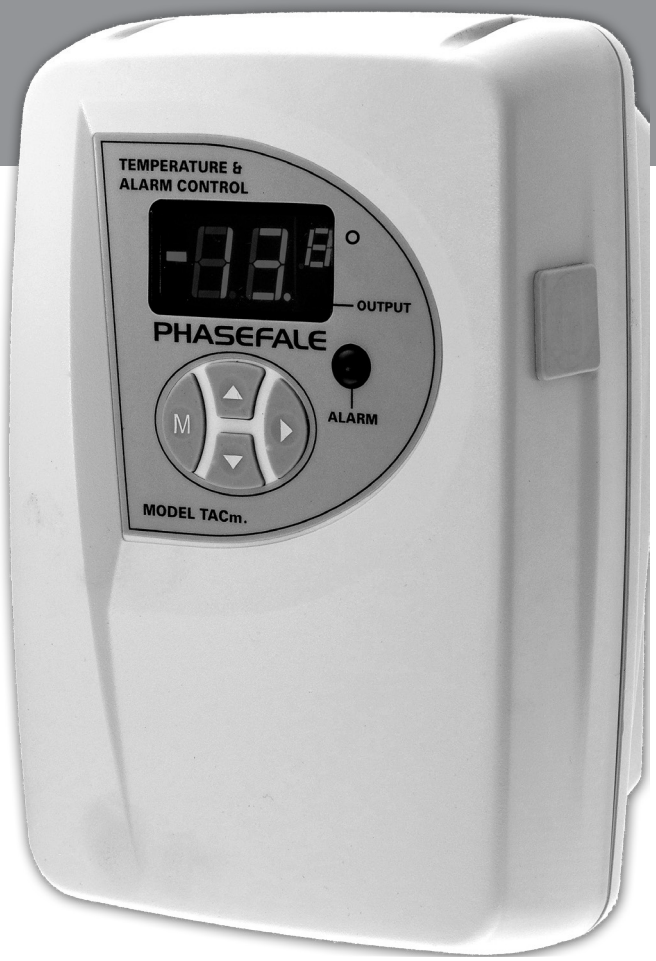
PHASEFALE



TACmk2

Cool Room and Freezer Controller

- **INSTALLATION**
- **OPERATION**
- **PROGRAMMING**

Revised: November 2020

CONTENTS

Overview and Introduction

Phasefale's TACM is simple to set up and operate. It has many great features including a real time clock for defrost cycle and a USB port. Temperature logs, events and settings can be read and written to a memory stick. The temperature is shown on the LED display. If cooling or heating operations occur a point will appear at the end of the display. Flashing of the temperature indicates an alarm situation. During defrost, dF is displayed. The programmed settings may be viewed by pressing the M button for 2 seconds. All settings are held in memory even during power loss.

Specifications

Input: 120/240VAC 50/60Hz 8 Watts

Cool/Light O/P: 10A, 120/240VAC Resistive

Heater/Fan O/P: 20A, 120/240VAC Resistive

Operating Ambient Temperature: 32°F – 104°F (0°C to 40°C)

Weight: 2.4 lbs. (1.09 kg)

c UL US

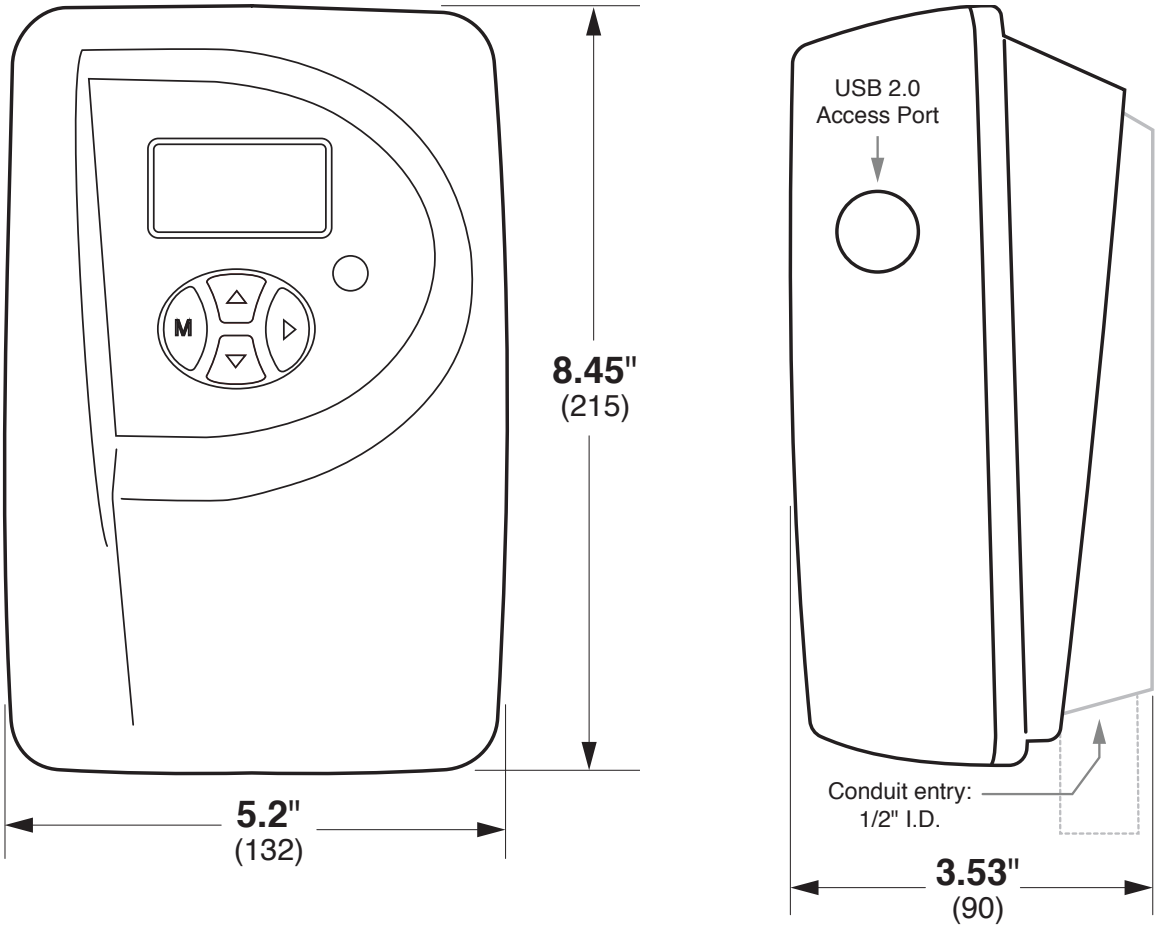
LISTED

SA44947

Refrigeration Control

Warranty

18 months from date of purchase or 12 months after installation date. For full warranty details visit phasefalecontrols.com.



1. Installation

Enclosure Installation

Please refer to the mounting instructions section 8.

Real Time Clock (RTC) - battery activation

The RTC battery has a plastic insulator (right hand side of PCB) to save the battery during storage. Remove the insulator before commissioning to activate RTC time keeping.

Temp Sensor (M Probe) Installation

The temperature sensor is an NTC thermistor of extreme accuracy (0.5°F) and has a non-linear resistance-temperature characteristic (see chart below). The M Probe should be mounted in the return air space.

> **NOTE:** A **minimum of 6" or 150mm** of sensor cable should be in the refrigerated space to ensure accurate temperature sensing.

If the M Probe sensor cable is open, the TACmk2 will display “Er” to indicate a fault. If a defrost termination sensor is used, refer to the IOM of the appropriate manufacturer for correct positioning.

The sensor cable is double insulated and does not need to be enclosed in a conduit. The sensor is not polarity sensitive to the connection. The cable can be extended, using double insulated cable, to a maximum length of 328 ft or 100m. The join must be well insulated and away from dirt and moisture.

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 of 10A. The control and light outputs are rated at 10A resistive.

IMPORTANT: Motors larger than 1 HP MUST be switched via a relay or contactor.

The dialer output provides alarm contacts that open on alarm or power loss. The contacts can be connected to a security system to provide a remote alarm.

If the heater and fan relay PCB is fitted, follow the instructions supplied with it. The optional toggle defrost, synchronizing time, terminate defrost, distress, clear memory and acknowledge inputs are extra low voltage inputs and require voltage free contacts. Closing the contacts momentarily will initiate the function. 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.

Installation Self Test

SELF TEST:
Press 5 sec.

Press **M** and **^** together for **5 seconds**. The TACmk2 automatically cycles its outputs in the following sequence:

Display	Action	Sec.
CO/CF	Control On & Off	10/4
LO/LF	Light On & Off	4/4
dO/dF	Dialer On & Off	4/4
bO/bF	Buzzer On & Off	4/4
HO/HF	Heater On & Off	4/4
FO/FF	Fan On & Off	4/4

PROGRAMMING

The basic programming steps are:

- “Unlock” the TACmk2’s 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.

UNLOCK:
Press 5 sec.

A) To unlock the TACmk2 and alter the settings, press **M** and **>** together **for 5 seconds**. UL will be displayed to indicate that the system is unlocked.

SETTINGS:
Press to toggle

B) After the TACmk2 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	32.0	Control Setpoint °F (-112~ +302°F) CUTIN
dI	Ec	Differential Temp °F 0.1~9.0°F, Ec: economy CUTOUT
AH	55	High Alarm Temp. °F (-148~ +302°F)
AL	23.0	Low Alarm Temp. °F (-148~+302°F)
At	90	Alarm Time Delay (0~240 minutes)
nd	1	Number of defrosts per 24hr (0~12)
dd	30	Defrost duration (1~240minutes)

ADJUST:
Setting Values

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.

STORE:
New Values

IMPORTANT: "M" must be pressed to store new values

EXIT:
Prog. Mode

E) If no button is pressed for 60 seconds the TACmk2 will once again lock itself and further alterations will not be allowed until unlocked again. This will also occur if the **>** key is pressed during the programming operation.

ADVANCED:
Press 10 sec.

2B. Advanced [AA menu] Programming Options

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 10 seconds, at which time the symbol AA is displayed.

Program items that can be accessed in the advanced menu are indicated in the following table and are explained under their appropriate function headings. The current software version for the TACmk2 is displayed at the end of the AA1 menu.

Setting	Default	Value Shown (adjustment range)
AA	14	Alarm Acknowledge / (0~240) mins
LS	4	Limit Start Time (0~99) mins
tr	41	Defrost Terminate or Range °F (17.6° ~59°F)
Co/He	Co	Cooling or heating
dt	1	Heater drain period (0~12) mins
Ft	1	Fan delay/ Pump down time (0.0~4.0) mins
dE/dg	dE	Electric or Hot gas defrost
tE/rA	tE	S2 input as TEmperature sensor defrost terminate or RAnge via external potentiometer
Sd/Hd	Sd	Show/Hide temperature display during defrost
St1	0	Start Defrost offset 1 (0.0 – 23.9)
St2	0	Start Defrost offset 2 (0.0 – 23.9)
St3	0	Start Defrost offset 3 (0.0 – 23.9)
St4	0	Start Defrost offset 4 (0.0 – 23.9)
St5	0	Start Defrost offset 5 (0.0 – 23.9)
St6	0	Start Defrost offset 6 (0.0 – 23.9)
St7	0	Start Defrost offset 7 (0.0 – 23.9)
St8	0	Start Defrost offset 8 (0.0 – 23.9)
St9	0	Start Defrost offset 9 (0.0 – 23.9)
St10	0	Start Defrost offset 10 (0.0 – 23.9)
St11	0	Start Defrost offset 11 (0.0 – 23.9)
St12	0	Start Defrost offset 12 (0.0 – 23.9)
doA	off	Door Alarm (off, noA, 1, 2... 60m)
CA	0.0	Calibration Offset (-18° to +18°F)
	54	Software Version

2B. Real Time Clock – RTC [AA2 menu] Programming Options

REAL TIME:
Press 15 sec.

By holding down the **M** and **>** keys for a total of 15 seconds you can access the Real Time Clock Menu. To set the time ensure insulator is removed in minutes simply use the **^** or **v** keys to select the value and press **M** to save the value into memory and then you can set the hours repeat this process for the day, the month and the year.

Setting	Default	Value Shown (adjustment range)
°C/°F	°C	Set Units of Temperature
t1n	0	Minutes (0-59)
t1h	0	Hours (0-23)
dtd	0	Day (0-31)
dtn	0	Month (0-12)
dty	0	Year (10-20)

2C. Load Defaults [LOd menu] Programming Options

LOAD Default:
Press 20 sec.

To unlock your TACmk2k2 and to load defaults by holding down the **M** and **>** keys together for 20 seconds. There are currently two sets of load defaults built into the TACmk2 software although provision are made to add more in future.

Setting	Default	Value Shown (adjustment range)
Out		Saves settings to the memory stick
Usb		Reads settings from the memory stick
no		Doesn't load defaults
dF1		Cool Room Default
dF2		Freezer Default
dFr		*Special function "R"
dFv		*Special function "V"

The default profiles for cooler and freezer applications make the programming easier. Load the default profile that is compatible with the application. For example, if you have a cooler application load the cooler default profile by unlocking the LOd menu and selecting dF1. The unit will automatically set the attributes approximately to the attitudes you would typically use for a typical application. Finish by fine tuning the individual attributes to match your application needs.

DF1- Standard Cool Room settings

Set point=39.2°F, differential= 1, Alarm High = 50°F, Alarm Low = 30.2°F, Alarm time= 90, number of defrosts =4, Defrost duration = 30

DF2 -Standard Freezer Room settings

Set point= -0.4°F, differential = 3, Alarm High = +14°F, Alarm Low = -10°F, Alarm time = 90, number of defrosts = 4, Defrost duration = 25

Save Settings to USB

Settings can be written to a file on the USB Memory stick. To do this go to the LOD menu as in Load Defaults and select the OUT option and press M. The settings are written to a file called SETTING.TXT which can be edited with a plain text editor. The setting values are written as integers as stored in the processor, for example a setpoint of 38°F will be written to the file as value 34 and a differential of 3 will be written to the file as value 17. Refer to Table 1 “Fahrenheit to Celsius Conversion” and Table 2 “Fahrenheit Differential to Display Values” on page 15.

Read Settings from USB

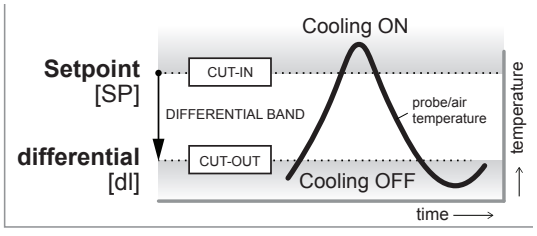
To read the SETTING.TXT file into the TACmk2 access the LOD menu select the USB option and press M. The settings will be read from the USB stick and stored into the processor.

2D. PROGRAMMING EXAMPLE

A small produce cooler needs to be controlled at +38.0°F. We want a high alarm at +48.0°F and a low alarm at +28°F to prevent the produce from freezing. Being a small room, we will set the alarm time to 60 minutes. We will want a differential of 3°F and two 45 minutes defrost periods per day.

- Unlock the TACmk2 using **M** and **>** keys. Display reads UL
- Display shows SP e.g. +39.2°F
- Increase the CUTIN setpoint by pressing ^ key until +41.0°F is displayed store the new setpoint with by pressing **M** key
- dl (for differential) then Ec (Economy mode*) is displayed.
- by pressing **^** or **v** keys until 3°F is displayed store by pressing **M** key
- AH +50°F is displayed, decrease the high alarm to +48.0 using **v** key store by pressing **M** key
- AL +30°F is displayed, decrease the low alarm setting to +28°F using **v** key store by pressing **M** key
- At 90 is displayed, decrease the alarm time delay to 60 using **V** key, store by pressing the **M** key
- nd 1 is displayed. Increase by pressing **^** key until 2 is displayed store by pressing **M** key

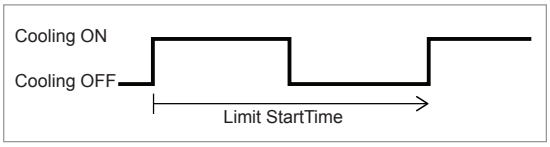
Note: There are three programming options in differential dl:



1. **Ec** Economy mode - a method to reduce energy usage whilst using the internal limit start timer to protect the compressor.
2. **AU Auto** setup - Default settings (for all the programmable values) based on your setpoint are loaded into the TACmk2’s memory.
3. **0.1 to 9.0 Differential Temperature** in °F - The specific temperture required for the control. (See Cooling and Heating Operations)

3. Cooling and Heating Operation

Heating and cooling control is between the setpoint SP (CUT IN) and the setpoint minus the differential dI (cut out). For example: SP = 50.0°F, dI = 2.0°F: control between 48.0°F and 50°F. Another example: SP = - 8.0°F, dI = 2.0°F: control between -10.0°F and -8.0°F. The Heating and Cooling options HE and Co [AA menu] select whether the C1/C2 output controls heaters or coolers. In heating mode there is no limit start timer or defrost function and programming options that relate to defrosts will be skipped. If Cooling is selected, a limit start timer protects against short cycling the compressor. The timer will prevent the cooling output turning on for a period starting the previous time the cooling output turned on. Once this period has elapsed the output is free to turn on as required. LS is the limit start delay which is the delay to stop unit switching on and off too often this is the anti-short cycle timer for C1/C2. C1/C2 comes on when cooling is required, as shown in this diagram:



AA is the alarm acknowledge period the unit will not go into alarm again for this period once an alarm has been acknowledged.

The terminate/range temperature function tE/rA [AA menu] sets a temperature terminated defrost tE if a probe is connected (See Defrost), or it sets the range offset rA as described below:

An external trim pot of 100k Ohm value may be used to modify the control temperature up or down by 41°F, 50°F, 59°F or 68°F as set by the tr setting. The programmed value SP then becomes the “midpoint” of the setpoint range. 0k Ohm gives the minimum, 100k Ohm gives the maximum and 50k Ohm leaves the setpoint unchanged. If no trim pot is connected, the setpoint remains unaltered. The high and low alarm temperatures AH, AL will be shifted in conjunction with the setpoint SP. Note that SP, AH and AL will reflect the altered setpoints when viewed by pressing M from normal operations. By using fixed resistors, specific temperature setpoints can be set up using a rotary switch or time clock.

4. Alarm

The Alarm function has a high temperature (in °F) setpoint, AH, a low temperature (in °F), AL, and a time delay, At. If either setpoint is exceeded for longer than the time delay an alarm will occur. If cooling mode is selected the low alarm will occur in 1/4 of the time delay At. The optional distress alarm will initiate an alarm immediately if connected. An Alarm is indicated by the temperature display flashing accompanied by the sounding of a buzzer, a flashing alarm light and/or a dial signal if these accessories are connected.

An alarm may be acknowledged by pressing **>** key momentarily or via an external switch. The light will then be steady on and the buzzer and dialer off for the period set by AA [AA menu]. The alarm will reoccur after this period unless the temperature returns to normal. An Alarm Memory is shown by the display flashing but no other alarm indications. This indicates that an alarm has occurred but that the temperature has since returned to normal. It may be cleared by pressing the **>** key.

Door Alarm Function

Connect a switch across S5 and GND (close/shorted) is door close and open circuit = door open. It can be programmed as a monitor only (noA, or alarm 1-60 minutes.) The door status is monitored on the memory stick. Access from AA menu after defrosts.

If a hot gas defrost is used [dg in advanced menu], the light output cannot be used as an alarm light, the buzzer and dialer outputs still operate as normal during alarm.

5. Defrost

The defrost duration dd is the time in minutes in which the refrigeration is switched off and the heaters are on. Defrosts are spaced at nominated times during the day and the number per day is set by nd. Press **^** key to find out when the next defrost will occur, td is displayed, followed by the number of hours until the next defrost. Similarly, pressing **v** key displays Fd followed by the number of hours since the last defrost occurred. The decimal place represents 10 minutes, i.e. 2.4 is 2 hours and 40 minutes.

To initiate a Toggle, Defrost, hold the **>** key for 1 second and either dF or Co will be displayed, to indicate whether the refrigeration is presently in defrost or cooling mode. Press the **^** key followed by **M** to initiate a defrost or press the **v** key followed by M to terminate a defrost. This function can also be accomplished with an external toggle defrost switch (which will alternate the status between defrost and cooling when closed) or via the terminate defrost input (which will terminate a defrost and initiate a drain period).

Further defrost functions can be accessed via [AA menu]. The Sd (Show defrost) function alternates the display between dF and the temperature during defrosts, also the dFd defrost drain time and the dFf defrost fan time are also shown whilst in operation. Whilst Hd (Hide defrost) causes the display to show only dF during defrost. Also, accessible [AA menu], The Heater Drain Time dt [AA menu] sets the period in minutes from the end of the defrost period dd until the cooling output is allowed to operate. The Ft Fan Delay Time sets the period in minutes from the end of the drain time when cooling comes on to the time when the fans are allowed to operate. The decimal place the dE/dg (Electric/hot Gas defrost) [AA menu] allows the unit to control Electric (Liquid, Heater and Fan) or Hot Gas (Liquid, Suction, Hot Gas and Fan) defrosts.

A Hot Gas defrost uses the Light output as the Suction solenoid control and the Ft setting as a pump down time. The Hot Gas output sequence is as follows.

Real Time defrosts

One of the best features the TACmk2 has is the ability to program real time defrosts. Once you have programmed the real time clock into the controller using the Load Defaults Menu you can enter up to 12 real time defrosts. In the UL menu select the number of defrost you want each 24 hours using the nd setting. The real time defrosts can be programmed by unlocking the AA1 menu and entering the time offsets for defrosts in the settings S1-S12.

Hot Gas Sequence

Output Representing	C Liquid	L Suction	H Heater	F Fan	Time
Cooling	on/off	on	off	on	
P/D	off	on	off	on	Ft
Defrost	off	off	on	off	dd
Drain	off	off	off	off	dt
Fan	on/off	on	off	off	Ft
Cooling	on/off	on	off	on	

A second M Probe may be used as a temperature termination sensor for the defrost. It is used between the GND & S2 outputs. The tE/rA setting should be set to tE and the defrost terminate temperature set by tr at 41°F, 50°F, 59°F or 68°F.

6. Temperature Logs using Memory Stick

The TACmk2 will automatically start logging temperature a soon as you plug a USB memory stick into the USB port. The sensor temperature and time will be logged once per minute to a file called LOG.TXT. Events such as alarms and programming will be appended with the current time to a file called EVENTLOG. TXT. For data logging applications it is important that the time and date is set correctly to ensure records are correct. Removing the USB memory is ok (no logs are stored while it is removed) and TACmk2 will resume logging when the USM stick is re-inserted.

The RTC must be set correctly for logging, removing the insulator AND set the correct time and date. The USB plug provided can be left as is when logging is not required, and no memory stick fitted; When logging is employed, cut 3 sides of the plug to allow a flap which raises for the memory stick as shown in the photo.

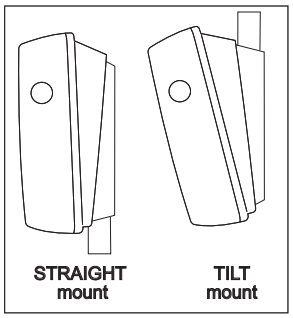
7. Firmware Upgrades

Make a backup of settings first:
firmware updates over-write all programmed settings!

It is possible to upgrade the firmware to units in the field with a USB memory stick. Load the “tacmv2.hex” file onto a USB memory stick and then plug your memory stick into the USB port. Power down the TACmk2 and power back up again while holding all 4 keys down and with the USB in the USB port. The display will toggle between the bottom two segments, then chase, then tAc will appear on the display before going into normal mode of operation. The new firmware will then be automatically loaded into the processor.

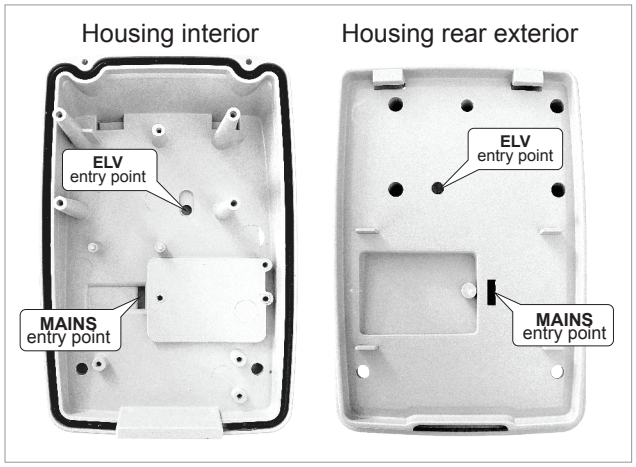
8. Enclosure Mounting

1. Determine if straight or tilt mounting is appropriate for the application. The wall mount conduit entry points are at the bottom for straight mount and at the top for tilt (approx. 15°) mounting.



2. Attach the wall mount base using the 4 off 6mm mounting holes, centers are 90mm high x 72mm wide. (Mounting screws not included). For conduit entry, the cables for the TACm can enter through the 2 x 20mm (3/4") conduit entry points placed 30mm apart. Use a hole-saw as shown to open 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 VAC 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. Before fitting the enclosure base over the wall mount base, feed the ELV cabling through the opening under the circuit board and up to the top of the board. The hole can be enlarged as required. For maximum environmental protection, keep the hole as small as possible and later it can be silicone sealed. Similarly feed the LV mains cables through the rectangular slot, enlarging as required. For maximum safety, ensure LV and ELV cables are segregated. Locate the enclosure base over the all mount base with the top 2 lugs and bottom screws provided.



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

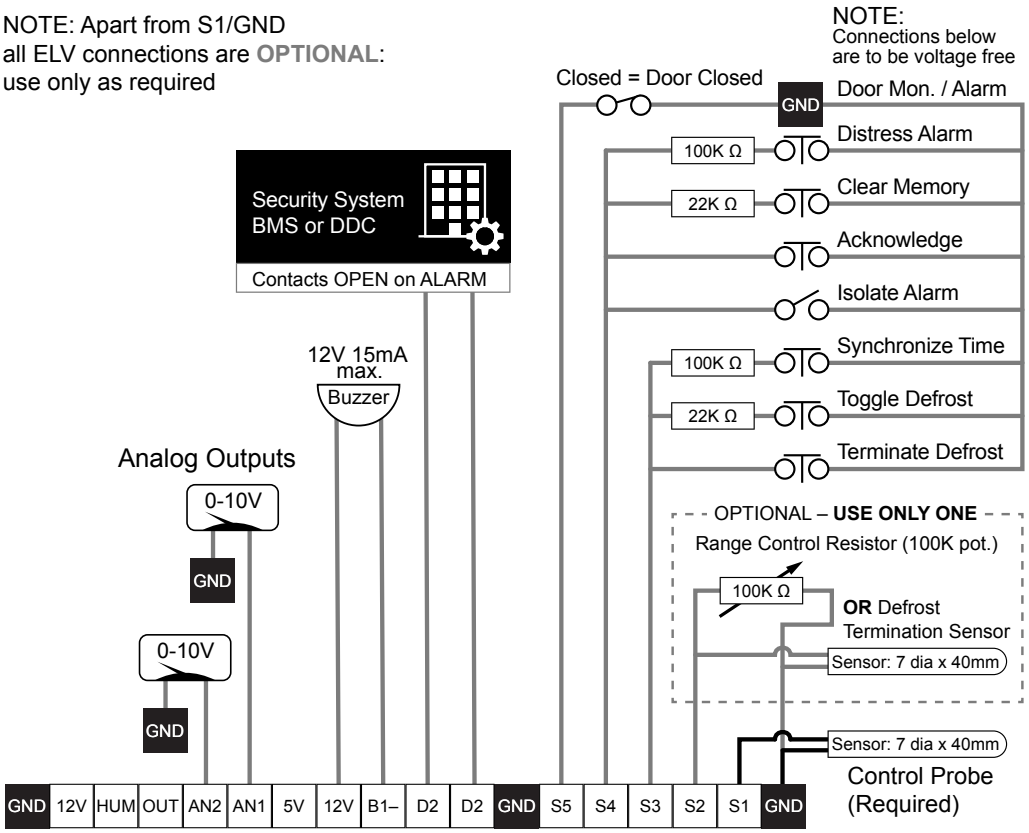
5. After all electrical connections have been made, with the ELV cables along the top of the main PCB and LV connections across the bottom, the enclosure cover can be fitted in the following sequence:
   - · Ensure the circular rubber gasket is snug in the channel around the base.
   - · Tilt the cover 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.

9. Alphabetical List of Display Indications

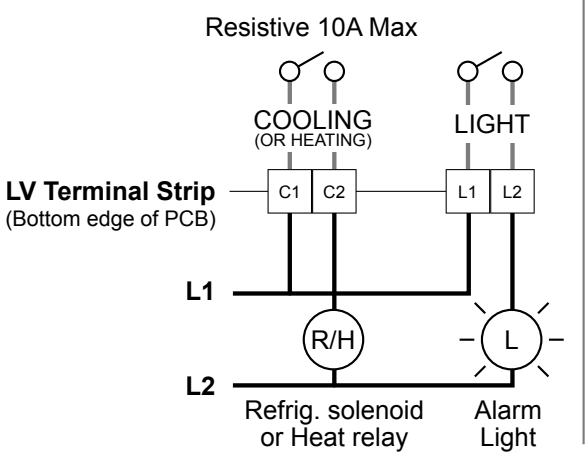
Display	Setting	Default	Display	Setting	Def.	Disp.	Setting	Def.
AA	Alarm Ackn. Time	14	**dor**	Door open		**LO**	Light Off	
AC	AC Main Failure		**dt**	drain time mins	1	**LS**	Limit Start delay mins	4
AH	High Alarm °F	10	**dF1**	Cool Room default		**nd**	number of defrosts	
AL	Low Alarm °F	-1	**dF2**	Freezer Default		**no**	exit load default menu	
At	Alarm time mins	90	**dFF**	Defrost Fan time		**noA**	Door monitor (not alarm)	
AU	Automatic Setup		**dFd**	Defrost drain time		**°C**	Temp in Celcius	
bO	Buzzer ON		**dtd**	RTC-days	1	**°F**	Temp in Fahrenheit	
bF	Buzzer Off		**dtn**	RTC- month	1	**Out**	Save settings to USB	
CA	Calibrate	0	**dty**	RTC-Year	20	**PL**	Power Loss	
Co	Cooling Mode	Co	**Ee**	Economy mode	Ec	**rA**	Range via pot. °F	tE
co	Cooling ON		**Er**	Probe Error		**Sd**	Show temp during defrost	S
CF	Cooling Off		**Fd**	from last defrost hrs		**SP**	Set-point (cutin)	4
dd	defrost duration mins	30	**FF**	Fan at		**td**	time to next defrost hrs	
dE	Electric Defrost	dE	**FO**	Fan On		**tE**	temperature terminate	tE
dF	Defrost/Dialer Off		**Ft**	Fan delay time mins		**t1n**	RTC-mins	0
dg	Hot gas defrost	dE	**Hd**	Hide Defrost Temp	Sd	**t1h**	RTC-hours	0
di	differential°F	Ee	**HE**	Heating mode	Co	**tr**	defrost termination	9
dO	Dialer ON		**HF**	Heater Off		**UL**	programming un-locked	
doA	door Alarm	oFF	**HO**	Heater On		**USB**	Read settings from USB	
			LF	Light Off		**54**	Software Version	
			Lo	Logging				

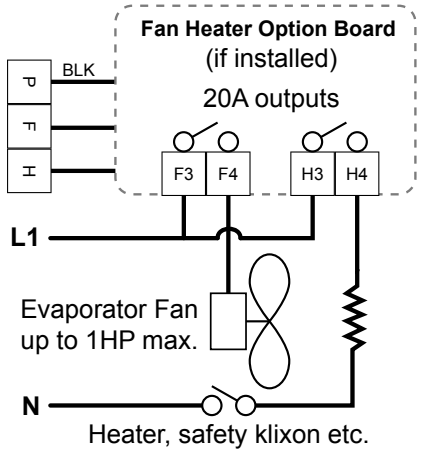
10. Wiring Diagrams

Extra Low Voltage Wiring - Top Edge of PCB



ELV Terminal Strip





Fit Link for 120VAC

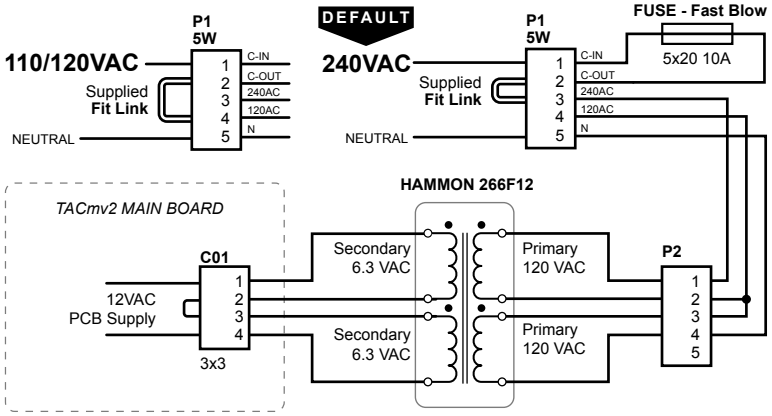


Table 1: Fahrenheit to Celsuis Conversion

°F	°C	°F	°C	°F	°C	°F	°C
-40.0	-40.0	-9.0	-22.8	22.0	-5.6	53.0	11.7
-39.0	-39.4	-8.0	-22.2	23.0	-5.0	54.0	12.2
-38.0	-38.9	-7.0	-21.7	24.0	-4.4	55.0	12.8
-37.0	-38.3	-6.0	-21.1	25.0	-3.9	56.0	13.3
-36.0	-37.8	-5.0	-20.6	26.0	-3.3	57.0	13.9
-35.0	-37.2	-4.0	-20.0	27.0	-2.8	58.0	14.4
-34.0	-36.7	-3.0	-19.4	28.0	-2.2	59.0	15.0
-33.0	-36.1	-2.0	-18.9	29.0	-1.7	60.0	15.6
-32.0	-35.6	-1.0	-18.3	30.0	-1.1	61.0	16.1
-31.0	-35.0	0.0	-17.8	31.0	-0.6	62.0	16.7
-30.0	-34.4	1.0	-17.2	32.0	0.0	63.0	17.2
-29.0	-33.9	2.0	-16.7	33.0	0.6	64.0	17.8
-28.0	-33.3	3.0	-16.1	34.0	1.1	65.0	18.3
-27.0	-32.8	4.0	-15.6	35.0	1.7	66.0	18.9
-26.0	-32.2	5.0	-15.0	36.0	2.2	67.0	19.4
-25.0	-31.7	6.0	-14.4	37.0	2.8	68.0	20.0
-24.0	-31.1	7.0	-13.9	38.0	3.3	69.0	20.6
-23.0	-30.6	8.0	-13.3	39.0	3.9	70.0	21.1
-22.0	-30.0	9.0	-12.8	40.0	4.4	71.0	21.7
-21.0	-29.4	10.0	-12.2	41.0	5.0	72.0	22.2
-20.0	-28.9	11.0	-11.7	42.0	5.6	73.0	22.8
-19.0	-28.3	12.0	-11.1	43.0	6.1	74.0	23.3
-18.0	-27.8	13.0	-10.6	44.0	6.7	75.0	23.9
-17.0	-27.2	14.0	-10.0	45.0	7.2	76.0	24.4
-16.0	-26.7	15.0	-9.4	46.0	7.8	77.0	25.0
-15.0	-26.1	16.0	-8.9	47.0	8.3	78.0	25.6
-14.0	-25.6	17.0	-8.3	48.0	8.9	79.0	26.1
-13.0	-25.0	18.0	-7.8	49.0	9.4	80.0	26.7
-12.0	-24.4	19.0	-7.2	50.0	10.0	81.0	27.2
-11.0	-23.9	20.0	-6.7	51.0	10.6	82.0	27.8
-10.0	-23.3	21.0	-6.1	52.0	11.1	83.0	28.3

Table 2: Fahrenheit Differential to Display value

°F	Value #	°F	Value #	°F	Value #	°F	Value #
0.1	**1**	2.5	**14**	4.8	**27**	7.2	**40**
0.3	**2**	2.7	**15**	5.0	**28**	7.3	**41**
0.5	**3**	2.8	**16**	5.2	**29**	7.5	**42**
0.7	**4**	3.0	**17**	5.4	**30**	7.7	**43**
0.9	**5**	3.2	**18**	5.5	**31**	7.9	**44**
1.0	**6**	3.4	**19**	5.7	**32**	8.1	**45**
1.2	**7**	3.6	**20**	5.9	**33**	8.2	**46**
1.4	**8**	3.7	**21**	6.1	**34**	8.4	**47**
1.6	**9**	3.9	**22**	6.3	**35**	8.6	**48**
1.8	**10**	4.1	**23**	6.4	**36**	8.8	**49**
1.9	**11**	4.3	**24**	6.6	**37**	9	**50**
2.1	**12**	4.5	**25**	6.8	**38**		
2.3	**13**	4.6	**26**	7.0	**39**		

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