Thyratron Thermostat

"eThermostat"

- User Manual -

INDEX

1. INTRODUCTION

Thyratron develops and produces innovative and cost efficient power and control solutions for appliance OEMs worldwide. With product placements over the past 25 years in some of the harshest environments, Thyratron has acquired the know how to deliver reliable quality products.

The eThermostat is a device that controls temperature of refrigeration appliances. At the same time, it supervises voltage and frequency of the power supply to protect the compressor. (Appliances falling into EN/IEC 60335-2-89 scope).

1.1. Product Features Summary

- Electronic Thermostat with Defrost & Energy Save* mode. ***2.1***
- Voltage and Frequency supervisor. ***2.3***
- Ambient Temperature monitoring. ***2.5***
- Intelligent time delay. ***2.6***
- Reconnecting voltage hysteresis. ***2.7***
- Parameter transfer. 3
- Configurable parameter list in order to optimize the performance of the refrigerator. **Σφάλμα! Το αρχείο προέλευσης της αναφοράς δεν βρέθηκε.**

*Energy Save mode can be activated with optional door sensor

2. ELECTRONIC THERMOSTAT

2.1. Defrost & Save Energy Mode

The Thyratron thermostat is capable of controlling - depending on parameter settings - the refrigerator's temperature from -28oC to +50oC, with a programmable differential. The thermostat achieves that by controlling the compressor and evaporator fan motor by monitoring inputs and using algorithms to achieve functions like defrost and Energy Saving. The parameters of these functions are adjustable by the OEM to create the ideal profile for each cooler model.

A further Feature of the Thyratron Thermostat is the programmable “Limp Home” mode. In the unlikely event a cabinet temperature sensor failure is detected; the cooler will cycle on pre-programmed compressor on/off cycles to maintain the cooler operational.

2.2. Hardware

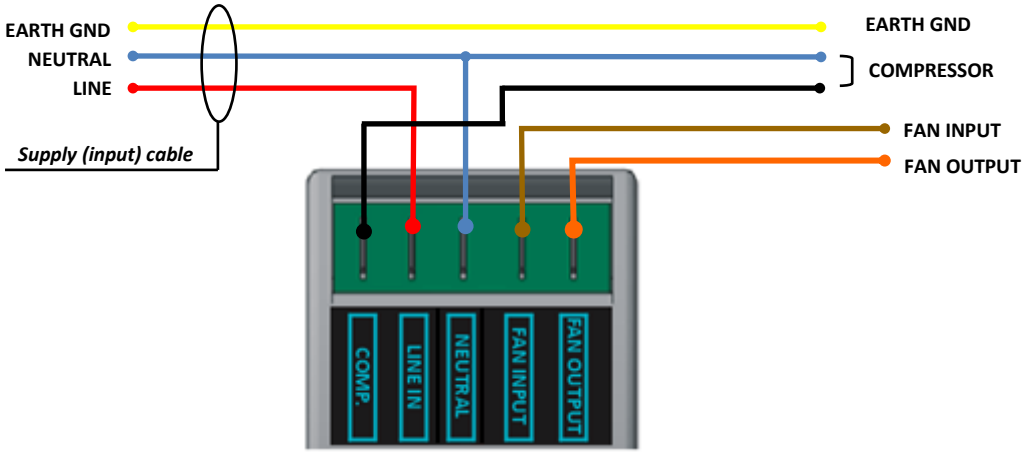
Fan Out		*Remote Status Indicators (LEDs) / Programming Serial Port 9600/8/N/1*	**Port B**
Fan In			
NEUTRAL		*Temperature Sensor 2 / Selection Switch / Door sensor/ Temperature Adjustment)*	**Port A**
LINE IN			
COMPRESSOR		*Temperature Sensor 1*	**Sensor**

2.3. Connection Diagram

Check the insulation of the supply (input) cable according to local regulations before connecting to the ECU.

PPS WAVE is intended to be used with the protection of a fuse gG, type B, IEC60269-3-1.

Confirm compatibility with connection terminals as well as insulation. The connectors are Fast On terminals 6.3x0.8mm.



2.4. Voltage And Frequency Supervisor

Thermostat monitors voltage and frequency of main power and cuts off the output to the compressor and Fan Motor when the input mains voltage and/or frequency are out of limits. These values are programmable and at the parameter list you can find the limits and default values.

2.5. Ambient Temperature Monitoring

Thermostat monitors the temperature of its surrounding area and in case it detects a value higher than the upper limit value or a temperature rise pace greater than 15°C per 16 minutes it cuts out the output to protect the cooler and itself. Thermostat will reconnect the output when the temperature of the surrounding areas falls below 50°C and the rate of temperature rise becomes lower than 15°C per 16 minutes.

TEMPERATURE LIMIT	MAX TEMPERATURE RISING PACE
+85 °C	DT > 15 °C / 16 min

2.6. Intelligent Time Delay

Intelligent time delay provide a period of time to allow balance of the

pressures of the refrigeration circuit between cycles, preventing startup under high pressure thus extending the lifetime of the compressor.

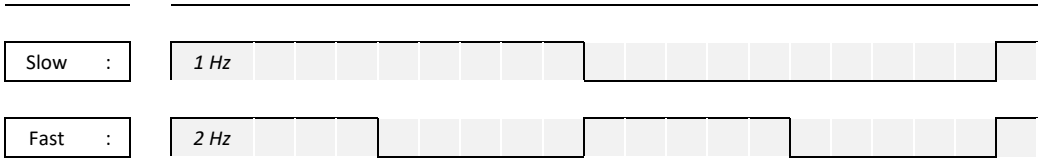
A randomized small time window will prevent simultaneous startup of multiple coolers at a single location to protect from sudden voltage drops and potential power supply overload.

2.7. Reconnecting Voltage Hysteresis

If the Thermostat reconnects after a cut off and the line voltage fluctuates near the Thermostat's input lower limit voltage, it will utilize a small a voltage window to avoid continuous cutoffs triggered from the connecting voltage drop that may occur.

2.8. LED Indication

EVENT	LED
Time delay	Blink Slow
Frequency out of limits	Blink Fast



3. PARAMETERS

The eThermostat is supplied with predetermined default settings. Parameter sets can be modified and transferred to the device utilizing a laptop with the necessary software and programming dongle supplied by Thyratron.

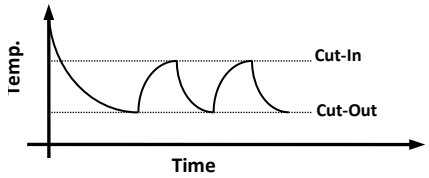
Parameter table			Units	Value		
				Default	Min	Max
Electrical Limits	Voltage	Low Limit	VAC	180	160	250
		High Limit	VAC	245	160	250
	Frequency	Minimum	Hz	47	45	55
		Maximum	Hz	53	45	55
Operational mode	Normal Mode Temperature target	Cut-Out	°C	2	-28	50
		Cut-in	°C	4	-28	50
	Fan time	ON	min	3	1	120
		OFF	min	3	1	120
	Winter Mode Temperature target	Cut-Out	°C	6	-28	50
		Cut-in	°C	8	-28	50
	Limp Mode - Compressor time	ON	min	3	1	120
		OFF	min	12	1	120
	Delay after interrupt		min	3	1	10
Energy Saving mode	Energy Saving mode switch	Disabled=0, Enabled=1		1	0	1
	Temperature target	Cut-out	°C	10	-28	50
		Cut-In	°C	12	-28	50
	Time to enable Energy Saving mode		Hours	4	1	24
	Time duration of Energy saving mode		Hours	6	1	24
	Fan time	ON	min	2	1	120
		OFF	min	2	1	120
Defrost mode	Defrost mode switch	Disabled=0, Enabled=1		1	0	1
	End temperature target		°C	15	-28	50
	Time to enable Defrost mode		Hours	2	1	24
	Maximum defrost time		min	20	1	120
	Fan time	ON	min	1	1	120
		OFF	min	1	1	120
Port Control	Port A control	Door sensor = 0, Temp switch = 1, Temperature Knob = 2, Light Sensor = 3, None = 4		0	0	3
Lead Synchronize Fan & Comp.	Synchronization Disable = 0		Sec	10	0	10

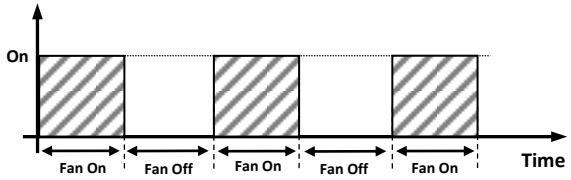
3.1. Electrical Limits

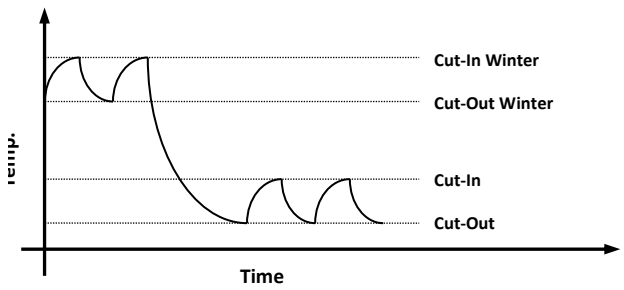
VOLTAGE	
High Limit	It is the highest operational voltage before the device will cut out its output.
Low Limit 	It is the lowest operational voltage before the device will cut out its output. At reconnect conditions, must take into account the voltage window hysteresis (~7VAC). ***The ''Voltage Low Limit'' must be less than ''Voltage High Limit'' at all times.***

FREQUENCY	
Max	It is the highest operational frequency before the device will cut out its output.
Min 	It is the lowest operational frequency before the device will cut out its output. ***The ''Minimum Frequency'' must be less than ''Maximum Frequency'' at all times.***

3.2. Operational mode parameters

TEMPERATURE TARGET	
Cut-in ***(Set Point + Differential)***	It is the Highest temperature value, that the refrigerator chamber return air will reach when Operational Mode is enabled.
Cut-out (Set Point) 	It is the lowest temperature value, that the refrigerator chamber return air, will reach when Operational Mode is enabled. The 'Temperature Cut-out'' and "Temperature Cut-in" must be less than "Energy Save Cut –out" and "Energy Saving cut-in" accordingly, at all times.
	

FAN TIME	
ON	Defines the time during which the refrigerator fan will be enabled.
OFF	Defines the time during which the refrigerator fan will be disabled.
	

WINTER MODE TEMPERATURE TARGET	
The thermostat can be configured to operate with a selector switch (optional 2 position rocker switch). This switch can allow selection of Winter/Summer (Operational) Mode with different Cut-out and Cut-in Temperatures	
Cut-Out	It is the lowest temperature value, that the refrigerator chamber return air, will reach when Operational Mode is enabled.
Cut-In	It is the Highest temperature value, that the refrigerator chamber return air will reach when Operational Mode is enabled.
	

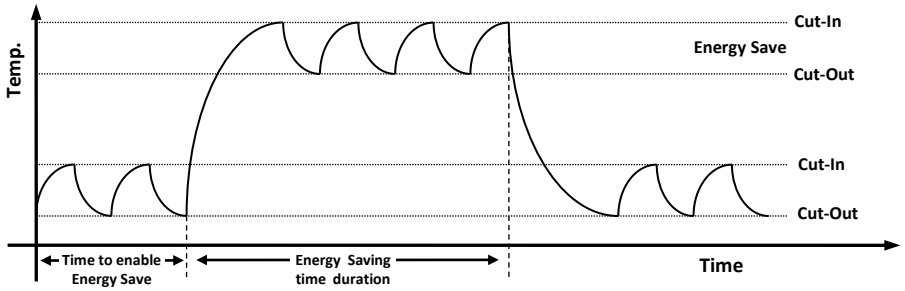
LIMP HOME - COMPRESSOR TIME	
Time ON	It is time period the compressor will be enabled in order for the cooler to maintain low temperature, in the unlikely event of a temperature sensor malfunction.
Time OFF	It is the time period the compressor will be disabled in order for the cooler temperature to rise to a slightly higher temperature to enable cycling, in the unlikely event of a sensor malfunction.

DELAY AFTER INTERRUPT
It is the time when the thermostat won't have enabled output despite being turned on. In this state, the LED will blink on and off.

3.3. Energy Saving mode

Energy Saving mode allows the cooler to reach a higher set point and cut in temperature to decrease energy consumption during times when the cooler is idle and not required to work in fully operational status (weekends, holidays, night times, etc).

For this mode to be available, a door sensor must be installed. Energy Saving Mode is activated after a certain time of door inactivity. In case the cooler door opens during the Energy Saving Mode then automatically the mode will be terminated no matter how much time has elapsed.



ENERGY SAVING MODE SWITCH			
Disable:	0	**Enable:**	1

TEMPERATURE TARGET	
Cut-out	It is the lowest temperature value the refrigerator chamber will reach when Energy Saving Mode is enabled.
Cut in	It is the highest temperature value the refrigerator chamber will reach when Energy Saving Mode is enabled.

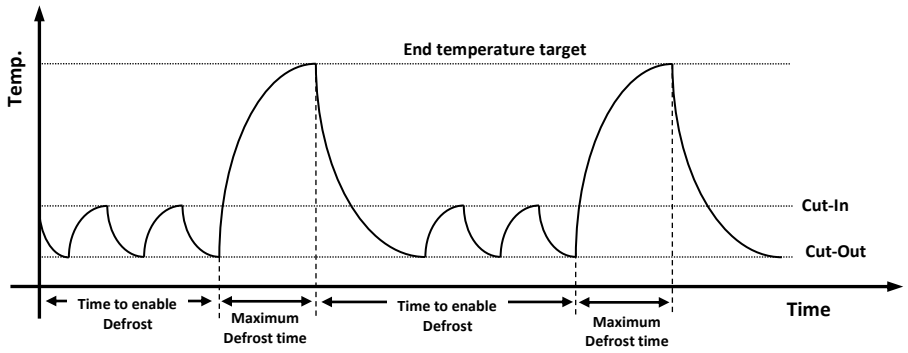
TIME TO ENABLE ENERGY SAVING MODE
It is the time period that has to elapsed without any door opening, in order for the Energy Saving Mode to be enabled.

TIME DURATION OF ENERGY SAVING MODE
It is the maximum time period the Energy Saving Mode will be enabled, if no door opening occurs.

FAN TIME	
ON	Defines the time during which the refrigerator fan will be enabled.
OFF	Defines the time during which the refrigerator fan will be disabled.

3.4. Defrost mode

''Defrost mode'' is a time based defrost cycle to clear the cooler's evaporator from any ice accumulation especially in humid locations. The time period that has to elapse for Defrost mode to start is configurable as well as the fan ON-OFF time



DEFROST MODE SWITCH			
Disable:	0	**Enable:**	1

END TEMPERATURE TARGET
It is the actual temperature value that once reached the Defrost Mode will be disabled.

TIME TO ENABLE DEFROST MODE
It is the maximum continuous time of operation (Operational Mode or Energy Saving Mode) until Defrost Mode is enabled.

MAXIMUM DEFROST TIME
It is the maximum continuous time the Defrost Mode could be enabled if no interference happens, like a door opening.

FAN TIME	
ON	Defines the time during which the refrigerator fan will be enabled.
OFF	Defines the time during which the refrigerator fan will be disabled.

3.5. Port Control

3.5.1. Port A control

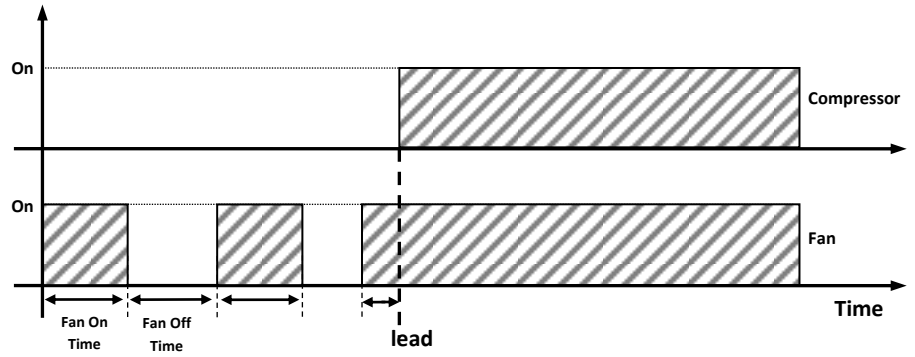
Defines the if the input will be utilized as a door sensor or a temperature switch.

3.5.2. Port B control

3.6. Synchronize Fan & Compressor control

This control, enables the fan operation during the compressor operation, moreover, the fan starts the operation before the compressor in a time that is specified by the lead parameter.

LEAD SYNCHRONIZE FAN & COMP.			
Disable:	0	**Enable:**	1 - 10



4. ACCESSORIES

Port A of the eThermostat is programmable by the user via computer or mobile app, so it can be connected to it a variety of sensors. These sensors and their function are summarized in the table 1.

Port B can be used for serial communication or it can be used in order to drive external Leds. The eThermostat automatically recognizes which peripheral is connected in the Port B checking the Port every 10 seconds.

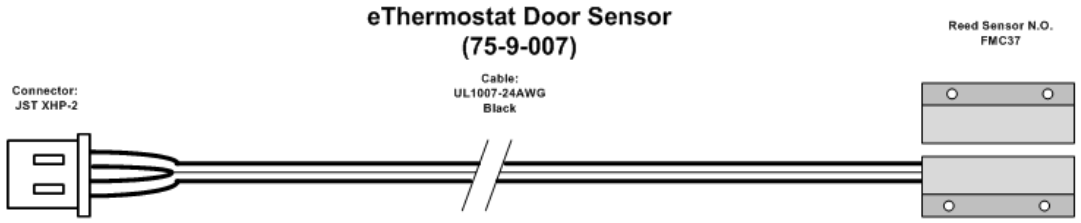
Options	**Function**
Door Sensor	Detects if the door is open or closed
Switch	Switching between two different cooling operation modes
Light Sensor	Detects brightness so can be programmed for S.E mode at night
Temperature Knob	Analog adjustment of the target Temperature

Table 1 Port A Options and their function

Options	**Function**
External Leds	
PC Programmer	
Wireless Progr.	

Table 2 Port B Options and their function

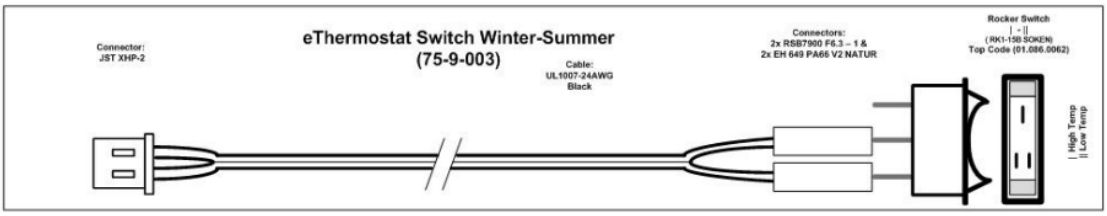
4.1. Door Sensor



Door Sensor can be connected to Port A of the eThermostat. Also in the Parameters, field Port A must be programmed to the specified value.

With the door Sensor detected when the door is open or closed. The status of the door affects the operation of the fan and the Energy Saving mode. By using door sensor records the door openings per hour in the last 24 hours and can be presented graphically by using the option of Wireless module and Android App.

4.2. Temperature Switch



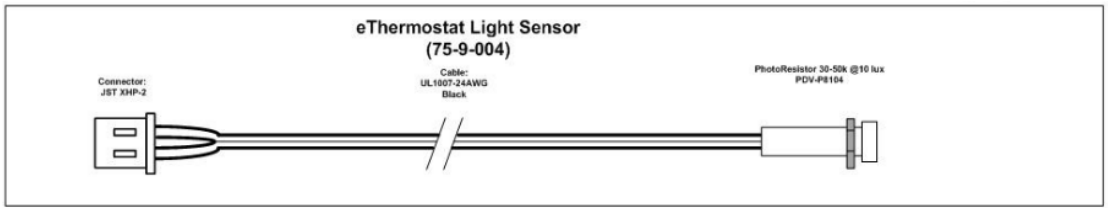
Temperature Switch option can be connected to Port A of the eThermostat. Also in the Parameters, field Port A must be programmed to the specified value.

By using the switch you can select the cut in and cut out temperature between two sets of target temperature that shown in Table 3. When the switch is in position I, the Winter mode set of parameters is selected otherwise Normal Mode is selected.

Parameter table			Units	Value		
				Default	Min	Max
Operational mode	Normal Mode Temperature Target	Cut-Out	°C	2	-28	50
		Cut-in	°C	4	-28	50
	Winter Mode Temperature Target	Cut-Out	°C	6	-28	50
		Cut-in	°C	8	-28	50

Table 3 Normal and Winder Mode target temperatures

4.3. Light Sensor



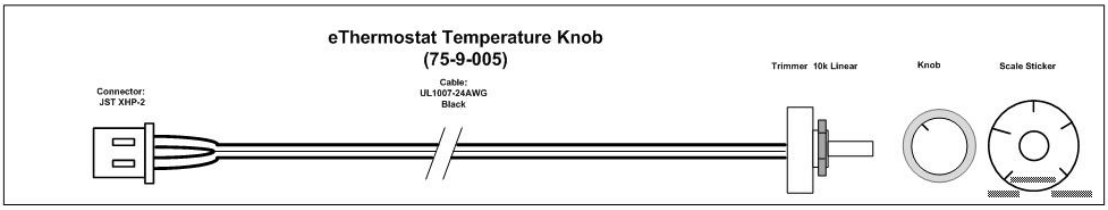
The Light Sensor Option can be connected to the Port A of the eThermostat. Also in the Parameters, the field Port A must be programmed to the specified value.

The Light Sensor can detect if there is lighting or not. If the brightness falls below of a threshold, the eThermostat operates in Energy Saving Mode set of temperature targets. Otherwise it operates in Normal Mode temperature target shown in Table 4.

Parameter table			Units	Value		
				Default	Min	Max
Operational mode	Normal Mode Temperature Target	Cut-Out	°C	2	-28	50
		Cut-in	°C	4	-28	50
	Energy Saving M. Temperature Target	Cut-Out	°C	10	-28	50
		Cut-in	°C	10	-28	50

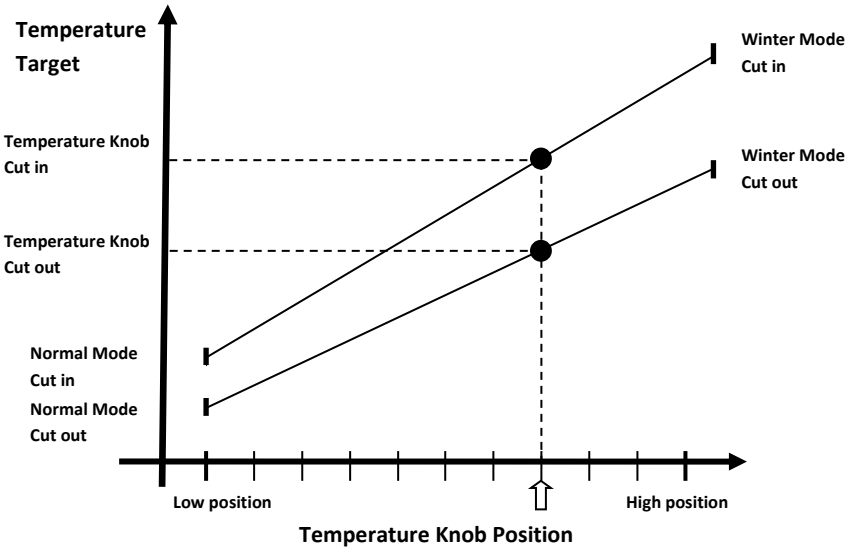
Table 4 Normal and Energy Saving Mode target temperatures

4.4. Temperature Knob

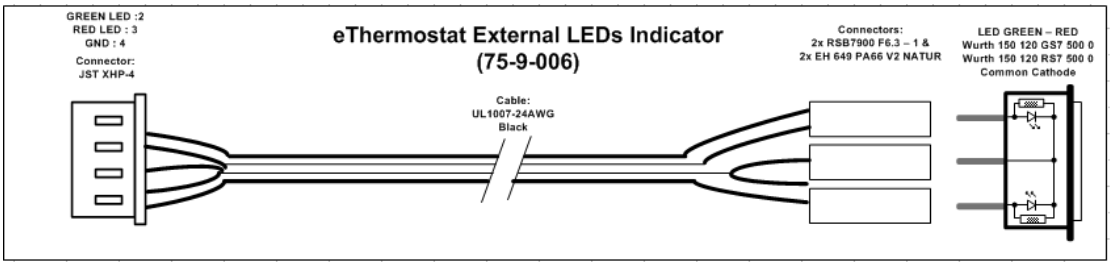


The Temperature Knob Option can be connected to Port A of the eThermostat. Also in the Parameters, field Port A must be programmed to the specified value.

With the Temperature Knob, the cut in and cut out target temperatures can be adjusted between Normal and Winter Mode temperature targets as shown in the graph below.



4.5. External LEDs Indicator



The External Led Indicator Option can be connected to the Port B of the eThermostat. After the connection the eThermostat automatically recognizes the options and changes their own operation.

The external LEDs are showing the operation status of the eThermostat. They can light up (Green - Orange - Red)continuously or blinking with frequency 1Hz or 2Hz. Table 5 shows the meaning of the LEDs lighting:

	Indicator Color		
Compressor ON	on		
Comp. Off due to Thermostat		on	
Comp. Off due to other Limits			on
Start Up Delay due to Thermostat Limits	1Hz		
Defrost Mode		1Hz	
Start Up Delay due to Voltage Limits			1Hz
Start Up Delay at Energy Saving Mode	2Hz		
Frequency Out Of Limits		2Hz	
Ambient Temperature Out Of Limits			2 Hz
Limp Mode Activated	Toggle 1Hz		Toggle 1Hz

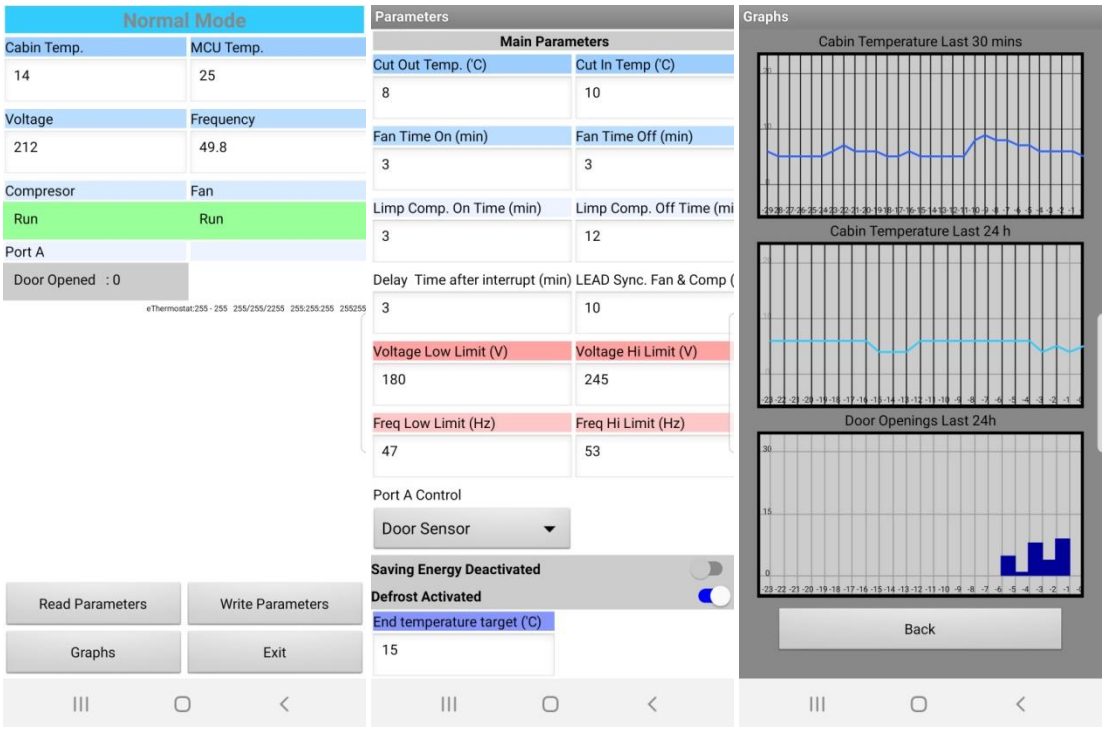
Table 5 External LEDs indication status

4.6. Wireless module

The Wireless Module Option can be connected to Port B of the eThermostat. These options are recognized automatically by the eThermostat.

Using these options can activate a connection between eThermostat and an Android Device by using the Bluetooth Connection of the Android Device.

At the side of the Android Device must be installed the "eThermostat Tools" application. By using this app you can see Live Data, Captured Data, Read and Change the Parameters of the eThetmostat.



5. TECHNICAL SPECIFICATIONS

THERMOSTAT SPECIFICATIONS		
Operating conditions	Nominal Voltage	230 VAC
	Operation Voltage Bandwidth	160 - 250 VAC
	Ambient Temperature	Tmin -40°C Tmax+50°C
	Humidity	0 - 85 %RH
	Compressor Output Current Capacity	10(6)A
	Fan Motor Output Current Capacity	3(3)A 250 VAC 3(3)A 30VDC
Thermal protection		- Temperature limits +85 °C - Temperature differential 15 °C / 16 min
Plastic Housing		UL94 V-0 Flame Retardant
Relay Life time		Compressor Relay lifetime cycles > 100.000
		Fan Relay lifetime cycles > 50.000
Pollution Degree		III (3)
CTI		> 250
Insulation (between Main Power and Accessible Parts)		Reinforced
Power Connections		6.3mm x 0.8mm flat, terminal
Total weight (g)		0.155 kg
Accuracy	NTC Sensor	± 0.5 °C *(Operating Temp. Range: -28°C to +50°C)*
	eThermostat	± 0.5 °C

6. STORAGE

Should not be stored in high temperature or high humidity condition. Usage, beyond the specified shelf life could compromise product long term reliability. The suitable conditions are +5 to +35°C and less than 75%RH in Relative Humidity indoor. Shelf Life, 2 years.

7. APPROVALS

Approvals		
CB - Test Certificate	IEC 60730-1 : 2013 + A1 IEC 60730 - 2 - 9 : 2015 + A1 : 2018	The controls pass the GW750 test according IEC 60335-1:2010 clause 30.2.3.2. Relays separately tested as sealed device according to IEC / EN 60079-15:2010 clause 22.5.
CE0413 - Declaration of Conformity - Verification of Conformity	EN 60730 - 1 : 2016 EN IEC 60730 - 2 - 9 : 2019	
RoHS III (EU Directive 2015/863)		

Further Information

Support: rnd@thyratron.gr
Sales: sales@thyratron.gr
Site: www.thyratron.gr
Follow us at linked in, Facebook
Address: KydoniesVasiliko, Erymanthos, Achaia, GR25008, GREECE
Tel: +30 26940 61868 Fax: +30 26940 62001