PHASEFALE JouleTemp

HACCP AUSTRALIA
FOOD SAFETY PROGRAMME
ACCREDITATION

N757

Quality System
Quality Endorsed Company
ISO9001 QEC12298
Standards Australia

Introduction

Thank you from Phasefale and congratulations of your purchase of JouleTemp, a unique controller capable of controlling temperature and humidity in cool rooms, freezer rooms and other atmospheres with precision and unique communication, logging and other capabilities. The browser based access of all controller settings and interactions make JouleTemp a powerful control yet simple to use and reliable in operation. JouleTemp also offers Modbus TCP for direct communications with building management systems and other "front end" software packages. JouleTemp menus and displays are based on Phasefale's TACm originally released in 1989! and still a favorite of users Australia wide.

Display/Keyboard operation: Summary

Display shows temperature with 0.1℃ or 0.1℉ decim al precision
Display flashing temperature indicates a current or previous alarm
Temperature alternating with dF indicates control is currently in defrost
Large alarm LED flashes on/off during alarm or steady on during alarm acknowledge
Decimal point below small digit flashing indicates a network alarm
Lower right hand decimal point of small digit indicates control output (usually cooling) in ON
Alarm ack: Press > to acknowledge prior alarms and set temp display to steady
Display Settings: Press M for controller to automatically display main settings (Sp, dI, AH, AL, At, nd, dd)
Initiate, Terminate defrost: Press > for a few seconds until Co is displayed, then ^ key until dF, then M and a defrost is initiated. To terminate, press > until dF steady, v until Co and M to terminate.
Self Test: a cycle of outputs is initiated by pressing M and ^ for 5 seconds.
Humidity: where active the display cycles between "t" and temperature, then "h" and humidity

Programming JouleTemp via keyboard\LED display.

JouleTemp can be programmed via the keyboard interface or via the web browser interface, although only parameters indicated with a bracketed abbreviation (e.g. Setpoint [SP]) on the browser pages are available to be set via the keyboard. All the basic parameters required for regular control, alarm and defrost can be set via the keyboard. Certain parameters (e.g. email address) are only able to be set via the web browser interface. Programming JouleTemp via the keyboard\LED display is the same procedure and sequence as TACm, with some slightly altered and new parameters.

UL/ SP [SP Keypad menu] Settings

A series of functions and commands can be accessed during the Unlocking stage by pressing the M and > keys for a total of 5 seconds, at which time the symbol UL, then SP is displayed. Program items that can be accessed in this menu are indicated in the following table. Detailed information on the function and meaning of the AA1 menu items is described in the JouleTemp Browser Settings section.
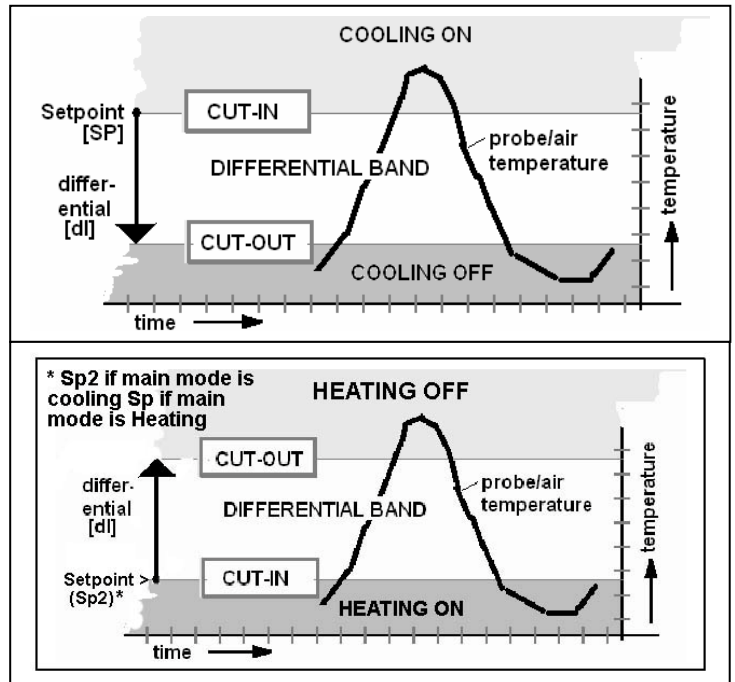
Summary of UL/SP Keyboard Menus

Setting	Display
UL	(Briefly) indicates controller has entered **UnL**ocked or programming mode.
SP	Control Setpoint CUTIN
DI	Differential Temp
AH	High Alarm Temp
AL	Low Alarm Temp
At	Alarm Time Delay
Nd	Number of defrosts per 24hr
Dd	Defrost duration

AA1 [AA1 Keypad menu] Advanced Set 1 Settings

A further series of functions and commands can be accessed during the Unlocking stage by pressing the M and > keys for a total of 10 seconds, at which time the symbol AA1 is displayed. Program items that can be accessed in the advanced menu are indicated in the following table. Detailed information on the function and meaning of the AA1 menu items is described in the JouleTemp Browser Settings section.

Summary of AA1 Keyboard Menus

Refer detailed functional description JouleTemp Settings for a complete description of various functions

Setting	Value Shown
AA	Alarm Acknowledge
LS	Limit Start: minium allowed time between cooling (or heating) starts in minutes
tr	Defrost Terminate temperature
CO/HE	Cooling or heating mode for C1/C2 output
dt	Heater drain period (0~12minutes)
Ft	Fan delay/ Pump down time (0.0~4.0 min.)
dE/ H^g	Electric or Hotgas defrost
tE/rA	S2 input as temp. sensor defrost terminate or rAnge via external potentiometer.
Sd/Hd	Show/Hide temperature display during defrost
St1- S12	Time of first, 2nd…12th defrost (shown in decimal hours)
CA	Calibration Offset (-9.9 to 9.9℃)
0.5^2	Software Version – 52 in this example.

AA2 [AA2 Keypad menu] Advanced set 2 Settings

A further series of functions and commands can be accessed during the Unlocking stage by simply pressing the M and > keys for a total of 15 seconds, at which time the symbol AA2 is displayed. Program items that can be accessed in the advanced menu are indicated in the following table. Detailed information on the function and meaning of the AA2 menu items is described in the JouleTemp Browser Settings section.

Access: hold M and > for 15 seconds (next menu after AA1)

Summary of AA2 Keyboard Menus

Also refer detailed functional description JouleTemp Settings for a complete description of various functions

Setting	Value Shown
TAJ/TAC	JouleTemp or TACm compatibility mode
℃ /℉	Celsius or Fahrenheit display
AOn/AOF	Alarm used=AOn / not used =AOF
LAF/LAO/LAC/LCC/LCH	Light output as flashing=LAF, open=LAO, closed=LAC, 2nd cooling setpoint=LCC,2nd heating=LCH
dAo/dAc	Dialer output open for alarm=dAo, closed alarm=dAc
Fan/FCC/FCH/FHu	Fan output as fan=FAn, 2nd cooling setpoint=FCC,2nd heating=FCH, Humidity: FHu
HdF/HCC/HCH/HHu	Heater output as heater=HdF, 2nd cooling setpoint=HCC,2nd heating=HCH Humidity: HHu
bnu/buS	Buzzer not used=bnu or Buzzer used=bus
t1n, t1h	Timeclock minutes, Timeclock hours
dtd,dtn,dty	Date days, months, year
IP1,IP2,IP3,IP4	IP number (IP1 most significant)
Lo^g	Data Logging Type -see table below
Lop	Data Logging Period -minutes 1-60
dOr	Door monitor not used= nu, monitor only=on, Alarm=AL
dOt	Door alarm time
HOP*	Humidity Cntrl Mode: oFF, Readout/monitor only (ro), Humidify(Hu),dehumidify (dHu), Heat +Cool (dHc), Anti-sweat (AS)
HLH*	Humidity Cutin (0-100) RH%
HLL*	Humidity Cutout (0-100) RH%
HAh*	Humidity High alarm (0-100) RH%
HAL*	Humidity Low Alarm (0-100) RH%
HLs*	Humidity Limit Start (0-99.9) mins
HLt*	Humidity Limit Temp – max Temp error 0.0-20.0℃ before humidity control d isabled
Hit*	Humidity Sensor type 4-20mA on H- (HH1) or Voltage type on S6 (HS6)
HcH*	Humidity Sensor Voltage type upper limit Default = 3.89V
HcL*	Humidity Sensor Voltage type upper lower Default = 0.75V
*Optional Humidity	* Only active if additional cost module is enabled
PID~	Proportional, Integral Derivative Function –oFF or ON
Ppg	Proportional Gain (0-99.9)%
Pig	Integral Gain (0-99.9)%
Pid	Differential Gain (0-99.9)%
Ptn	Minimum Switching time (0.0 -99.9 mins)
~optional PID	~ Only active if additional cost module is enabled

Data Logging Options

JouleTemp can data log from 1 to 4 sensor points as follows:

Log Options
1. Control (S1)
2. Control (S1) and Defrost (Termination sensor S2)
3. Control (S1) and Humidity (H- or S6)
4. Control (S1), Defrost (S2) & Humidity (H- or S6)
5. Control (S1), Defrost (S2) & Temp (S7)
6. Control (S1), Defrost (S2), Humidity (H- or S6) & Temp (S7)

Important! If **log Options** are changed the memory is automatically **cleared** – same function as in the Maintenace Page "Clear All Logs" Button. **Log Period (Lop)** (1-60 Mins.) Change this parameter to set the logging period. Note: changing Lop does NOT clear all logs.

LOd [LOd Keypad menu] –Load Memory Settings
Access: hold M and > for 20 seconds (next menu after AA2). Select required option with ^ and v buttons and press M to accept. LOd settings are available on the Maintenance browser page.

Summary of LOd Keyboard Menus

Setting	Value Shown
ALL	Reset **ALL** user adjustable parameters. [IP to 192.168.160.100]
PAs	Reset admin password for browser programming access
No	Do not load or change memory values

Installation Self-Test

Press M and ^ together for 5 seconds. The JouleTemp automatically cycles its outputs in the following sequence: Note: there is a more sophisticated test function available in the maintenance web page.

Display	Action	Duration sec.
CO/CF	Control On&Off	10/4
LO/LF	Light On&Off	4/4
dO/dF	Dialler+Buzzer	4/4
HO/HF	Heater On&Off	4/4
FO/FF	Fan On&Off	4/4

Example 1. Programming a cool room via keyboard.

JouleTemp The basic programming steps are:
"Unlock" the JouleTemp permanent memory for programming
Select the setting to be adjusted.
Alter the setting to your desired value.
Store the changed value.
Return to normal operation.
a) To unlock the JouleTemp and alter the settings, press M and > together for 5 seconds. UL will be displayed to indicate that the system is unlocked.
b) After the JouleTemp is unlocked press M until the setting you wish to alter is displayed. The settings and values are displayed in the table below:

Setting	Default	Display adjustment range
SP	0.0	Control Setpoint ℃ (-99 ~ +99℃) CUTIN
DI	Ec	Differential Temp ℃ 0.5~5℃, Ec: economy
AH	13	High Alarm Temp. ℃ (-30~ +60℃)
AL	-5.0	Low Alarm Temp. ℃ (-40~+50℃)
At	90	Alarm Time Delay (0~99 minutes)
Nd	1	Number of defrosts per 24hr (0~6)
Dd	30	Defrost duration (1~99minutes)

c) After the setting to be adjusted is displayed, you can increase or decrease the setting by pressing ^ or v until the numerical value required is displayed.

d) To store the changed value, press the M button. The new value is now stored indefinitely and will remain during power loss.

e) If no button is pressed for 60 seconds the JouleTemp will once again lock itself and further alterations will be disallowed until unlocked again. This will also occur if the > key is pressed during the programming operation.

Remember! you must store each altered value using M

Example 2. Programming a Fruit Room

A small fruit room needs to be controlled at 1.0°C. We want a high alarm at 9.0°C and a low alarm at -2.0°C to prevent the fruit from freezing. Being a small room, we will set the alarm time to 60 minutes. As we are energy conscious, we will use the economy mode of operation. We want two 45 minute defrosts per day.

Step 1 Use the auto-setup to load suitable settings:

Unlock the TACm using M and > keys. Display reads UL, then...

Display shows SP eg. 5.0.

Decrease the CUTIN setpoint by pressing v until 1.0 is displayed.

Store the new setpoint with M.

dl (for differential) then Ec (Economy mode*) is displayed.

Press v and AU (Automatic mode*) is displayed.

Store the automatic setting with M key.

* There are three programming options in differential dl :

Ec Economy mode - a method to reduce energy usage whilst using the internal limit start timer to protect the compressor.

AU Auto setup - Default settings (for all the programmable values) based on your setpoint are loaded into the JouleTemp's memory.

0.5 to 5.0 Differential Temperature in °C - The sp ecific temperature required for the control. (See Cooling and Heating Operations)

Step 2 The JouleTemp has stored those values, but we now "fine tune" the settings for our application:

Unlock the JouleTemp: M and >

Display UL.

SP then 1.0 is displayed, press M

dl then EC is displayed, press M.

AH then 14 is displayed, decrease the high alarm to 9.0 using > Store the new high alarm setting with M.

AL then -4.0 is displayed, increase the low alarm setting to -2.0 using ^

Store the new low setting using M

At then 90 is displayed, decrease the alarm time delay to 60 using v, then store with M.

nd then 1 is displayed. We want 2 defrosts so press ^ then M to store.

dd then 30 is displayed, set the defrost duration to 45 and store with M

Step 3 Check our Settings

Press M for 2 seconds, and our stored values are automatically displayed.

The TACm is now ready for operation.

Browser Interface - JouleTemp Standard Web pages

Joule Temp has 5 standard pages, each with the following functionality;

Page address	Main Use
/index.html	User access to JouleTemp, optionally a graph can be displayed on this page. Provides control, alarm and defrost status.
/mobile.html	User access via mobile phone or pda (graphics not included). Temperature graphs not included on this page. Fast loading, provides control, alarm and defrost status.
/settings.html (password protected)	Display and setting of primary control, alarm, email and defrost settings.
/options.html (password protected)	[only accessed through settings.html page] Display of advanced programming options -AA2 Relay control , Network, time, Humidity*, PID*, logs, etc.
/maintenance.html (password protected)	[only accessed through settings.html page] Import and export of JouleTemp settings to text file, display and diagnostics of inputs and outputs, Software version display

Main Page
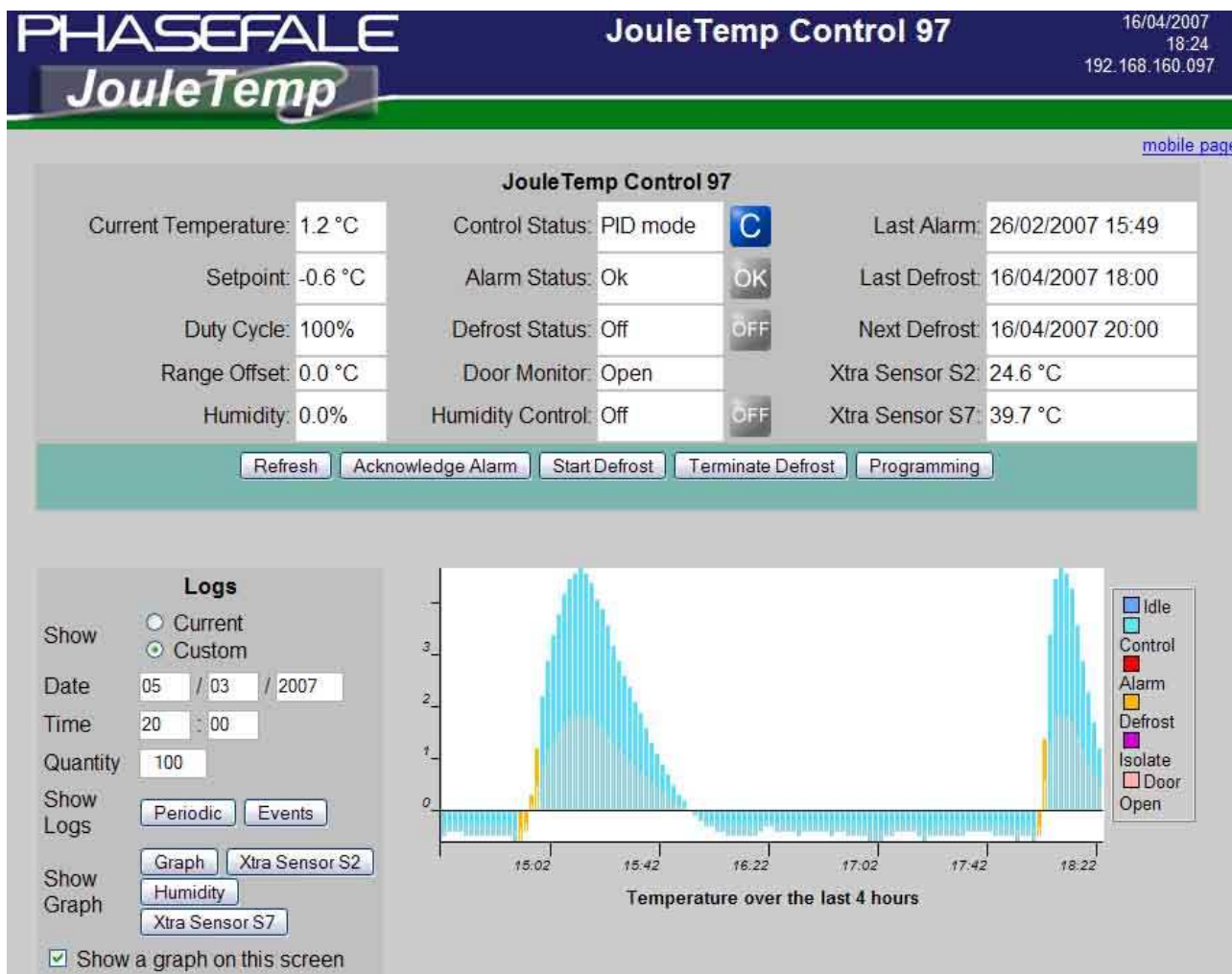
Tips on using the index page:

- *The temperature graph can be turned on and off (speeds refresh time) with "Show.." checkbox.*
- *Hover over temperature bars to get a time and status pop up information box*
- *Refresh button updates screen with latest information*
- *Acknowledge alarm will suppress alarm output for AA time (see settings)*
- *Start/Terminate defrost for defrost control*
- *Programming links to settings page (username [admin] and password [pass] are required.)*
- *Click on top right corner link to mobile page suitable for mobile phones*
- *Top bar indicates controller name, its current time and date plus IP settings*
- *Logs can be from present back for a quantity of logs (set by LP logging period)*
- *To log from a specific date and time, click Show custom and enter date and time*
- *Logs can be for main sensor, S2 defrost sensor, S7 temp. & or Humidity.*
- *Periodic logs generate a table which can be saved and used as import to Excel spreadsheet*
- *Events logs are a chronological record of all JouleTemp events as they occur.*
- *The main graph bars may have a pink section indicating the door was open at the time*
- *Control status icon changes to indicate status for quick recognition from off, cooling, not used and heating*
- *Alarm status icon changes from not used, no alarm, alarm, alarm memory*
- *Defrost status icon changes from off, pump down, defrost, drain, fan delay.*
- *Door status indicates door open or closed when used*
- *Xcore14 (description can be set) shows optional auxiliary sensor reading, also can be graphed in logs section*

Joule temperature Cool Room: displays the description programmed into the JouleTemp (up to 32 characters)

Date/Time: displays the date and time as stored in JouleTemp real time clock (this may be different from your PC's time)
192.168.1.200: displays the IP of the JouleTemp.

Note temperature : may be in Celsius or Fahrenheit according to setting.
Current Temperature: main temperature sensor reading. updated every 60 seconds or whenever you press refresh
Setpoint: This is the top range of the temperature control setting, above this temperature the control will go into cooling mode to reduce temp
Differential: the temperature band below the setpoint. [Or CUTIN = setpoint, CUTOUT= setpoint-differential ;another convention for the control settings]
Range offset: the setpoint and alarm settings can be "offset" by this amount if the control is setup for this function
Control Status: displays current control condition: not used (i.e. no control function is set) off, cooling, heating
Alarm status: displays current alarm status: not used (i.e. no alarm function is set), off, memory (an alarm has occurred and has not been acknowledged), Timing (the temperature is currently above/below the alarm limit but has not exceeded the alarm delay time), Alarm (temp has been outside the alarm limits for the delay time) or Acknowledged (an alarm is active but has been acknowledged. the alarm will re-initiate after the alarm acknowledge time elapses if it remains outside the limits)
Defrost status: not used (i.e. no defrost function is set), off, defrost (defrost condition), drain (drain condition), Fan Delay (fan delay condition)
Door: not used (not set to monitor the door input on S5) , open, closed
S2 Sensor reading (description may change default= Defrost Termination): not used, or temp.
Last Alarm: date and time of last registered alarm on control
Last defrost: date and time of last registered defrost on control
Next defrost: date and time of next programmed defrost on control

Compatibility mode: JouleTemp (allows additional functionality - all settings effective) or TACm (only original TACm functionality is available - e.g. 6 defrosts per day)
Temperature units: Celsius or Fahrenheit. Note the resolution of JouleTemp is 0.1℉ or .05℃ which all ows direct conversion of settings
Alarm Function: Used, Not Used (alarm settings ignored and no alarms generated)
L Relay function: Alarm Flash, Alarm open, Alarm close, Cooling Sp2, Heating SP2
D Relay Function: Open on Alarm, close on Alarm
F Relay function: Evap Fan, Cooling Sp2, Heating SP2
H Relay Function: Defrost Heater Output, Cooling Sp2, Heating SP2
Buzzer Function: Used, Not used (silent alarm you can disable the buzzer with this option)
Enable Time and Date Change: unchecked (time and date changes will NOT be applied), Checked (time date changes are applied)
Time Hours(24hh) [th]: set the hours - 24 hour format. Note changes only take effect if enable checked
Time minutes [tn]: set the minutes. Note changes only take effect if enable checked
Network IP [IP1, IP2,IP3,IP4]: Set IP. Note if a change is made here the controller will respond to the new IP number and will cease to respond to the current IP display in top header. You can use the keypad menu to recover the IP to a valid range for your LAN settings.

Control, Alarm and Defrost Icons

the control, alarm and defrost conditions also include an icon for quick recognition. exceptional conditions (alarm, and Defrost) are animated to attract attention.

Control Buttons

Refresh: click this button to update the page including all readings and graph.
Acknowledge alarm: click to acknowledge an active alarm (this will put alarm light to steady ON, and security relay to normal. If alarm conditions persist, the alarm will re-activate after the alarm acknowledge period. If an alarm Memory condition is active, clicking Alarm acknowledge will clear the memory condition and alarm will be off.
Start Defrost: initiates a defrost sequence
Terminate defrost: terminates defrost, starting with a drain condition
Programming: access the controller settings. This option requires a username admin & password (default pass)

Logs

Show from current date/time: when checked the graph, Termination sensor, periodic and Events buttons operate from the current time of the JouleTemp back in time for the quantity of logs set. When unchecked, JouleTemp uses the date and time as set.
Quantity: sets the number of logs to be displayed separated by the log period (set from 1 to 900 max)

Log Control Buttons

Graph: opens a graph of the main sensor temperature in a separate window. The number of points displayed is set by the quantity option (max=600 depending on browser). Hover over various points to get a pop up reading of the point including temp, control, alarm, defrost and door status. The graph page includes a close button to close the page and return to the main page

S2 Sensor reading (description may change default= Defrost Termination): as per Graph but for the second sensor where fitted.

Periodic: a table of data including date, time, temp, s2 temp, alarm, control, defrost, alarm and door status. This data can be saved as a text file and imported into Excel to manipulate the data as required. The periodic data includes a fixed time period (as set by the logging period) for the number of points set in quantity.

Events: a table of event based items with date, time, event, temp, s2 temp, alarm, control, defrost, alarm and door status. Events include abnormal or exception events such as alarm, alarm restoral, programming changes, and are stored as they occur.

Graph

The main page automatically displays a graph with the last 120 points (2 hours when logging period is set to 1 minute). A legend is included which details the various status conditions at the time of the log with alarm ,then defrost then control condition displayed by a color code. In addition, the lower 1/3 of the trace will show a pink band to indicate if a door open was also registered. By hovering over the band, a pop up message displays detailed information including temp, control, alarm, defrost and door status.

Graph Legend

Idle: medium blue : control output is in the off state
Control: light blue : control output is in the ON state
Alarm: red: the control is in alarm (highest priority)
Defrost: amber : control is in defrost condition
Isolate: purple: the control or alrm function has been turned off
Door Open: pink in lower 1/3 status bar: door contacts open.

Mobile page

This page is included to be accessed by mobile phones over the internet and is a "cut down" version of the main index page-perfect for the limited screens on mobile phones. There is the ability to acknowledge alarms and initiate and terminate defrosts, it also includes a link to the mobile settings page described below. The direct link to this page is …../mobile.zhtml

Mobile settings page

There is also a program button on the mobile page which links to a password protected settings page with a limited set of programming parameters as shown in the screen shot to the right. The direct link to this page is …../set/set_mob.zhtml

Settings Page

The majority of JouleTemp programming items (Sp, AA1 and AA2 keyboard menus are accessed and changed on this page. To change a setting, enter the desired value in the entry box and click on the save settings button (one at top and at bottom of page). Note: after clicking, WAIT until hourglass has stopped before clicking other buttons (such as main page) as settings re not updated until hourglass stops.

Name: JouleTemp Control 97
IP: 192.168.160.097
Current Temperature: 0.4 °C
Xtra Sensor S2: 24.7 °C
Alarm Status: Ok
Control Status: PID mode
Defrost Status: Off
Door: Open
Last Alarm: 26/02/2007 15:49
Last Defrost: 16/04/2007 18:00
Setpoint: -0.6 °C
Duty Cycle: 100%
Range Offset: 0.0 °C
Next Defrost: 16/04/2007 20:00
Date: 16/04/2007
Time: 18:27
[Refresh]
[Acknowledge Alarm]
[Start Defrost]
[Terminate Defrost]
[Program]
goto normal page

Name: 97 JouleTemp
IP: 192.168.160.097
Setpoint (SP) [-1.5] °C
Differential (di) [1.0] °C
Alarm High (AH) [4.0] °C
Alarm Low (AL) [-44.0] °C
Alarm Delay (At) [4.0] min.
Defrosts Per Day (nd) [12]
Defrost Duration (dd) [8.0] min.
[Save Settings]   [Main]

JouleTemp Control 97

16/04/2007
18:29
192.168.160.097

PHASEFALE *JouleTemp*

[Main Page] [Save Settings]

Normal Settings

Setpoint (SP)	-0.6	°C
Differential (di)	1.1	°C
Alarm High (AH)	37.8	°C
Alarm Low (AL)	-17.8	°C
Alarm Delay (At)	90.0	min.
Defrosts Per Day (nd)	12	
Defrost Duration (dd)	4.0	min.

General Settings

Main Description	JouleTemp Control 97
Sensor 2 Description	Xtra Sensor S2
Sensor 7 Description	Xtra Sensor S7
Admin Password	pass
Events to Email	None
Send to Email Address	
SMTP Server	
Server Requires Authentication	☐
Account	
Password	

AA1 Settings

Alarm Ack. (AA)	14.0	min.
Limit Start (LS)	4.0	min.
Setpoint 2 (SP2)	20.0	°C
Terminate Setpoint (Tr)	40.0	°C
Operating Mode	Cooling	
Drain Delay (dt)	0.0	min.
Fan Delay (Ft)	2.0	min.
Defrost Mode	Electric	
S2 Input Function	Terminate	
Defrost Temperature	Show	
Defrost Start 1 (St)	0.0	Hours
Defrost Start 2 (St2)	2.0	Hours
Defrost Start 3 (St3)	4.0	Hours
Defrost Start 4 (St4)	6.0	Hours
Defrost Start 5 (St5)	8.0	Hours
Defrost Start 6 (St6)	10.0	Hours
Defrost Start 7 (St7)	12.0	Hours
Defrost Start 8 (St8)	14.0	Hours
Defrost Start 9 (St9)	16.0	Hours
Defrost Start 10 (S10)	18.0	Hours
Defrost Start 11 (S11)	20.0	Hours
Defrost Start 12 (S12)	22.0	Hours
Sensor Calibration (CA)	0.0	°C

[Save Settings] [Main Page] [Network] [Maintenance] [Advanced]

Tips on using the setting page:

- *Hover over settings boxes to get a pop up information box on the setting*
- *After changing a setting wait until hourglass stops to ensure setting has been updated*
- *Network and Maintenance pages can only be accessed from this page*
- *The Advanced settings (screen shot below) and Maintenance pages can only be accessed from the links on this settings page*

Detailed functional description JouleTemp Settings

Setpoint [Sp]: This is the top range of the temperature control setting, above this temperature the control will go into cooling mode to reduce temp

Differential [dI]: the temperature band below the setpoint. [Or CUTIN = setpoint, CUTOUT= setpoint-differential ;another convention for the control settings]

Alarm High [Ah]: upper limit of normal temperature range

Alarm low [AL]: lower limit of temperature range

Alarm Delay [Ad]: delay time before a temperature alarm occurs (prevents false alarms due to door openings, defrosts etc}

Defrosts per Day [nd]: number of defrosts per 24 hour period

Defrost duration [dd]: time of defrost (excluding drain and fan delay periods which add to the overall defrost time)

Alarm Acknowledge [AA]: time min minutes that and alarm is suppressed before re-initiating

Limit Start [LS]: once the control output has come on and then shut off again, this time must elapse BEFORE the control can start again. This can be used to limit the number of starts per hour a compressor or solenoid will have (e.g. 6 minutes will limit the # of starts per hour to 10)

Setpoint 2 [Sp2]: second control setting cutin point (if used). The differential used for the cutout point is dI as per the main control setpoint

Terminate Setpoint [tr]: where a defrost termination sensor is used the setting where the defrost is terminated and the drain period begins (this function shortens the defrost duration [dd] to prevent excess heat build up in the coil during defrost. A second temperature sensor fitted in the evaporator coil is required for this function.

**Operating Mode: Cooling (default cooling application), Heating, Cooling+Heating

Drain Delay [dt]: (use this setting for electric defrost applications where a defrost heater is used) after the defrost heater shuts off a period in which the solenoid, fan and heater are off. This allows the heat from the heater to permeate the evaporator and melt all the ice build up but prevents overheating of the coil.

Fan Delay [Ft]: (use this setting for electric defrost applications where fan control is used). After the drain period, the cooling output comes on but the fan is delayed so as to prevent water on the coil being sprayed around the room by the fan. After the fan delay the coil is again cooled and excess water frozen.

**Defrost mode: Electric, Hot Gas. Electric: control output is off during defrost, drain periods. For Hotgas setting, the Light relay is used as a suction line solenoid.

**S2 Input Function: Terminate (input looks for a temperature sensor which can be a termination sensor embedded in the evaporator coil OR a logging sensor) , Offset (expecting a 0-100k Ohm resistor/trim pot to offset setpoint and alarm settings via the tr value. Range offset varies linearly between 0 ohm - SP-rA, 50k Ohm -Sp=nominal, 100k Ohm: Sp=Sp+rA

Defrost Temperature [Sd/Hd]: Show (alternate temperature reading with a dF to indicate system in defrost), or Hide (show temperature reading only)

*Defrost Start 1 [St]: time of first defrost (hours and decimal minutes). Visible depending on how many defrosts per day [nd] are set. may be grayed out if nd=0

*Defrost Start 2 [St2]: time of 2ndt defrost (hours and decimal minutes). Visible/grayed out depending on how many defrosts per day [nd] are set. Note St2 must be set After st time

Defrost Start 3-12 as per above may be visible or grayed out

Sensor Calibration [CA]: allows an offset of up to +/- 9.9 Celsius or Fahrenheit into control. displayed Temperature and control functions ill include any calibration settings applied here.

Network Settings [no keypad menus for these parameters]

These settings not available via the JouleTemp keyboard and must be made via the browser interface

Main Description: the name which appears at the top of the page and also in emails sent by JouleTemp
Sensor S2 Description: a 32 character description (default is Defrost Termination)
Admin Password: 32 character password for setting page access (default is pass). Important Note if this password is lost, it can be reset to "pass" bwith the keyboard LOd menu and selecting the Pas option.
Events to Email: none (do not send emails), All (includes all exception events -e.g. setting change, manual defrost initiate, etc), Alarm (only alarm events)
Send to email address: user account email address e.g. bob@hotmail.com
SMTP Server: server IP address. This address must be on the same subnet range as the JouleTemp and be a fixed IP 192.168.156.21 (Note: as JouleTemp does not support fully qualified domain names it must be a fixed IP server address)
Server requires authentication: Yes or No
Account: server account (usually same as send to account)
Password: email account password.

PHASEFALE
JouleTemp

JouleTemp Control 97

16/04/2007
18:32
192.168.160.097

[Main Page] [Programming] [Save Settings]

AA2 Settings

Compatibility Mode	JouleTemp ▾
Temperature Units	Celcius ▾
Control Sensor Type	M probe (S1) ▾
Alarm Function	Used ▾
L Relay Function	Alarm Close ▾
D Relay Function	Alarm Close ▾
F Relay Function	Humidity ▾
H Relay Function	Def Heater ▾
Buzzer Function	Not Used ▾
Date Display	dd / mm / yyyy ▾
Enable Time and Date Change	☐
Time (24Hr:min)	18 : 32
Date (dd / mm / yyyy)	16 / 04 / 2007
Network IP	192 168 160 097
Log Type (LOg)	Con Def Hum & S7 ▾
Log Period (LOP)	2 min.
Door Mode (DOR)	Monitor ▾
Door Alarm Delay (DOT)	1.0 min.

[Save Settings] [Main Page] [Programming]

Humidity Settings

Humidity Operating Mode (HOP)	Dehum. (Heat+Cool) ▾	
Humidity Control Limit High (HLH)	55	%rh
Humidity Control Limit Low (HLL)	39	%rh
Humidity Alarm High (HAH)	100	%rh
Humidity Alarm Low (HAL)	0	%rh
Humidity Alarm Delay (HAt)	1.0	min.
Humidity Limit Start (HLS)	1.0	min.
Humidity Input Type (Hit)	4-20mA (H1) ▾	
Humidity Limit Temperature (HLT)	1.9	°C
Humidity Calibrate High (HCH)	3.89	Volts
Humidity Calibrate Low (HCL)	0.75	Volts

PID Settings

PID Control (Pid)	On ▾	
Proportional Gain (PPg)	99.9	
Integral Gain (Pig)	99.9	
Differential Gain (Pdg)	99.9	
Minimum Switching Time (Ptn)	0.2	min.

Advanced Options – AA2, Humidity, PID Settings Page

Refer summary table below for detailed information on settings.
Special Comments;
JouleTemp compatibility mode is recommended as it allows more defrosts
If using **-80 type friges**, Use special sensor and S8 input in place of standard S1 input
Light(L), Fan & Heater can operate as default or alternative outputs, Dialler (D) outputs n/closed (default) or n/open
Buzzer can be disabled
Gateway IP setting is required for external email server addresses.
Humidity settings only valid if humidity is enabled in Maintenance section.
Humidity control options are Monitor, Humidify, De-Humidify and Anti-Sweat using humidity control output or De-humidify using Heat+Cool outputs. Anti-Sweat operates between HLH (95%) and HLL (5%) and drives the OUT1 (off= 0v, ON=+12v) signal for a Solid State Relay.
Humidity Calibration High & Low functions only valid for Voltage Style sensor fitted to S6
PID settings only valid if enabled in Maintenance section. Note if humidity is enabled, and you want to LOG it, you must set Log type to include Humidity.

Maintenance Page

Note: "Clear All Logs" requires a password to delete, "**deletalljt**"

Tips on using the maintenance page:

- *Software version is displayed top right*
- *Input voltages are displayed which can be checked and compared using a multimeter*
- *Time and date can be set from here directly*
- *Clear all logs clears time and date stamped logs in memory*
- *Load defaults loads defaults into controller as per settings reference table*
- *Export settings generates a separate page with a text based list of all JouleTemp settings*
- *Import settings updates controller to a settings file: when completed JouleTemp jumps to the settings page to indicate a successful load.*
- *Output over-rides are for 1 minute only after which JouleTemp resumes normal operation*
- *Optional Modules Humidity and PID can only be activated via this page using Web interface.*

Setting File

JouleTemp can export and import a text based settings file which can be edited. A partial text file can be imported to change only the parameters required, as an example the following file would only change the 3 listed parameters;

```
Setpoint (SP): 12.4
Differential (di): 2.5
Alarm High (AH): 23.9
```

Network Page

Network page is used to setup links from JouleTemp to each other over the network

Optional Modules – Humidity & PID Control

The optional (available at additional cost) Humidity and PID modules are Enable and Disabled from this page. To obtain the activations code, make a not of your JouleTemp Serial number (4986529196) and ring

Phasefale for a price and code. Once enabled, Humidity & PID information becomes active on the main page, advanced settings page and programmable keys on the JouleTemp. Note when humidity is enabled, the display cycles between "t" and the control temperature and "h" and the humidity in RH%

Tips on using the network page:

- *Controllers only on the same range (first three IP numbers the same) can be linked*
- *The Alarm ANY option will generate alarms of any kind on the controller set with the link. In other words a single JouleTemp can be used to connect to an alarm system and monitor other JouleTemp. The ANY option also includes network alarms picked up by the controller being monitored*
- *The Alarm Local option will generate alarms on the controller set with the link. It will generate alarms from the originating JouleTemp as long as they have been generated at the JouleTemp and are not network based*
- *The Link option means the link will be presented on the index screen but the JouleTemp will not be monitored for alarms*
- *Once the links are saved, the index screen then includes a link and icons of the monitored JouleTemp, including a temperature reading.*
- *When setting up multiple controllers, assign consecutive IP addresses to speed network alarm performance*

Summary Table JouleTemp programming items

Item	Menu	Kbd?	Description	Units	Default	Low	High
SP	SP/5		Setpoint Cutin	°C / °F	0.0	-99.9	+99.0
dl	SP/5		Differential	°C / °F	0.5	0.0	5.0
AH	SP/5		High Temperature alarm	°C / °F	10.0	-99.0	+99.0
AL	SP/5		Low Temperature alarm	°C / °F	-20.0	-99.0	+99.0
At	SP/5		Alarm time delay	Mins.	90.0	0.0	99.0
nd	SP/5		Number defrosts per 24 hours	Units	1	0	12
dd	SP/5		Defrost Duration	Mins.	30.0	0.0	99.9
AA	AA1/10		Alarm Acknowledge	Mins.	10.0	0.0	99.9
LS	AA1/10		Limit Start time	Mins.	4.0	0.0	99.9
SP2	AA1/10		Setpoint 2 Cutin	°C / °F	0.0	-60.0	199.0

Tr	AA1/10		Terminate Setpoint	℃ / ℉	8.0	0.0	99.9
Op:Co	AA1/10		Operating Mode- Cooling:Co or Heating:HE		Co	Co	HE
TAC/TAJ	AA1/10		TACm:TAC / Joule Temp:TAJ Compatibility		TAJ	TAJ	TAC
dt	AA1/10		Drain Time	Mins.	1.0	0.0	12.0
Ft	AA1/10		Fan Delay Time	Mins.	1.0	0.0	4.0
El/Hg	AA1/10		Def mode-Electric:EL/Hotgas:Hg-light relay used for suct.sol.		def:El	Hg	
S2:		No	S2 Sensor description:	text	Def		20 ch.
S7		No	S7 Description	text	S7		20 Ch.
Sd/Hd	AA1/10		Show or Hide defrost	units	Sd	Sd	Hd
St	AA1/10		Time first defrost	Hrs.mins	3.0	0.0	23.9
St2..S12	AA1/10		Time 2nd, 3rd,…12th Defrost	Hrs.mins	3.0	0.0	23.9
CA	AA1/10		Sensor Calibration offset	℃ / ℉	0.0	-9.9	+9.9
TAJ	AA2/15		JouleTemp:TAJ or TACm:TAC defr. compatibility mode		TAJ	TAJ/TAC	
℃ / ℉	AA2/15		Celsius or Fahrenheit operation	℃ / ℉	℃	℃	℉
CS1	AA2/15		Use Standard temp input S1:CS1 or -80°Type S8:CS8		CS1	CS1/CS8	
AOn	AA2/15		Alarm is active:AOn or not:AOF		AOn	AOn/AOF	
LAF	AA2/15		Light relay operation flash:LAF, open:LAO,close: LAC, Cool SP2:LCC, Heat SP2:LCH, Hum LAH		LAF	LAF/LAo/LAC /LCC/LCH/LAH	
IP1,…4	AA2/15		Network IP number	192.168.160.100		0	255
t1n	AA2/15		Real time clock RTC minutes	Mins.		0	59
t1h	AA2/15		RTC clock hours setting	Hours.		0	59
dtd	AA2/15		RTC clock day setting	Date		1	31
dtn	AA2/15		RTC month setting	Month		1	12
dty	AA2/15		RTC year setting	Year		2000	2099
Log	AA2/15		Log Period	Mins.	5	1	60
Description		No	Controller Description	text			35 ch.
Admin pwd		No	Administrator settings password		pass		15 ch.
Email addr.		No	Email events to address				50 ch.
Email type		No	Email events off-0, alarm-1 or all-2		0	0	2
SMTP Srvr		No	Mail server address				30 ch.
Email auth		No	Email acct. require:1 authorization or not:0		0	0	1
Email acct		No	Email account				50 ch.
Email pwd		No	Email account password				15 ch.
dAo	AA2/15		D1/D2 contacts alarm open=dAo/ closed=dAc		dAo	dAo/dAc	
Fan	AA2/15		F1/F2: FAn,Cool SP2:FCC,Heat SP2:FCH, Hum FHu		FAn	Fan/FCC/FCH/FHu	
HdF	AA2/15		H1/H2:HdF,Cool SP2:HCC,Heat SP2:HCH Hum HHu		HdF	HdF/HCC/HCH/HHu	
Bus	AA2/15		Buzzer used:buS, not used: bnu		buS	buS/bnu	
dOr	AA2/15		Door Monitor not used:nu, monitor:on, alarm:AL	nu		Nu/on/AL	
dot	AA2/15		Door alarm delay	Mins.	0	0	99.9
S'w Ver.	AA2/15		Software Version Display				
Lod *	LOd/20		Load memory –no, bus,ALL		no	No/bus/ALL	
HOP*	AA2/15		Humidity Cntrl Mode: oFF, Readout/monitor only (ro), Humidify(Hu),dehumidify (dHu), Heat +Cool (dHc), Anti-sweat (AS)				
HLH*	AA2/15		Humidity High cutin * Optional	%RH	50	0-99%	
HLL*	AA2/15		Humidity Low Cutout	%RH	45	0-99%	
HAH*	AA2/15		Humidity High Alarm	%RH	60	0-99%	
HAL*	AA2/15		Humidity Low Alarm	%RH	40	0-99%	
HAt*	AA2/15		Humidty Alarm Delay Time	mins	0	0-99 min	
HLS*	AA2/15		H Limit Start (min time between starts)	mins	0	0-99 min	
HLT*	AA2/15		Max Temp error(before stopping humidity control)	°C / ℉	20.0	0.0-20.0°	
HiT*	AA2/15		Humidity Input Type 4-20mA:HHI, Volts S6:HS6		HHI	HHI/HS6	
Pid *	AA2/15		PID control On/oFF * Optional		oFF	On/oFF	
PPg *	AA2/15		Proportional Gain - consult Phasefale for		50.0	0-99.9	
Pig *	AA2/15		Integral Gain PID control settings		50.0	0-99.9	
Pdg *	AA2/15		Differential Gain		50.0	0-99.9	
Ptn *	AA2/15		PID Minimum Switching Time		0.0	0-99.9	

Installation

Temperature Sensor (M Probe) Installation

The temperature sensor is an NTC thermistor of extreme accuracy (0.2℃), and it has a non-linear resistanc e-temperature characteristic (see chart at right). [This is the standard Phasefale Mprobe as used in TACm, Pressnet, TA1, etc]. It is ideally mounted in a position where refrigerated air is circulating. It can

Resistance / T Deg C chart (M Probe)
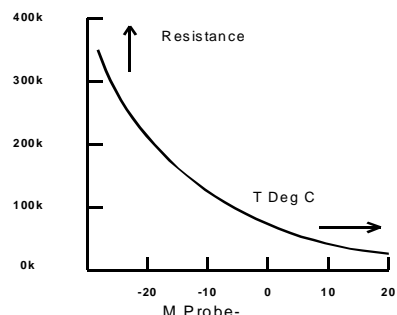
be situated in the air off the evaporator coil (coldest) or return air (warmest) position as preferred.

At least 150mm of the sensor cable needs to be in the refrigerated space to ensure accurate temperature sensing.

If the sensor cable is open [Ero] or short [Erc] circuit, the display will indicate the fault. If a defrost terminate probe is used it should be mounted centrally in the evaporator coil.

The sensor cable is double insulated and therefore does not need to be enclosed in a conduit. There is no polarity to the sensor connection and it may be extended up to 100 metres by joining an extra cable (use double insulated cable) but the join must be well insulated and away from any dirt or moisture.

Dirt or moisture at the join will reduce the resistance of the probe and result in a higher temperature reading than normal. *(-80℃ Type Sensors are wired to Terminal S8 instea d of S1 and set in AA2 menu)*

Electrical Installation

Refer also to the electrical wiring diagram for connection details. The Active supply to the unit should be fused with a maximum rating suit suit total load. The control and light outputs are rated at 10A resistive. Motors larger than 1 HP MUST be switched via a relay or contactor

The dialler output provides alarm contacts that open on alarm or power loss. The contacts can be connected to Phasefale's AD2 telephone dialler to provide a remote alarm using existing phone lines.

If an AD2 is connected, the +12 and GND terminals can be used to supply 12V DC to the dialler. The correct polarity is indicated on the wiring diagram. If a battery is fitted, connect the AD2 to the battery.

If a battery back-up (PSB30) unit is to be used to supply 12V DC to the AD2, it may also be used to supply back-up power to the JouleTemp by connecting L and G from the PSB30 to +12 and GND on the JouleTemp.

The PSB30 is supplied with the battery + lead disconnected. Reconnect once mains power is connected.

If the PCB option board for heater and fan outputs is to be fitted, follow the instructions supplied with it.

The optional toggle defrost, terminate defrost (or 2nd sensor), distress, clear memory, door switch and acknowledge inputs are extra low voltage inputs and require voltage free contacts. Closing the contacts momentarily will initiate the function, the door switch input constantly monitors if enabled in programming. Refer to the wiring diagram for correct wiring of these inputs. The optional Alarm Isolate input requires voltage free contacts and is active while the contacts remain closed.

Modbus TCP Interface

JouleTemp includes a modbus interface which allows building management systems to communicate. Communications functions includes reading of all major status, control and defrost settings and current values, plus writing control, alarm and defrost parameters.   The following table describes the various parameters and their read/write status plus functions.

Joule Temp Modbus Parameters						
#	R/W	Descr.		#	R/W	Descr.
COILS WITH STATUS TO READ				REGISTERS WITH SETTINGS (cont.)		
0	Read	Alarm, any type		108	Read	Control Descr. ch. 16-17
1	Read	temp. Alarm		109	Read	Control Descr. ch. 18-19
2	Read	Door Alarm		110	Read	Control Descr. ch. 20-21
3	Read	Distress Alarm		111	Read	Control Descr. ch. 22-23
4	Read	Network Alarm		112	Read	Control Descr. ch. 24-25
5	Read	Alarm Acknowledged		113	Read	Control Descr. ch. 26-27
6	Read	Memory		114	Read	Control Descr. ch. 28-29
7	Read	Isolated		115	Read	Control Descr. ch. 30-31
8	Read	Defrost		116	Read	Control Descr. ch. 32-33
9	Read	Pumpdown		117	Read	Control Descr. ch. 34-35
10	Read	Drain		118	R/W	Setpoint (0.1C steps)
11	Read	Fan Delay		119	R/W	Differential (0.1C steps)
12	Read	Control Relay		120	R/W	Alarm High (0.1C steps)
13	Read	2nd Control Rly Heating		121	R/W	Alarm Low (0.1C steps)
14	Read	2nd Control Rly Cooling		122	R/W	Alarm Delay (seconds)
15	Read	Door Open		123	R/W	Number Defrosts per day
16	Read	Humidity Alarm		124	R/W	Defrost Duration (seconds)
17	Read	Humidity Control				
COILS TO INITIATE ACTIONS (WRITE VAL 1 TO INITIATE)				125	R/W	Alarm Acknowledge Per.(secs)
100	Write	Do Alarm Acknowledge		126	R/W	Limit Start Period (seconds)
101	Write	Do Clear Memory		127	R/W	Setpoint 2 (0.1C steps)
102	Write	Initiate Defrost		128	R/W	Terminate temp. (0.1C steps)

103	Write	Terminate Defrost		129	R/W	Mode (0=cooling, 1=heating)
REGISTERS WITH READINGS				130	R/W	Drain Time (seconds)
0	Read	S1 temp. (0.1C steps)		131	R/W	Fan Tine (seconds)
1	Read	S2 temp. (0.1C steps)		132	R/W	Defr. time 1 (minutes after 00:00)
REGISTERS WITH SETTINGS				133	R/W	Defr. time 2 (minutes after 00:00)
97	Read	Software version		134	R/W	Defr. time 3 (minutes after 00:00)
98	Read	Alarm Status		135	R/W	Defr. time 4 (minutes after 00:00)
99	Read	S1 temp.		136	R/W	Defr. time 5 (minutes after 00:00)
100	Read	Control Descr. ch. 0-1		137	R/W	Defr. time 6 (minutes after 00:00)
101	Read	Control Descr. ch. 2-3		138	R/W	Defr. Time 7 (minutes after 00:00)
102	Read	Control Descr. ch. 4-5		139	R/W	Defr. time 8 (minutes after 00:00)
103	Read	Control Descr. ch. 6-7		140	R/W	efr. time 9 (minutes after 00:00)
104	Read	Control Descr. ch. 8-9		141	R/W	Defr. time 10 (minutes after 00:00)
105	Read	Control Descr. ch. 10-11		142	R/W	Defr. time 11 (minutes after 00:00)
106	Read	Control Descr. ch. 12-13		143	R/W	Defr. time 12 (minutes after 00:00)
107	Read	Control Descr. ch. 14-15		144	R/W	Calibration (0.1C steps)

JouleTemp Ethernet connection options

To extract the full potential of JouleTemp an Ethernet connection is required which is available in a few ways. The following methods are available, a computer administrator is required to establish connection as this is beyond the scope of technical support provided by Phasefale. JouleTemp supports 10 Base Ethernet with a fixed IP. **Important: DHCP & Fully qualified domain name servers are not supported**. Refer connection diagram page 18.

To connect directly to JouleTemp with your notebook

Consult your computer administrator as this is beyond the scope of the tech support provided by Phasefale. Note JouleTemp does not support DHCP and a fixed IP is required to be programmed into the control. Adjust the PC's TCP/IP to a fixed address with the same range programmed into the JouleTemp. Use a crossover cable (special version of a RJ45 Patch lead obtainable from computer shops) and plug directly into the JouleTemp. Use your browser to type the IP directly: e.g. 192.168.1.98. Alternatively, using regular patch leads and a computer HUB, SWITCH or ROUTER make connections from JouleTemp to the hub, and your laptop to the hub. Refer schematic connection diagram page 18.

To access your JouleTemp on a LAN

Consult your computer administrator as this is beyond the scope of the tech support provided by Phasefale. Note JouleTemp does not support DHCP and a fixed IP is required to be programmed into the control. Ensure the programmed IP is different for each JouleTemp and if they're on the same LAN IP1, IP2, IP3 will be the same, which will also coincide with the PC you use to access the JouleTemp. Refer diagram page 18.

Access to your JouleTemp on the Internet

It is possible to display your JouleTemp on the internet: consult your computer administrator as this is beyond the scope of the tech support provided by Phasefale. One method is as follows: if you have a fixed IP address at your premises (e.g. a mail server on your local LAN such as mail.company.com.au and a router with ports forwarding capability, you can assign local IP numbers to a port address, e.g. 80. The internet address for a control would then be http://mail.company.com.au:80. As an example, your Local IP range is 192.168.10.??? and you setup 4 JouleTemp as follows;
JouleTemp 1 Cool Room   192.168.10.124   set port forward to 80 Internet address: http://mail.company.com.au:80
JouleTemp 2 Produce Room   192.168.10.125   set port forward to 81 Internet address: http://mail.company.com.au:81
JouleTemp 3 Freezer   192.168.10.126   set port forward to 82 Internet address: http://mail.company.com.au:82
JouleTemp 4 Fruit and Veg Room   192.168.10.127   set port forward to 83 Internet address: http://mail.company.com.au:83

Note that port 80 is a standard port forward for web pages, other ports may be blocked by certain firewalls and security measures taken by ISP's and phones. Consult your Computer administrator for more details.

C-Tick Compliance

JouleTemp is Tested to AS/NZS CISPR 22:2004 "Information technology equipment -Radio disturbance characteristics - Limits and method of measurement". PASS Class A Industrial. Warning. This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Enclosure Installation /Cabling Routing

1 Decide if you want straight (left picture) or tilt mounting. The wall mount conduit entry points are at the bottom for straight mount and at the top for tilt (approx 15 degrees) mounting.

2 Mount the wall mount base using the 4 off 6mm mounting holes, centers are 90mm high x 72mm wide. (Fixings not included). For conduit entry, the cables for the JouleTemp can enter through the 2 x 19mm conduit entry points placed 30mm apart. Use a knife as shown to open out the holes. Alternatively, the cables can come through the rear of the mounting surface, simply drill a hole in the wall mount base.

For maximum safety, bring LV mains cables (e.g. 240 V AC supply, compressor/evaporator control, fan, heater and alarm light) in through a different conduit than the Extra Low voltage cables (e.g. Sensor cable, alarm isolate, defrost terminate, alarm buzzer and security etc.)
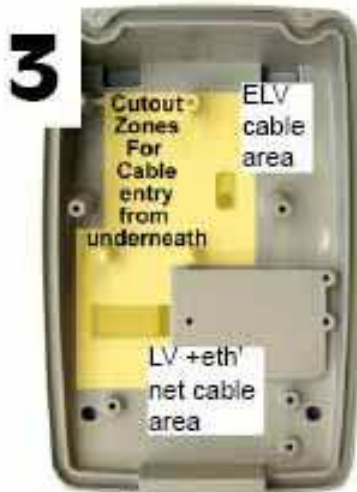
3 Locate the enclosure base over the wall mount base with the top 2 lugs and bottom screws provided

Before fitting the enclosure base over the wall mount base, areas for entry can be enlarged as required with a sharp knife or drill. Feed the ELV cabling through the opening under the circuit board and up to the top of the board. For maximum environmental protection, keep the hole as small as possible and later it can be silicone sealed. For maximum safety, ensure LV and ELV cables are segregated.

4 For an electric defrost system, the optional board is fitted at the bottom of the enclosure base using the 3 screws supplied. When fitting the Quick connect cable connectors, ensure they face upwards and are fully seated to prevent fouling the enclosure when it is fitted later

5 Feed ELV cabling over top edge of board into push fit connectors. Maximum cable size is 0.5mm2 and strip 6mm bare cable. After fitment, gently tension cable and it is then secure. Route LV cables under bottom left edge and into screw terminals there.

6 After all electrical connections have been made, with the ELV cables along the top of the main PCB and LV connections across the bottom, the enclosure cover can be fitted in the following sequence:
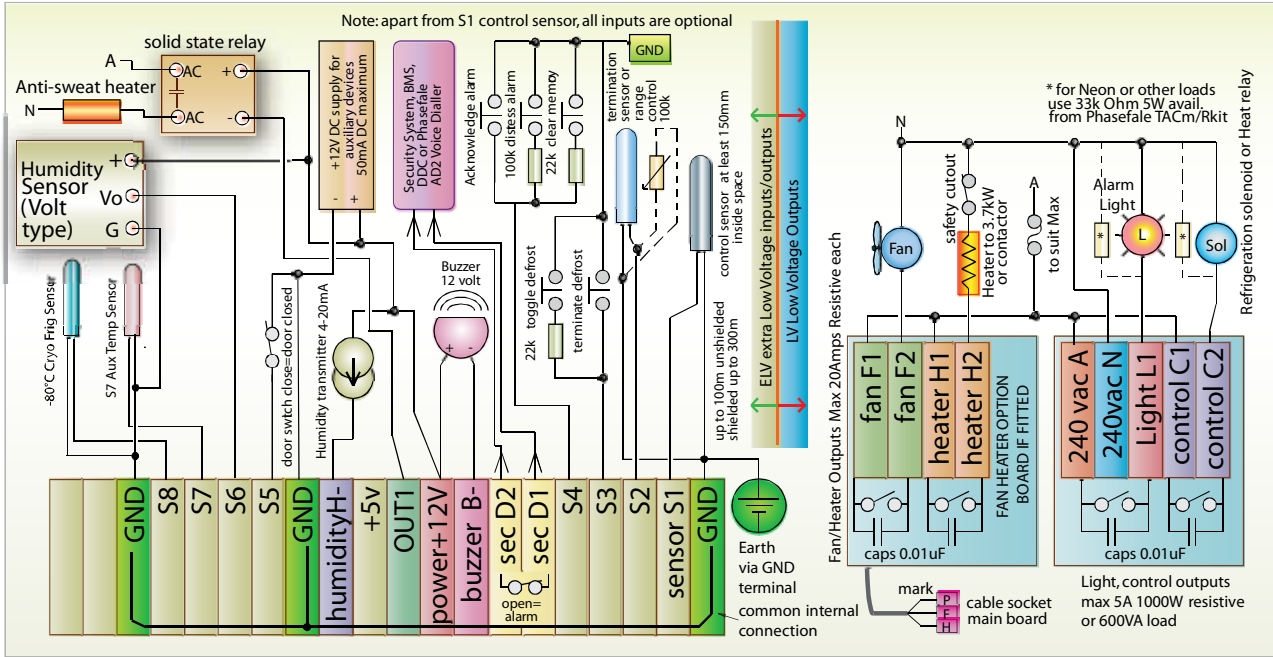- ensure the circular rubber gasket is snug in the channel around the base.
- tilt the cover and locate it under the lug across the bottom of the enclosure base.
- swing the cover against the base and secure with the 2 supplied screws, for a complete seal tightening them so the gap between the base and cover is even around the whole perimeter.

Wiring Schematic

Note: apart from S1 control sensor, all inputs are optional

Note: Humidity via S6 or H- additional cost option. S8 Input used for -80℃ Type sensor. RS485 not implemented in JouleTemp standard version.

Connector Positions and Ethernet Cabling
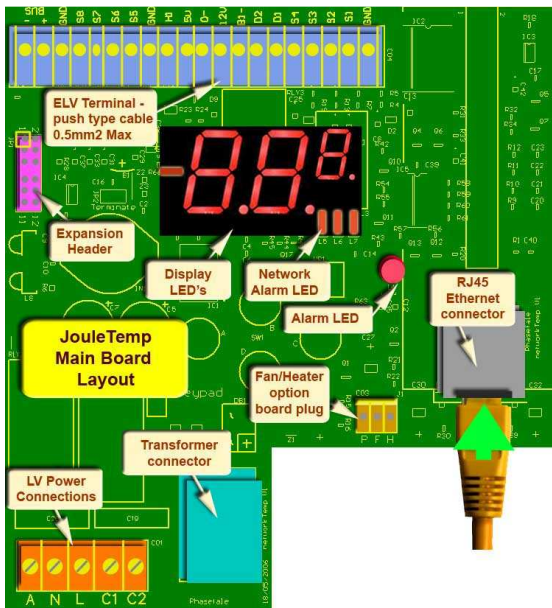
Above: connecting your JouleTemp to a laptop or PC via direct connection or via a switch/hub/router

Left: Main board connector positions

This document is available online at http://www.phasefale.com.au/TechSupport.htm go to document directory and select JouleTemp directory.