ems25*plus* MkII
Product Manual

Issue 4

elstat
Cooler Thinking

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1.   CONTROLLER

EMS (energy management system) controllers from Elstat are used in a variety of drinks coolers, optimising energy savings, without compromising
on drinks serving temperature.

A range of controllers are available to suit applications such as:

▸ Single door coolers

▸ Double door coolers

▸ Open front coolers

▸ Vending machines

▸ Sub-zero beer coolers

The purpose of this guide is to explain in detail all information regarding Elstat ems25*plus* MkII controller including the user interface, parameters, accessories and troubleshooting.

1.1   Water ingress

Elstat products have been designed to minimise any risks associated with water ingress and ems25*plus* MkII controller is IPX5 certified. The OEM or installer is responsible to ensure that local/country laws and regulatory requirements are met.

1.2   Controller functionality

Feature	Description
User and diagnostic information	3-digit, 7-segment display that displays the product temperature and other information such as defrost or teach and alarm conditions. Also push buttons, that enable the end-users to cancel alarms and service technicians to run test routines.
Product temperature	An appliance sensor measures temperature of the refrigeration compartment. EMS controllers use the refrigeration temperature to manage the product temperature.
Refrigeration system high temperature alarm	An optional condenser sensor measures the temperature of the refrigeration system. EMS controllers use the temperature to alert to problems such as blocked condensers.
Motion detection	A remote and/or integrated motion sensor enables EMS controllers to detect activity when someone moves in front of the cooler.
Door open detection	A door switch enables EMS controllers to detect cooler activity when someone opens the cooler doors.

The controllers switch the following cooler components:

Feature	Description
Compressor	EMS controllers switch the compressor to manage the temperature of the refrigeration compartment.
Evaporator fan	EMS controllers can control the evaporator fan. This can be configured using firmware and would be in place of controlling light functionality.
Lights	EMS controllers can control the cooler lights to save energy. This can be configured using firmware and would be in place of controlling evaporator fan functionality.

1.3   User interface

The ems25plus Mk II controller is available with either an integrated or a remote motion sensor. Both variants are made from food grade plastics and are safe for internal installation.

Controller with remote motion detection (RMD)	Controller with integrated motion detection (IMD)
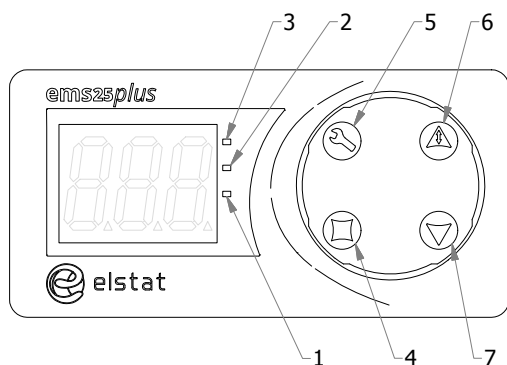
The remote motion sensor must be installed where it can 'see' activity. This variant of the CDM can be installed internally on the cooler.

This variant should always be installed where the sensor can 'see' activity.

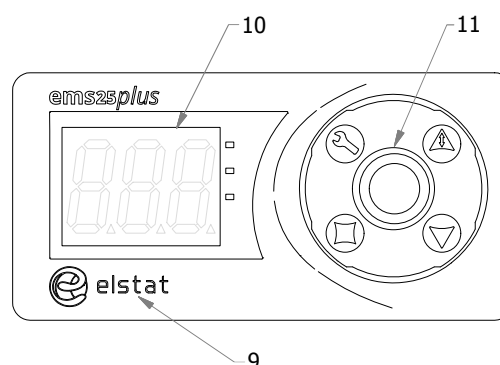| Item	LED Indicator	Function	Colour
1	Saving temperature disable	On if the saving mode temperature is disabled. The controller maintains ready mode temperature at all times.	Red
2	Motion	On when motion is detected.	Red
3	Compressor	On when the compressor is running.	Green

The controller buttons access the menu to view parameter values, reset the EMS controller, and to run test routines.

Item	Push Button	Name	Function
4		Teach	Sets the EMS controller to an "Off period" for up to one hour.
5		Set	Selects menu options and scrolls through the parameters.
6		Up	Increases parameter values, cancels teach mode & toggles summer/winter mode (when not in teach mode).
7		Down	Scrolls down menus, decreases parameter values and cancels alarms.

Item	Push Button	Name	Function
9	-	Logo	Elstat logo
10	-	LED	3-digit 7-segment LED display
11	-	Sensor	Motion sensor

1.4   Wiring diagram
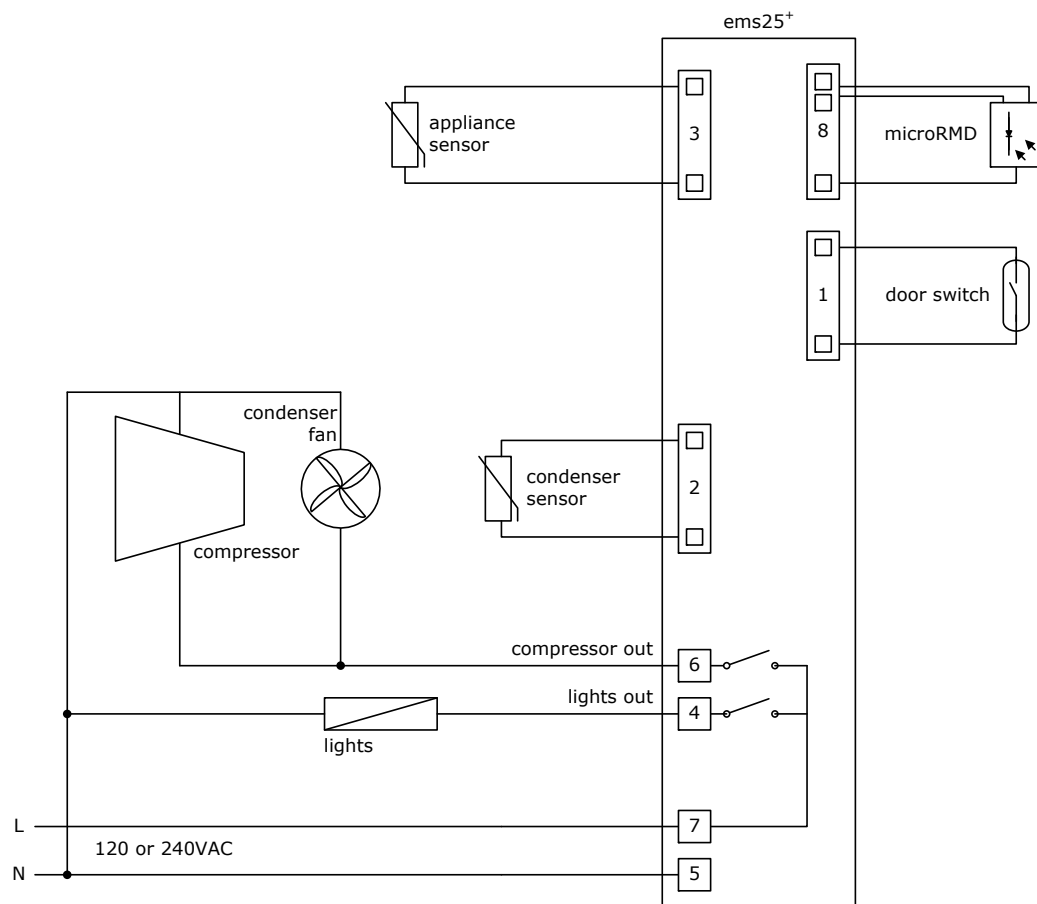
Note

Drip loops must be made in all cables.
For security, once fitted, the rear cover can only be removed using a tool, such as a small, flat bladed screwdriver.

1.5   Rear view (Input reference)

1. Door switch

2. Condenser sensor

3. Appliance sensor

4. Lights out

5. Neutral

6. Compressor out

7. Live

8. microRMD and parameter programming port

1.6   Controller mounting

ems25 series controllers have an IP (ingress protection) rating of IPX5 protection against water jets. An appropriate level of protection must be given for the effects of water ingress due to water jetting, condensation, product spillage, and so on.
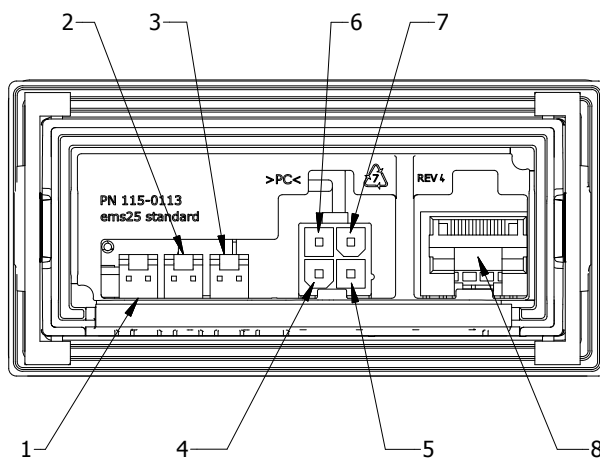
> **Note**
> The ems25 series controllers must not be exposed to temperatures greater than 55°C (131°F) or lower than 0°C (32°F).

ems25 series controllers are designed for panel mounting. The panel aperture dimensions are shown.
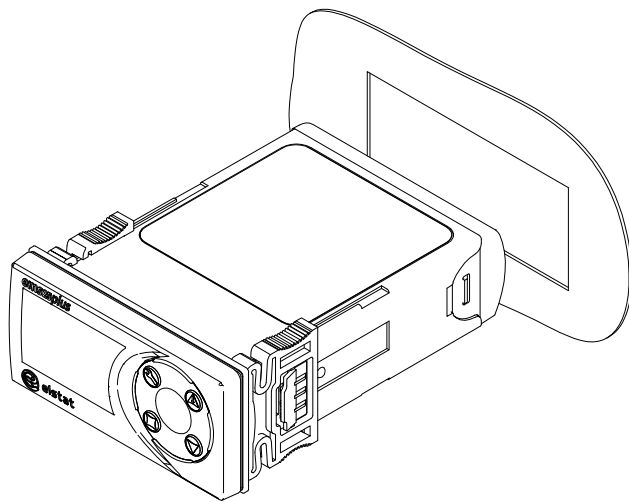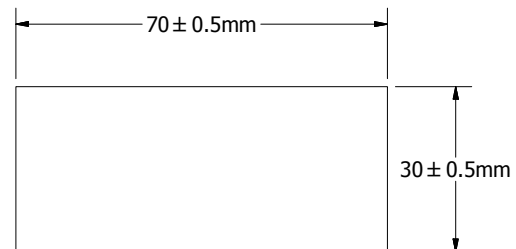
To mount an ems25 series controller, insert the EMS controller into the aperture as shown.

Then, secure the EMS controller into position using the supplied display side-clips as shown.
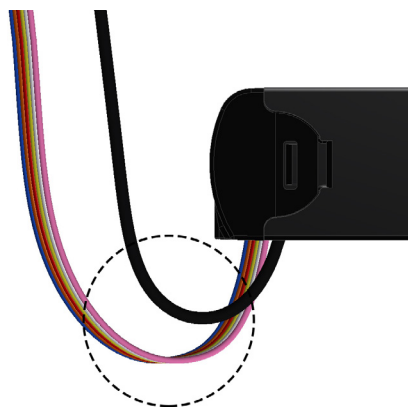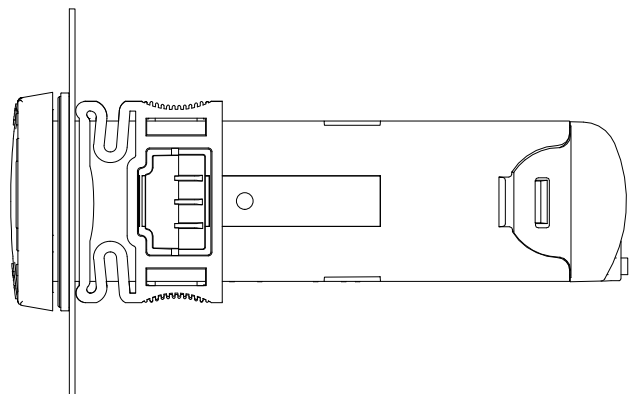
Cable routing to the EMS controller is critical as water can trace or follow the cable downwards.

Therefore, immediately prior to the connection to the controller, a drip loop must be formed in all wiring as shown.

> **Note**
> Cable routing looms must not be secured to hot pipes or vibrating components. Secure cable routing looms with clips where ever possible.

1.7   Overall dimensions
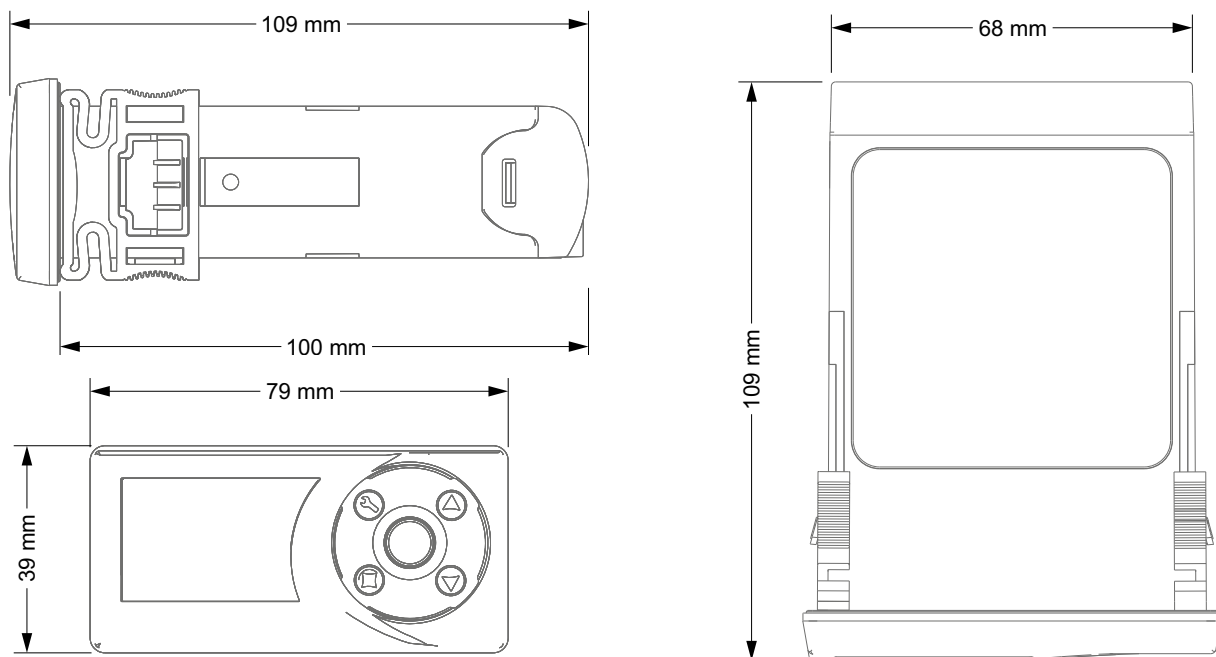
1.8   Relay Ratings

1.8.1   As per EN60730-1, -2-9 & IEC60370-1, -2-9

Relay	Automatic Cycles	Load Type	Load Rating
Compressor	100,000	Resistive/Inductive	6(6)A 0.6pf, 240VAC
Light	30,000	Resistive/Inductive	2(2)A 0.6pf, 240VAC

1.8.2   As per UL60730-1, -2-9 & CAN/CSA E60730-1, -2-9

Relay	Automatic Cycles	Load Type	Load Rating
Compressor	100,000	Motor	6FLA/36LRA, 120VAC
Light	6,000	Ballast	250W, 120VAC

1.8.3   As per GB14536.1 & GB14563.10

Relay	Automatic Cycles	Load Type	Load Rating
Compressor	100,000	Resistive/Inductive	6(6)A 0.6pf, 240VAC
Light	30,000	Resistive/Inductive	2(2)A 0.6pf, 240VAC

1.9   Environmental ratings

Characteristic	Rating
Ambient Temperature - T_{MIN}	0°C (32°F)
Ambient Temperature - T_{MAX}	55°C (131°F)
IP Rating	IP45
Housing Material*	Black polycarbonate

*Glow-wire compliant as per IEC60335

> **Note**
> This controller is designed for integration into 3rd party equipment only and should be installed according to these instructions and all relevant local electrical and safety standards.

1.10   Additional information

Characteristic	Rating
Construction	Incorporated Control
Over Voltage Category	II
Pollution Degree	2
Software Class	A
Type Action	1B
Rating Impulse Voltage	IEC: 2500V, UL: 1500V

1.11   Temperature input ranges

Sensor	Input range (°C)	Input range (°F)
Appliance sensor	-15°C to 23.3°C +/- 0.5°C	5°F to 74°F +/- 1°F
Condenser sensor	50°C to 125°C +/- 5.0°C	122°F to 257°F +/- 10°F

> **Note**
> The NTC thermistor from Elstat is rated at -35°C to 125°C (-31°F to 257°F).

2. ACCESSORIES

2.1   Temperature sensors

Temperature sensors are available from Elstat with various cable lengths. To help identify sensor cables during the installation, Elstat can supply sensor cables with blue identification sleeves. For example, if the appliance sensor cable is plain black; the condenser sensor cable can be purchased with a blue identification sleeve.

The sensor circuit is designed for safety extra low voltage (SELV). Therefore, if the sensor cable needs to be joined during production or maintenance, only connectors normally used in SELV circuits can be used.

> **Note**
>
> Connectors designed to carry mains voltages must not be used to join cables to the sensor circuit.

The temperature sensors have a negative temperature coefficient (NTC). Each make and type of sensor has a specific resistance versus temperature curve. Therefore, only sensors supplied by Elstat should be used. The NTC thermistor is rated from -35ºC to 125ºC (-31ºF to 257ºF).

2.1.1   Appliance sensor

The appliance sensor measures air temperature of the refrigerated compartment by measuring the return air temperature.
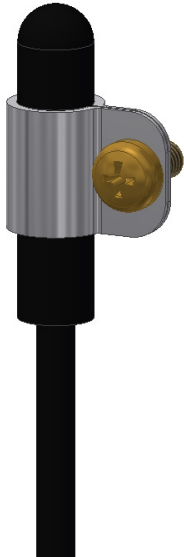
The diagram shows the recommended position of the appliance sensor.

The appliance sensor measures the air temperature after the air has been drawn over the products. The return air provides a close approximation of the product temperature.

To measure the return air temperature, secure the sensor to allow air to flow over the sensor head.
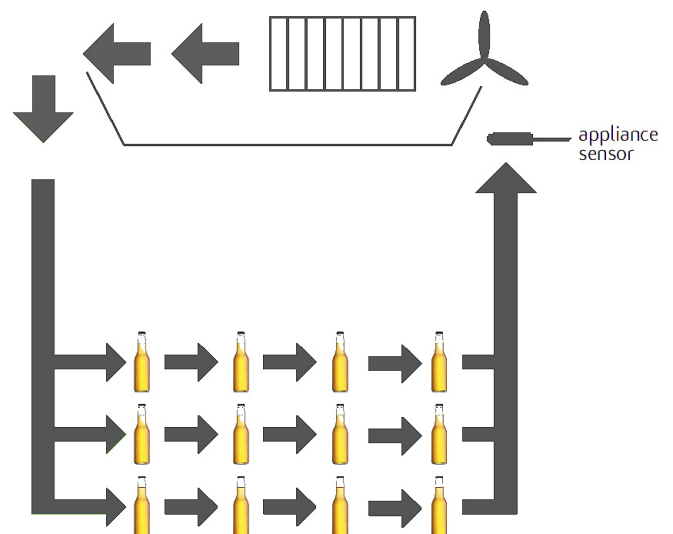
The sensor head should be placed at a right-angle to the air flow and secured using a P-clip. The sensor head should not be completely covered by the P-clip or the sensor will not function correctly.

> **Note**
>
> The sensor head is fragile and can easily be damaged. Do not use cable ties to secure the sensor head or sensor cable as this invalidates the warranty.

To help place the appliance sensor, the parameter calibration 1 (CA1) defines an offset temperature.

2.1.2   Condenser sensor

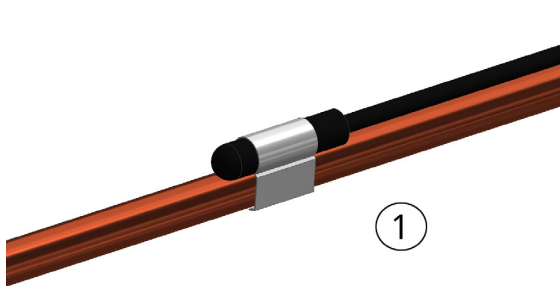This sensor measures the temperature of the refrigeration system. Excessive condenser temperature is usually due to poor preventive maintenance, such as poorly cleaned condenser, or condenser fan failure. EMS controllers can generate alarms if the refrigeration system temperature rises too high.
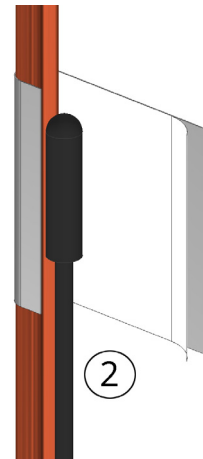
> **Note**
> Condenser sensor needs to be mounted on the liquid pipe of condenser.

The value of the high temperature is set by measuring the refrigeration system temperature, when the condenser is approximately 75% blocked.

The temperature is then set as the value of the condenser high temperature (Ht) parameter. Ensure that the condenser sensor is fixed using a metal pipe clip (1) or foil tape (2) as shown.

Elstat can supply pipe clips for 6-8 mm and 8-10 mm pipes.

> **Caution**
> Do not use cable ties.
> The head of the sensor is fragile and can be easily damaged. Using cable ties to secure the sensor head or sensor cable invalidates the warranty.
> Do not attach sensor cables to hot pipes or allow the sensor cables to come into contact with hot pipes.

2.2   Door switch

Door switches are used to detect door openings. They are SELV (safety extra low voltage) components that are able to create an open and closed circuit. The enhanced door switch, and activator, are over-moulded for increased physical protection and resistance to water ingress.

Door switches are available with various cable lengths (L).

Door switches must be used with the corresponding activator.
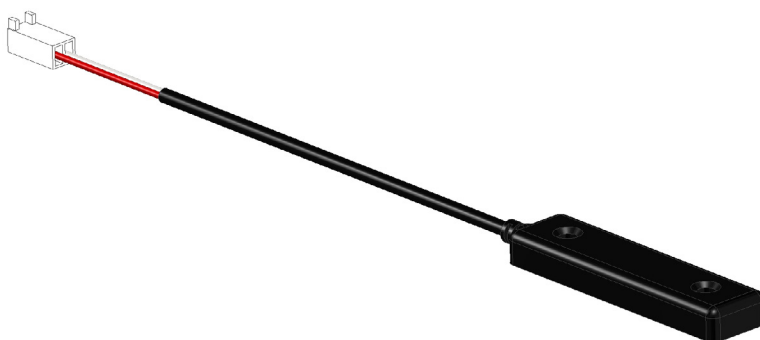
Door switches are usually mounted with the door switch on the cooler and the activator on the door. Both components must be fixed using counter sunk screws or bolts with the following characteristics:

▶   Head: countersunk, maximum diameter 5.0mm (0.24in)
    Thread: maximum diameter 3.0mm (0.16in)

▶   The screws must be tightened to a maximum torque of 0.5Nm (0.37lb ft)

> **Note**
>
> Door switches and activators supplied by Elstat must not be installed using rivets. Using rivets invalidates the warranty.
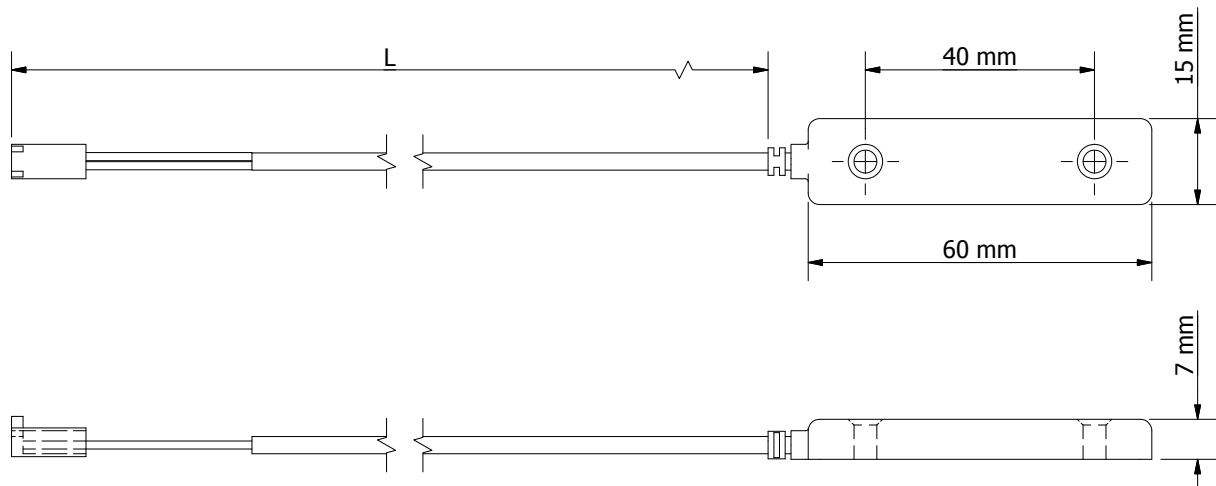
The alignment of the door switch and activator is critical for the correct operation of the door switch. The table details alignment tolerances.

	Alignment	Dimensions	Notes
X	Horizontal	0mm (0in) +/- 20mm (0.7in)	Measured when the door is closed and the gap (z-dimension) is correct.
Y	Vertical	0mm (0in) +/- 10mm (0.4in)	Measured when the door is closed and the gap (z-dimension) is correct.
Z	Gap	0mm (0in) to 5mm (0.2in) +/- 2mm (0.07in)	

The diagram below shows the horizontal, vertical, and gap alignment between the door switch and the activator for open and closed doors.
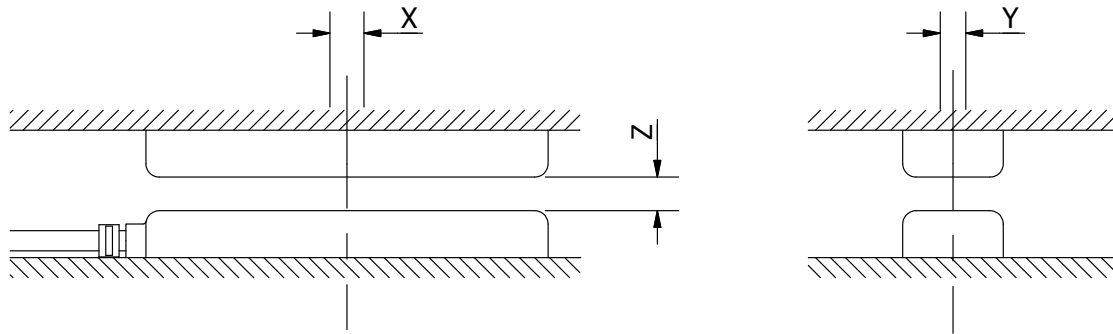
To mount door switches on double-door coolers, two door switches must be connected in series. Connect two door switches in series as follows:

- ▶ Remove the two wires from one of the connectors. Be careful not to damage the terminals.
- ▶ Remove the white wire from the second connector. Again, be careful not to damage the terminal.
- ▶ Insert the white wire of the first cable into the connector of the second cable ensuring that the terminal is in the correct orientation.
- ▶ Connect the red wire from the first cable and the white wire from the second cable together using a butt splice or similar.

The image below shows two door switches connected in series.
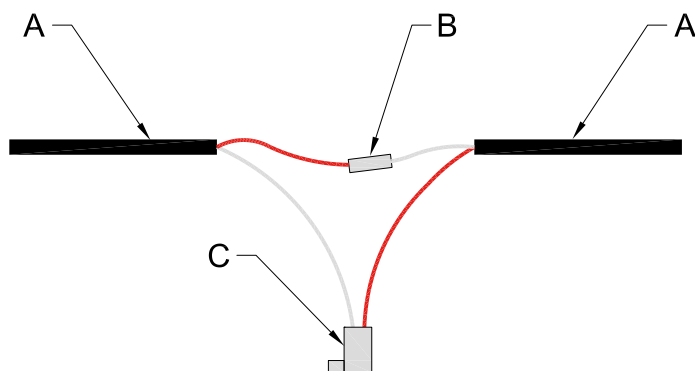
A - Door switch cables

B - Cable connector

C - Molex connector

2.3   Motion sensor

Motion sensors are passive infra-red (PIR) devices that detect activity. The diagram shows the detection pattern of motion sensors.
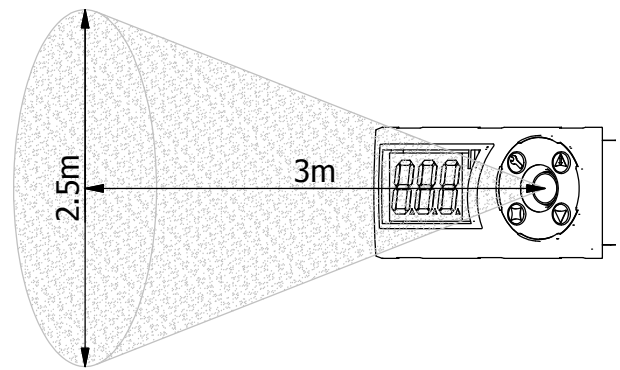
The motion sensor must have an uninterrupted view directly in front and to the sides.

The preferred location of the motion sensor is in the upper section or in header panel of the cooler to ensure the best motion detection and to lower the risk of the motion sensor being blocked by objects such as packages.

For EMS controllers with or without integrated motion sensor, a remote motion sensor can be used.
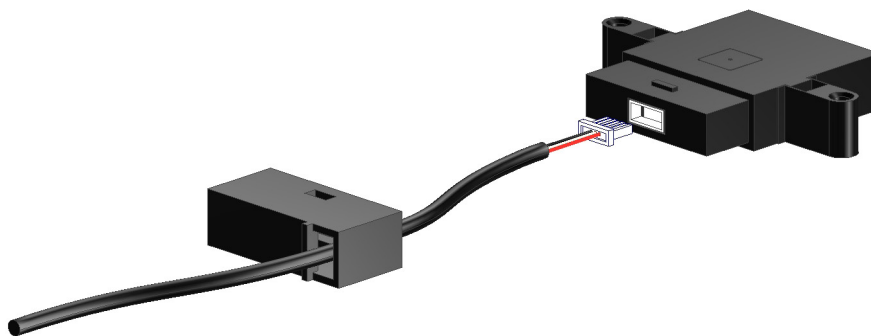
The motion sensor head is supplied detached from the cable to allow the cable to be easily routed through holes or foamed into place as required by the OEM or installer.

The motion sensor should be mounted vertically with the connector at the bottom for optimal performance. Mounting horizontally with the connector at the side results in the motion sensor being less sensitive. However, the motion sensor still works correctly.

The motion sensor must not be located behind any material such as glass or polycarbonate.

For a motion sensor that is not mounted flush with the panel, the diagram shows the minimum recommended clearances to ensure motion detection.

For example, if the motion sensor is mounted 15mm behind the panel, a 30mm diameter aperture is required.
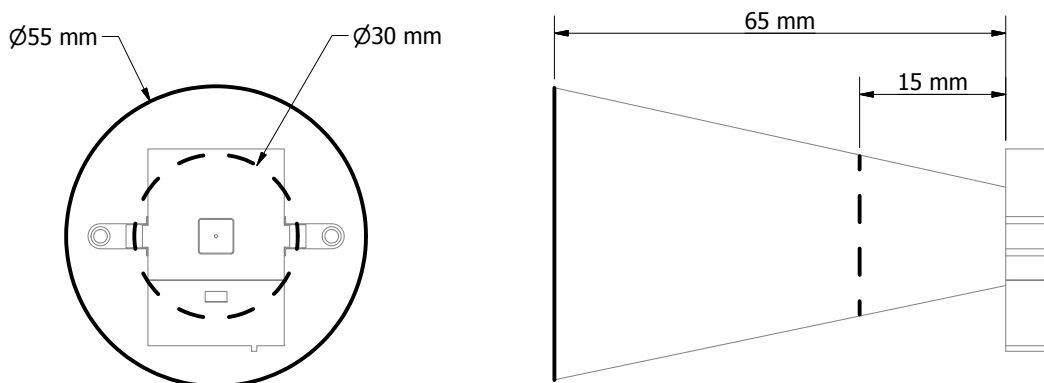
The motion sensor head must be fixed using counter sunk screws or bolts with the following characteristics:

▶ Head: countersunk, maximum diameter 6.0mm (0.24in)

▶ Thread: maximum diameter 4.0mm (0.16in).

The screws must be tightened to a maximum torque of 0.5Nm (0.37lbfft).

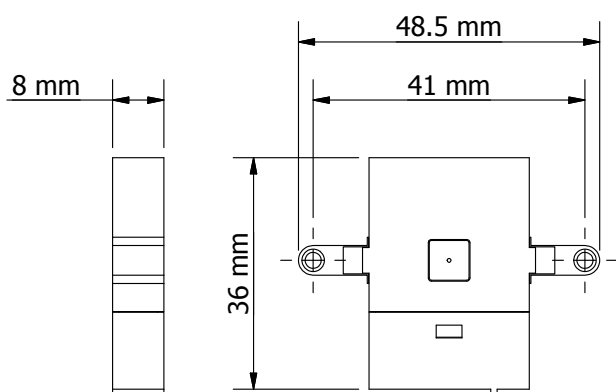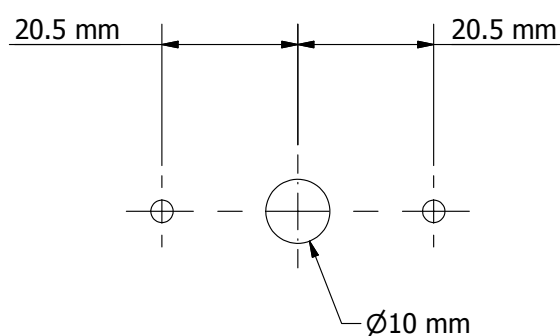> **Note**
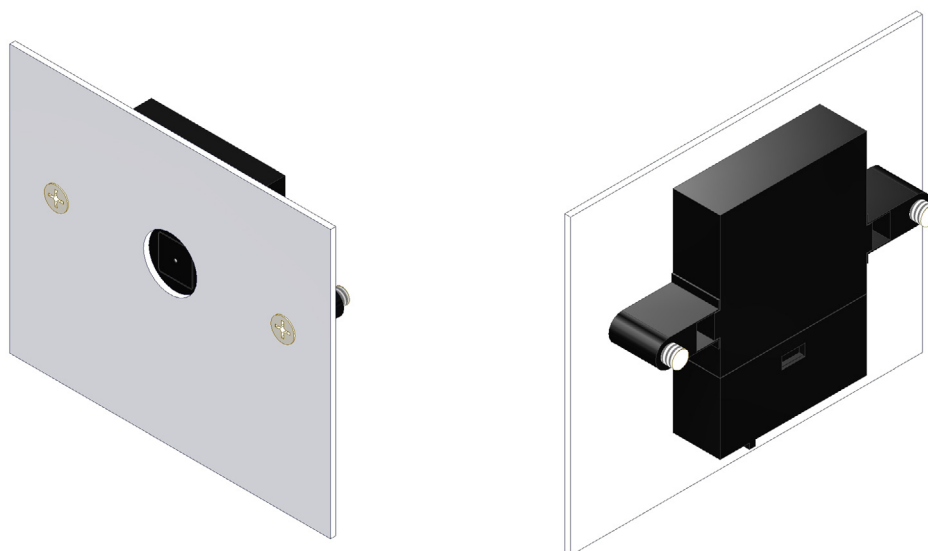> Using rivets invalidates the warranty.

Overall dimensions of the motion sensor

Dimensions of the mounting holes

Sample of a mounted motion sensor

2.4   Decorative trims

Decorative trim kits are supplied separately from ems25 series controllers in order to allow for custom installation. Two kit sizes are available, small and large.

> **Note**
> Ensure that a matching quantity of decorative trims are ordered with controllers.
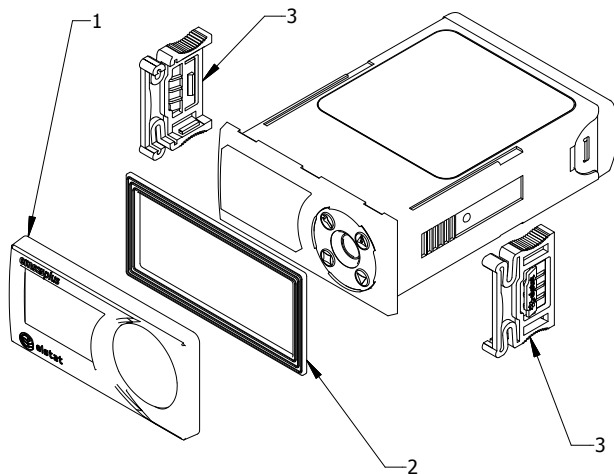
2.4.1   Small decorative trim kit

The small decorative trim kit is available in black and it consists of:

1 - small decorative trim (x 1)

2 - gasket (x 1)

3 - side clips (x 2)

Fit the decorative trim and gasket to the controller as shown.
Insert the controller into the cooler aperture and use the supplied side clips to secure the controller into position.

> **Note**
> The side clips hold the controller in position, make sure that the fit is not loose.
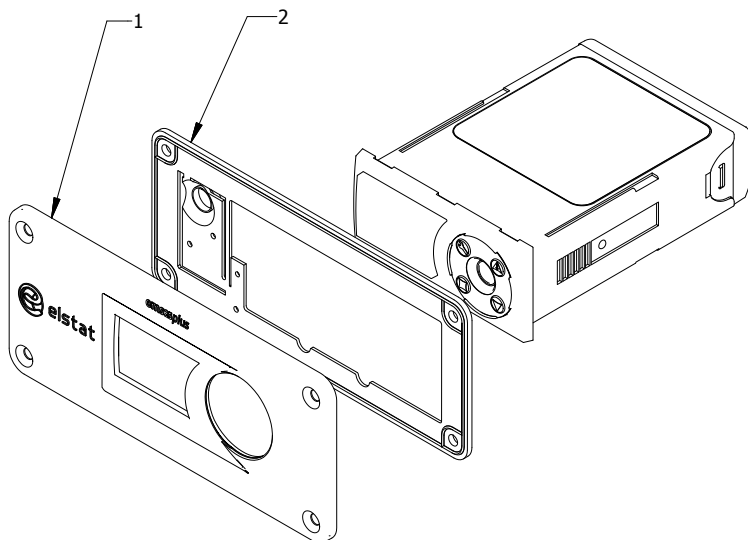
2.4.2   Large decorative trim kits

The large decorative trim kit is available in black and it consists of:

1 - small decorative trim (x 1)

2 - gasket (x 1)

This kit allows the ems25 series to be installed into an aperture for an ems55 series controller.

Fit the decorative trim and gasket to the controller as shown.
Insert the controller into the cooler aperture.
Once fitted, the decorative trim kit can be screwed into place.

> **Note**
> No side clips are supplied with large decorative trim kits.

3.   USER GUIDE

3.1   Power up sequence

At the power up, the EMS controller displays the power-up sequence as follows:

8.8.8.	8 .8 .8 . to confirm that all segments of the display are functioning correctly
U05 L04	Platform type and firmware version. (Example)
C4- -75	Checksum of the parameter set. (Example)

The display then shows the appropriate display code. For example, the temperature or the word USE.

3.2   Function buttons

The EMS controller buttons access the EMS controller menus to view parameter values, reset the EMS controller, and to run test routines.

The EMS controller buttons perform the following functions:

Push Button	Name	Function - end user	Function - service engineer
⬛	Teach	Starts a Teach period.	Use as part of the controller password.
🔧	Set		Use as part of the controller password. Selects menu options. Scrolls through the parameters.
🔼	Up	Cancels teach mode & Toggles summer/winter mode when not in teach mode	Use as part of the controller password. Increases the parameter values.
🔽	Down	Cancels alarms.	Use as part of the controller password. Scrolls down menus. Decreases parameter values

3.3   Display codes

Display	State	Description
USE / **4.0**	Ready mode	EMS controllers display the appliance sensor (cooler cabinet) temperature, or the word USE. Usually the cooler lights are switched on. See "How to check that EMS controllers are working correctly"
- - -	Saving mode	EMS controllers keep products between the saving mode temperatures unless the saving temperature is disabled. The saving temperature disabled LED shows whether the saving mode temperature is disabled. The cooler lights are off unless the light delay (Ld) parameter keeps the lights on for a short period after the EMS controller switches to the saving mode.
dEF	Defrost mode	EMS controllers switch off the compressor and switch on the fan, if applicable. The compressor LED should be off and the evaporator fan will be running if applicable (OS=2)
d0	Door open	EMS controllers display d0 to show that the cooler door is open.
≡	Alarm: Door open	EMS controllers will sound an alarm buzzer if the cooler door remains open for the alarm delay (Ad) duration. If the cooler door is still open after the time defined by the buzzer duration (b1) parameter, the EMS controller switches off the compressor.
888	Freeze-up protection	EMS controllers disable the compressor to prevent over cooling and run the evaporator fan, if applicable. Problems may occur if the ambient temperature falls below 0°C (32°F) or if the appliance sensor fails. See "How to troubleshoot problems with freeze-up protection (888)"
rSF	Alarm: Refrigeration system failure	See "How to troubleshoot refrigeration system failure (rSF) alarms"
PF1	Alarm: Appliance sensor failure	See "How to troubleshoot temperature sensor alarms"
PF2	Alarm: Condenser sensor failure	
- - -	Teach mode	The controller will display 3 horizontal bars when placed in teach mode by pressing the teach button.

Display	State	Description
SU	Summer mode	Indicates that cooler is in summer mode. Summer mode has no effect on the operation of the controller. (this is the default setting)
WI	Winter mode	Indicates that cooler is in winter mode. Winter/Summer mode is changed by holding the UP button for 5 seconds. When in winter mode the controller should switch OFF the compressor at SP+OFS (SSP+OFS when in saving mode).

3.4   The menus

The table below describes the EMS controller menus. Use the Down button to scroll through the menu and the Set button to select.

Menu	Display	Description
Parameter list	**PS**	Displays the parameters and the parameter values.
Test routine	**tSt**	Enters the test routine that tests the relays, temperature sensors, door switch, and motion sensor.
Faults	**FLt**	Displays the last three faults (alarms). See "How to view the last three alarms (FLt)"
Stats	**StA**	Displays a statistical scroll.
Half reset	**Hr**	Clears the self-learning matrix.
Full reset	**Fr**	Elstat use only.
Data dump	**ddP**	Elstat use only.

> **Note**
> The full reset is accessed with a password supplied by Elstat. It is not recommended for the end user to have access to this option.
> The data dump is for Elstat use only for testing and development purposes.

3.5   Accessing menu

The password is a unique sequence of button operations.

Step	Action		Display
1	Press and hold the Set button	🔧	
2	The EMS display shows		*PAS*
3	Press the Set button four times (x 4)	🔧	
4	Press the Up button once (x 1)	🔼	
5	Press the Down button twice (x 2)	🔽	
6	Press the Teach button twice (x 2)	⬚	
7	The EMS display shows:		*PS*
	You have successfully entered the EMS menu.		

Once in the menu structure use the Down button to scroll through the menu and set to select an option.

3.6   Viewing the parameter settings (PS)

View the parameter settings to check the values of the parameters as follows:

Step	Action	Display
1	Press and hold the Set button until PAS is displayed.	*PAS*
2	Enter the button sequence of the password.	
3	Ensure that PS is displayed.	*PS*
4	Press the Set button to view the parameter name and it's value alternate on the display.	
5	Keep the Set button pressed to scroll through the parameter settings.	

3.7   Runing the test routine (tSt)

The test routine tests the following:

- ▸ All load relays
- ▸ Analogue inputs (temperature sensors and door switch)
- ▸ Motion sensor.

Should a problem be suspected with the ems, it is recommended that the test routine is carried out before disconnecting or replacing the EMS controller.

The test routine can detect any loose or disconnected cables and check that the EMS is connected properly to the lights, fan and compressor.

Step	Action		Display
1	Press the Set button	🔧	
2	The EMS display shows		PAS
3	Enter the appropriate password to access the menu.		
4	The EMS display shows:		PS
5	Press the Down button and scroll to the test (tSt) menu	▼	
6	The EMS display shows:		tSt
7	Press the Set button to test the seven segment display	🔧	
8	The EMS display shows:		888
9	Press the Set button to start the relay test	🔧	
10	The EMS display shows:		rEL
11	Press the Up button to start the relay test:	⬆	

3.7.1 The relay test

Button	Display	Test	Check
	L Ic	Light relay*	Cooler lights are on*
	FAn	Evaporator fan relay*	Evaporator fan is running*
	CP	Compressor relay	Compressor is running and compressor LED is on
	OFF	Relay off	Relays are off

*Dependent on the configuration of the OS parameter.

> **Note**
> To switch off the relays that are on, press the Teach button.

Step	Action		Display
12	Press the Set button and the Teach button together		
13	The EMS display shows		**AnA**
14	Press the Up button to begin the analogue input test:		

3.7.2   The analogue input test

Button	Display	Test	Check
⬆	**-2.5**	Appliance sensor temperature	Displayed temperature is correct
⬇	**d0** / **CLO**	Door switch	Door is open (dO) or closed (CLO)
⬙	**51.0** / **125**	Condenser sensor temperature	Displayed temperature is correct. (Between 51.0 and 125°C)

3.7.3   The motion sensor test

Step	Action		Display
15	Press the Menu button and the Teach button together	🔧 ⬙	
16	The EMS display shows		**PIr**
17	Press the Teach button	⬙	
18	Place your hand about 300mm from the motion sensor		
19	Move your hand from left to right.		
20	Check for the following:		
21	The display count increments for each detected movement. The motion LED flashes for each detected movement.		
22	Press the Set button and the Teach button together	🔧 ⬙	
	The test routine ends		

3.8   Viewing the last three alarms (FLt)

It is possible to view the last three alarms and understand problems that have occurred with the EMS controller.

Step	Action		Display
1	Press and hold the Set button	🔧	
2	The EMS display shows		PAS
3	Enter the appropriate password to access the menu		
4	The EMS display shows:		PS
5	Press the Down button and scroll to FLt	▼	
6	The EMS display shows:		FLt
7	Press the Set button to select	🔧	
	The EMS displays the last three faults		
	The last three faults, or alarms, to occur are displayed for example:		
8	A condenser high temperature alarm has occurred		Ht
9	An appliance sensor alarm has occurred		PF1
10	A condenser sensor alarm has occurred.		PF2

> **!** **Note**
> The alarms may have been cleared, or cancelled, by the retail outlet operators.

3.9   Performing a statistical Scroll (StA)

Depending on the model, controllers start gathering a variety of statistics when first powered up. Statistics provide information on the following, dependent on firmware:

▶   Activity: Average number of motion counts and door openings.

▶   Compressor: Average number of compressor cycles and total compressor runtime.

▶   Operation: Settings of the activity frequency (AF) parameter and the saving temperature disable (PEr) parameter.

▶   Temperature: Average, Lowest and highest temperature measured on the appliance sensor.

> **Note**
> A full reset clears all the gathered statistics.
> Please see the following list which describes the statics available to view on your controller model.

The controller then scrolls through the statistics pausing for 6 seconds at each statistic before returning to normal operation. The 3-digit display can show values from '0' to '999.'

For values of 1000 and above, the display shows the value as a rounded decimal number. For example, 1.1 represents 1100, 1.2 represents 1200, and so on.

Step	Action		Display
1	Press and hold the Set button	🔧	
2	The EMS display shows		PAS
3	Enter the appropriate password to access the menu.		
4	Press the down button to scroll through the main menu to the Statistical Scroll.	▼	
5	Press the Set button to enter the statistical scroll	🔧	StA

Display	Statistic	Description
AF	Activity frequency	Value of the activity frequency AF parameter. Possible values are: 0, 1, 2 or 3. (0 = low, 2= high and 3 = automatic)
CC	Compressor cycles	Total number of compressor cycles since first powered up or last full reset

Display	Statistic	Description
CH	Compressor runtime	Total number of hours that the compressor has run since the controller was first powered up or since the last full reset.
dC	Door openings	Total number of door openings since first powered up or last full reset.
HI	Highest temperature	Highest temperature measured by the appliance sensor during the past 24 hours.
LO	Lowest temperature	Lowest temperature measured by the appliance sensor during the last 24 hours.
At	Average temperature	Average temperature measured by the appliance sensor in the last 24 hours.
Cnt	Motion counts	Total number of motion counts since first powered up or last full reset.
PEr	Saving temperature disable	Value of the standby temperature disable PEr parameter. Possible values are: OFF or ON. OFF = Saving temperature disable is switched off. ON = Saving temperature disable is switched on.

3.10   Performing a half reset (Hr)

Perform a half reset to clear the self-learning matrix if the EMS controller has been unable to detect activity correctly, for example, the view of the motion sensor was blocked, or if the cooler has been moved to a new location.

Step	Action		Display
1	Press and hold the Set button	🔧	
2	The EMS display shows		**PAS**
3	Enter the appropriate password to access the menu.		
4	Press the Down button to scroll to the half re-set menu:	▼	**Hr**
5	Re-enter the menu entry password:		

Step	Action		Display
6	Press the Set button four times (x 4)	🔧	
7	Press the Up button once (x 1)	⬆	
8	Press the Down button twice (x 2)	▼	
9	Press the Teach button twice (x 2)	⬛	
	The controller should reset and begin the power-up sequence.		

4. CONTROLLER FUNCTIONALITY

EMS controllers have the capability to manage the following:

▶ Condenser
EMS controllers monitor the temperature on the condenser and prevent high temperature by shutting off the compressor if necessary. This is optional for EMS controllers, and dependent on controller specification.

▶ Compressor
EMS controllers use the compressor to control the temperature of the refrigeration compartment.

▶ Evaporator fan
EMS controllers switch the evaporator fan to manage the temperature of the refrigeration compartment. This is optional for EMS controllers, and dependent on controller specification.

▶ Lights
EMS controllers manage the cooler lights for marketing and energy saving purposes. This is optional for EMS controllers, and dependent on controller specification.
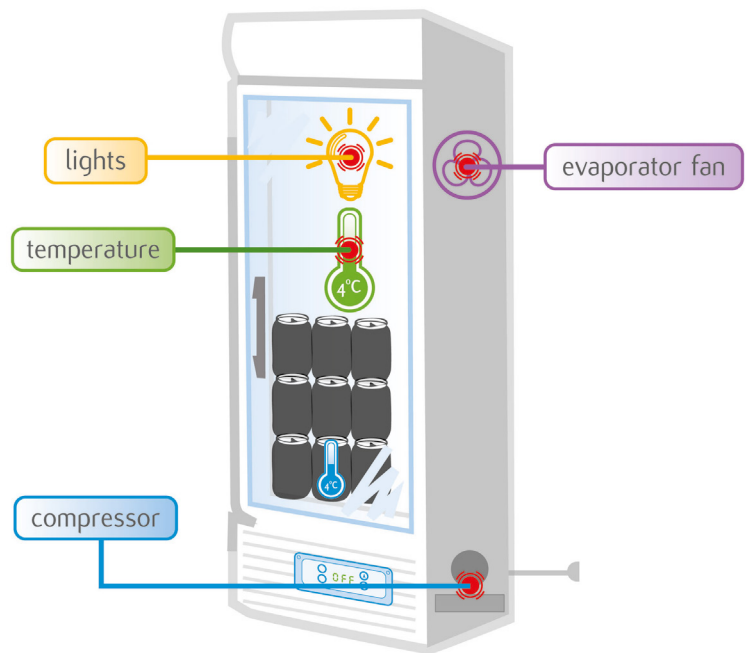
4.1 Defrost

Defrost cycles minimizes the risk of the evaporator icing up. The defrost cycle occurs periodically as defined by the defrost interval (dE). The defrost interval starts when the EMS controller is powered up or at the end of an uninterrupted pull down.

The defrost cycle ends after the time defined by the defrost duration (dd) or on reaching the defrost termination temperature (dtd), as shown.
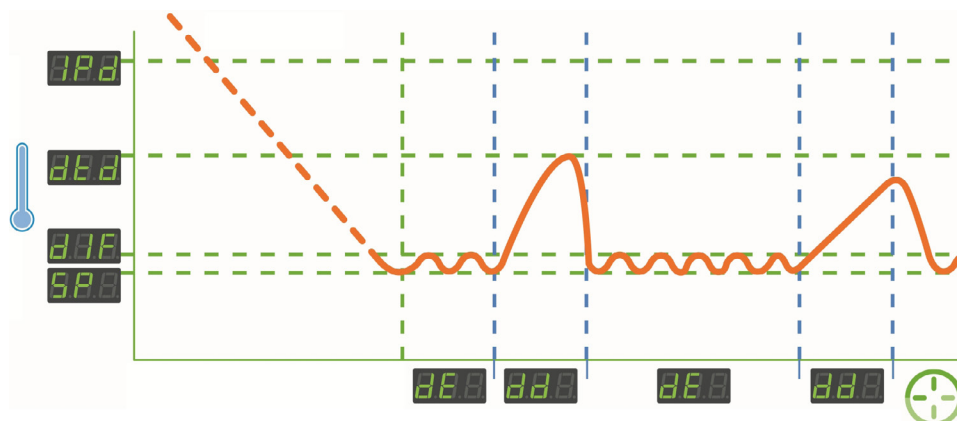
4.2   Lights management

EMS controllers, dependent on settings, can be configured to manage the cooler lights. In the saving mode, the cooler lights are usually off. For marketing purposes, light delay (Ld) can keep the cooler lights on for a short period after the EMS controller switches to the saving mode.

Otput select (OS = 1) can keep the lights on for the duration of the saving mode.

4.3   Evaporator fan management

EMS controllers, dependent on settings, can be configured to manage the evaporator fan. The evaporator fan will run continuously when the compressor is running. For periods that the compressor is not running, the evaporator fan will cycle.

> **Note**
> The evaporator fan will run continuously when the controller is in a defrost period.

The evaporator fan cycle is defined by the fan cycle on (FCO) and fan cycle off (FCF) parameters. The fan cycle starts with a fan cycle on (FCO) period as shown.
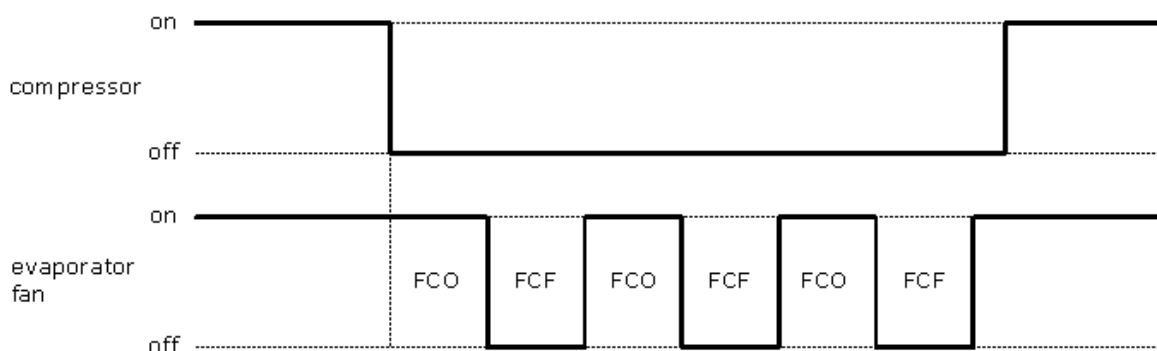
EMS controllers stop the evaporator fan when the cooler door is opened.

To prevent excessive condensation on the evaporator in environments where warm, and presumed humid air is present, the controller runs the evaporator fan continuously if the temperature exceeds the fan set point (FSP) temperature. EMS controllers run the evaporator fan, even if the cooler door is opened, and continues to run the evaporator fan until reaching the set point (SP) temperature.

If the OS parameter is set to 00 or 01 the evaporator fans are not selected. Instead the controller manages the lights.

4.4   Alarms

For alarm conditions, the EMS controller displays the appropriate alarm code and, optionally, sounds an alarm buzzer. Buzzer enable (b0) defines whether to sound a warning buzzer for alarm conditions. Buzzer duration (b1) defines the duration of the buzzer for door alarms.

> **Note**
> For door open alarms, the buzzer sounds regardless of the buzzer enable (b0) setting.

4.5   Compressor management

EMS controllers manage the compressor to maintain the product temperature between the set point (SP) temperature and the set point (SP) plus differential (dIF) temperature in the ready mode or between the saving set point (SSP) temperature and the saving set point (SSP) plus the saving differential (Sd) temperature in the saving mode.

To ensure that the pressures within the refrigeration system have time to equalize during compressor off cycles, the compressor rest time (rt) defines the minimum time that the compressor can be switched off.

Compressor manufacturers usually recommend a minimum compressor rest time. The compressor rest time (rt) helps to avoid the following:

▶   Passing peak current through the windings of the compressor motor

▶   Switching off the refrigeration system on the thermal overload protection

▶   Short-cycling the refrigeration system.

However, if ready mode and saving mode differential temperatures are too small the EMS controller may cycle the compressor on the compressor rest time (rt).

If the compressor runs continuously for too long without reaching the set point (SP) temperature, a refrigeration system failure (rSF) alarm activates alerting to possible problems with the refrigeration system.

EMS controllers can monitor the refrigeration system temperature using a condenser sensor. Monitoring the refrigeration system temperature can help detect problems, such as a blocked condenser.

If the temperature measured on the condenser sensor reaches the condenser high temperature (Ht), the EMS controller disables the compressor and activates the (Ht) alarm. The condenser high temperature (Ht) is set by measuring the refrigeration system temperature when the condenser is 75% blocked.

EMS controllers manage the failure of a temperature sensor as follows:

▶   Appliance sensor failures indicated by PF1 alarms, EMS controllers stop running the compressor and then waits 60 seconds before rebooting (switch off and then switch on). If the fault continues, the EMS controller repeats and continues the cycle.

▶   Condenser sensor failures indicated by PF2 alarms, EMS controllers continue running the compressor. EMS controllers alternate the display between PF2 and the appliance sensor temperature.

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5.   HOW EMS CONTROLLERS WORK - SELF-LEARNING

EMS controllers monitor the cooler activity to record consumer patterns. EMS controllers use the learnt patterns to switch between the following modes:

▸   Ready mode the product is at the correct serving temperature and the cooler lights are on.

▸   Saving mode the product temperature is allowed to rise to save energy and the cooler lights are off. In the saving mode, the EMS controller is switched on and the saving temperature always stays within the pre-set limits to ensure that the cooler can lower to the ready mode temperature within the defined time.

5.1   Example

After learning the activity patterns during the learning period, EMS controllers work as follows:

▸   Prior to the outlet opening the EMS controller ensures that the products are at the correct serving temperature before the first sale.

▸   The EMS controller sets the cooler into the ready mode when the outlet is open.

▸   The EMS controller detects activity using the motion detector and door switch.

▸   The EMS controller continually updates the activity patterns

▸   The EMS controller manages the cooler temperature and lights to optimize energy savings without any manual intervention.

▸   The EMS controller sets the cooler to the saving mode when the outlet closes.

5.2   Self-learning

The activity frequency (AF) parameter determines the amount of activity required to set a 30-minute period as an active period. The activity frequency (AF) parameter is usually set to require one door opening or one motion detection to set a 30-minute period to active. However, for specific installations, the activity frequency can be configured to require more activity to set a 30-minute period to ready.

The activity frequency (AF) parameter can also be set to automatically determine the optimal level of activity required to a set a 30-minute period to ready.

To set the activity frequency (AF) automatically, EMS controllers run for 48 hours to determine the optimum activity frequency (AF).

> **Note**
>
> If the activity frequency is set to automatic, EMS controllers must be allowed to run (powered up) continuously for 48 hours before the EMS controller starts to build the self-learning matrix.

EMS controllers then start the learning period (LP) after the 48 hours required to set the activity frequency (AF).
EMS controllers remain learning in the ready mode for the period defined by the learning period (LP). The learning period (LP) sets EMS controllers to use a 1-day or 7-day learning period.

EMS controllers build the complete 7-day self-learning matrix as follows:

▸   1-day learning period: the EMS controller runs in ready mode for the first day (24 hours). The EMS controller then uses the learnt matrix of day 1 for the next six days. The controller continues building the matrix as it moves through the 6 days until a complete 7-day matrix has been learnt and then implements accordingly.

▶   7-day learning period: the EMS controller runs in the ready mode for the first 7 days until a complete 7 day matrix has been built and then implements accordingly.

The table describes the total time that EMS controllers run in the ready mode only, after being powered up. This is the minimum time before EMS controllers switch to the saving mode.

Learning period (LP)	Activity frequency (AF)	Minimum time in ready mode only
1 day	Pre-set	1 day (24 hours)
1 day	Automatic	3 days (72 hours)
7 days	Pre-set	7 days
7 days	Automatic	9 days

5.3   Activity

EMS controllers learn when retail outlets are open or closed by monitoring activity. For example, people opening and closing the cooler door to retrieve products or movements detected in front of the cooler. EMS controllers detect activity as follows:

▶   Door switch to detect door openings as customers open the cooler door to retrieve products.

▶   Motion sensor to detect movement in the front of the cooler.

> **Note**
> EMS controllers must be able to detect activity to work correctly. The motion detector should never be obstructed.

The diagram shows the detection pattern of the motion sensor.

EMS controllers use activity to determine when retail outlets are open and closed. Periods with activity mean the retail outlet is open, and periods without activity mean the retail outlet is closed.

EMS controllers run coolers in the ready mode during periods with activity and the saving mode during periods without activity.

EMS controllers record the periods with and without activity in the self-learning matrix.
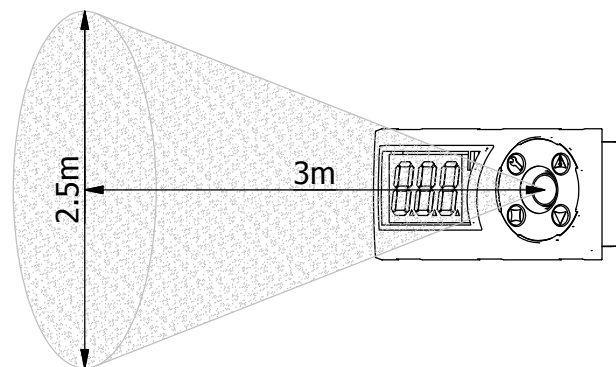
5.4   Saving mode

EMS controllers run in the saving mode when retail outlets are closed.

In the saving mode, the product temperature is allowed to rise to a predefined temperature. The saving mode temperature range is defined by saving set point (SSP) and the saving differential (Sd).

The compressor runs until the saving set point (SSP) temperature is reached and then stops until the measured temperature reaches the saving set point (SSP) plus saving differential (Sd) temperature.
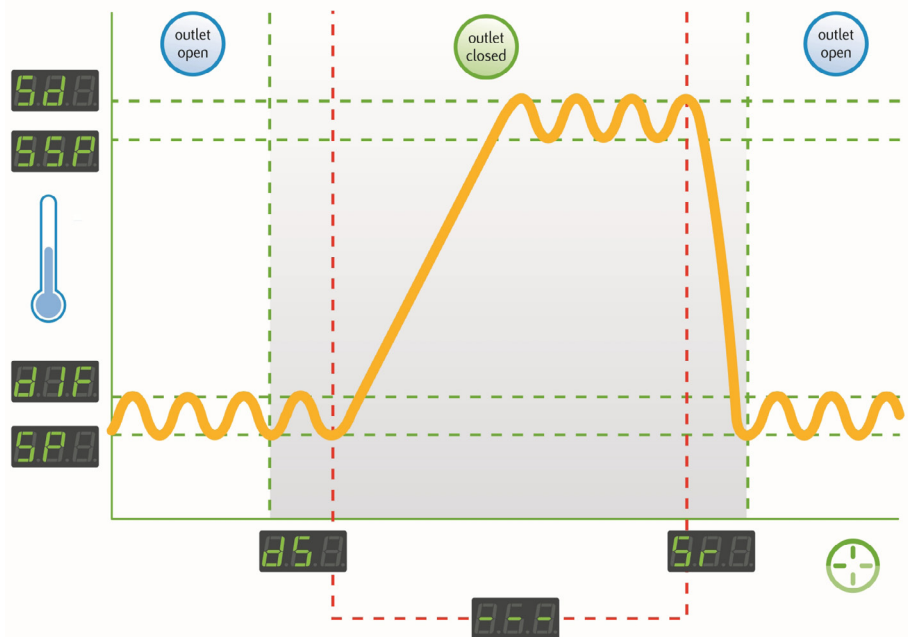
The EMS controller starts lowering the product temperature in the saving restart period (Sr) before the ready mode starts, ensuring that the cooler has sufficient time to reach the ready mode temperature from the saving mode temperature.

However, the saving temperature disable (PEr) can set EMS controllers to maintain the ready mode temperature at all times. During the saving mode, the controller displays three dashes, (---), and the cooler lights are usually switched off.

If the cooler door is opened or the motion sensor detects activity during the saving mode, EMS controllers switch on the cooler lights for the remainder of the current 30-minute period, but do not return to ready mode temperatures.

5.5   Switching between the ready and saving mode

A key characteristic of an EMS controller is the saving restart period. The saving restart period is time allocated for the cooler to lower the product temperature to the ready mode temperatures from the saving mode temperatures. A typical saving restart period is 120 minutes.

Whist in the saving mode, the EMS controller must look ahead in the self-learning matrix for a ready period by the time defined by the saving restart period (Sr). For example, the EMS controller looks 2 hours ahead.

If the EMS controller detects a ready period, the EMS controller starts to lower the product temperature, as shown.
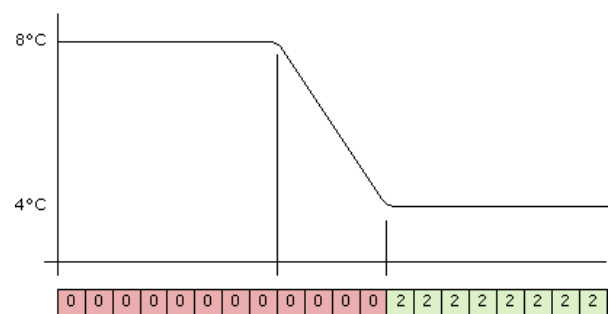
The EMS controller remains in saving mode if there are no ready periods within the next 2 hours as defined by the saving restart time (Sr). The EMS controller ignores periods of inactivity if the time to the next active period is less than the saving restart time.

For example, the diagram below shows a period of inactivity, saving (0) at 18:00 followed by two monitor (1) periods. In this instance, the EMS controller would ignore the saving (0) at 18:00 and switch to the saving mode at 19:30.
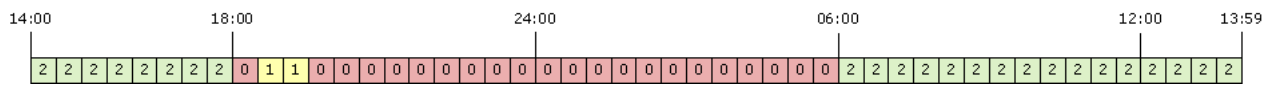
> **Note**
> EMS controllers always run in the ready mode for periods in the self-learning matrix that are set to 1 (monitor) or 2 (ready).

5.6   Ready mode

EMS controllers run in the ready mode when outlets are open.

In the ready mode, the product is at the correct serving temperature and the cooler lights are on. EMS controllers ensure that the product is at the correct serving temperature by keeping the product temperature within the range defined by set point (SP) parameter and the differential (dIF) parameter.

The EMS controller runs the compressor until the set point (SP) temperature is reached. The compressor is then stopped until the measured temperature reaches the set point (SP) plus differential (dIF) temperature.
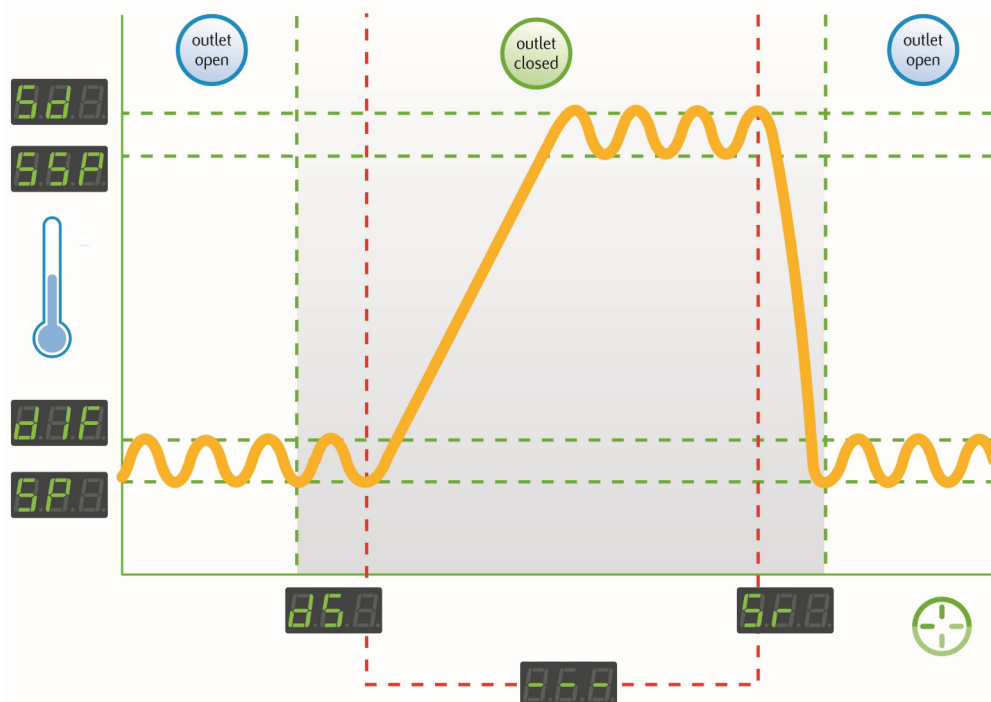
During the ready mode, EMS controllers display appliance sensor temperature 3.0, for example or the word USE as defined by display (dIS) parameter. If the EMS controller displays the appliance sensor temperature, the display stability (d2) parameter can dampen the rate of change of the displayed temperature. For example, to filter short fluctuations in the air temperature due to the door opening, which has no affect on the product temperature.

At the end of the ready mode, EMS controllers switch to the saving mode. However, the delay to saving (dS) parameter can delay the switch to the saving mode. The delay helps ensure that, for example, the EMS controller remains in the ready mode during periods without activity immediately prior to outlets closing for marketing purposes.

5.7   Teach mode

EMS 25 Plus controllers have a function called teach mode that can be operated via the front panel.

The teach mode function enables outlet operators to put the controller into a one hour "off period" manually.

When the teach button pressed for 5 seconds the controller switches all the relays off for one hour (Light is exempt if OS = 1).

During the one hour, the motion detector input is disabled. Therefore, the controller does not detect motion.

Opening the cooler door or holding the up button for 5 seconds and then releasing, returns the controller to normal operation.

At the end of the one hour period, the controller returns to normal operation in the saving mode or ready mode (as dictated by the matrix).

The teach function does not affect the stored learning matrix of the controller. However no activity is placed in the matrix while the controller is in teach mode.

> **Note**
> Elstat recommends that outlet operators do not manually switch controllers to the teach mode.
> This functionality aims to stop outlet operators switching off coolers.

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6.   ALARMS AND TROUBLESHOOTING

Various messages are displayed on EMS controllers to indicate alarm conditions. Use the following section to troubleshoot EMS controllers.

6.1   How to check that EMS controllers are working correctly

During the ready mode, the EMS controller displays the appliance sensor temperature, such as 4 .0, or the word USE. The option to display the temperature or the word USE is set by the display (dIS) parameter. Follow the chart to ensure that the EMS controller is working correctly in the ready mode for coolers with door switches fitted. For information about the display (dIS) parameter see "Display (dIS)".
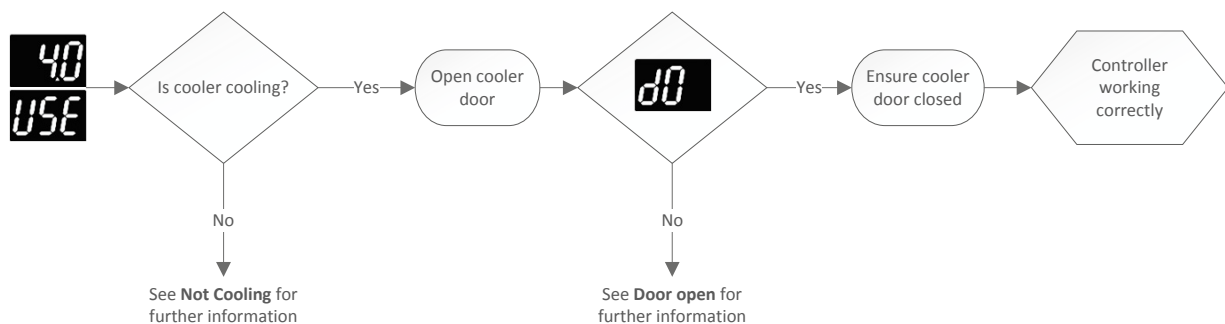
6.2   Door open alarm - display

The EMS controller displays d0 to show that the cooler door is open. However, if the door remains open for the duration of alarm delay (Ad), a buzzer sounds.

Then, if the door is still open after the time defined by the buzzer duration (b1) parameter, the EMS controller switches off the compressor and displays three horizontal bars, as shown. Closing the door clears the alarm. However, if the alarm continues follow the flowchart for door alarms.

6.3   How to troubleshoot problems with freeze-up protection (888)

Problems with freeze-up protection may occur if the ambient temperature falls below 0°C (32°F) or if the appliance sensor fails. For information about the freeze-up protection parameter see "Freeze-up protection (dtt)".
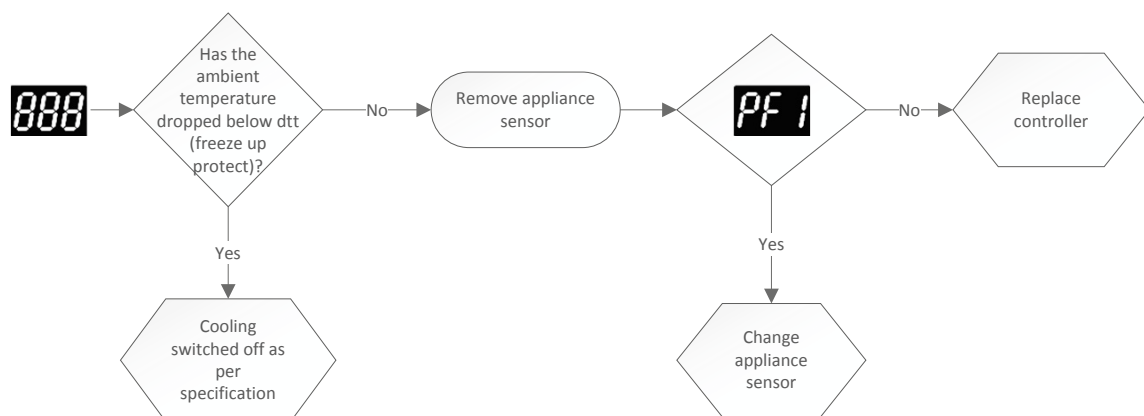
6.4   How to troubleshoot door alarms

Door open alarms are triggered if the cooler door is left open for longer than the time defined by the alarm delay (Ad) parameter. If the door is closed, and a door open alarm is registered, this may indicate problems with the cooler door or the door switch. For information about the alarm delay (Ad) parameter see "Alarm delay (Ad)".
Follow the chart to troubleshoot door open alarms on coolers with a door switch.
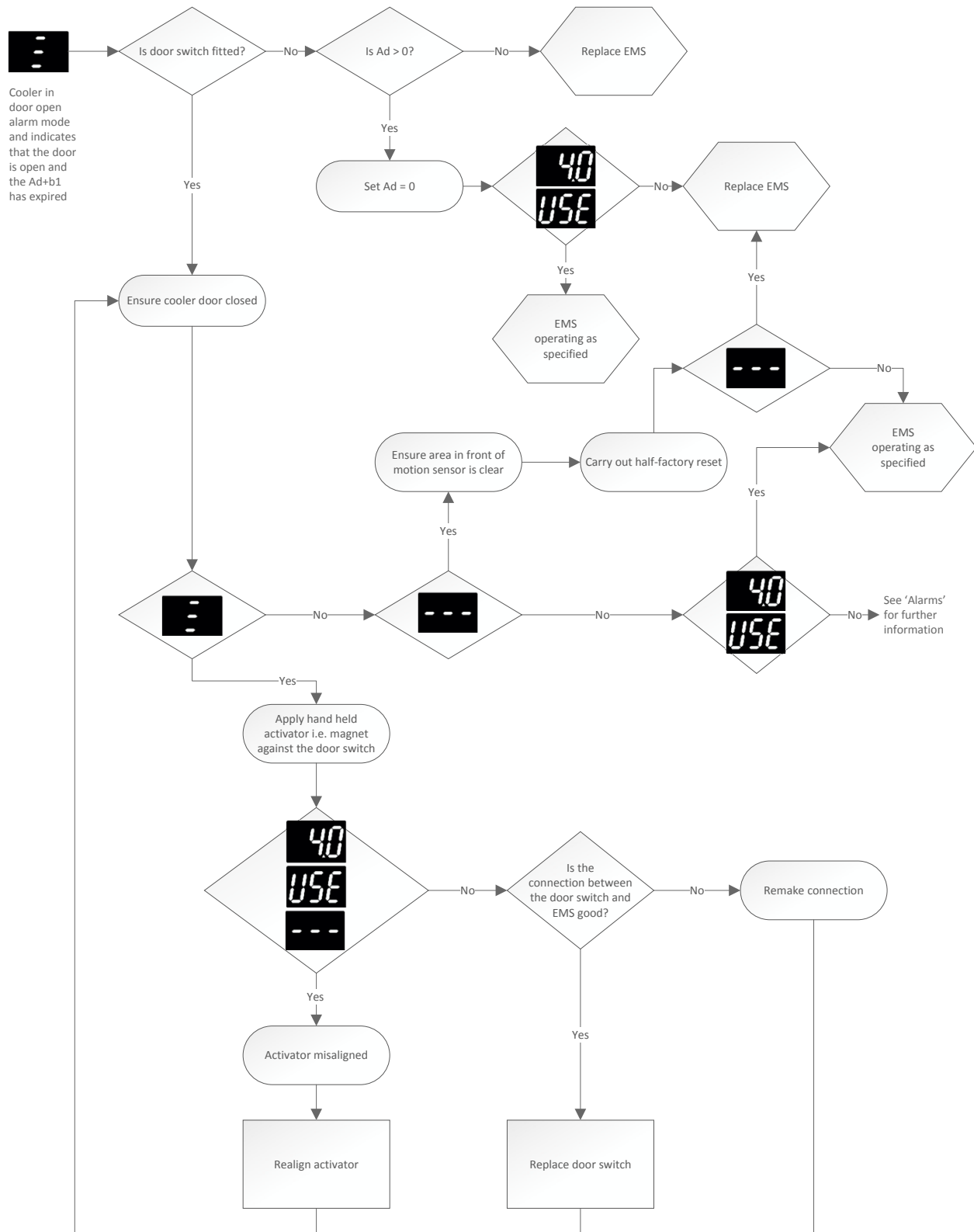
6.5   How to troubleshoot not cooling problems

Follow the chart to troubleshoot problems of the cooler not cooling, i.e. the cooler or product is warm.

```
┌─────────────────┐                    ┌─────────────────┐
│ Cooler or       │                    │ Check cooler    │
│ product is warm │                    │ wiring and fuses│
└────────┬────────┘                    └────────▲────────┘
         │                                      │ No
         ▼                                      │
     ◇ Is controller on? ──No──▶ ◇ Is power available      ──Yes──▶ ⬡ Replace controller
                                   at the controller
                                   main connector?
         │ Yes
         ▼
     ◇ Is the compressor ──Yes──▶ ◇ Is compressor ──Yes──▶ ⬡ Refrigeration
        LED on?                      running?                  system fault
         │ No                          │ No
         ▼                             ▼
     ◇ Is controller ──Yes──▶     ◇ Power available at        ──No──▶ Replace controller
        indicating a fault?          controller compressor
         │ No          │                connector?
         ▼             ▼                 │ Yes
     ◇ Is the      ⬡ See Alarms          ▼
        controller                    ⬡ Compressor fault
        in defrost
        (dEF displayed)?
         │ No
         ▼
     ⬡ Replace controller
```

6.6   How to troubleshoot refrigeration system failure (rSF) alarms

Refrigeration system failure (rSF) alarms trigger if the set point (SP) temperature is not reached within the time defined by the compressor runtime (Ct) parameter. For information about the set point and compressor run time parameters see "Refrigeration system failure (Ct)" and "Set point (SPC or SPF)".

Follow the chart to troubleshoot refrigeration system failure.

```
[rSF] → (Reset alarm - press Down button once) → <Is the product freezing?> --Yes--> <Is the appliance sensor short circuit? (23.3°C or 74°F)> --Yes--> [Replace sensor]
                                                          |                                          |
                                                          No                                         No
                                                          ↓                                          ↓
                                              See Not cooling for                              [Replace controller]
                                              further information
```
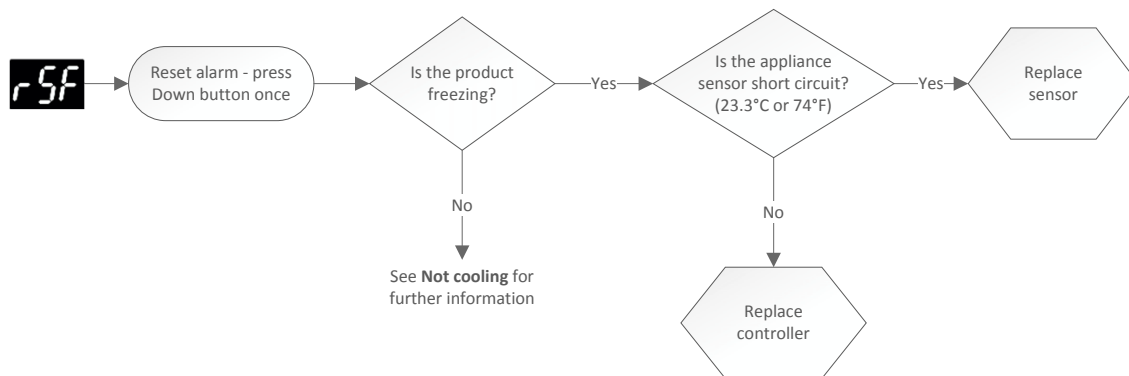
6.7   How to troubleshoot temperature sensor alarms

Follow the chart to troubleshoot problems with the temperature sensors.

```
                                                                                    [Replace faulty sensor]
                                                                                            ↑
                                                                                           Yes
[PF1]                                                                                       |
[PF2] → <Perform the analogue sensor test> → <Are sensors securely fitted?> --Yes--> <Is either sensor open circuit?> --No--> [Replace controller]
                                                     |                                       ↑
                                                     No                                     No
                                                     ↓                                       |
                                            (Secure loose sensor)                            |
                                                     ↓                                       |
                                            <Alarm cleared?> ---------------------------------
                                                     |
                                                    Yes
                                                     ↓
                                            [Fault cleared]
```
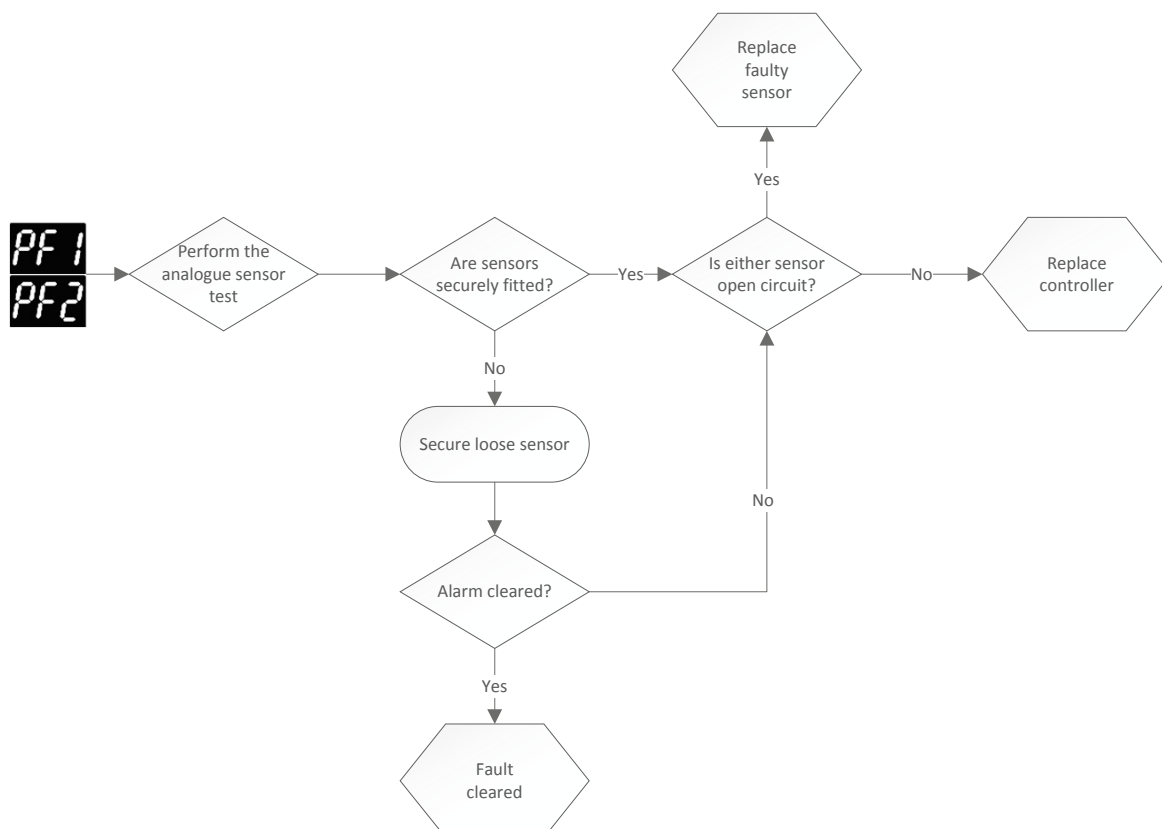
PF1 and PF2 on a controller display always indicates a sensor failure. Elstat controllers manage sensor failures as follows:

▶   PF1 alarms: EMS controllers stop running the compressor and then waits 60 seconds before re-starting (switch off and then switch on).

If the fault continues, the EMS controller repeats and continues the cycle until the fault is corrected.

▶   PF2 alarms: EMS controllers continue running the compressor. EMS controllers alternate the display between PF2and the appliance sensor temperature indicating a fault.

For more information see "Running the test routine (tSt)".

6.8   How to troubleshoot condenser high temperature (Ht) alarms

Condenser high temperature (Ht) alerts to problems with the refrigeration system such as a blocked condenser or faulty condenser fan. For information about the condenser high temperature (Ht) parameter see "Condenser high temperature (Ht)".

Follow the chart to troubleshoot condenser high temperature (Ht) alarms.
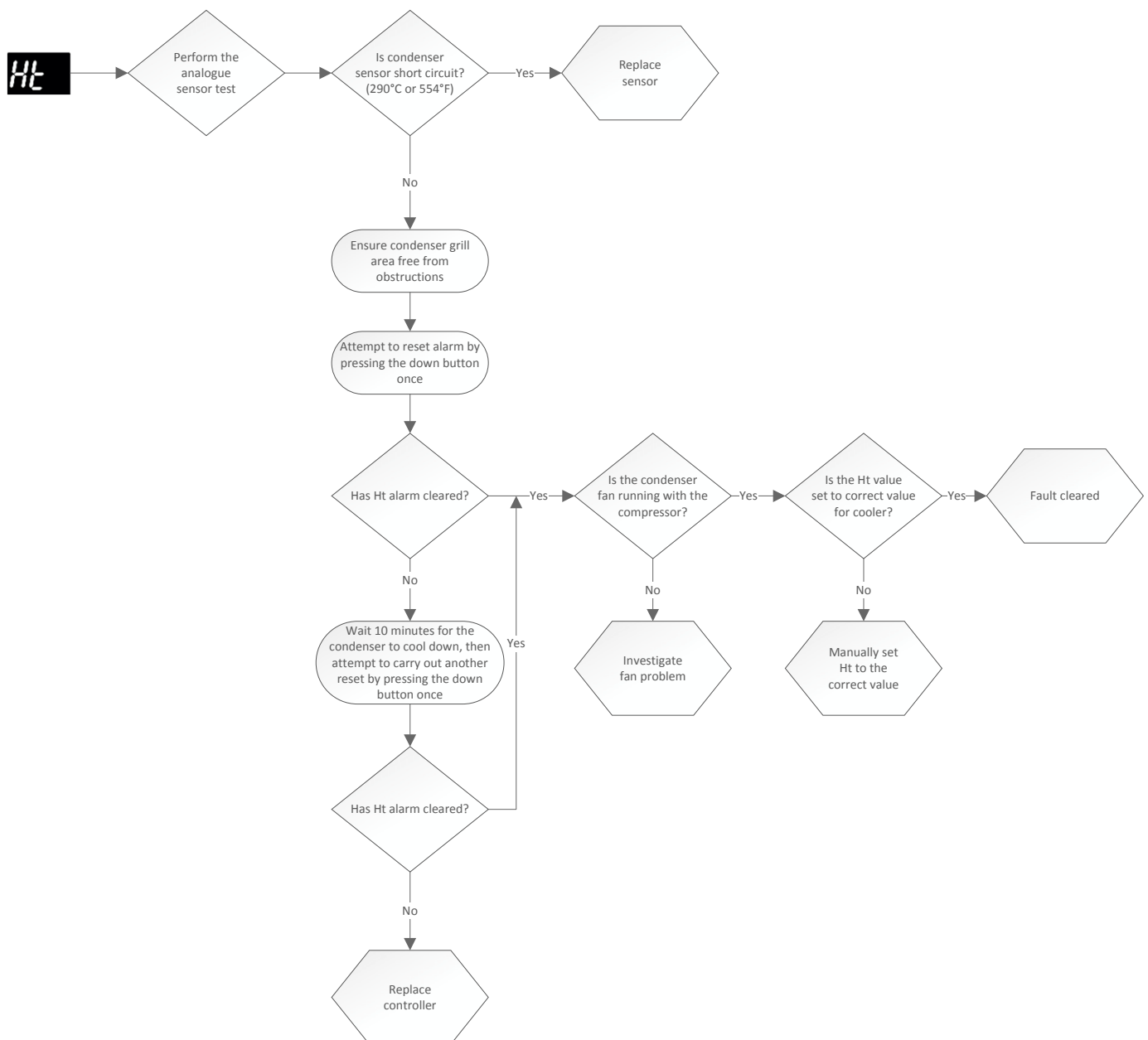
7.   PARAMETER REFERENCE

The parameter reference lists all the parameters and describes each parameter in full. The parameter values vary between different cooler types, cooler characteristics, operating environments, brand requirements, and operational preferences.

Operation parameters define the alarms, self-learning, lights management, and also the delay to saving and the saving temperature disable.

Parameter settings are defined by customers - OEMs, Bottlers and Brands - using an XML request form, and supplied in the relevant parameter information document.

Shown is a full list of parameters and descriptions, ranges and default values of each parameter is detailed for reference information. Firmware: Glass Door Cooler

7.1   Parameters by function

Temperature	Celsius or Fahrenheit (CF) Set point (SP) and Differential (dIF) Saving set point (SSP), Saving differential (Sd) and Saving temperature disable (PEr) Appliance sensor: calibration 1 (CA1)
Operation	Saving restart (Sr) Delay to saving mode (dS) Freeze-up protection (dtt) Compressor rest time (rt)
Defrost	Defrost interval (dE) and Defrost duration (dd) Defrost termination temperature (dtd) Uninterrupted pull down (IPd) (if applicable)
Self-learning	Learning period (LP) and activity frequency (AF)
Display	Display (dIS) and Display stability (d2)
Lights	Light delay (Ld) and Output Select mode (OS)
Evaporator fan	Fan set point (FSP) Fan cycle on (FCO) and Fan cycle off (FCF)
Alarms	Alarm delay (Ad) Buzzer enable (b0) and Buzzer duration (b1) Refrigeration system failure (Ct) Condenser high temperature (Ht)

7.2   Parameters definition

7.2.1   Celsius or Fahrenheit (CF)

Display	**CF**
Description	Option to set the EMS controller to Celsius (°C) or Fahrenheit (°F).
Considerations	• A global reset sets EMS controllers using Fahrenheit (°F) to Celsius (°C). • Applies to all temperature settings and values.
Range	00 (°C) or 01 (°F)
Global default	00 (°C)

7.2.2   Set point (SPC or SPF)

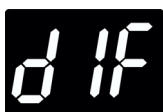|	
Display	**SPC SPF**
Description	Defines the compressor cut-out temperature during the ready mode. The set point (SP) temperature is the lowest measured temperature under normal operating conditions. The set point is displayed as SPC (set point Celsius) or SPF (set point Fahrenheit) depending on whether the EMS controller is set to use Celsius or Fahrenheit.
Considerations	Must be above the freeze-up protection (dtt) temperature.
Range	-9.9 to 9.9°C (14 to 50°F)
Global default	3.0°C (37°F)

7.2.3   Differential (dIF)

Display	**dIF**
Description	Defines the compressor cut-in temperature when added to the set point (SPC or SPF) temperature during the Ready mode.
Considerations	If the differential (dIF) is set too low, for example, less than 2.0°C the compressor may cycle on the minimum compressor rest time (rt).
Range	0.0 to 9.9°C (0 to 18°F)
Global default	4.0°C (7°F)

7.2.4   Calibration 1 (CA1)

Display	**CA1**
Description	Calibrates or adds an offset to temperatures measured by the appliance sensor.
Considerations	Applied to all temperatures measured on the appliance sensor.
Range	-9.9 to 9.9°C (-18 to 18°F)
Global default	0.0°C (0°F)

7.2.5   Saving set point (SSP)

Display	**SSP**
Description	Defines the compressor cut-out temperature during the Saving mode.
Considerations	Must be set above the set point (SP).
Range	0.0 to 9.9°C (32 to 50°F)
Global default	7.0°C (45°F)

7.2.6   Saving differential (Sd)

Display	**Sd**
Description	Defines the compressor cut-in temperature, when added to the saving set point (SSP) temperature, during the Saving mode.
Considerations	If the saving differential (Sd) is set too low, for example less than 2.0°C, the compressor may cycle on the minimum compressor rest time (rt).
Range	0.0 to 9.9°C (0 to 18°F)
Global default	4.0°C (7°F)

7.2.7   Uninterrupted pull down (IPd)

Display	IPd
Description	Defines the temperature that if exceeded starts an uninterrupted pull down, i.e. the Controller switches on the compressor and runs the compressor continuously until the product reaches the set point (SP) temperature. During this time, defrost cycles do not occur.
Considerations	Must be set as follows: • Above the saving set point (SSP) plus saving differential (Sd) temperature. • Above the defrost termination (dtd) temperature.
Range	0.0 to 30ºC (32 to 86ºF)
Global default	20ºC (68ºF)

7.2.8   Freeze-up protection (dtt)

Display	dtt
Description	Defines the temperature to stop further cooling to prevent freeze-up due to low temperature.
Considerations	Must be set below the set point (SP) temperature.
Range	-15 to 10ºC (5 to 50ºF)
Global default	0.0ºC (32ºF)

7.2.9   Defrost termination temperature (dtd)

Display	dtd
Description	Defines the temperature to end the defrost cycle. Ending defrost cycles on temperature minimizes the duration of defrost cycles.
Considerations	• Must be set above the set point (SP) plus differential (dIF) temperature. • Must be set below IPd. • If icing up occurs, review the values of the defrost parameters.
Range	1 to 30ºC (33 to 86ºF)
Global default	10.0°C (50°F)

7.2.10   Fan set point (FSP)

Display	**FSP**
Description	Prevents excessive condensation on the evaporator in environments where warm, and presumed humid, air is present by operating the evaporator fan. If the fan set point (FSP) temperature is exceeded, the evaporator fan runs continuously even if the door is opened. On reaching set point (SP) temperature the evaporator fan resumes normal operation and so switches off during door openings.
Considerations	Not related to fan cycle on (FCO) or fan cycle off (FCF). Fan parameters will only be viewable if OS is set at 02.
Range	01 to 30ºC (33 to 86ºF)
Global default	15ºC (59ºF)

7.2.11   Condenser high temperature (Ht)

Display	**Ht**
Description	Defines the maximum temperature measured in the refrigeration system by monitoring the condenser sensor. On reaching the condenser high temperature (Ht), the controller disables the compressor and activates an alarm.
Considerations	• Requires a condenser sensor. • To set the condenser high temperature (Ht), measure the refrigeration system temperature when the condenser is 75% blocked. • To disable, set below 50ºC or 122ºF.
Range	0.0 to 125ºC (32 to 257ºF)
Global default	0.0ºC (32ºF) - disabled.

7.2.12   Winter Offset (OFS)

Display	**OFS**
Description	Winter Offset - The EMS adds this parameter value as an offset to the set point & Saving set point, when set to winter mode via the UP button.
Considerations	When in winter mode the controller should switch OFF the compressor at SP+OFS (SSP+OFS when in saving mode). Note: Switch ON temp should be SP+OFS+DIF (SSP+OFS+SD when in saving mode).
Range	0 - 9
Global default	3

7.2.13   Compressor rest time (rt)

Display	rt
Description	Defines the minimum time between compressor cycles. The compressor rest time ensures that the pressures in the refrigeration system have time to equalize during compressor off-cycles. The compressor rest time (rt) helps to avoid the following: • Passing peak current through the windings of the compressor motor • Switching off the system on the thermal overload protection • Short cycling of the system.
Considerations	If set too low, the compressor rest time may cycle on the set point (SP) and differential (dIF) temperatures or the saving set point (SSP) and saving differential (Sd) temperatures.
Range	1 to 30 minutes
Global default	3 minutes

7.2.14   Delay to saving (dS)

Display	dS
Description	Defines the delay in switching to the Saving mode from Ready mode. The delay starts at the end of the last active 30 minute period of the Ready mode.
Considerations	Must be set in multiples of 30 minutes.
Range	0 to 120 minutes (in multiples of 30 minutes)
Global default	00 (no delay)

7.2.15   Lights delay (Ld)

Display	Ld
Description	Defines the delay to switch off the cooler lights after the controller switches to the Saving mode.
Considerations	Must be set in multiples of 30. Should only take affect once Delay to saving (dS) has completed.
Range	0 to 120 minutes
Global default	00 (no delay)

7.2.16   Saving restart period (Sr)

Display	**Sr**
Description	Cooler runs at the ready mode temperatures for the duration of this period to ensure that the product is at the ready mode temperatures prior to retail outlet opening time.
Considerations	• Set and verified by OEMs through the test protocol to ensure that product temperatures are within specification when outlets open. • Must be set in multiples of 30 minutes. • Depending on OS setting, the cooler lights would normally be off.
Range	0 to 240 minutes (in multiples of 30 minutes)
Global default	120 minutes

7.2.17   Refrigeration system failure (Ct)

Display	**Ct**
Description	Defines the maximum continuous runtime of the compressor without reaching the set point (SP) temperature. If the set point (SP) temperature is not reached within this time, the controller enters an RSF alarm.
Considerations	None
Range	00 to 100 hours
Global default	72 hours

7.2.18   Defrost interval (dE)

Display	**dE**
Description	Defines the period between the end of defrost cycle and beginning of the next defrost cycle. A time-based defrost cycle helps improve evaporator efficiency.
Considerations	In the event of power loss, the defrost interval (dE) is not maintained. The defrost interval is reset. If icing up occurs, review the values of the defrost parameters.
Range	0 to 199 hours
Global default	06 hours

7.2.19   Defrost duration (dd)

Display	
Description	Defines the maximum time of a defrost cycle.
Considerations	If icing up occurs, review the values of the defrost parameters.
Range	1 to 199 minutes
Global default	15 minutes
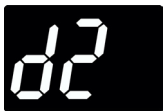
7.2.20   Fan cycle on (FCO)

Display	
Description	Defines the active period of the evaporator fan while the compressor is switched off.
Considerations	Fan cycle is the fan cycle on (FCO) time + the fan cycle off (FCF) time. Fan parameters will only be viewable if OS is set at 02.
Range	1 to 30 minutes
Global default	30 minutes

7.2.21   Fan cycle off (FCF)

Display	
Description	Defines the inactive period of the evaporator fan while the compressor is switched off.
Considerations	Fan cycle is the fan cycle on (FCO) time + the fan cycle off (FCF) time. Fan parameters will only be viewable if OS is set at 02.
Range	0 to 30 minutes
Global default	1 minute

7.2.22 Display stability (d2)

Display	**d2**
Description	Defines the rate of change of the displayed temperature. Limiting the rate of change provides a dampening effect so as not to concern users should the air temperature rise quickly due to a door opening. Increasing the value for the display stability (d2) slows the rate of change of the displayed temperature.
Considerations	Use the global default value for normal operation.
Range	1 to 254
Global default	2

7.2.23 Buzzer enable (b0)

Display	**b0**
Description	Enables or disables a warning buzzer for alarm conditions. Door open alarms always sound the warning buzzer regardless of this parameter setting.
Considerations	The following alarm conditions trigger the buzzer: Refrigeration system failure (rSF), Sensor failure (PF1, PF2) and Ht alarms. Door alarms sound the buzzer as standard.
Range	00 (disabled) or 01 (enabled)
Global default	01 (enabled)

7.2.24 Buzzer duration (b1)

Display	**b1**
Description	Defines the duration of the buzzer for door open alarm conditions. If the door remains open after the buzzer duration (b1), the controller switches off the compressor (and fan if applicable) until the door is closed.
Considerations	The controller switches off the compressor after the duration defined by alarm delay (Ad) + buzzer duration (b1).
Range	1 to 254 seconds
Global default	60 seconds

7.2.25   Alarm delay (Ad)

Display	**Ad**
Description	Defines the maximum time the cooler door can be open before sounding the alarm buzzer.
Considerations	If disabled, the door switch is also disabled - if so the controller does not detect door openings therefore, it does not: • Update the self-learning matrix for door activity. • Manage the evaporator fan for door activity. • Sound door alarms if the door is left open.
Range	00 to 30 minutes
Global default	00 (disabled)

7.2.26   Activity frequency (AF)

Display	**AF**
Description	Defines the minimum number of door openings or motion counts to indicate an active 30 minute period in the self-learning matrix, as described below.
Considerations	See below.
Range	See below.
Global default	00 (low frequency)

The table below describes the values for activity frequency (AF).

Value	Name	Description
00	Low frequency	1 door opening or 1 motion count
01	Medium frequency	1 door opening or 3 motion counts
02	High frequency	2 door openings or 6 motion counts
03	Automatic	The EMS controller runs continuously for 48 hours in the ready mode. After 48 hours, the EMS controller sets the value of the activity frequency to 0, 1, or 2.

> **Note**
>
> If AF is set to 3, the controller must run continuously for 48 hours to set the value of the activity frequency. If power is lost during the 48 hour period, the controller restarts the 48 hour period.
> The controller must complete the 48 hour period to determine the activity frequency before starting the 1-day or 7-day learning period.

7.2.27   Motion sensor enable (Sn)

Display	**Sn**
Description	Enables the input from the motion sensor.
Considerations	Must be disabled if a motion sensor is not fitted.
Range	00 (disabled) or 01 (enabled)
Global default	01 (enabled)

7.2.28   Saving temperature disable (PEr)

Display	**PEr**
Description	Disables the saving mode temperatures so that the controller maintains the Ready mode temperatures at all times. Disabling the Saving mode temperatures does not affect the light functionality.
Considerations	None
Range	00 (off) or 01 (on)
Global default	00 (off)

7.2.29   Learning period (LP)

Display	**LP**
Description	Defines whether the controller uses a 1-day or a 7-day learning period.
Considerations	None
Range	00 (1 day) or 01 (7 days)
Global default	00 (1 day)

7.2.30   Display (dIS)

Display	*d I5*
Description	Defines whether the controller displays the temperature (3.0 for example), or the word USE during the Ready mode.
Considerations	EMS Controllers will always display alarms regardless of the dIS setting.
Range	00 (USE) or 01 (temperature)
Global default	01 (temperature)

7.2.31   Output Select (OS)

Display	*05*
Description	Sets the cooler lights to remain on at all times for display purposes. The coolers lights will remain on during saving mode. Or turns the light relay into a fan relay. • If set to (00) the lights will switch off when the cooler is in saving mode, and switch on when the cooler is in ready mode. • If set to (01) the lights will remain on in the cooler when the controller goes into saving mode. • If set to (02) the relay will be used to control the fan, thus enabling the fan functionality.
Considerations	Lights on at all times does not affect saving temperature. This parameter allows the selection of either light functionality, or fan functionality - not both.
Range	0 - 2
Global default	0

8.   PRODUCT APPROVALS

Conformité Européene / European Conformity (CE)	
	EN60730-1 EN60730-2-9

European Norms Electrical Certification (ENEC)	
	EN60730-1 EN60730-2-9

International Electrotechnical Commission (IEC)	
	IEC60730-1 IEC60730-2-9 Glow wire IEC60335-1

North America (including Canada) - UL mark (Component Recognition)	
	UL 60730-1 / CSA E60730-1 UL 60730-2-9 / CSA E60730-2-9

China Quality Certification	
	GB14536.1-2008 GB14536.10-2008

9. GLOSSARY OF TERMS

9.1   Acronyms

The table below explains the meanings of the most common acronyms used in this manual.

Acronym	Meaning	
ems or EMS	Energy Management System	The Elstat range of products in this group are all energy management systems.
GDC	Glass Door Cooler	A cooler type which determines a firmware variant Elstat uses on certain products.
XML	Extensible Mark-up Language	XMLs are used by Elstat to transfer parameter sets to EMS controllers. The XMLs (parameter sets) determine how a controller will operate.
SELV	Safety Extra Low Voltage	IEC defines a SELV system as "an electrical system in which the voltage cannot exceed ELV under normal conditions, and under single- fault conditions, including earth faults in other circuits". Safety Extra Low Voltage as described in BS EN 60335 Household and similar electrical appliances - Safety standards.
IEC	International Electrotechnical Commission	Publisher of international standards for all electrical, electronic and related technologies.
IP	Ingress Protection	A protection rating achieved by the controller preventing intrusion and water into the housing of the controller.

9.2   Controller and accessory terms

The table below describes the meanings of some of the terms used frequently within the manual in relation to the controller and accessories.

Term	Meaning
Ready mode	The cooler is operational and cooling products to the set point.
Saving mode	The cooler is saving energy and cooling products to the saving set point.
Appliance sensor	A sensor which measures the temperature inside the cooler cabinet to give an approximation of the product temperature inside.
Self-learning	How the EMS learns ready and saving periods.
Matrix	The matrix is populated according to activity levels and the EMS manages the cooling system accordingly.
microRMD	A remote motion detector (sensor) supplied with controllers which do not have an integrated motion detector. The microRMD can be fitted anywhere it can detect motion allowing the controller to be installed out of sight.
Firmware	The code written into the EMS micro-controller containing the rules and algorithms of operation. Every controller contains firmware and the version of firmware is identified during power up by two, three digit numbers.
Checksum	The checksum is a 'sum' which identifies which parameter set - or XML file - has been loaded onto a controller. It is unique to each parameter set.

ems25*plus* MkII
Product Manual

Installation & set up guide
User guide
Parameters & accessories
Troubleshooting

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