modification / display of setpoints, limits and timeclock settings. All communication is via a daisy chain 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.

Each GUARDIAN controller has a unique unit number address UU/u which is used to select the appropriate unit for interrogation or modification.

UU is stub no. 1-80

u is case / coldstore number 1-3.

i.e. case 3 stub 56 has address 56/3

and coldstore stub 45 has address 45/1

Some communication commands may use 'wildcard' stub number 99 and 'wildcard' case number 9 to access all stubs on the highway or all cases in a stub.

GUARDIAN controllers are inactive until they are addressed.

When the organisation of commands on the RS485 highway is under the control of a Woodley Mk V then GUARDIAN units only accept status requests which transmit case, discharge and return air temperatures and defrost status.

GUARDIAN Autograph or RM-256 Refrigeration Monitor Communication commands available are:-

- a) Transmit Unit Status            which replies with command plus stub status & case temperature
- b) Transmit Values                which replies with stub address plus latest signed temperature values, time, trip states, relay states and internal status
- c) Transmit Setpoints            which replies with setpoints and limits.  
System Sn and unit Addresses Axxx may not be changed via the RS485 serial link
- d) Receive setpoints with new setpoint values
- e) Receive Time and Date with new hours and minutes, day, month and year for real time clock
- f) Initiate/Terminate a hot gas or off-cycle defrost
- g) ON auto / FANS only / case OFF selection for case cleaning

## RCU12 AUTOGRAPH FORMATS

### F2 Stub Detail Display

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]														
COLES OCEAN GROVE STUB DETAILS										14:31:41 Fri Mar 07 1997				
Stub	name	Status	Case_1	Case_2	Case_3	Case_4								
2	A1 13DOOR F/FOOD		-3.5	-7.5	-8.0									
DEFROST TIMES														
Stub	Type	Status	T1	T2	T3	T4	T5	T6	Per(m)					
2	A1 13DOOR F/FOOD	gdFr	0130	1330	0000	0000	0000	0000	45					
SETTINGS														
Stub	Control	Prod	Rly3	Type	no/day	Defrost	Term	dif	per	delays	Liq	Fan	Alarm	
2	-23	99	HTR	gdFr	2	01 30	25	2	45	1	1	90	8	
TEMPERATURES														
Stub	n/f	Avq.	T1	T2	T3	T4	T5	off_sw	n/f	Status				
Case	c	d	r	i	o	off	S/H	SH-SP	U%	Input	Output	Alarm		
2/1	-3.5	-3.5	2.0	-23.0	-2.5	o/c	20.5	5.0	100.0	....	C.3F	Alarm		
2/2	-7.0	-7.5	1.0	-24.0	-3.5	o/c	20.5	5.0	100.0	....	C.3F	Alarm		
2/3	-8.0	-8.0	-2.0	-28.5	-6.5	o/c	22.0	5.0	100.0	....	C.3F	Alarm		
										F9	F10			
										Next Page	Done			

### F7 Setpoints Display page 1

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]															
SAFEWAY CAMBERWELL STUB SETTINGS										10:02:41 Mon Mar 17 1997					
4	SYS	A2	24FT	F/F	1	2	3	4							
Time: 1001															
c	Control	cutin		-27											
pr	Product	Ratio		50											
	Relay 3	Type		HTR											
	Defrost	Type		HG-T											
dn	No. of	defrosts/day		2											
1H	First	defrost hours		2											
1t	First	defrost mins		0											
d	Termination	temp.		15											
dd	Termination	diff.		5											
dP	Defrost	Period (m)		35											
Lt	Liquid	Draindown (m)		1											
Ft	Fan	delay (m)		1											
Gt	Alarm	Guardtime (m)		90											
Ad	Alarm	differential		12											
DEFROST TIMES															
4	SYS	A2	24FT	F/F	Type	Status	T1	T2	T3	T4	T5	T6	Per(m)		
4	SYS	A2	24FT	F/F	HG-T		0200	1400	0000	0000	0000	0000	35		
F1	F2	F3	F4											F9	F10
Edit	Transfer	Name	Setup											Next Page	Done

*F7 EET Settings page 2*

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]				
COLES OCEAN GROVE		STUB SETTINGS		14:32:23 Fri Mar 07 1997
2 A1 13DOOR F/FOOD		1	2	3
		1431	1431	1431
Unit Type	RCU	RCU	RCU	RCU
Control Type	EET	EET	EET	EET
sh SuperHeat High	9	9	9	9
sl SuperHeat Low	5	5	5	5
sa SuperHeat Alarm	0	0	0	0
sb Stable Band	0	0	0	0
sd Stable Delay (m)	20	20	20	20
E Evaporating Temp.	-15	-15	-15	-15
dr Defrost Recovery %	65	65	65	65
so Start Output %	65	65	65	65
tf Time oFF (m)	1	1	1	1
tn Time oN (m)	2	2	2	2
ot Fan off time(m)	0.0	0.0	0.0	0.0
bt Bypass Time (m)	0.0	0.0	0.0	0.0
Pt Pumpdown Time(m)	0.0	0.0	0.0	0.0
St Suction Time (m)	0.0	0.0	0.0	0.0

F1	F2	F3	F4	F9	F10
Edit	Transfer	Name	Setup	Next Page	Done

*F1 Display Store Temperatures*

[Microm Electronics - Guardian AutoGraph Terminal v5.0d1]						
COLES SIH MELBOURNE		Store Temperatures		21:56:52 Fri Apr 25 1997		
Stub	name	Status	Case_1	Case_2	Case_3	Case_4
1	*** SYSTEM A ***					
2	A1 17DR GDFZ	DEFROST	-17.5	-17.0	-16.5	-16.0
3	A2 9DR GDFZ	OFF	-18.0	s/c Fail		
4	A3 3DR GDFZ BAKE	*ALARM	-10.5 High			
5						
6						
7	*** SYSTEM B ***					
8	B1 15DR GDFZ	Fail	-15.5	-16.5	o/c Fail	
9	B2 3DR GDFZ		-16.5			
10	B3 F/F C/R		-16.0			
11						
12						
13						
14						
15						
16						

F3	F9	F10
Graph	Next Page	Done

*F2 2DEF Detail Display*

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]													
SAFEWAY CAMBERWELL STUB DETAILS												10:00:53 Mon Mar 17 1997	
Stub	name	Status	Case_1	Case_2	Case_3	Case_4							
3	SYS A4 12FT+C/E		-24.0	-25.0	-23.0								
DEFROST TIMES													
Stub	Type	Status	T1	T2	T3	T4	T5	T6	Per(m)				
3	SYS A4 12FT+C/E	HG-T	0300	1500	0000	0000	0000	0000	35				
SETTINGS													
Stub	Control	Prod	Defrost			delays							
cutin	ratio	Rly3	Type	no/day	start	Term	dif	per	Liq	Fan	Alarm		
c	PR%			dn	hrs_min	d	dd	dP	Lt	Ft	Gt	Ad	
3	-27	50	HTR HG-T	2	03 00	15	5	35	1	1	90	12	
TEMPERATURES													
Stub	n/f	Avg.	T1	T2	T3	T4	T5	off_sw	n/f	Status			
Case	c	d	r	i	o	off	S/H	SH-SP	U%	Input	Output	Alarm	
3/1	n/f	-24.0	n/f	n/f	n/f	n/f	n/f	n/f	n/f	....	C...		
3/2	n/f	-25.0	n/f	n/f	n/f	n/f	n/f	n/f	n/f	....	C...		
3/3	n/f	-23.0	n/f	n/f	n/f	n/f	n/f	n/f	n/f	....	C...		
										F9	F10		
										Next Page	Done		

*F2 'Stub' Detail Display*

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]													
SAFEWAY CAMBERWELL STUB DETAILS												10:02:04 Mon Mar 17 1997	
Stub	name	Status	Case_1	Case_2	Case_3	Case_4							
4	SYS A2 24FT F/F		-28.0										
DEFROST TIMES													
Stub	Type	Status	T1	T2	T3	T4	T5	T6	Per(m)				
4	SYS A2 24FT F/F	HG-T	0200	1400	0000	0000	0000	0000	35				
SETTINGS													
Stub	Control	Prod	Defrost			delays							
cutin	ratio	Rly3	Type	no/day	start	Term	dif	per	Liq	Fan	Alarm		
c	PR%			dn	hrs_min	d	dd	dP	Lt	Ft	Gt	Ad	
4	-27	50	HTR HG-T	2	02 00	15	5	35	1	1	90	12	
TEMPERATURES													
Stub	n/f	Avg.	T1	T2	T3	T4	T5	off_sw	n/f	Status			
Case	c	d	r	i	o	off	S/H	SH-SP	U%	Input	Output	Alarm	
4/1	n/f	-28.0	-27.0	-25.5	-26.0	-27.5	o/c	o/c	n/f	....	C.3F		
										F9	F10		
										Next Page	Done		

*F6 Zone Display for 'Stub'*

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]								
SAFeway CAMBERWELL		ZONE ALARM LIMITS		14:41:54 Fri Mar 07 1997				
1 SYS A2 MODS 4-7								
Point		Value	ALARM	Type	Mode	Setpoint	Diff/Dial	Guard(m)
Temp.1		n/f		0	0	-27.0	12.0	90
2	AVERAGE	-28.0		0	0	-27.0	12.0	90
3	MODULE 28	-26.5		0	0	-27.0	12.0	90
4	MODULE 29	-26.0		0	0	-27.0	12.0	90
5	MODULE 30	-26.0		0	0	-27.0	12.0	90
6	MODULE 31	-27.5		0	0	-27.0	12.0	90
7	MODULE 32	o/c		0	3	-27.0	12.0	90
8		o/c		0	3	1.0	12.0	90
9		n/f		0	3	0.0	12.0	90
InputA	Door	off		0	3			0
	B OFF	off		0	3			0
	C Fans Only	off		0	3			0
	D Defrost	off		0	3			0
	E Heater	off		0	1			0
	F Fan-C	off		0	3			0
	G Fan-B	off		0	3			0
	H Fan-A	on		0	1			0

F1	F2	F3	F4	F9	F10
Edit	Transfer	Name/Addr	Setup	Next Page	Done

*F6 Zone Display for Temperature Monitor 'Rmu8' with 'H246'*

[Microm Electronics - Guardian AutoGraph Terminal v5.0f1]								
SAFeway CAMBERWELL		ZONE ALARM LIMITS		14:42:21 Fri Mar 07 1997				
11 RACKS A-C TEMPS								
Point		Value	ALARM	Type	Mode	Setpoint	Diff/Dial	Guard(m)
Temp.1	RACK-A SUCTION	-6.5		0	3	0.0	5.0	30
2	RACK-A DISCHARGE	81.0		0	3	0.0	10.0	30
3	RACK-B SUCTION	8.0		0	3	0.0	5.0	30
4	RACK-B DISCHARGE	70.0		0	3	0.0	10.0	30
5	RACK-C SUCTION	7.0		0	3	0.0	5.0	30
6	RACK-D DISCHARGE	70.0		0	3	0.0	10.0	30
7		n/f		0	3	0.0	5.0	30
8		n/f		0	3	0.0	5.0	30
9		n/f		0	3	0.0	5.0	30
InputA		on		0	3			0
	B OFF	off		0	3			0
	C	off		0	3			0
	D	off		0	3			0
	E	on		0	3			0
	F	off		0	3			0
	G	off		0	3			0
	H	on		0	3			0

F1	F2	F3	F4	F9	F10
Edit	Transfer	Name/Addr	Setup	Next Page	Done

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## Setup / commissioning Parameters

### PP05 Normal Control Menu settings

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting	
CASE	Cut-in setpoint for Liquid valve 1	°C	<b>c</b>	-40	-40	40
	<b>(2DEF)</b>					
	Cut-in setpoint for liquid valve 2	°C	<b>2</b>	-40	-40	40
	<b>(4 OC)</b>					
	Cut-in setpoint for liquid valve 3	°C	<b>3</b>	-40	-40	40
	Cut-in setpoint for liquid valve 4	°C	<b>4</b>	-40	-40	40
dEFr	Defrost type			Hg-T	O-C	gdFr
	Number of defrosts per day		<b>dn</b>	dn04	dn00	dn06
	First defrost time T1 hours	hrs	<b>1h</b>	1h00	1h00	1h23
	First defrost time T1 minutes	min	<b>1t</b>	1t30	1t00	1t59
	Delay 2nd defrost by n hours if dn=2	hrs	<b>d2d</b>	d2d3	d2d0	d2d9
	Defrost period	min	<b>1P</b>	15	2	99
	Defrost periods system 2 (4oc,)	min	<b>2P</b>	30	2	99
	Defrost periods system 3 (both)	min	<b>3P</b>	30	2	99
	Defrost periods system 4(4oc,)	min	<b>4P</b>	30	2	99
	Defrost termination temperature (not Off-Cycle cases)	°C	<b>dt</b>	15	0	40
	Defrost termination differential (for Hotgas-Cycle cases only)	°C	<b>dd</b>	0	0	40

EEU=

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Superheat High. Maximum	°C	<b>SH</b>	8	0	40
Superheat Low. Minimum	°C	<b>SL</b>	3	0	40
Superheat Alarm Limit at which superheat recovery is actioned.	°C	<b>SA</b>	1	0	40
Stable Band	°C	<b>Sb</b>	0	0	99
Stable band Delay time	sec	<b>Sd</b>	30	0	99
Pack Evaporating temperature	°C	<b>E</b>	0	-40	40
Defrost Recovery Valve position	%	<b>dr</b>	50	0	99
Starting Output	%	<b>So</b>	50	0	99
Superheat Alarm Time OFF	min	<b>tF</b>	01	01	15
Superheat Alarm Time ON	min	<b>tn</b>	02	01	15

Unit

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Model type selection			ru12	ru10	2dEF
Display type		<b>Sd</b>	Sd9	Sd9	Sd8
Stub number		<b>Sn</b>	Sn01	Sn01	Sn80
Case number (normally 3 max.)		<b>Cn</b>	Cn 1	Cn 1	Cn 4
Autograph address number		<b>A</b>	A 03	A 01	A255
Input 2 selection			Htr	Htr	door
4oc and 2DEF multicase probe configurations			4011	4011	5010
Product ratio %	%	<b>Pr</b>	50	0	99
Digital alarm detection and display			ndad	ndAd	dAd



**PP07 Alarm Limit Menu settings**

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Temperature number 1 Alarm type		<b>1-AL</b>	nonE	Hi	nonE
Alarm Limits	°C	<b>1</b>	-40	-40	40
Temperature number 2 Alarm type		<b>2-AL</b>	HiLo	Hi	nonE
Alarm Limits	°C	<b>2</b>	-25	-40	40
Temperature number 3 Alarm type		<b>3-AL</b>	nonE	Hi	nonE
Alarm Limits	°C	<b>3</b>	-40	-40	40
Temperature number 4 Alarm type		<b>4-AL</b>	nonE	Hi	nonE
Alarm Limits	°C	<b>4</b>	-40	-40	40
Temperature number 5 Alarm type		<b>5-AL</b>	nonE	Hi	nonE
Alarm Limits	°C	<b>5</b>	-40	-40	40
Temperature number 6 Alarm type		<b>6-AL</b>	nonE	Hi	nonE
Alarm Limits	°C	<b>6</b>	-40	-40	40
Guardtime	mins	<b>gt</b>	gt 30	gt 00	gt 99
Alarm differential	°C	<b>Ad</b>	Ad 05	Ad 02	Ad 40
Digital input - A Alarm type		<b>A-AL</b>	nonE	on	nonE
Guardtime for input A	mins	<b>A</b>	A 00	A 00	A 99
Digital input - b Alarm type		<b>b-AL</b>	nonE	on	nonE
Guardtime for input b	mins	<b>b</b>	b 00	b 00	b 99

### PP09 System Menu settings

rtc=	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Real clock time hours		<b>rh</b>	rh00	rh00	rh23
Real clock time minutes		<b>rt</b>	rt00	rt00	rt59

SySt	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Cooling differential for control	°C	<b>cd</b>	cd00	cd00	cd05
Defrost Liquid draindown delay time in minutes		<b>Lt</b>	Lt01	Lt01	Lt05
Defrost Fan delay time in minutes		<b>Ft</b>	Ft01	Ft01	Ft10
Control air temp. alarm Guardtime in minutes		<b>Gt</b>	30	0	99
Alarm differential control air	°C	<b>Ad</b>	5	2	40

### PP11 Special Menu settings

bAud Loopi	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Communications baud rate	baud		9600	9600	nonE
Proportional Gain		<b>P</b>	P 30	P 00	P255
Integral Gain		<b>I</b>	i 01	i 01	i255
Differential Gain		<b>d</b>	d 00	d 00	d255
Bleed position	%	<b>bL</b>	bL05	bL00	bL99