GUARDIAN
HVAC-20
HVAC and Lighting Control Unit
for Supermarkets and Coldstores

- **Average temperature & humidity control**
- **Heat Reclaim & 4-stage heating**
- **Economy Dampers & 4-stage cooling**
- **timeclock, temperature & fan control**
- **Automatic Generator Test**
- **Fire and security alarms**
- **temperature & overload alarms**
- **HVAC dehumidification setpoint optimization option for minimum energy**
- **Aisle Heating control**
- **local panel display and setup**
- **remote communications to GUARDIAN Autograph Terminal**

Operation and Setup Manual

GUARDIAN HVAC-20 Controller is a mains powered, rail-mounted HVAC & Lighting Controller for supermarkets which is configurable as either :-

- **HVAC** - Temperature and humidity control and monitoring for heating, cooling and/or dehumidification of the SALESFLOOR ambient air using the average of two temperature and two humidity probes.
- **SALE** - Temperature and humidity control & monitoring for heating, cooling and fresh air dampers for the SALESFLOOR ambient air (as HVAC-14 operation).
- **PLANT** - Temperature dependent PLANTROOM staged ventilationcontrol with additional time-scheduled heating, lighting or ventilation control outputs with overload detection (as HVAC-14 operation).
- **STORE** - Similar facilities to Plantroom for time-scheduled STOREROOM staged ventilation control (as HVAC-14 operation).
- **AISLE** - Four stages of Aisle heating or variable valve heating control.

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

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Contents

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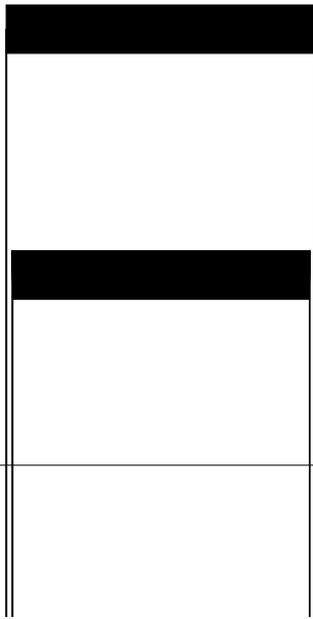
SKD.9 buttons have the following functions when pressed:

@	**'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 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   4.8b**

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

> **diSc =Oc= FAIL**

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=    ?    PPOO   /:/   PPO5   ?
```

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=    ?    PPOO   /:/   PPO5   ?
```

Enter Passcode PP05 as button sequence above

```
@:@   Uni t   ?    SALE   /:/   HUAC   ? HUAC
```

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

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
@:@   SnO1   /:/   Sn60     ?    Sn60
  @   CnO1     ?   CnO1
  @   AOO1   /:<   A18O     ?    A18O
```

@: @   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 model (HVAC-20)

HVAC-20 'SALE'   Salesfloor HEATING/COOLING
HVAC-20 'Stor'   Storeroom and fan control
HVAC-20 'Plnt'   Plantroom and office control
HVAC-20 'HvAC'   Store dehumidification
HVAC-20 'PFAn'   Industrial pump and 2-speed fans

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 HVAC-20 controller is housed in **two** DIN rail mounting enclosures each with 20 screw clamp connectors. The second unit is the 8-X Extension unit (see page 11)

HVAC20 'HVAC'

- **HVAC** - Temperature and humidity control and monitoring for heating, cooling and/or dehumidification of the SALESFLOOR ambient air using the average of two temperature and two humidity probes.

HVAC-20 Input/Output Signals

HVAC-20		
Analogue Inputs		
H1	Humidity HA	0 - 100%
H2	Humidity HB	0 - 100%
P3	Fire Alarm	Off = Alarm
P4	Security Alarm	Off = Alarm
Optional	Compressor Capacity or Economy Dampers	0 - 10 V DC
Digital Inputs		
T1	Store Air Temperature TA	
T2	Cooling Discharge	
T3	Heating Discharge	
T4	Outside Air	
T5	Off Input	Closed = Off
T6	Store Air Temperature Tb	
Mains Inputs 230Vac		
	Supply Air Proving	
	Generator Running Input	8-X Extension Unit
Relay Outputs 230/24v AC 3 amp. Maximum Accumulative Current 10 amp.		
RLY1	Economy Dampers	
RLY2	Heat Reclaim	
RLY3	Heating Stage 2	
RLY4	Heating Stage 3	
RLY5	Cooling Stage 2	
RLY6	Cooling Stage 3	
SSR7	Supply Air Fan	
8-X Extension RLY1	Generator Test Output	
8-X Extension RLY2	Not Used	
8-X Extension RLY3	Fan Speed-2 Output	
8-X Extension RLY4	Heating Stage 4	
8-X Extension RLY5	Cooling Stage 4	
8-X Extension RLY6	Cooling Stage 5	
8-X Extension SSR7	HVAC System Healthy	

HVAC-20 Termination Wiring
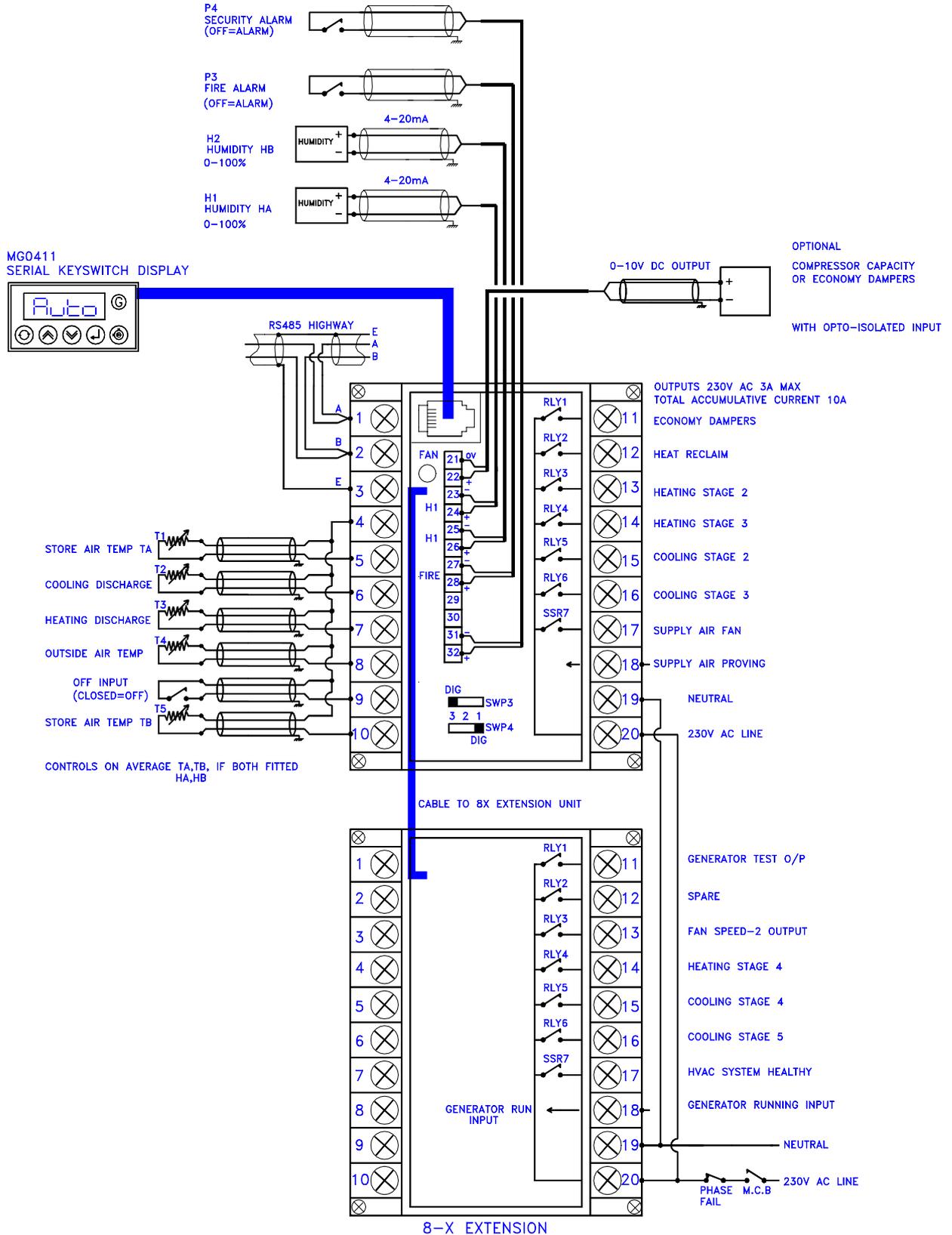
HVAC20 'SALE'

The HVAC 20 can perform all functions of a HVAC14 if so required.
This 'SALE' function is not economically performed by a HVAC20 and therefore not a usual configuration.
The 'SALE functions if actually setup on the HVAC20 are the same as those described for
 HVAC14 'SALE' in the HVAC14   OPERATION & SETUP MANUAL

HVAC20 'Stor'

The HVAC 20 can perform all functions of a HVAC14 if so required.
This 'Stor' function is not economically performed by a HVAC20 and therefore not a usual configuration.
The 'Stor' functions if actually setup on the HVAC20 are the same as those described for
 HVAC14 'Stor' in the HVAC14   OPERATION & SETUP MANUAL

HVAC20 'PLnt'

The HVAC 20 can perform all functions of a HVAC14 if so required.
This 'Plntr' function is not economically performed by a HVAC20 and therefore not a usual configuration.
The 'PLnt' functions if actually setup on the HVAC20 are the same as those described for
 HVAC14 'PLnt' in the HVAC14   OPERATION & SETUP MANUAL

HVAC20 'PFAn'

The HVAC 20 can perform all functions of a HVAC14 if so required.
This 'PFAn' function is not economically performed by a HVAC20 and therefore not a usual configuration.
The 'Stor' functions if actually setup on the HVAC20 are the same as those described for
 HVAC14 'PFan' in the HVAC14   OPERATION & SETUP MANUAL

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.

next   raise   lower   enter   keyswitch
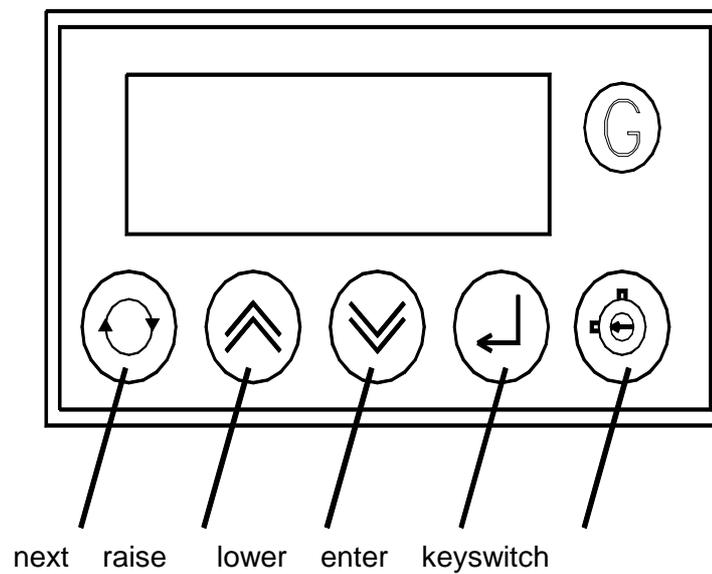
HVAC Control

HVAC control is run during store open hours as determined by Timeclock 1
It is also run out of hours if timeclock 1 is OFF and average salesfloor temperature is >24C or <17C
HVAC is controlled on average of TA,TB,HA,HB if fitted
Fire Alarm or OFF input stops all outputs
Security Alarm input is monitor only
Generator alarm is given if time scheduled generator test (timeclock 2) does not give run input within 2 minutes
Fan speed-1 is run if not OFF or fire alarm and when store open hours Timeclock 1 is ON
Fan speed-2 is run only during store open hours = timeclocks 1 and heating stage> 2 or cooling stage >1 and NOT fire alarm
HVAC Healthy goes off if any alarm is detected.
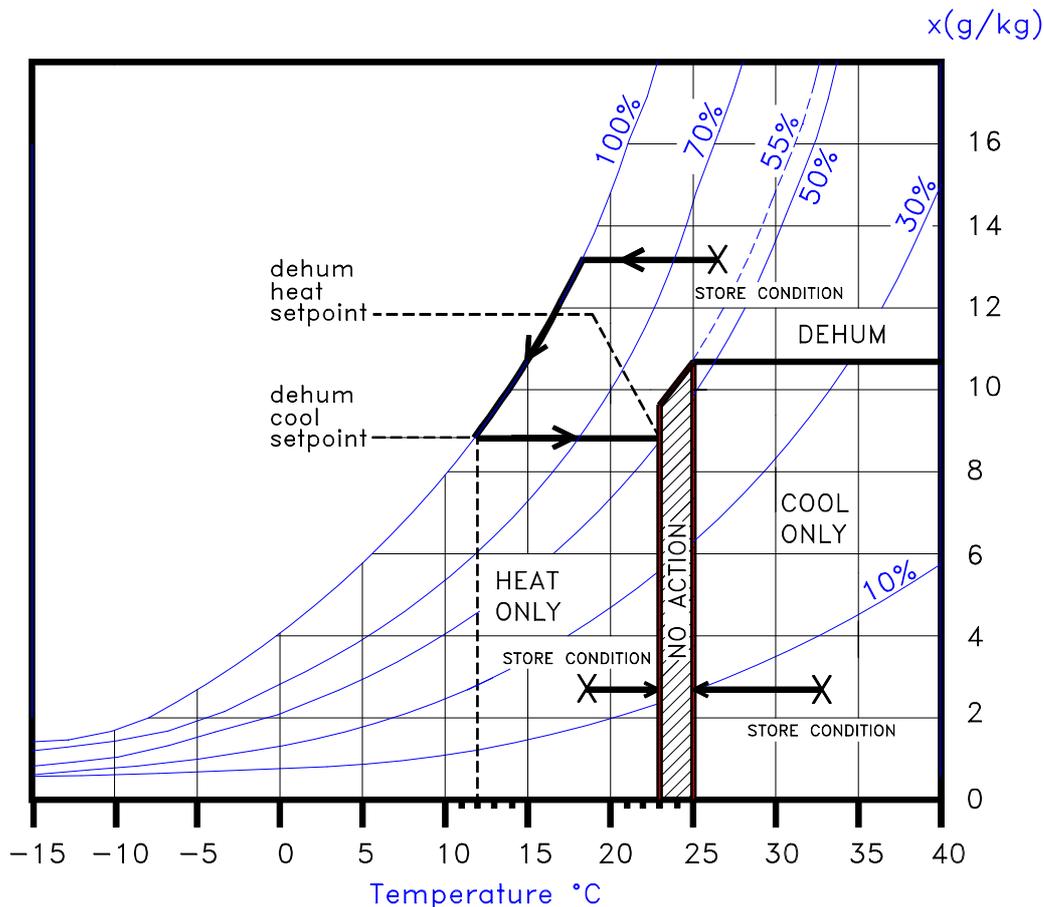
PSYCHROMETRIC CHART FOR HVAC CONTROLLERS

g:\ade\cad\symbols\psychart

DISPLAY INDICATIONS

When setup as 'HVAC', the controller reverts to the default display if no buttons have been pressed for 3 minutes and displays the average salesfloor temperature (T1 and T6)
Pressing the NEXT push button displays the next channel identification with the temperature or humidity value for the channel. Repeated pressing of next displays in sequence the points listed below:-

Identity	Temperature on display	
==23	Average (T1,T6) salesfloor air temperature	
c=13	Cooling discharge air temperature	T2
d=24	Heating discharge air temperature	T3
o=16	Outside air temperature	T4
4=oc	OFF switch state (sc=closed for OFF)	T5
HA47	Salesfloor % humidity probe	HA
Hb48	Salesfloor % humidity probe	HB
1=24	Salesfloor temperature probe	T1
6=22	Salesfloor temperature probe	T6
SC13	Present Setpoint for cooling	
SH24	present Setpoint for heating	
YYYY	Present Control Mode	
YYYY = HEAt	Control action is reheat only to fixed setpoint (FHnn). Heating stages turned on in sequence, cooling valves closed	
COOL	Control action is cool only, fixed setpoint (Fcnn). Liquid valves staged open.	
OFF	No control action, reheat and cooling valves are closed. Alarms are inhibited.	
DHun	Control action is Dehum mode with cooling setpoint (dCnn) and reheat setpoint (dHnn.) Heating and cooling staged on as required	
=123	Relay output states R1 to R3	
4567	Relay output states R4 to R7	
AbCd	R1 to R4 on 8-X Extension unit	
Efg=	R5 to R7 on 8-X Extension unit	
H-Ab	Input and timeclock status	

Default Displays

The default display	==24	Defaults to average Salesfloor Temperature

and is replaced by a status message if any of the following conditions occur:-

	8888	After power on restart
	u1. 1d	Software version displayed after power on or after OFF
	Auto	Restart routine in progress
	OFF=	HVAC selected OFF mode from PC or local display
=PC=	FAI L	PC or RS485 communications Fail
Ai r=	FAI L	Supply air failure input active
Fi rE	FAI L	Fire alarm input detected - stops all outputs
SECu	FAI L	Security Alarm

Alarm Indications

Alarms alternately flash with selected temperature channel during Default and Normal operation.   **Hi, Lo, OC, SC.,PC FAIL**
Alarms are not displayed during Setup operation.
All alarms are reset automatically when the fault has disappeared.
Alarms are setup from the Keypad using Passcode PP07 or from the PC using F5 compressors F6 limits.
IF no RS485 highway is connected then the PC FAIL message can be removed by selecting setup as follows:-

@: @	SEt=	?	PP00	/: /	PP11	?
@: @	bAud	?	9600	/: /	nonE	? none
@: @	End=	?	==24			

Temperature Alarms

Temperature alarms are indicated on LED displays as:-

Hi ==	If the temperature is above the control setpoint plus alarm differential for longer than the guardtime
==Lo	If the temperature is below the setpoint minus alarm differential for longer than the guardtime

Temperature alarms are inhibited when '-OFF' is selected from the keypad, the local OFF switch or from the remote PC.
Alarm Guardtime count is reset each time the discharge air returns within limits.
Alarm states **Hi** and **Lo** are automatically reset when the discharge air returns within limits.

Probe FailsAlarm Indications:

=OC=	Open circuit probe
=Sc=	Short circuit probe

USEFUL BUTTON SEQUENCES

The following button sequences should prove useful during normal service operation

Check Unit Model

@:@	SEt=	?	PP00	/:/	PP05	?
@:@	Uni t	?	HUAC	This unit model is 'HVAC'		
@:@	End=	?	==23			

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

Select System No and Address

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

@:@	Uni t				
@:@	Sn01	/:/	Sn60	?	Sn60
@	Cn01	?	Cn01		
@	A001	/:<	A180	?	A180
@:@	End=	?	==26		

Select HVAC Mode to AUTO

@:@	SEt=	?	PP00	/:/	PP09	?
@:@	HUAC	?				
@:@	db01	?				
@	CooL	/:<	Auto	?	Auto	
@:@	End=	?	==26			

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.

SEt=   Press ?

PP00   Set passcode PP05, PP07, PP09 or PP11 by using the / and < pushbuttons

PP05   PP09 ?   PP07 ?   PP11 ?

                                                            PP11
                                                            menu
                                                            page 27

                                        PP07 menu page 26

                    PP09 menu page 20
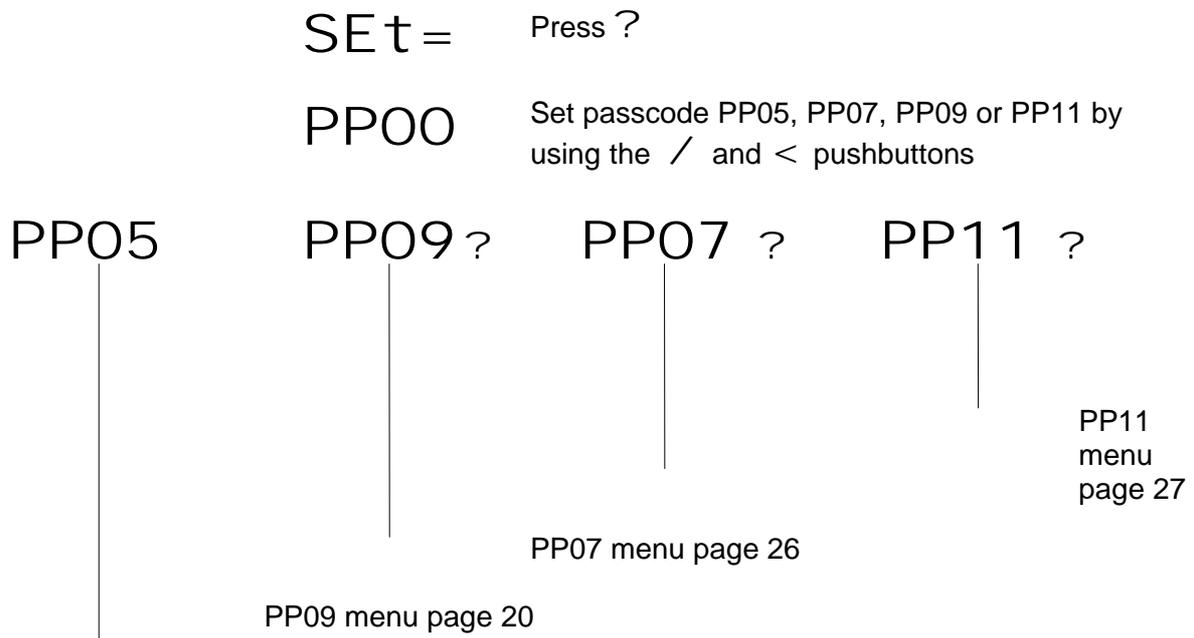
Press   @   to sequence through the following PP05 menu selections
Press   ?   to select the displayed menu

Uni t   HVAC unit identity
         Page 19

tESt   Test relays
         Page 19

End=   Return to normal operation

Setup Functions (level 1) passcode 05

PP05 Menu
Unit
Uni t

Press @ to sequence through Setup selections

Press / or < to change the settings

Press ? to accept the settings

Model type selection

YYYY

see HVAC14 Manual	YYYY = SALE	Salesfloor Heating/cooling
see HVAC14 Manual	Stor	Storeroom and Fan control
see HVAC14 Manual	PLnt	Plantroom and office control
	HvAC	Store dehumidification
see HVAC14 Manual	PFAn	Industrial Pump and 2-speed Fans
	AiSl	Aisle heating control.

Stub number

Snnn   nn = 1 to 80

Case number

Cn=n   n = 1 to 4
normally = 1

Address number

Annn   nnn = 1 to 255, 213 to 225

Digital alarm option selection

YYYY

YYYY = ndad	No digital alarm display on keypad
nda	No digital alarms – digital alarms inhibited
dad	Digital alarms displayed on keypad

Test
tESt

Press @ to sequence through the relay selections

Press ? to switch the relays on and off

Relay R1

1OFF   1=on

Relay R2

2OFF   2=on

etc. to

Relay R7

7OFF   7=on

All outputs return to automatic control when SETUP is ended

End
End=

Return from Setup to normal operation

Setup Functions (level 2) passcode 09

PP09 Menu

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

Press ? to select the displayed menu

Real time clock	rtc=	Page 20
Time clock 1 settings	tCL1	Page 21
Time clock 2 settings	tCL2	Page 21
(Only if HVAC selected)	HuAC	Page 22
	COOL	Page 24
Adjust response of stages of heating	HEAt	Page 24
Adjust delay time (minutes) between stages for both heating	DELY	Page 25
	End=	Return to normal operation

Real time clock
rtc=

Press @ to sequence through 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

Timeclock 1 settings
tCL1

Press @ to sequence through Setup selections

Change by / or < and then press ?

Used to schedule daily store open HVAC running times

1Hnn	Sunday time on Hours	nn = 00 to 23
1nnn	Sunday time on minutes	nn = 00 to 59
1hnn	Sunday time off hours	nn = 00 to 23
1Fnn	Sunday time off minutes	nn = 00 to 59
2Hnn	Monday time on hours	nn = 00 to 23
2nnn	Monday time on minutes	nn = 00 to 59
2hnn	Monday time off hours	nn = 00 to 23
2Fnn	Monday time off minutes	nn = 00 to 59

etc. to

7Hnn	Saturday time on hours	nn = 00 to 23
7nnn	Saturday time on minutes	nn = 00 to 59
7hnn	Saturday time off hours	nn = 00 to 23
7Fnn	Saturday time off minutes	nn = 00 to 59

Timeclock 2 settings
tCL2

Press @ to sequence through Setup selections

Change by / or < and then press ?

Used to schedule weekly Generator run Test
Similar to timeclock 1 (skipped if SALE, or Pfan)

1Hnn	Sunday time on Hours	nn = 00 to 23
1nnn	Sunday time on minutes	nn = 00 to 59
1hnn	Sunday time off hours	nn = 00 to 23
1Fnn	Sunday time off minutes	nn = 00 to 59

etc.

IF time on = time off then timeclock always ON   0, 0 is always ON
IF time on = 0 or time off=0 then timeclock always OFF   0, 1 is always OFF
(Only if HVAC is selected)

HuAC

Press @ to sequence through Setup selections

Change by / or < and then press ?

Reheat level setpoint	Fhnn	nn = 10 to 35 °C
Cool only level setpoint	FCnn	nn = 10 to 35 °C
Cool setpoint (Dehum mode)	dCnn	nn = 10 to 35 °C
Reheat setpoint (Dehum mode)	dHnn	nn = setpoint in range 10 to 35 °C
Dew point depression	tdnn	nn = Dew point depression. Number of degrees C below dew point to ensure de-humidification. Used in De-Hum mode.
Auto HVAC control mode selection	YYYY	

when   yyyy =

Auto	(normal automatic state) Control action is in automatic mode and control action is calculated using a physcrometric chart using the average Relative Humidity and average salesfloor temperature readings. Control actions wait 5 minutes before changing mode in order to prevent chatter at the boundaries. Liquid valves are staged open if cooling required. Heaters are staged on if heating required.
HEAt	Control action is reheat only to fixed setpoint (Fhnn). Liquid valve closed.
OFF=	No control action, reheat and cooling are turned off. Liquid valve closed. Alarms are inhibited.
CooL	Control action is cool only, fixed setpoint (Fcnn). Liquid valves staged open.
dhun	Control action is Dehum mode with cooling setpoint (dCnn) and reheat setpoint (dHnn). Liquid valves staged open.

Fresh air dampers (R1) are open if the outside air temperature is between 14 and 20 °C and cooling is required (salesfloor temperature > cooling setpoint).

Analogue output
control use selection.

YYYY

when yyyy =

SEL0   No analogue output used.

SEL1   Control loop is being used to control economy dampers.

SEL2   Control loop is used for first stage of heating.

SEL3   Control loop is used for second stage of heating.

SEL4   Control loop is used for third stage of heating.

SEL5   Control loop is used for first stage of cooling.

SEL6   Control loop is used for second stage of cooling.

Adjust response of stages of cooling
COOL

Minimum for cooling control	ctnn	nn = 0 to 40°C Even if the store temperature is not at required temperature the control system will not allow the discharge air into the store to go below this limit.
Dead band for cooling control	dbnn	nn = 0 - 9
Fast band for cooling control	Fbnn	nn = 0 - 9
Cooling Algorithm stage UP	CAnn	nn = 0 - 9 If CA = 0 then fastband operation is ignored.
Cooling Algorithm stage DOWN	CAdn	nn = 0 - 9 If CA = 9 then maximum response is given.

Cooling Algorithm factor determines the response of the cooling if the temperature is outside the setpoint +/- fastband.

Outside Air Damper Low Cutin	Ldnn	nn = 0 to 20 °C
Outside Air Damper High Cutout	Hdnn	nn = 10 to 30 °C

Adjust response of stages of heating HEAt

Maximum for heating control	htnn	nn = 0 to 40°C Even if the store temperature is not at required temperature the control system will not allow the discharge air into the store to go above this limit.
Dead band for heating control	dbnn	nn = 1 - 9
Fast band for heating control	Fbnn	nn = 1 - 9
Heating Algorithm stage UP	CAun	nn = 0 - 9 If CAu = 0 then fastband operation is ignored
Heating Algorithm stage DOWN	CAdn	nn = 0 - 9 If CAd = 9 then maximum response is given.

Heating Algorithm factor determines the response of the heating if the temperature is outside the setpoint +/- fastband.

Adjust delay time (minutes) between stages for both heating and cooling

DELY

Press @ to sequence through Setup selections

Change by / or < and then press ?

Cooling stage delay minutes	Cdn. n	n.n = 0 - 5.0
Heating stage delay minutes	Hdn. n	n.n = 0 - 5.0

End

LooP

LOOP Proportional	P=05	P-Term
LOOP Integral	I =05	I-Term
LOOP Differential	d=00	D-Term

End=   Return to normal operation

Setup Functions (level 3) passcode 07

PP07 Menu

Alarm Monitor Settings

Temperature number	**n=AL**	n = 1 to 9 Press @ to select Temperature (1 to 9) Press ? for selected temperature
Alarm type selection	**YYYY**	Change by / or < and then press ?

YYYY = hi	Goes into alarm above SP+Ad after Gt
lo	Goes into alarm below SP-Ad after Gt
both	Goes into alarm if hi or lo after Gt
nonE	Never goes into alarm

Guardtime	**gtnn**	nn = 0 to 90 mins
Alarm Differential	**Adnn**	nn = 1 to 40 °C
Digital input d	**d-AL**	d = A to H Use @ to select digital input (A to H) Press ? to display for selected input
Digital alarm type selection	**YYYY**	

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	**d=nn**	nn = 0 to 90 mins

Input allocation and default settings are:-

Input A	Timeclock 1	None
Input b	Timeclock 2	None
Input C	FIRE ALARM	If ON - STOP ALL
Input d	SECURITY ALARM	If ON
Input E	HVAC mode	None
Input F	OFF switch	None
Input G	GENERATOR FAIL	If OFF when Generator ON
Input H	SUPPLY AIR PROVING	If OFF - STOP ALL

Digital guardtimes all have default value of 0 mins

Setup Functions (level 3) passcode 11

PP11 Menu

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

Press ? to select the displayed menu

Serial communications port	bAud	Page 27
Humidity sensor scaling	SCAL	Page 27
	End=	Return to normal operation

Serial communications port
bAud

Press @ to sequence through Setup selections

Press / or < to change then ? to accept

Communications baud rate	9600	nonE	'None' removes PC FAIL if no PC present
Parity selection	8n-2	8E-1 8n-1	
Future log modes	oFF=		

Humidity sensor scaling
SCAL

Press @ to sequence through Setup selections

Press / or < to change th en ? to accept

Humidity sensor 1	=P1=	Press?	
		L000	0ma value = 0% RH
		H100	
Humidity sensor 2	=P2=	Press?	
		L000	0ma value = 0% RH
		H100	20ma value = 100% RH
Future - not used	=P3=	not used press @	
Future - not used	=P4=	not used press @	

End

End=   Return from SETUP to normal operation

COMMUNICATIONS

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

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

Each HVAC-20 has a unique unit number address Annn and System Number Snn which is used to select the appropriate unit for interrogation or modification.
Sn is system no. 1-80   normally 71, 72 for HVAC20
Annn is address 1-255   normally 213, 216

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.

HVAC-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 Setpoints which replies with setpoints and limits

Uuu addresses may not be changed via the link.

Receive setpoints with new setpoint values

PC FORMATS HVAC-20

F5 COMPRESSORS DISPLAY

```
===============[Microm Electronics - Guardian AutoGraph Terminal v5.0f]===========
 Coles Newfarm              Compressor Overview      20:54:49 Mon Apr 28 1997
Unit_____name_____..status._SUCTION_____SETPOINT_____DISCHARGE____CAPACITY____
  1 LT  RACK A  R507       FAIL      0.4         0.7        13.8         81.0
  2 LT  RACK B  R507       Htr       1.0         0.7        15.0        100.0
  3 MT  RACK C  R507       FanC      2.4         2.8        16.0         69.0
  4 MT  RACK D  R507                 4.3         3.4        17.3         73.0
  5
  6
  7
  8
  9
 10 COLES  MAIN A/C                 21.5        21.0        19.5         Heat
 11 OFFICE A/C                      20.0        22.0        o/c          Auto
 12 PLANT  ROOM FANS                23.5        28.0        s/c          Auto
 13 SHOP  FANS 1                    o/c         26.0        s/c          Auto
 14 SHOP  FANS 2                    o/c         26.0        s/c          Auto
 15


  F1       F2       F3       F4              F6        F7          F8           F10
 Edit    Detail  Graph  Setpoints          Limits  Configure  Alarm List      Done
```

F5 COMPRESSORS F2 DETAIL DISPLAY(HVAC20)

```
===============[Microm Electronics - Guardian AutoGraph Terminal v5.0f]===========
 Coles Newfarm              Compressor Detail        20:53:17 Mon Apr 28 1997
Unit_____name_____..status._SUCTION_____SETPOINT_____DISCHARGE____CAPACITY____
 10 COLES MAIN A/C                 21.5        21.0        19.0         Heat

                   Average Temp SalesfloorT1 SalesfloorT2   Outside Air
  HVAC   Temps.        21.5          21.0         21.5          19.0
                   Average Rh%  SalesfloorH1 SalesfloorH2      Mode
  Humidity Rh%         49.0          45.0         53.0          Heat
                   Discharge     Setpoint      Fan-1       Timeclock 1
  Cooling  Deg C       19.0          10.0          on            on
                   Discharge     Setpoint      Fan-2       Timeclock 2
  Heating Deg C        19.0          18.0         off           off
                   Cooling %     Dampers     Heat Reclaim HVAC Control
  Compr. Capacity      0.0           off          off
                   Cooling-2     Cooling-3    Cooling-4    Cooling-5
  Cooling Relays       off           off          off          off
                   Heating-2     Heating-3    Heating-4    Heating-5
  Heating Relays       off           off          off          off
                   Supply Air   FIRE ALARM!  SECURITY ALM   Generator
  Inputs               run                         on           off

   F1                                                          F9       F10
 FindComp                                                  NextComp   Done
```

F5 COMPRESSORS F4 HVAC20 CONTROL SETTINGS

```
=========[Microm Electronics - Guardian AutoGraph Terminal v5.0c]========
  COLES TOOWOOMBA          Compressor Setpoints      04:34:40 Mon Oct 21 1996
   9 COLES A/C PLANT
                            =Value=        =Max=        =Min=
 1 Fixed Heat Setpt         21.0           30.0         20.0
 2 HVAC-SALEFLOOR            3.0             3.0          0.0
 3 Damper Low Limit         20.0           20.0         10.0
 4 Damper HighLimit         24.0           30.0         15.0
 5 Fixed Cool Setpt         23.0           30.0          0.0
 6 Dehum Cool Setpt         10.0           30.0          0.0
 7 Dehum Heat Setpt         30.0           30.0         20.0
 8 Deadband                 1.0             5.0          0.1
 9 Cool Fast Zone           5.0            10.0          1.0
10 Cool Up Algrithm         5.0             9.0          0.0
11 Cool Down Algthm         5.0             9.0          0.0
12 Cool Stage Delay         1.0             5.0          0.5
13 Heat Fast Zone           5.0            10.0          1.0
14 Heat Up Algrithm         5.0             9.0          0.0
15 Heat Down Algthm         5.0             9.0          0.0
16 Heat Stage delay         1.0             5.0          0.5

          F2                      F6                       F10
       Transfer                Settings                   Done
```

F5 COMPRESSORS F6 ALARM LIMITS (HVAC)

```
==========[Microm Electronics - Guardian AutoGraph Terminal v5.0f]========
  Coles Newfarm          Alarm & Trip Limits      20:53:49 Mon Apr 28 1997
  10 COLES MAIN A/C      -     SALESFLOOR HVAC
                    = Value Alarm Ð=Low_Alarm==High_Alarm=Deadband====Guardtime=
1 Sales Temp. Avg.      21.0            0.0         44.0        5.0         2.0
2 Cooler Discharge      19.5            ..           ..         ..          ..
3 Heater Discharge      19.0            ..           ..         ..          ..
4 Outside Air Temp      19.0            ..           ..         ..          ..
5 Cooling   %           0.0             ..           ..         ..          ..
6 Humidity % Avg.       49.0            ..           ..         ..          ..
7 Cooling Setpoint      10.0            ..           ..         ..          ..
8 Heating Setpoint      18.0            ..           ..         ..          ..
9 Mode                  Heat            ..           ..         ..          ..
====== INPUTS ======= state Alarm Ï type_mode_guard====== OUTPUTS ==== state =
A Timeclock-1            on        8     3    0   I                         off
B Timeclock-2            off       8     3    0   J Fresh Air Damper        off
C FIRE ALARM !!                   13     0    0   K Heat Reclaim            off
D SECURITY ALARM!        on        8     0    0   L Heating Stage 2         off
E                                 13     3    0   M Heating Stage 3         off
F Off Switch             .        11     3    0   N Cooling Stage 1         off
G Generator Test         off       8     1    2   O Cooling Stage 2         off
H Supply Air Fans        run       9     1    0   P Cooling Stage 3         on
= F1 ===== F2 ===== F3 =========x======= F6 ====== F7 ==== F9 ==== F10 =
FindPage Transfer Name                  Set Limits   Setup  Next Page   Done
```

F9 NEXT PAGE HVAC TIMECLOCK 1

```
==========[Microm Electronics - Guardian AutoGraph Terminal v5.0f]========A
  Coles Newfarm          Alarm & Trip Limits      20:54:02 Mon Apr 28 1997
  10 COLES MAIN A/C      -     HVAC TIMECLOCK 1
                    = Value Alarm Ð=   TIME ON== ======   TIME OFF= ======
1 Sunday               0.0              0        ..        0          ..
2 Monday               0.0              0        ..        0          ..
3 Tuesday              0.0              0        ..        0          ..
4 Wednesday            0.0              0        ..        0          ..
5 Thursday             0.0              0        ..        0          ..
6 Friday               0.0              0        ..        0          ..
7 Saturday             0.0              0        ..        0          ..
8 Temperature T1       21.0            ..        ..        ..         ..
9 Temperature T6       21.0            ..        ..        ..         ..
====== INPUTS ======= state Alarm Ï type_mode_guard====== OUTPUTS ==== state =
A HVAC Timeclock        on        8     0    0   I                         off
B Gen.Test T/clock      off       8     0    0   J Generator Test          off
C                                 13     0    0   K spare                   off
D                                 13     0    0   L Fan Speed-2             off
E                                 13     0    0   M Heating Stage 4         off
F                                 13     0    0   N Cooling Stage 4         off
G                                 13     0    0   O Cooling Stage 5         off
H                                 13     0    0   P HVAC Healthy            on
= F1 ===== F2 ===== F3 =========x======= F6 ====== F7 ==== F9 ==== F10 =
FindPage Transfer Name                  Set Limits   Setup  Next Page   Done
```

F9 NEXT PAGE GENERATOR TEST TIMECLOCK 2

```
╔═════════════════[Microm Electronics - Guardian AutoGraph Terminal v5.0f]═══════════╗
║ Coles Newfarm                 Alarm & Trip Limits          20:54:28 Mon Apr 28 1997║
║ 10 COLES MAIN A/C         -    GEN. TEST T/CLK2                                     ║
║════════════════════ Value Alarm Ð= TIME ON══ ══════════ TIME OFF═ ═══════          ║
║1 Sunday             0.0             0           ..          0          ..           ║
║2 Monday             0.0          1000           ..       1030          ..           ║
║3 Tuesday            0.0             0           ..          0          ..           ║
║4 Wednesday          0.0             0           ..          0          ..           ║
║5 Thursday           0.0             0           ..          0          ..           ║
║6 Friday             0.0             0           ..          0          ..           ║
║7 Saturday           0.0             0           ..          0          ..           ║
║8 Humidity H1       45.0            ..           ..         ..          ..           ║
║9 Humidity H2       52.0            ..           ..         ..          ..           ║
║══════ INPUTS ═════ state Alarm Ï type_mode_guard╤══════ OUTPUTS ═══ state ═         ║
║A HVAC Timeclock     on           8    0    0  ║I                      off          ║
║B Gen.Test T/clock   off          8    0    0  ║J                      off          ║
║C                                12    0    0  ║K                      off          ║
║D                                12    0    0  ║L                      off          ║
║E                                12    0    0  ║M                      off          ║
║F                                12    0    0  ║N                      off          ║
║G                                12    0    0  ║O                      off          ║
║H                                12    0    0  ║P                      off          ║
║═ F1 ═════ F2 ═════ F3 ═════════════╪══════════ F6 ══════ F7 ═══ F9 ═══ F10 ═        ║
║FindPage Transfer Name                         Set Limits  Setup  Next Page   Done   ║
╚════════════════════════════════════════════════════════════════════════════════════╝
```

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GUARDIAN CONTROLS
international

Setup / commissioning Parameters

PP05 (Level 1) Settings

Uni t

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Model type selection			SALE	SALE	Aisle
Stub number		*Sn*	Sn01	Sn01	Sn80
Case number (normally 3 max.)		*Cn*	Cn 1	Cn 1	Cn 4
Autograph address number			A255	A 00	A255
Digital alarm detection and display			ndAd	ndAd	dAd

PP09 (level 2) Menu Settings

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
rtc=	Real clock time hours	Hrs	*rh*	rh 00	rh 00	rh 23
	Real clock time minutes	mins	*rt*	rt 00	rt 00	rt 59
tCL1	Sunday Time On Hours	Hrs	*1H*	00	00	23
	Sunday Time On Minutes	mins	*1n*	35	00	59
	Sunday Time Off Hours	Hrs	*1h*	00	00	23
	Sunday Time Off Minutes	mins	*1F*	35	00	59
	Monday Time On Hours	Hrs	*2H*	00	00	23
	Monday Time On Minutes	mins	*2n*	35	00	59
	Monday Time Off Hours	Hrs	*2h*	00	00	23
	Monday Time Off Minutes	mins	*2F*	35	00	59
	Tuesday Time On Hours	Hrs	*3H*	00	00	23
	Tuesday Time On Minutes	mins	*3n*	35	00	59
	Tuesday Time Off Hours	Hrs	*3h*	00	00	23
	Tuesday Time Off Minutes	mins	*3F*	35	00	59
	Wednesday Time On Hours	Hrs	*4H*	00	00	23
	Wednesday Time On Minutes	mins	*4n*	35	00	59
	Wednesday Time Off Hours	Hrs	*4h*	00	00	23
	Wednesday Time Off Minutes	mins	*4F*	35	00	59
	Thurday Time On Hours	Hrs	*5H*	00	00	23
	Thurday Time On Minutes	mins	*5n*	35	00	59
	Thurday Time Off Hours	Hrs	*5h*	00	00	23
	Thurday Time Off Minutes	mins	*5F*	35	00	59
	Friday Time On Hours	Hrs	*6H*	00	00	23
	Friday Time On Minutes	mins	*6n*	35	00	59
	Friday Time Off Hours	Hrs	*6h*	00	00	23
	Friday Time Off Minutes	mins	*6F*	35	00	59
	Saturday Time On Hours	Hrs	*7H*	00	00	23
	Saturday Time On Minutes	mins	*7n*	35	00	59
	Saturday Time Off Hours	Hrs	*7h*	00	00	23
	Saturday Time Off Minutes	mins	*7F*	35	00	59

GUARDIAN CONTROLS
international

PP09 (level 2) Menu Settings(cont)

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
tCL2	Sunday Time On Hours	Hrs	*1H*	00	00	23
	Sunday Time On Minutes	mins	*1n*	35	00	59
	Sunday Time Off Hours	Hrs	*1h*	00	00	23
	Sunday Time Off Minutes	mins	*1F*	35	00	59
	Monday Time On Hours	Hrs	*2H*	00	00	23
	Monday Time On Minutes	mins	*2n*	35	00	59
	Monday Time Off Hours	Hrs	*2h*	00	00	23
	Monday Time Off Minutes	mins	*2F*	35	00	59
	Tuesday Time On Hours	Hrs	*3H*	00	00	23
	Tuesday Time On Minutes	mins	*3n*	35	00	59
	Tuesday Time Off Hours	Hrs	*3h*	00	00	23
	Tuesday Time Off Minutes	mins	*3F*	35	00	59
	Wednesday Time On Hours	Hrs	*4H*	00	00	23
	Wednesday Time On Minutes	mins	*4n*	35	00	59
	Wednesday Time Off Hours	Hrs	*4h*	00	00	23
	Wednesday Time Off Minutes	mins	*4F*	35	00	59
	Thurday Time On Hours	Hrs	*5H*	00	00	23
	Thurday Time On Minutes	mins	*5n*	35	00	59
	Thurday Time Off Hours	Hrs	*5h*	00	00	23
	Thurday Time Off Minutes	mins	*5F*	35	00	59
	Friday Time On Hours	Hrs	*6H*	00	00	23
	Friday Time On Minutes	mins	*6n*	35	00	59
	Friday Time Off Hours	Hrs	*6h*	00	00	23
	Friday Time Off Minutes	mins	*6F*	35	00	59
	Saturday Time On Hours	Hrs	*7H*	00	00	23
	Saturday Time On Minutes	mins	*7n*	35	00	59
	Saturday Time Off Hours	Hrs	*7h*	00	00	23
	Saturday Time Off Minutes	mins	*7F*	35	00	59

PP09 (level 2) Menu Settings(cont)

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
HuAC	Relative Humidity setpoint	°C	*rH*	rH 55	RH45	rH55
	Cool only level setpoint	°C	*FC*	FC 10	FC10	FC35
	Cool setpoint (Dehum mode)	°C	*dC*	dC 10	dC10	dC35
	Reheat setpoint (Dehum mode)	°C	*dH*	dH 10	dH10	dH35
	Dew point depression		*td*	td 00	td00	td05
	HVAC control mode selection			Auto	Auto	dHun
	Analogue output mode selection Sel0 not used Sel1 Enconomy Damper control Sel2 to Sel4 Heating control Sel5 to Sel6 Cooling control			Sel0	Sel0	Sel6
COOL	Minimum discharge temperature into store		*ct*	ct 00	ct00	ct40
	Dead band for cooling control		*db*	db 00	db00	db09
	Fast band for cooling control		*Fb*	Fb 00	Fb00	Fb09
	Cooling Algorithm stage UP		*CAu*	CAu 0	CAu0	CAu9
	Cooling Algorithm stage DOWN		*CAd*	CAd 0	CAd0	CAd9
	Outside Air Damper Low Cutin	°C	*Ld*	Ld 00	Ld00	Ld20
	Outside Air Damper High Cutout	°C	*Hd*	Hd 10	Hd10	Hd30
HEAt	Maximum discharge temperature into store.		*ht*	ht 00	ht00	ht40
	Dead band for heating control		*db*	db 00	db00	db09
	Fast band for heating control		*Fb*	Fb 00	Fb00	Fb09
	Heating Algorithm stage UP		*HAu*	HAu	HAu0	HAu9
	Heating Algorithm stage DOWN		*HAd*	HAd	HAd0	HAd9
dELY	Cooling stage delay minutes		*Cd*	Cd 0.0	Cd0.0	Cd5.0
	Heating stage delay minutes		*Hd*	Hd 0.0	Hd0.0	Cd5.0
LooP	LOOP Proportional		*P*	P 0	P 00	P255
	LOOP Integral		*I*	i 0	i 00	i 255
	LOOP Differential		*d*	d 0	d 00	d 255

PP11 (level 3) Menu Settings

		unit	ACTUAL settings	Default setting	Min. setting	Max. setting
bAud	Communications baud rate			9600	9600	nonE
SCAL	Humidity sensor 1 0ma value P1		*L*	L 000	L 000	L 255
	Humidity sensor 1 20ma value		*H*	H 000	H 000	H 255
	Humidity sensor 2 0ma value P2		*L*	L 000	L 000	L 255
	Humidity sensor 2 20ma value		*H*	H 000	H 000	H 255

PP07 (level 3) Menu Settings

	unit	ACTUAL settings	Default setting	Min. setting	Max. setting
Temperature number 1 Alarm type		*1-AL*	Hi	Hi	nonE
Alarm Limits	°C	*1*	−01	−40	40
Temperature number 2 Alarm type		*2-AL*	Hi	Hi	nonE
Alarm Limits	°C	*2*	−01	−40	40
Temperature number 3 Alarm type		*3-AL*	Hi	Hi	nonE
Alarm Limits	°C	*3*	−01	−40	40
Temperature number 4 Alarm type		*4-AL*	Hi	Hi	nonE
Alarm Limits	°C	*4*	−01	−40	40
Temperature number 5 Alarm type		*5-AL*	Hi	Hi	nonE
Alarm Limits	°C	*5*	−01	−40	40
Temperature number 6 Alarm type		*6-AL*	Hi	Hi	nonE
Alarm Limits	°C	*6*	−01	−40	40
Guardtime	mins	*gt*	gt 30	gt 00	gt 99
Alarm differential	°C	*Ad*	Ad 05	Ad 02	Ad 40
Digital input - A Alarm type		*A-AL*	oFF	on	nonE
Guardtime for input A	mins	*A*	A 00	A 00	A 99
Digital input - b Alarm type		*b-AL*	oFF	on	nonE
Guardtime for input b	mins	*b*	b 00	b 00	b 99
Digital input - C Alarm type		*C-AL*	oFF	on	nonE
Guardtime for input C	mins	*C*	C 00	C 00	C 99
Digital input - d Alarm type		*d-AL*	oFF	on	nonE
Guardtime for input d	mins	*d*	d 00	d 00	d 99
Digital input - e Alarm type		*e-AL*	oFF	on	nonE
Guardtime for input e	mins	*e*	e 00	e 00	e 99
Digital input - F Alarm type		*F-AL*	oFF	on	nonE
Guardtime for input F	mins	*F*	F 00	F 00	F 99
Digital input - g Alarm type		*g-AL*	oFF	on	nonE
Guardtime for input g	mins	*g*	g 00	g 00	g 99
Digital input - h Alarm type		*h-AL*	oFF	on	nonE
Guardtime for input h	mins	*h*	h 00	h 00	h 99