GUARDIAN

GUARDIAN 1287

Intelligent Temperature Controller

for supermarket cases & coldstores

* **case or coldroom temperature control**

* **electronic expansion valve control
   using Temperature or pressure**

* **liquid valve and defrost cycle control**

* **hotgas, trim heater and lighting control**

* **suction valve control with pulsed bypass**

* **control-air temperature alarm monitor**

* **blown-fuse trip alarm monitor**

* **evaporator temperatures monitor & display**

* **refrigerant gas level alarm monitor**

* **serial panel display and setup**

* **off/fans mode selection from panel keyswitch**

* **control mode selection from remote panel**

* **real time calendar clock**

* **remote communications to GUARDIAN Autograph
   Terminal or Woodley System 5**

  * **12 analog channels
       temperatures
       1 pressure, 1 gas level**

  * **3 control mode inputs
       1 coldstore door input
       1 trim heater fuse trip
          or defrost request
       3 fan-fuse trips**

  * **5 control relays
       1 defrost mode output
       1 expansion valve outputs
       2 optional expansion valves**

**issue V1.0d
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OVERVIEW

The GUARDIAN 1287 Temperature Controller is a mains-powered refrigerated   case or coldroom temperature and defrost controller which provides liquid valve or electonic expansion valve control for one or optionally 3 evaporators.

The GUARDIAN 1287 controller is mechanically and electrically compatible with the ITC-1085 controller whilst providing additional terminals for electonic expansion valve control on 3 coils, extra time-scheduled lighting and suction relay. Terminals for 3 extra monitoring channels for temperatures, pressure or a refrigerant gas level probe are also included. Setup and display facilities via a serial display panel are similar to the ITC-1085 but the display panel has been upgraded to contain a 2-position keyswitch for operator case cleaning selection of FANS, OFF, AUTO.

Communications with a GUARDIAN Autograph Terminal, or a Woodley System 5 to provide centralized alarm monitoring and parameter setup via a RS485 multi-drop highway.
The system comprises a) control unit,
                b) serial display unit
                c) up to 9/12 6-metre thermistor probes
The Controller provides facilities for:-

 a) Measurement of up to 9 or 12 refrigeration temperatures
    including:- return air, discharge air off each of up to
    3 coils, inlet and outlet temperatures for each of up to
    3 coils plus refrigerant gas level with reference
    validation and optional suction pressure for expansion
    valve control.
    Calculated   product temperature is displayed as   a
    percentage of the mean of discharge and return air.
    All temperatures are displayed in degree Centigrade as
    sign plus 2 digits on the 4-digit LED display panel.
    Values are rounded down ie -30.5 is displayed as -31.
    Channel identification of displayed temperatures
    alternates with the temperature value.

 b) Detection and optional display of 240vac input states on
    upto 4 blown fuse alarms (Fans a,b,c,trim heater d).
    The trim heater input may be selected as a mains
    defrost input.
    Fan-C input may be selected as a coldroom door input.
    A volt-free contact input is aternatively available for
    low-voltage coldstore door inputs.

 c) Detection of control air Hi,Lo alarms after guardtime.
    Alarms are inhibited during defrost cycles or case OFF.

 d)   Liquid solenoid valve control dependent on control air
    temperature, control setpoint and differential. The
    valve is de-energised when defrost or setup are in
    operation or on failure of the control air probe.

e) Defrost sequence initiation using internal defrost timeclock settings , draindown time and fan delay times if coldstore.

f) Display of Defrost in progress by -dEF, or pulldown after defrost by -Pd, instead of calculated product temperature.

g) control of the Defrost valve dependent on defrost termination temperature and termination cut-in setpoint and differential while defrost is in operation .
Defrost is inhibited during setup or on failure of the termination termperature probe.

h) Fan inhibit control output during 'Case OFF' or Hot Gas defrost cycles if coldstore.

i) Hotgas valve termination control for complete stub and Trim/Pan Heater control in defrost, Fans or OFF modes.

j) staggered restart delay dependent on stub number before opening liquid valves to prevent compressor start-up overload after trip or power fail.

k) Local modification and display of temperatures,unit number and control settings and defrost times via pushbuttons on the serial display panel.

l) Remote modification and display of temperatures, control settings,defrost times, control and alarm status via the RS485 multi-drop serial highway.

Additional features provided by the GUARDIAN 1287 include

m) Time-scheduled Lighting relay control output operated from the controller internal battery backed real-time clock, Autograph Terninal or Woodley System 5.

n) solid state control outputs providing electronic expansion valve control on 1 (optionally 3) evaporator coils.
When selected for electronic expansion valve control, pulse width modulation of the expansion valve outputs provides optimimum superheat setpoint control using dynamic compensation of the setpoint. The coil in temperature can be derived from either a thermistor probe or the equivalent suction temperature from a pressure input

o) Optional Hot gas suction valve with pulsed bypass period control from a solid state relays.

p) Skip all but first defrost per day if discharge and return air temperatures indicates the evaporator is still working efficiently

q) Delay second defrost by x hours if it is required to avoid defrosts during store open hours.

r) OFF/FANS/AUTO keyswitch on the serial display changes control mode as an alternative to selecting from Stub switches

p) Refrigerant Gas level alarm monitoring using a sensor and reference probe

CONTROL UNIT
The control unit comprises a printed circuit board which has
overall dimensions approximately:-

    base 150mm * hight 65mm * length 220mm.
    power 230vac at 5 watt
        12vdc at 10ma for status inputs
The 2-SSR expansion valve Solid state relay extension plugs
on top of the 1287
Input/output signals

analogue inputs (thermistor) (-40 to +40 deg.C)
    CPt   1   case or calculated product temperature
    DEL   2   discharge air temperature
    rEt   3   return air temperature
    Ei1   4   Evaporator inlet 1 temperature
    Eo1   5   Evaporator outlet 1 temperature
    Ei2   6   Evaporator inlet 2 temperature
    Eo2   7   Evaporator outlet 2 temperature
    Ei3   8   Evaporator inlet 3 temperature
    Eo3   9   Evaporator outlet 3 temperature
    PrES   10 Suction pressure(4-20ma,-1.0,24 bar)
    GASr   11 gas reference probe (future)
    GASL   12 gas level probe   (future)

Status input (12vdc 10 ma per input)
       IA   Coldstore Door contact
       IB   OFF for cleaning
       IC   FANS only
       ID   DEFROST request P/B
alarm trip input
       (230vac or 48vac)
       IE   Trim Heater fail/defrost request input
      (230vac only)
      IF   Fans c circuit fail/coldstore door
      IG   Fans b circuit fail
      IH   Fans a circuit fail
Relay output (5 Amp 230Vac n/o with suppressors)
    L   R1   lighting control/1085 LSV   (n/o)
    d   R2   defrost termination control (c/o)
    h   R3   trim/pan heater control   (n/o)
    F   R4   Fan control   (n/o)
Solid State Relay outputs (230Vac 0.5 AMP)
    C   SSR5   liquid valve control   (n/o)
    S   SSR6   suction valve control   (n/o)
Status output (12vdc)
       DEFROST request to other cases in stub
      (same terminal as defrost status input)
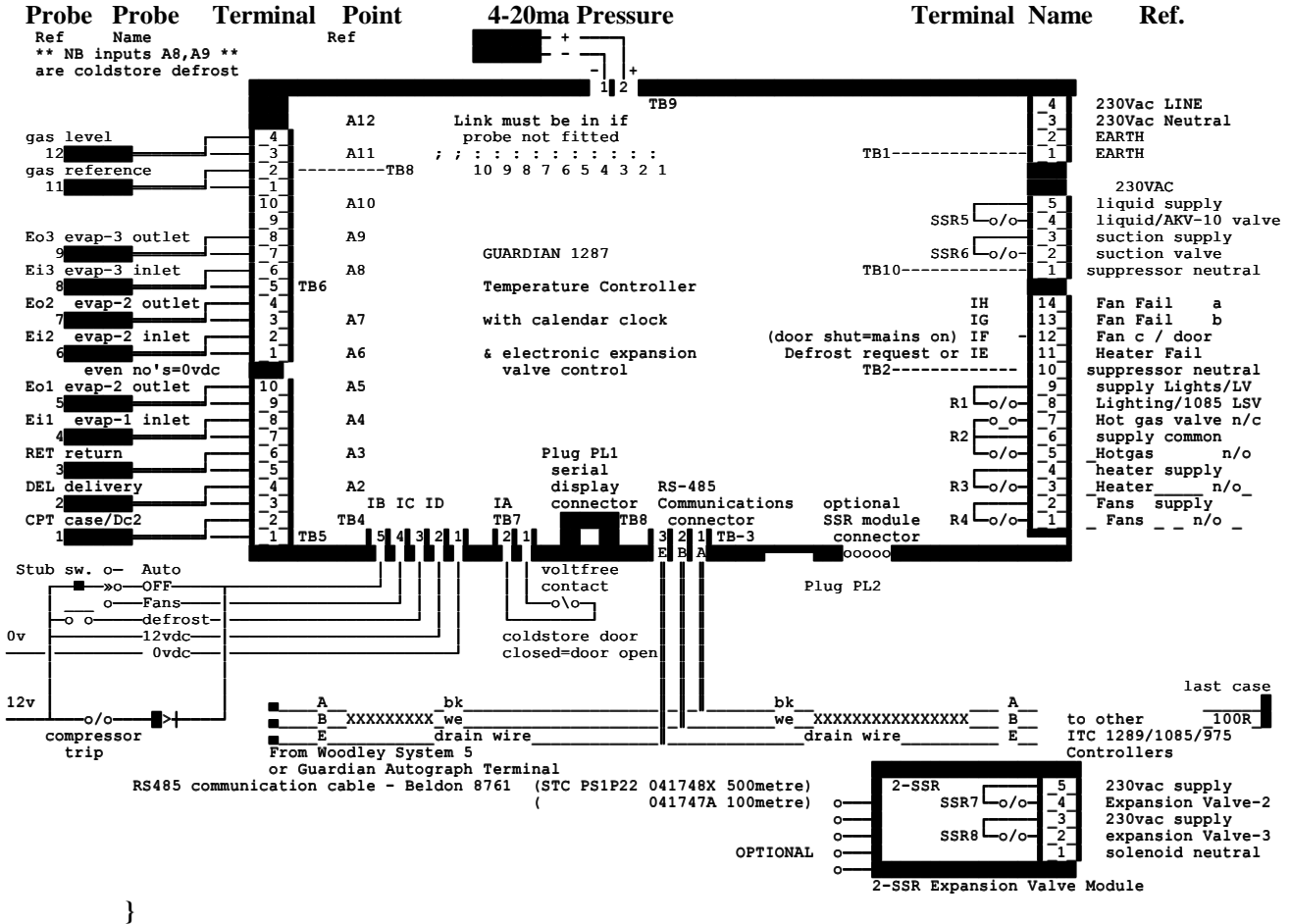**2-SSR module Solid State Relay outputs (230Vac 0.5 AMP)**
OPTIONAL
      SSR7 coil-2 modulating valve
      SSR8 coil-3 modulating valve
Communications   RS485 serial link at 9600 baud

GUARDIAN 1287 TERMINATIONS

Probe Probe   Terminal Point   4-20ma Pressure   Terminal Name   Ref.

Ref   Name   Ref
** NB inputs A8,A9 **
are coldstore defrost

gas level   4
12   3   A12   Link must be in if
gas reference   2   A11   probe not fitted
11   1   --------TB8   ; ; : : : : : : : : : :
                    10   10 9 8 7 6 5 4 3 2 1
                    9   A10
Eo3 evap-3 outlet   8
9   7   A9   GUARDIAN 1287
Ei3 evap-3 inlet   6   A8   Temperature Controller
8   5 TB6
Eo2 evap-2 outlet   4   A7   with calendar clock
7   3
Ei2 evap-2 inlet   2   A6   & electronic expansion
6   1   valve control
    even no's=0vdc
Eo1 evap-2 outlet   10   A5
5   9
Ei1 evap-1 inlet   8   A4
4   7
RET return   6   A3   Plug PL1
3   5   serial
DEL delivery   4   A2   display   RS-485
2   3   IB IC ID   connector   Communications   optional
CPT case/Dc2   2   TB4   IA   connector   SSR module
1   1 TB5   5 4 3 2 1   TB7   2 1   TB8 3 2 1 TB-3   connector

230Vac LINE   4
230Vac Neutral   3
EARTH   2
TB1-------------   1   EARTH

                           230VAC
                    5   liquid supply
SSR5 o-o   4   liquid/AKV-10 valve
                    3   suction supply
SSR6 o-o   2   suction valve
TB10------------   1   suppressor neutral

                    IH   14   Fan Fail   a
                    IG   13   Fan Fail   b
(door shut=mains on) IF - 12   Fan c / door
Defrost request or IE   11   Heater Fail
TB2-------------   10   suppressor neutral
                    R1 o-o   9   supply Lights/LV
                          8   Lighting/1085 LSV
                    R2 o-o   7   Hot gas valve n/c
                          6   supply common
                          5   Hotgas   n/o
                    R3 o-o   4   heater supply
                          3   Heater____ n/o_
                    R4 o-o   2   Fans supply
                          1   _ Fans __ n/o _

Stub sw. o-   Auto
          »o-OFF
          o-Fans
     o o-defrost-
0v   12vdc-
            0vdc-

12v
      o/o   >|-
compressor
   trip

voltfree
contact
  o\o

coldstore door
closed=door open

Plug PL2

last case
A____bk   bk____A
B_XXXXXXXX_we   we_XXXXXXXXXXXXXXX_B   to other   100R
E____drain wire   drain wire____E   ITC 1289/1085/975
From Woodley System 5   Controllers
or Guardian Autograph Terminal
RS485 communication cable - Beldon 8761 (STC PS1P22 041748X 500metre)
                              (041747A 100metre)

2-SSR   5   230vac supply
SSR7 o-o   4   Expansion Valve-2
                    3   230vac supply
SSR8 o-o   2   expansion Valve-3
OPTIONAL   1   solenoid neutral
2-SSR Expansion Valve Module

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SERIAL DISPLAY PANEL
The Serial Display Panel comprises a plastic enclosure
containing a PCB with four membrane pushbutttons, four LED
displays and a 2-position Keyswitch for FANS/OFF/AUTO
selection for case cleaning.
The serial display panel is connected to the ITC1085
controller PCB by a 1.2 metre, 6-core telephone cable.
Optional display cables are available in 2 metre, 5 metre, 10
metre and 20 metre lengths.
The plastic enclosure has bezel dimensions 94 x 48 x 3.5 mm
and clips into the 90 x 44 mm mounting aperture in the case
facia with a maximum behind-panel depth of 32mm.
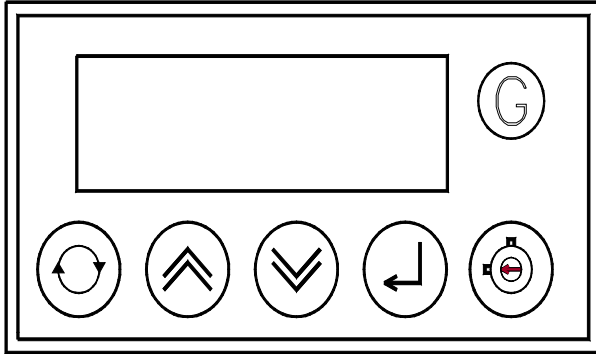
      next   raise   lower   enter keyswitch

The front panel houses:-

4 7-segment LED displays for channel/function/alarm
indication and a sign plus 2-digit temperature/setpoint
display.
4 pushbuttons next, raise, lower, enter, used in conjunction
with LED Displays to provide setup and display facilities.

1 2-position keyswitch for FANS/OFF/AUTO selection

The enclosure has a top-hinged flap which covers the
pushbuttons and LCD socket whilst providing a transparent
window for the 4 LED temperature display digits.

The temperature display flashes with control air alarm or
blown fuse fail conditions.

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
The display unit now displays FANS 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 case 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

DEFAULT DISPLAY

The controller reverts to the default display if no buttons have been pressed for 3 minutes and displays the case temperature CPT.
The default display is replaced by a status message if any of the following conditions occur.

    -dEF   while defrost is in progres
    -Pd   Pulldown from end of defrost cycle until
        control air temperature is within alarm band
    -FAn   selected for Fans Only prior to cleaning
        from local display, keyswitch or switch input
    -OFF - selected OFF for cleaning
        from local display, keyswitch or switch input
    Auto - after power on or case OFF waiting for
        restart delay before opening liquid valve.
    8888 - after power on until restart routine is
        complete
    1287 - unit hardware
    V1.0b- software version number

TEMPERATURE DISPLAYS

Pressing the NEXT push button displays the next channel identification which then alternates every 3 seconds with the temperature value for the channel. Repeated pressing of next displays in sequence the points listed below.

  identity   Temperature on display
  CPt   Calculated Product Temp. (control If 'CPon')
  dEL   delivery air temperature (normal control)
  rEt   return air   (coldstore control)
  Ei1   evaporator inlet coil-1
  Eo1   evaporator outlet coil-1
  Sh1   superheat evaporator -1
  Ei2   evaporator inlet coil-2
  Eo2   evaporator outlet coil-2
  Sh2   superheat evaporator -2
  Ei3   evaporator inlet coil-3
  Eo3   evaporator outlet coil-3
  Sh3   superheat evaporator -3
  if coldstore selected then Ei3,Eo3,Sh3 replaced by
  dt8   defrost termination on probe 8
  dt9   defrost termination on probe 9
 if EEP selected then
  PrES   2.35   suction pressure in bar guage
  ET   -17   equivalent suction temperature
        dependent on gas type
  rLy   control relay outputs
  CDFH
    C if Liquid Control relay energised   - 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

    EEu   Electronic expansion valve state

SrAE

    S superheat alarm   **- bar if not**

    r superheat defrost recovery   **- bar if not**

A or H Auto/Hold

     A - valve being modulated automatically

     H - valve modulation held whilst control air

       temperature is satisfied.

       the last valve percent output is remembered

    E expansion valve solenoid relay on

Etnn   Elapse time (Defrost mode only)

     where nn= minutes into defrost.

SEt   -   **goto Setup Mode when Enter pressed.**

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
diappeared.

Blown Fuse Alarms
Blown fuse Alarms are identified on LED display A-D as below
a   fan 1   display A
b   fan 2   display B
c   fan 3   display C
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
Hi if discharge air temperature is above the control
    setpoint plus alarm differential for longer thas
 the guardtime
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
open circuit probes indicate   OC on displays and value
shortcircuit probes indicate   SC   "
not fitted   probes indicate   nF (requires shorting link)
The liquid valve is closed on any failure of the control air
probe.

PC FAIL
If the 1287 has not received a RS485 command for 5 minutes
then the 'PC FAIL' message is dispalyed indicating a PC
communication failure.
If the 1287 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.
PC fail messages are also removed by selecting ndad or nda
under unit settings.

SETUP OPERATION
Setup operation lasts for a maximum of 5 minutes after being
activated by pressing enter with SEt on the display panel.
During setup operation, alarms, temperature and defrost
controls are inhibited.
On entry to Setup passcode PP00 is displayed.
To change any settings passcode PP05 or PP09 must be first
selected using raise and enter pushbuttons.
If the correct passcode is not entered then setup values may
be displayed but any attempted changes are ignored.

NEXT pushbutton sequences through the menu selections below;-

PP05 menus   PP09 menus
**   (commissioning)**
---------------------------   ----------------------
CasE   change control mode   rtc real time clock
**   or cooling setpoint   time and date**
DEFr   defrost type,   SySt system settings
**   times and settings   timers and alarms**
unit   stub and case identity   TCL1 Lighting Timeclock
**   (commissioning)   if 1287 selected**
test   toggle output relays
**   (faulty valve check)**
** End   return to normal operation   End return to normal**

ENTER menu selection or new value button
** - pressing the ENTER button selects the displayed menu**
above or stores the displayed value as the new value of the
selected function. The display 'winks' after a valid entry.

RAISE pushbutton -increments the displayed setpoint value.
If the raise button is held on for more than 1 seconds then
the value increases automatically
This button also provides quick access to 'SET' function when
pressed with default temperature on display.
LOWER pushbutton - decrements the displayed setpoint value.
If the lower button is held on for more than 1 seconds then
the value decreases automatically

SETUP FUNCTIONS (level 1)

Menus or functions are sequenced by pressing NEXT button.
Menus are selected by pressing ENTER button.
Mode and Type Functions are selected by pressing ENTER.
settings are increased by RAISE followed by ENTER
settings are decreased by LOWER followed by ENTER
new values are ignored if incorrect passcode is entered

Setup Functions available for setpoint change and display are

Menu   Function   Range   Units
PPOO   Passcode 5 must be entered before
**   any changes are accepted**

CASE   setpoint and control mode selection

  c   cut-in setpoint for Liquid Valve   -40 to +40 'C

   if not fitted link is inserted for probe 1 then

   CPon/CPoF select if control on CPT or discharge
        CPon control on CPT now on
        CPoF control on CPT now oFF -
          i.e. normal control on discharge temp

        The 1287 controller can be selected to control
        on   Calculated   Product   Temperature   (CPT)
        instead of disharge air for all defrost types
        except 'Stor' if 'CPon'is selected.
        Coldstore always control on return air.

   idEF / FAnS / OFF / Auto mode selection
        initiate defrost (only if in auto)
   FAns   Fans only prior to cleaning
        (not allowed for coldstore)
   OFF   select case OFF for cleaning
   Auto   return to Automatic control

  *** These selections only operate when KEYSWITCH
     selection inputs for OFF or FAnS are not present.

Cut-in Setpoint for Liquid Valve (c)

**To change the cooling cut-in setpoint for the liquid valve
the procedure is as follows:-**

     BUTTON   **DISPLAY**

keep pressing next button until   SEt is displayed
press enter button
          display now reads PP00
press raise button until display reads PP05
press enter button
press next button
          display now reads CASE
press enter button
          display now reads c xx (xx = old cut-in)
press raise or lower until display is c yy (yy = new cut-in)
press enter button
          display winks and still reads c-yy
press next button
          display now reads idEF
press next button
          display now reads OFF
press next button
          display now reads FAnS
press next button
          display now reads Auto
press next button
          display now reads dEFr
press next button
          display now reads unit
press next button
          display now reads test
press next button
          display now reads End
press enter button

display winks and displays case temperature -zz

The unit controls to the new discharge air cut-in setpoint (yy).

CASE FANS ONLY

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

      BUTTON   **DISPLAY**

keep pressing next button until   SEt is displayed
press enter button
       display now reads PP00
press raise button until display reads PP05
press enter button
press next button
       display now reads CASE
press enter button
       display now reads c nn
press next button
       display now reads idEF
press raise button until display reads FAns
press enter button
       display now reads -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 a 12vdc status switch input or RS485 communication command.
The case is switched OFF by selecting OFF mode.
The case is switched back on by selecting Auto mode.

CASE OFF for Cleaning

To switch off a case /coldstore for cleaning the procedure is as follows:-

      BUTTON   **DISPLAY**

keep pressing next button until   SEt is displayed
press enter button
       display now reads PP00
press raise button until display reads PP05
press enter button
press next button
       display now reads CASE
press enter button
       display now reads c nn
press next button
       display now reads idEF
press raise button until display reads OFF
press enter button
       display now reads -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 12vdc status switch input or a RS485 communication command.
The case is switched back on by selecting Auto mode.

CASE AUTO MODE .

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

BUTTON	DISPLAY

keep pressing next button until   SEt is displayed
press enter button
        display now reads PP00
press raise button until display reads PP05
press enter button
press next button
        display now reads CASE
press enter button
        display now reads c nn
press next button
        display now reads Auto
press enter button
      display winks and still reads 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 .

Initiate DEFROST

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

BUTTON	DISPLAY

keep pressing next button until   SEt is displayed
press enter button
        display now reads PP00
press raise button until display reads PP05
press enter button
press next button
        display now reads CASE
press enter button
        display now reads c nn
press next button
        display now reads idEF
press enter button
        display now reads -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 or
Coldstore.
DEF mode may be selected remotely via a 12vdc status pushbutton
input or RS485 communication command.
The defrost may be terminated (after draindown delay) by selecting
Auto mode.

DEFROST SETUP
The following settings determine the defrost control
sequence, termination temperature, defrost times and periods.

DEFr defrost type times and settings

   O-C ,HG-C,HG-t,Stor,HGt8 defrost type
   O-C = Off-cycle defrost
   HG-C = Hotgas Cycle on differential
   HG-t = Hotgas terminate on discharge air
   Stor = Coldstore terminate on probe T8 or T9
   HGt8 = Hotgas terminate on probe T8 or T9

   For all defrost selections except 'Stor' coldstore, the
   fans and trim heaters defrost state can be selected
   during defrost as follows
Fnon/FnoF   Fans on/oFF during defrost   default on
tron/troF   Trim Heaters on/OFF during defrost   default on

  dn number of defrosts per day   0 to 6
  1h first defrost time T1 hours   0 to 5 hrs
d2dx delay 2nd defrost by x hours if dn=2   0 to 9 hrs
  1t first defrost time T1 minutes   0 to 59 min
  dP defrost period   0 to 60 min
  d   defrost termination temperature   0 to +40 'C
    (not Off-Cycle cases)
  dd defrost termination differential   1 to +10 'C
    (for Hotgas-Cycle cases only)

UNIT configuration

Unit

    1085/1088/1080/975/1287 model type selection   1287

      1085 case/coldroom controller (retrofit)

      1088 future

      1080 model suitable for alarm monitoring on 9
    temperature and 8 digital inputs. (see PP07)

      975 model for Autograph Software V2 compatibility

      1287 model with lighting & AKV10 control

  LSOL/EET /EEP control type selection where

      LSOL is liquid solenoid valve control

      EET Electronic expansion valve control using
        coil-in and coil-out temperatures

      EEP Electronic expansion valve control using
        suction pressure and coil-out temperatures

     If EET or EEP is selected then evaporating
      temperature is displayed then

  E-10 Evaporating temp. of pack system (-40 to 40øC -10)

    If 'EEP' is selected then the pressure transducer
   cutout and range and gas type are displayed:-

  Ed10 Evaporating temp. differential. (5 to 20øC   10)
     Pressure control is inhibited above E+Ed

  Ph24 Pressure Transducer 20ma highrange value
          (1 to 24 bar guage 24)

  PL-1 Pressure transducer 4 ma lowrange (-1 ,5   -1)
     r22 /NH3/404A gas type required for calculation of
     equivalent suction temperature from pressure input
     the value is dispalyed as Ei1 coil-in temperature

  Sd9 /Sd8 serial display type where

    Sd9 is serial display with keyswitch

    Sd8 is 1085 or Guardian SKD8 serial display

  Sn Stub number   **1 to 80**

  Cn Case number (normally 3 max.)   **1 to 4**

  Annn Woodley MkV address number   **1 to 255**

 *** Woodley MDM address automatically calculated is
   (Sn x 3) + Cn-1   eg stub 30 case 2 has MDM address
        (30 x 3) + 2-1 = 91.

  Htr /HgaS control relay 3 selection as

    Htr = trim heater control

    Hgas = pack hotgas valve control output

    3   = future

    Alr. = alarm unit (see later).

  PR00 Product ratio % (see later)   **0 to 99**

  tP22, tP20. temperature probe thermistor resistance

    where tp22   is 2.2 Kohm at 25C (standard)

      tP20   is 2.0 Kohm at 25C

  ndad/nda / dad digital alarm detection and display

      ndad = no digital alarm display

      nda = no digital alarms required

      dad = digital alarms displayed

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 valves 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 30 and 50%. With valves in this band defrost recovery is reasonably efficient.

During restart or defrost recovery the valve is maintained at preset defrost or startup open positions (dr% or So%) until the coil in temperature is below E +5) øC. The control goes into automatic Electronic expansion valve control below this level.

If EET type is selected and the coil in temperature is reading 5øC above the E limit then the controller goes into superheat recovery mode.

If EEP type is selected and the coil in temperature is reading EdøC above the E limit then the controller shuts off the valve and inhibits any further control.

Product Ratio.

If probe 1 (case) has no probe wired to it and a 'not fitted' link inserted then the default temperature value displayed and logged for probe 1 is the PR% ratio of the discharge and return air.

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

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

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

The Product Ratio PR% is setup using passcode 5 under UNIT selection provided the 'not fitted' link has been inserted. If the 'not fitted' link is not present then case displays ' oc ' and the PR% menu is not displayed.

The required PR% value is entered using raise or lower followed by enter as for other parameters.

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

By selecting CASE CPon, this calculated product temperature can be used for control instead of discharge air on all Defrost types except coldstores.

ALARM UNIT
The ITC 1287 may be configured as a supermarket central alarm
indicator and teledialler unit for systems using the Guardian
GUARDIAN
M Autograph Terminal.

The required settings are

UNIT   Sn=80   stub number
Cn=1   case number
A=249   unit address
ALr.   Alarm selection for relay 3 (only if A=249)

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

relay 2 (defrost) closes n/c contacts for 5 seconds to initiate
an alarm via the store teledialler
relay 3 (Heater) flashes the alarm lamp every half second
until the ACCEPT pushbutton is pressed when it
goes steady.
relay 4 (fans)   energises remote flashing beacon in store
which stops when ACCEPT pushbutton is pressed.
input 4 (heater fail) is used for the ACCEPT pushbutton input.

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.

TEST RELAYS/VALVES

   teSt   force output relays on/off

       Pressing ENTER with Test on displays relay outputs in
       sequence with their current state e.g.   C on
       The state of a relay may be toggled by pressing
       ENTER when the particular control output is on
       display. Relay outputs return to automatic settings
       when SETUP is terminated.

       Relay allocations for different model selections are:-

{

```
_____
MODEL   |    1085    |     1287    |
defrost |            |             |
control | LSOL   EET | LSOL   EET/EEP |
Relay 1 | LV  C | -   |LIGHTS L |LIGHTS L |
Relay 2 | DEF  d | DEF  d | DEF  d | DEF   d |
Relay 3 | HTR  H | HTR  H | HTR  H | HTR   H |
Relay 4 | FANs F | FANS F | FANS F | FANS  F |
SSR  5  | off   | EEV C | LV   C | EEV   C |
SSR  6  | off   | off   |Suct_V 6 |Suct_V 6 |
SSR  7  | off   | off   | off   | off   |
SSR  8  | off   | off   | off   | off   |
Logic 9 |defr  9 | defr 9 | defr  9 | defr  9 |
```

      LOGIC 9 is the latching inter-stub 12vdc defrost request signal
      }

   End   return from SETUP to normal operation

SETUP FUNCTIONS (level 2)
passcode PP09
normally FACTORY settings

  Menus or functions are sequenced by pressing NEXT button.
  Menus are selected by pressing ENTER button.
  settings are increased by RAISE followed by ENTER
  settings are decreased by LOWER followed by ENTER
  new values are ignored if incorrect passcode is entered

Setup Functions available for level 2 change and display are

Menu	Function	Range	Units	FACTORY

      SETTING
PPOO Passcode 9 must be entered before
    any changes are accepted

rtc real time clock
   These settings are updated by the Central Alarm System
   rh rt clock time hours   **0 to 23 hrs correct**
   rt rt clock time minutes   **0 to 59 min "**
   sun /nnon/tues/uued/thu/fri/sat weekday selection
Syst
   cd cooling differential for control   **0 to 5 'C 0**
   Pt defrost pumpdown delay time   **0.0 to 9.9 min 0.0**
   dt defrost draindown delay time   **1 to 20 min 1**
   bt bypass valve delay after draindown 0.0 to 9.9 min 0.0
   Lt Liquid delay after suction   **0.0 to 9.9 min 0.5**
   Ft defrost Fan delay time   **0 to 20 min 1**
   tn time on for suction valve pulsing 0.0 to 9.9 min 0.1
     during bypass period
   tF time oFF for suction valve pulsing 0.0 to 9.9 min 0.1
     during bypass period

   gt control air temp. alarm Guardtime   **0 to 99 min 45**
   Ad Alarm differential control air   **2 to 40 'C 5**

     Calculated defrost times - display only
  1h Defrost T1 time hours   **0 to 23 hrs**
  1t Defrost T1 time minutes   **0 to 59 min**
  2h Defrost T2 time hours   **0 to 23 hrs**
  2t Defrost T2 time minutes   **0 to 59 min**
  3h Defrost T3 time hours   **0 to 23 hrs**
  3t Defrost T3 time minutes   **0 to 59 min**
  4h Defrost T4 time hours   **0 to 23 hrs**
  4t Defrost T4 time minutes   **0 to 59 min**
  5h Defrost T5 time hours   **0 to 23 hrs**
  5t Defrost T5 time minutes   **0 to 59 min**
  6h Defrost T6 time hours   **0 to 23 hrs**
  6t Defrost T6 time minutes   **0 to 59 min**

LIGHTING SETUP

SETUP FUNCTIONS (level 2)   passcode 09 (continued)
With 1287 selected, the case lighting relay output is switched on
and off dependent on the day of week and the timeclock setting for
the appropriate day.
The timeclocks can be overridden by communication commands from the
GUARDIAN Autograph Terminal or the Woodley System 5.
If a lights ON command is given then the lights stay ON until the
next automatic LIGHTS OFF time.
If a lights OFF command is given then the lights stay OFF until the
next automatic LIGHTS ON time.
The Autograph Terminal also provides global time-scheduling of
controllers.

LIGHTS are switched OFF if FANS only or OFF modes are selected.

LIGHTS ALWAYS OFF if either or both times are zero
LIGHTS ALWAYS ON if both times are the same but not zero

Menu	Function	Range	Normal	Default
tCL1	**Timeclock 1 settings**			
1H..	**sunday time on Hours**		**1H09**	**09**
1n..	**minutes**		**1n30**	**30**
1h..	**time off Hours**		**1h16**	**16**
1F..	**minutes**		**1F30**	**30**
	for weekday 1 (Sunday) gives time on=0930			
	time off=1630			
2H..	**monday time on Hours**		**1H08**	**08**
2n..	**minutes**		**1n30**	**30**
2h..	**time off Hours**		**1h20**	**20**
2F..	**minutes**		**1F30**	**30**
	for weekday 2 (Monday) gives time on=0830			
	time off=2030			
3H..	**tuesday**			
4H..	**wednesday**			
5H..	**thursday**	**as above**		
6H..	**friday time on Hours**		**1H08**	**08**
6n..	**minutes**		**1n30**	**30**
6h..	**time off Hours**		**1h21**	**21**
6F..	**minutes**		**1F30**	**30**
	for weekday 6 (Friday) gives time on=0830			
	late closing time off=2130			
7H..	**saturday time on Hours**		**1H08**	**08**
7n..	**minutes**		**1n30**	**00**
7h..	**time off Hours**		**1h20**	**20**
7F..	**minutes**		**1F30**	**30**
	for weekday 7(Saturday) gives			
	early opening time on=0800			
	time off=2030			
End	**return from SETUP to normal operation**			

SETUP FUNCTIONS (level 3)   passcode 07

Alarm   Monitor settings (normally for 1080 selection)

 When 1287 or 1085 control is selected these settings are
 automatically returned to the appropriate control limits.

 When used as an alarm monitor (1080) the temperature alarm
 setpoints and contact alarms may be setup as follows

 n-AL   Temperature n   (n=1 to 9)
     use 'next' to select Temperature (1 to 9) and press enter
     which display for selected temperature:-

     n-18 alarm setpoint(SP) for temperature n (-40 to 40øC)
         change by 'raise' or 'lower' and press 'enter'

     hi/lo/both/nonE Alarm type selection where
        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
          change by 'raise' or 'lower' and press 'enter'
 Gt   Guardtime   (0 to 90 minutes)
          change by 'raise' or 'lower' and press 'enter'
 Ad   Alarm differential   (2 t0 40 øC)
          change by 'raise' or 'lower' and press 'enter'

 x-AL   Digital input (x=A to H)
     use 'next' to select digital input(A to H) and press enter
     which display for selected input:-

     on/ron/OFF/nonE digital Alarm type selection where
        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 'raise' or 'lower' and press 'enter'
     x 15 Guardtime for input x   (0 to 90 minutes)
          change by 'raise' or 'lower' and press 'enter'
Input allocation and default settings are :-

input A   door open   none
input b   OFF mode   none
input C   Fans only mode   none
input d   Defrost in progress   none
input E   Heater Fuse / external Defrost request   if oFF
input F   Fan C Fuse / coldstore door (if fitted)   if OFF
input G   Fan B Fuse (if fitted)   if OFF
input F   Fan A Fuse   if OFF

Digital guardtimes all have default value   0 mins

SETUP FUNCTIONS (level 4)
passcode 11
normally FACTORY settings only

The following parameters are setup at factory and do not normally require any changes.

Port   serial communications port
**   9600   communications baud rate 9600/nonE   9600**
**   'None' removes PC FAIL if no PC present**

** EEU Electronic Expansion Valve Parameters**
**   (Only if EET or EEP selected)**
**   F-EE/C-EE Factory/Commisioning change Settings   F-LP**
**   F-EE returns all parameters to default values below**
**   C-EE allows values to be changed during commisioning**
**   These parameters are for development purposes only and**
**   should NOT be changed.**
**   'F-EE' RETURNS TO DEFAULTS   default**
** SH Superheat High. Maximum superheat   (0 to 99 deg C   8)**
**   SL Superheat Low. Minumum superheat   (0.0 to 9.9 deg C 3)**
**   SA Superheat Alarm Limit at which superheat recovery is**
**   actioned.   (0 to 99 deg.C   1)**

**   Sb Stable Band. Taken +/- about current superheat setpoint.**
**   (0 to 9.9 deg.C   0)**
**   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)**
**   Sd Stable band Delay time   (0 to 99 mins.   0)**
**   Time after which Sb setpoint change is applied.**

**   dr Defrost Recovery Valve position.   (0 to 99%   50)**

**   So Starting Output.   (0 to 99%   50)**
**   Valve position after power restart or thermostatic cycle**
**   of AKV10**

**   tF Superheat Alarm Time OFF   (0 to 15 min   1)**
**   Valve is shut for this time after superheat alarm before**
**   attempting recovery procedure**
**   tn Superheat Alarm Time ON   (0 to 15 min   2)**
**   Valve is open for this time after superheat alarm and**
**   TF time above whilst attempting recovery procedure**

SETUP FUNCTIONS (level 4)   passcode 11 (continued)

LOOP.   Control PID Loop Parameters

    F-LP/C-LP Factory/Commisioning change Settings   F-LP
      F-Lp returns all parameters to default values below
      C-Lp allows values to be changed during commisioning
     These parameters are for development purposes only and
     should NOT be changed. 'F-LP' RETURNS TO DEFAULTS
                        default
    P Poportional Gain   (0 to 9.9   3.0)
    i Integral Gain   (0.00 to 0.99   0.01)
    d Differential Gain   (0.0 to 9.9   0.0)
    bL Bleed position.   (0 to 99%   10
     Sets minimum valve position.
    r Ramp rate.   (0.0 to 9.9 deg.C   0)
     Sets rate of change of superheat from SH to SL.
    it Integral Time   (0 to 99 mins   2)
     Delayed time for loop integral action.
    Pd Loop Period   (0 to 99 secs.   2)
    ct Coil Time   (0 to 99mins.   1)
     Time delay to establish coil-in/coil-out
     temperatures before control action starts.
    rt Ramp Time   (0 to 99 secs.   12)
     Time at which ramp rate, r, is applied.

End   return from SETUP to normal operation

CONTROL

FIG.1   LIQUID VALVE CONTROL

```
{           discharge air temperature
   \              ___/\
    \            _/  \_
     \          /     \
      \     c __/       \_           c  /| c=liquid cut-in
    ----------------x--------------------\------------------x-------------------- ^
      \_   _/            \_          _/ \_  differential cd øC
.........x ._/...........................x........._/.......x................... v
       \_/              c-cd \___   /   c-cd  \
                              \_/         \
 _____        __liquid valve__n/o____       ___
     _____/            _____/  _____
```
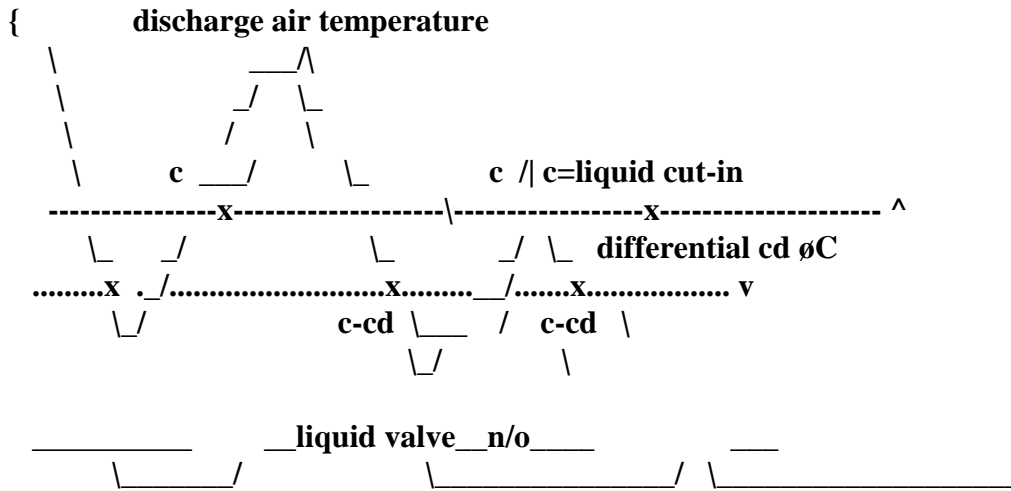
FIG.2   DEFROST CYCLE VALVE CONTROL

discharge air temperature

```
                    ___/\
                   _/   \_
                  /       \
        d ___/        \_          d /|  d  = Defrost Termination
      ------x-----------------\---------------x-|--------------------- ^
          _/            \_          _/ \_ dd = differential   |
      ../......................x........__/......x................. v
       /            d-dd \___  /      d-dd \             |
      /                    \_/         \             v
     /
```

```
      _
   ___/ _____initiate defrost_____
   _____defrost status input/output_____
   ____/                                _____
         _____
   _____/         defrost period  dP          _____
         _____      _____       _____
   _____/  _____n/o_____/      \____/   _____
   _____      _____ defrost valve(Hg-C)     _____
       \____/   n/c       _____/  _____/
    ____
   ____/ Pt _____pumpdown delay period_____
                   _____
   _____draindown delay period_____/ dt   _____
                     __
   _____bypass delay period_____/bt _____
   _____                             _____
       _____suction valve__n/o_____/\/\/
                   _____
   _____liquid delay period_____/  Lt _____
   ___                       _____
    _____liquid valve__n/o_____/
                   _____
   _____fan delay period_____/  Ft _____
   _____                         _____
       _____fans_(coldstore or FnOF)_____/

         _____pack hotgas valve _____
   _____/                    _____}
```
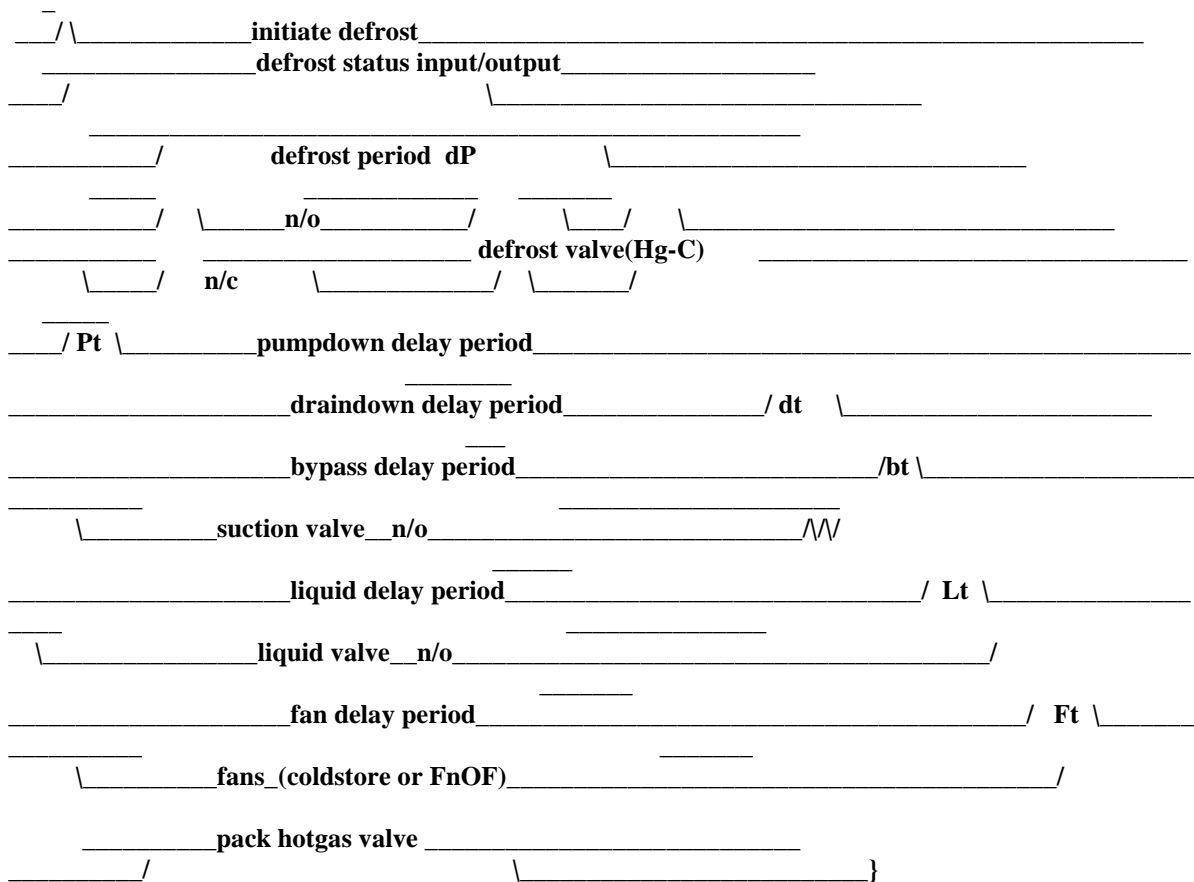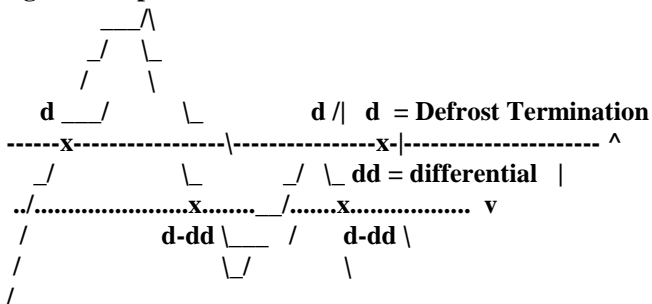
DEFROST CONTROLS
Hg-C, Hg-t, O-C , Stor.

Hg-C   -Hotgas cycle {
request ____/_____

**** PACK ****
```
                _____hot gas_____
Hotgas valve__/                        _____ shut_____
     _____                     ____open_____
Suction valve_____shut_____/
                        _open
bypass valve_____/   _____
```

**** CASE ****
```
                _____run_____
FANS-1,2,3
                _____on_____
Trim Heaters
       _____                       ____open_____
LV         _____shut_____/
        _open_     __      _____   __
HGV1 __shut__/    \____/ _____/     \__/ _____
        ............... defrost time-1....... _____
draindown _____/ dt _____
                        _____
liquid delay_____/ Lt   _____
```


}

Hg-t - Hotgas terminate
{
request _____/_____

defrost status _____defrost any case in stub _____
input/output__/   ___stub done_____

PACK   _____hot gas_____
Hotgas valve__/   ___coolant_____
_____   ____open_____
Suction valve_____shut_____/
**   open_____**
bypass valve_____/   _ _____ _____
_____run_(_if FnOn)_____
FANS-1,2   \ ......stop (if FnOF)................................./
_____on__(if trOn)_____
Trim Heaters \.......off.(if trOF)......................./
_____   ____open_____
LV1   _____shut_____/
**   _open_____**
HGV1 __shut__/   _____
**   .... defrost time-1.........................**

terminate case 1 x
**   _____**
draindown delay 1_____/dt 1 _____
**   _____**
liquid delay 1   _____/ Lt1 _____
**   _____   ____open_____**
LV2   _____shut_____/
**   _open_____**
HGV2 __shut__/   _____
**   .... defrost time-2...........................**

terminate case 2 x
**   _____**
draindown delay 2_____/ dt2 _____
**   _____**
liquid delay 2   _____/ Lt2 _____

}

O-C Off-Cycle Defrost
{

request ____/_____

PACK
3-way valve - not used
_____run_____
FANS 1,2
_____   ____open_____
LV1   _____shut_____/

HGV1 __ not used
.... defrost time-1............. _____
Liquid delay 1_____/ Lt1 _____

_____   _____
LV2   _____shut_____/

HGV2 __ 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 8 and 9
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          ____hot gas_____
Hotgasvalve_____/                _____
      _____                    ____open_____
Suction valve   \____shut_____/
                              open
bypass valve_____/   _____
      _____                      ____open_____
LV1      _____shut_____/
        _open_____
HGV1 __shut_____/                _____
     ............. defrost time-1...............
         _on_____
Pan Heater_____/                        \_____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 _____
   _run_____                       _____
FANS-1        \__stop_____/
```


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

}
```

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 ITC-1287 units in series.

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

Each ITC-1287 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 addresss   56/3

         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.

ITC-1287 units 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 the ITC-1287 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

   UUu Addresses may not be changed via the link

f) Receive setpoints with new setpoint values

h) Receive Time and Date with new hours and minutes, day, month and year for real time clock

i) Initiate/Terminate a hot gas or off-cycle defrost

m) ON auto/FANS only/case OFF selection for case cleaning
   from Autograph PC Terminal.

n) case OFF selection from pack system if pressure
   transducer fail, Watchdog Fail or Pack OFF mode selected.

n) case AUTO selection from pack system on pack restart or
   pack return to AUTO mode

GENERAL
Temperature specification 0-40 C for box and cases.
All setup parameters are saved in EEPROM.
A battery-backed real-time clock provides all defrost times.
Auto restart is performed after power-up and watchdog fail.
All termination is by two-part screwclamp connectors
Auto Restart
After power or WDT fail the unit automatically performs an auto restart routine which

> **a) Reinitialises all parameters from EEPROM**
> **b) Sets up all internal microprocessor settings**
> **c) Tests all display segments (8888)**
> **for a five second period.**
> **d) starts restart delay timer which inhibits liquid valve control to give staggered start.**
> **e) checks to see if a scheduled defrost cycle should be in progress and continues remainder of cycle if required.**

Item a) is also performed if a sumcheck error on the memory is detected.
Item b) is also performed every time the Watchdog timer is addressed .