EMS Technical Instruction Manual

Elstat Electronics Ltd

Version E46

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EMS-55-(R) Instruction Manual

GENERAL DESCRIPTION

The EMS (Energy Management System) saves energy by allowing the temperature in the cooler to rise during periods when the outlet is closed. The unit is totally self managing and does not require any interference of the user. It can substantially reduce the number of service calls whilst saving on average 38% energy.

To ensure that the product is at the correct temperature, the EMS will switch to operational mode 2 hours before the outlet opens (this timing is adjustable). Subsequently the control will switch to standby mode 1 hour after the outlet closes (again this timing is adjustable).

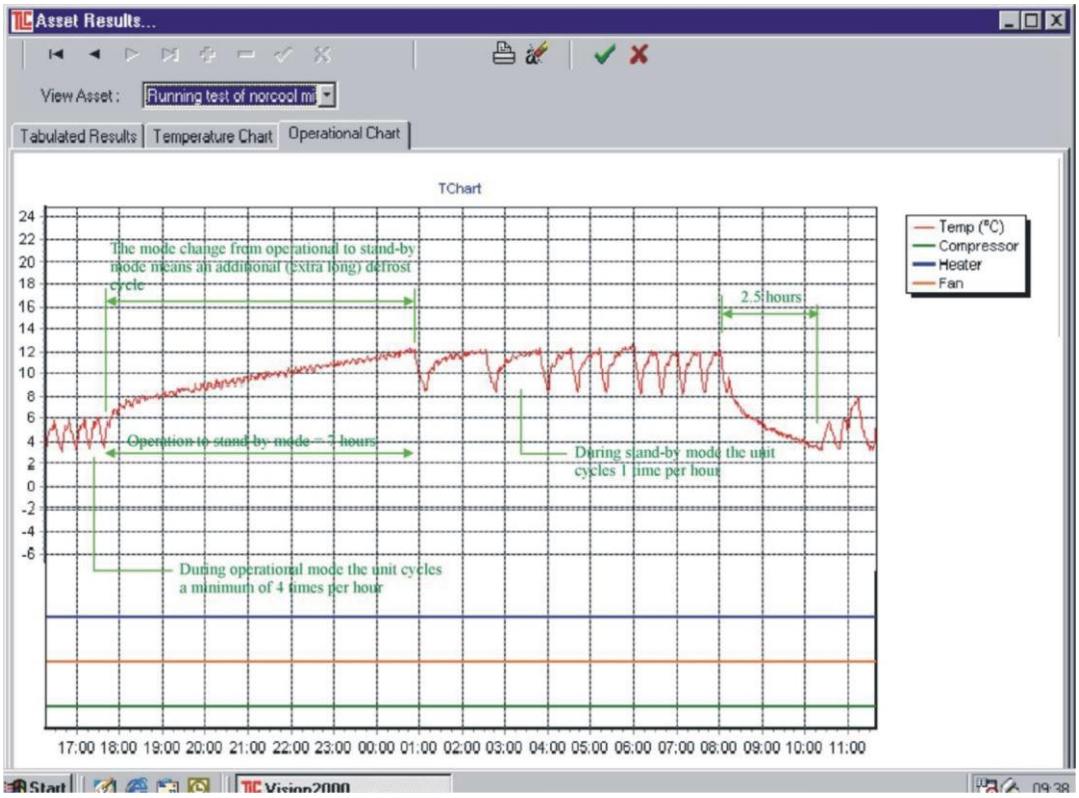
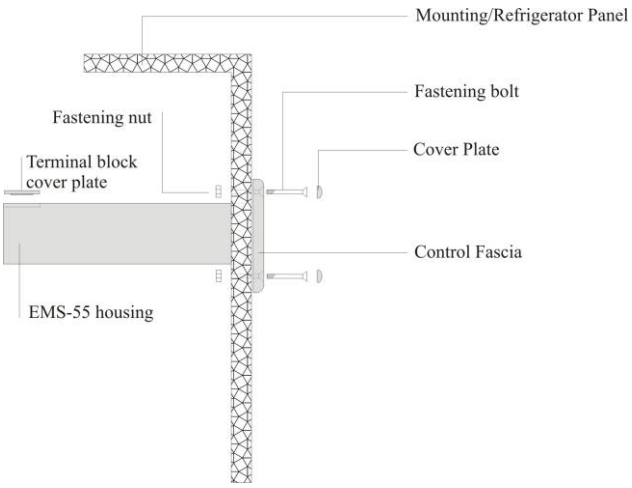


Fig. 1

Figure 1 shows a typical temperature graph. During stand-by period the temperature inside the appliance will rise to a higher (standby) level and the lights will be switched off.

INSTALLATION INSTRUCTIONS

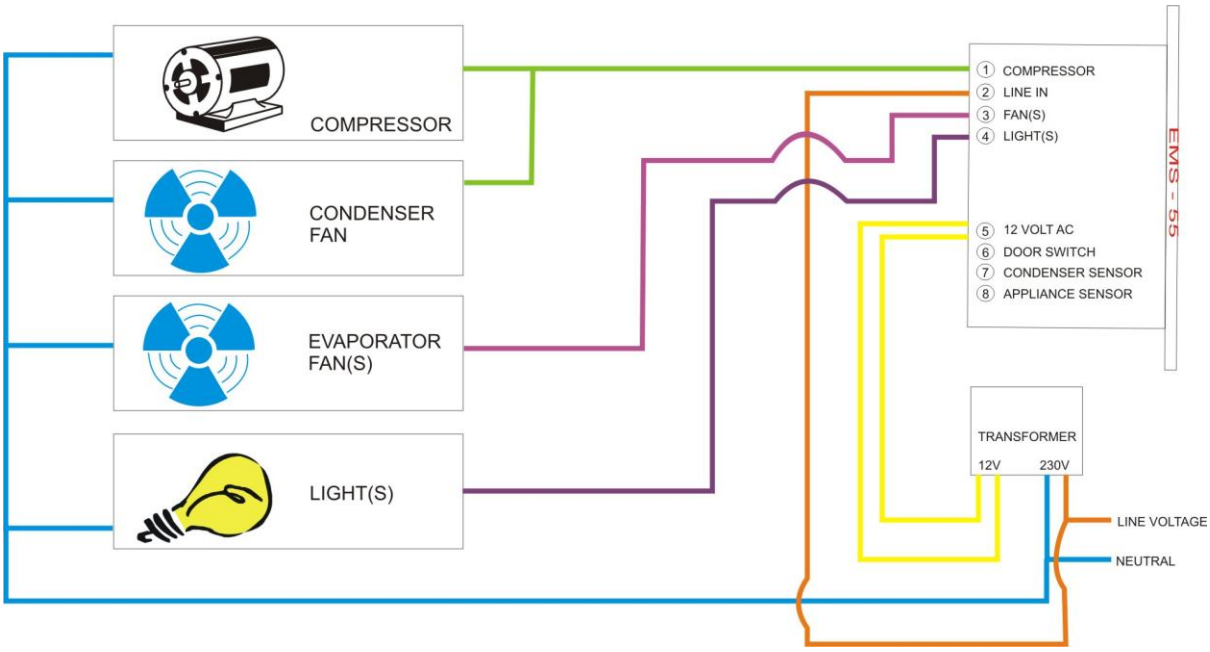
The EMS can be mounted either horizontally or vertically however, it is necessary when installing the EMS or RMD55 to ensure that the motion detection window has a clear and unrestricted view into the area in front of the cabinet.



CONNECTIONS

All line voltage connections are made via 6.5 mm spade terminals and all low voltage connections are made via screw terminal blocks. When installing the EMS it is recommended to use insulated connectors for all line voltage connections.

WIRING DIAGRAM



In addition to the above wiring diagram, a door switch should also be wired into the system. This connection must go directly from the door switch to the terminals on the EMS (see printed label on the control housing).

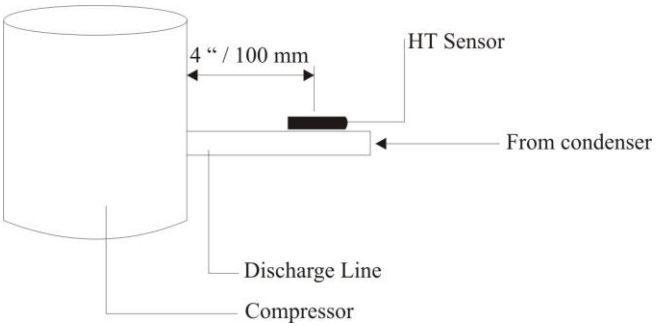
If a door switch is not used (not recommended) then a wire loop must be fitted to the door switch terminals on the EMS (see below).

LOCATING THE APPLIANCE SENSOR IN THE RETURN AIR

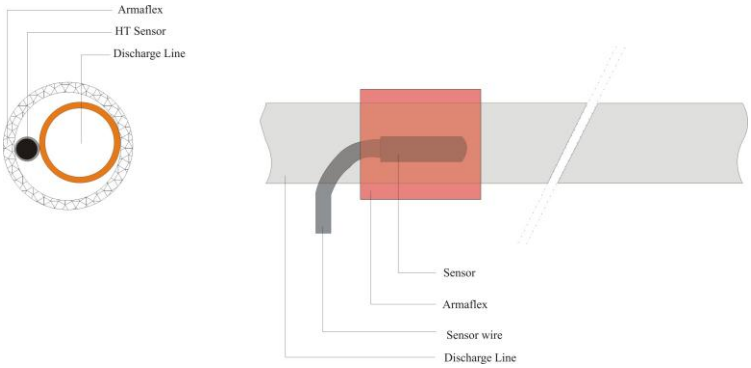
The most reliable and most accurate representation of the liquid temperature inside the appliance is the return air temperature. The air coming from the evaporator is, in the average cooler, between approximately -8 / -12 ^{O}C. This air is then distributed over the load of the appliance and therefore adopts the average temperature of the product it has been in contact with. By the time the air is returned to the evaporator it is an accurate representation of the (average) liquid temperature inside the cooler. It is for this reason that the EMS appliance sensor should be located in the return air.

LOCATING THE CONDENSER SENSOR

The EMS has a second temperature sensor for the discharge line, which is used to avoid the refrigeration system overheating. The compressor manufacturer will usually quote a maximum operating temperature measured at the top of the dome or on the discharge line 100mm away from the compressor. It is advised to locate the sensor on the discharge line.



To ensure more accurate sensing of the discharge line temperature it is advisable to cover both sensor and discharge line with an insulation material.



THE FASCIA MEMBRANE

The membrane cannot be removed from the control fascia, if attempted to do so, the membrane will be permanently damaged and cannot be re-used.

Membranes are available as spare-parts if so required, to order, contact the manufacturer of the control direct.

OPENING THE CONTROL

The EMS is ultrasonically welded together during its manufacture and thus any attempt to open the control will result in damage that cannot be rectified.

THE SELF LEARNING MODULE

The EMS is capable of learning the opening and closing times of the outlet where the appliance is located. During opening hours the control will switch the appliance to operational mode and during closing times the control will automatically switch the appliance to stand-by mode.

To achieve this each day is divided into 48 thirty minute periods and each period is represented by a single location in the EMS memory. Initially all the memory locations are set to zero (closed period) and are changed to a one (open period), if sufficient passers by or door openings are registered. When first installed, the cooler will run in operational mode for the first 48 hours (if the parameter AF=3). During this period the EMS will monitor the traffic in the vicinity of the cooler and will calculate its density to be high, medium or low. This is based upon the average number of motion counts and cooler door openings per day over the 48 hour period.

Category	Number of passers by registered per 24 hours	Number of door openings registered per 24 hours
Low traffic (0)	< 45	< 15
Medium traffic (1)	> 45	> 15
High traffic (2)	> 90	> 30

The EMS will then set the AF parameter automatically to one of the following:

- High traffic density setting (AF=2) will require 6 passers by or 2 door openings to register an active period
- Medium traffic density setting (AF=1) will require 3 passers by or 1 door opening to register an active period
- Low traffic density setting (AF=0) will require 1 passer by or 1 door opening to register an active period

After this initial period the control will start to learn the opening pattern of the outlet. For the next 24 hours (or if AF<3) the control will remain in operational mode. After this period and for the next six days it will act upon the pattern learnt during this 24 hours and will go into its standby mode during periods of inactivity (outlet closed periods). Once the first week has passed the EMS will implement the learnt pattern for each individual day whilst verifying that the data for that day is accurate. At the end of the second week the control will finish learning and will act upon the established activity pattern.

If the power to the EMS is lost, for whatever reason, then the matrix will remain in the memory for 3 days after this period the matrix will be lost. Once power is restored the EMS will relearn (see below).

To ensure that its firmware is suitable for all global time zones, the EMS is not subjected to “real time” but is operates purely upon days, hours, minutes and seconds.

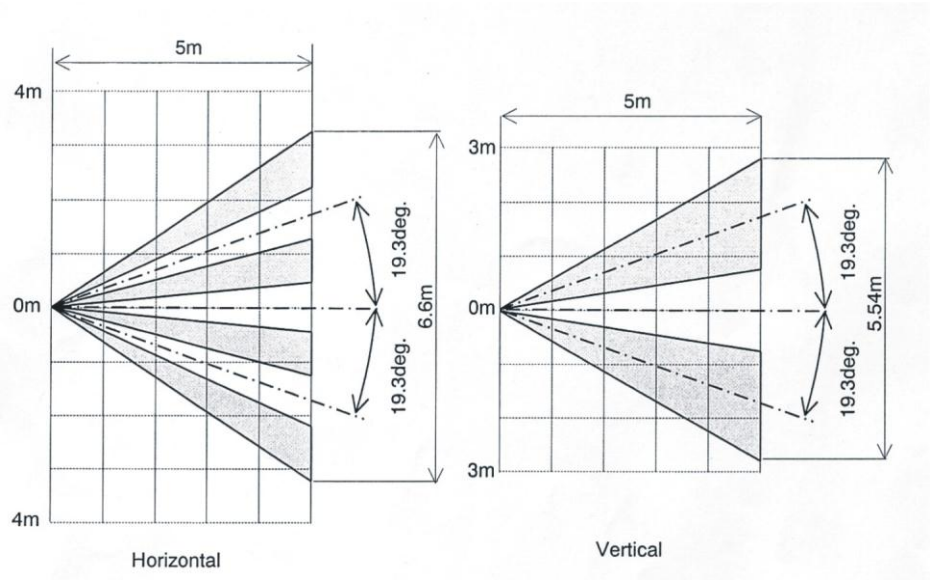
Components used to detect activity

For door openings

To detect door openings the EMS has an input for a door switch. This door switch must be a normally open type and as the contact is a dry (no current is involved) a switch with gold contacts or alternatively, a reed switch, may be used. Under no circumstances should the door switch be used to switch any load.

For passers by

To detect passers by a passive infra-red motion detector is used. This must be positioned so that it has an unrestricted view out of the front of the cooler. For the detector to function correctly it must not be placed behind glass.



The EMS55 has a motion detector integrated into the fascia of the control and the EMS-55-R has a connection for an external detector (RMD-55).

EMS-55 with integrated motion detector

EMS-55-R with external motion detector (RMD-55)

RE-LEARNING

If the outlet's business times change or the learnt pattern is incorrect then the EMS will automatically relearn. Under these circumstances the original pattern will be erased and the learning process will begin again from day 1. Please note that the activity frequency will not be recalculated during a relearn. For a relearn to occur the EMS must detect movement or the door being opened during a stand by period. (The EMS can only relearn if it has finished learning).

ERASING THE EMS MEMORY

Half factory reset

If required, the learnt pattern can manually be erased by the using the following procedure:

Disconnect the power to the control (unplug the cooler), push and hold the defrost button and restore the power. Keep the button pressed until the display shows the temperature again, release the button and the matrix will be erased. The control will then start to relearn. (During this procedure there will be a short period when the display is blank)

Full factory reset

A full factory reset will erase the matrix, reset all parameters to the default and reset all the statistics including the compressor running hours.

Disconnect the power to the control (unplug the cooler), push and hold the set and defrost buttons and restore the power. Keep the buttons pressed until the display shows the temperature again, release the buttons and the reset will be complete. (During this procedure there will be a short period when the display is blank). The control will then start to relearn. If the parameter AF default setting is 3 then the control will relearn its activity frequency. This reset is only applicable if the compressor is renewed or the default parameters need to be restored.

SOFT START FUNCTION

When a motor starts the start up current can be up to 6 times the running current, which means that when a compressor starts the current drawn could be up to 36 amperes for a running current of 6 amps (This inrush will only last a few milliseconds).

This start-up current in an electric motor is unavoidable but yet the total inrush current can be minimised by starting the motors at intervals. For example, rather than 2 motors starting at the same time they can be started separately and this is exactly what the EMS does so as to minimise the start-up current.

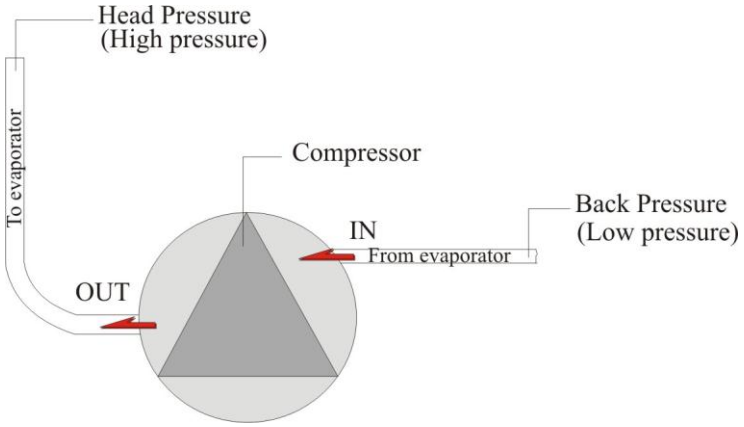
The delay between the start of the compressor and evaporator fans is approximately 20 seconds (this value is not programmable).

MINIMUM COMPRESSOR REST TIME

This feature is designed to avoid unnecessary damage to the compressor (the most expensive component) of the refrigeration system. When the compressor runs it generates a head pressure and a back pressure in the refrigeration system. This pressure remains in the system for a period when the compressor stops but it slowly equalises due to leakage in the valves. Testing has shown that equalisation of these pressures takes approx. 2 minutes and it is for this reason that the EMS has a minimum compressor rest time. (This value is adjustable by means of parameter RT and its default setting is 3 minutes).

The minimum compressor rest time avoids:

- High peak current through the windings of the compressor motor
- Switching off on the thermal overload protection
- Short cycling of the system



When a thermostat in a refrigeration system detects its pre-set temperature it switches off the compressor. If after a short period the door of the cooler is opened, the thermostat may achieve its switch on temperature very quickly. As there still may be high pressure in the outlet side of the compressor, an extremely high torque is required to restart the system. If the compressor is a non-capacitor start type then this may cause the system to switch off on its thermal overload protection. If this occurs it can take as long as 5 – 10 minutes before the thermal overload is restored. If the compressor is a capacitor (assisted) start type then the capacitor will provide the extra current needed to push through the existing pressures. However, the (unwanted and damaging) peak current will be conducted through the windings of the compressor. If however the pressures in the system are allowed to equalise then an early restart is prevented. Therefore the peak current drawn by the compressor would be kept to a minimum value.

AUTOMATIC DEFROST MANAGEMENT

To avoid "icing-up" of the cooler, the EMS automatically performs a periodic off cycle defrost depending upon the setting of parameters DE (defrost intervals) and DD (defrost duration). However, if the defrost cycle occurs during a high traffic period i.e. frequent door openings of the cooler, then the defrost cycle will automatically be terminated. This termination is based upon the temperature in the appliance and can be adjusted by parameter Dt (defrost termination temperature). The combination of frequent defrosts and the mode change from operational to stand-by will avoid the cooler icing up.
Keeping the evaporator of a cooler free of ice/frost development enhances the heat exchange and maintains the efficiency of the refrigeration system. If required a manual defrost can be performed by pressing the defrost button for 5 seconds. If the cabinet temperature is above the termination temperature then a manual defrost is inhibited.

VOLTAGE MANAGEMENT PROTECTION SYSTEM

Under voltage and to a lesser extent over voltage is damaging to an electric motors windings. The EMS is programmed with a Voltage Management Protection System to avoid unnecessary damage to the compressor when the appliance is installed in areas where the supply voltage is unstable. The line voltage centre differs around the world and therefore the switching levels are programmable to ensure that the EMS is suitable for worldwide use. When the system has switched off due to high voltage the display shows the letters "SHI" (supply high) and when switched off due to low voltage the display shows the letters "SLO" (supply low)

Please note that the EMS-55 does NOT rectify the voltage but merely monitors it and switches the refrigeration system on and off if the supply voltage falls below or rises above, the limits programmed in parameters HI and LO.

Below is the table with the value details for HI and LO parameters for the various voltages used throughout the world.

110V - 120V Line voltage

Line voltage	LO parameter value	Line Voltage	HI parameter value
95V	120	125V	175
98V	125	131V	180
100V	130	135V	185
103V	135	138V	190
106V	140	141V	195

220V – 240V Line voltage

LO parameter value	Line Voltage	HI parameter value	Line Voltage
130	173V	190	230V
135	178V	195	235V
140	182V	200	240V
145	187V	205	245V
150	192V	210	250V
155	197V	215	255V
160	203V	220	260V
		225	265V

100V Line voltage (Japan)

Line voltage	LO parameter value	Line Voltage	HI parameter value
79V	120	104V	175
81V	125	110V	180
84V	130	114V	185
87V	135	118V	190
90V	140	122V	195

SWITCHING THE LIGHTS ON/OFF

The EMS automatically controls the lights of the cooler and will switch them off during stand-by and back on during operational periods.

MANAGING THE INTERNAL FAN(S)

The EMS switches the internal evaporator fan(s), which gives the following benefits.

- During periods when the compressor is off the fan(s) will cycle and not only will this save energy but will increase the life expectancy of the fan(s) themselves.
- When the cooler door is opened, the fan(s) are switched off (even when the compressor is running). This means that the cold air in the cooler will not be pushed out and no ambient (warm) air will be drawn in.
- During an uninterrupted pull down the fan(s) will be run continuously even if the door is open.

THE DOOR OPEN ALARM

If the door of an appliance is accidentally left open the following would result:

- A rise in temperature of the load inside the appliance
- A substantial waste of energy to restore the required situation
- Additional and unnecessary running hours for the refrigeration system

The EMS monitors the door status by means of the door switch. If the cooler door is left open for the period set in parameter AD, then an internal buzzer will sound to attract attention. To avoid irritation caused by this alarm, the buzzer will sound for the length of time set in parameter B1. If the door is still open after the buzzer has sounded then the EMS will close down the refrigeration system and will not restart it until the door is finally closed. This function also means that the refrigeration system is not continuously running during a cabinet reload.

THE BLOCKED CONDENSER WARNING SYSTEM

If the condenser of a refrigeration system is blocked, the result is a rise in temperature of the discharge line and condenser.

The fact however, is that the final 20-30 % of the blockage generates a high rise in discharge temperature and therefore can be used as a positive signal.

Other causes of overheating can be:

- Extreme ambient temperatures
- The appliance being enclosed etc.
- Undersized condenser
- Oversized compressor/displacement etc.

To detect overheating the condenser sensor must be connected and then attached to the discharge line. When the system achieves the alarm temperature, the system will be switched off and the alarm notification will appear on the display of the control. To reset this alarm the UP button must be pressed.

THE REFRIGERATION SYSTEM FAILURE WARNING

The most common failures in a refrigeration system are:

- Blocked condenser
- Condenser fan failure
- Evaporator fan failure
- Refrigerant leak
- Blockage (capillary systems only)
- Electrical fault

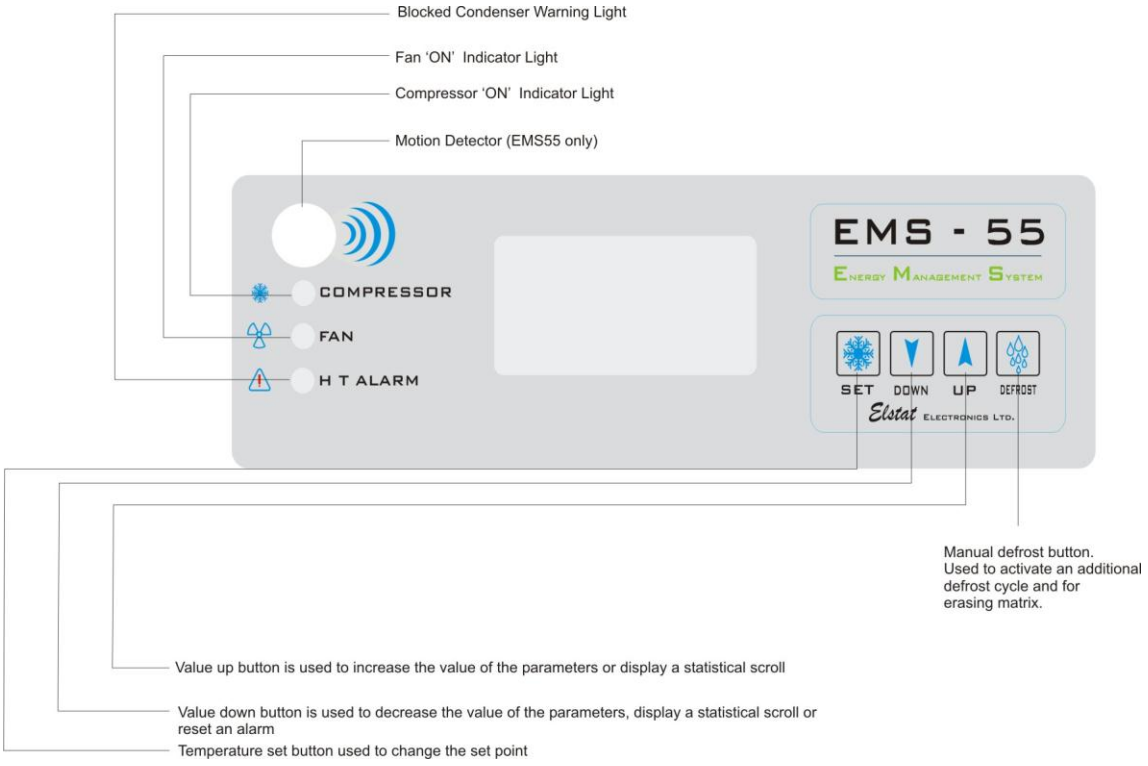
These failures can result in inefficiency or breakdown of the system. If not rectified these can and eventually damage the refrigeration system, for which the worst and most costly is damage to or even a burn out of the compressor.

The EMS monitors the time taken to achieve the set point (parameter CT) and if it is not reached in the set time interval then the refrigeration system will be shut down. In this case the display will show the letters “RSF” (Refrigeration System Failure). To reset this alarm the DOWN button must be pressed.

UNINTERRUPTED PULL-DOWN FUNCTION

If the temperature in the appliance rises above the value set in parameter IPD then the EMS will perform an uninterrupted pull down. This means that the refrigeration system will be activated and all defrost cycles will temporarily be suspended. This is to ensure that the load in the cooler is reaches its set temperature in the shortest possible time. In practical circumstances this will occur after, for example, a re-load. If the cooler is in operational mode the temperature will be reduced to operational level but when the cooler is in stand-by mode the temperature will be reduced to stand-by level.

BUTTON COMMANDS AND FASCIA LAY-OUT



Motion detection sensor

The motion detection sensor is fitted with a lens to enhance the detection range and angle.

Compressor “on” indicator light

This is a green LED that illuminates each time the compressor is running.

Fan “on” indicator light

This is a green LED that illuminates each time the (internal) fan(s) is running.

H T Alarm light

This is a red LED that only illuminates when the temperature on the discharge line rises above the preset parameter temperature. This overheating is often caused by a blocked condenser but can also be caused by a lack of ventilation to and from the refrigeration system.

LED Display

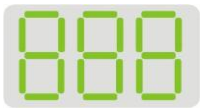
The EMS 3 digit LED display may show any of the following:

During power up the display initially shows 8.8.8. followed by two codes. The first code (e.g. E46) indicates the firmware version programmed into the control. The second code indicates the default parameter version (e.g. S04). During the development various upgrades have been produced and are recognised by these unique codes.

During operational mode the display will show the current appliance sensor temperature.

When the cooler is in stand-by mode or if the door has been left open for a long period then the display will show three bars - - -.

During normal operating mode press the SET button to access the Set Point. This represents the compressor cut out temperature during operational mode.



The system is in freeze up protection mode, which means that the temperature in the appliance is below the value set in parameter DTT. Whilst in this mode the EMS will inhibit the compressor and run the evaporator fan(s) continuously.

The EMS is performing a defrost cycle.

The door(s) of the appliance is open.

Refrigeration system failure on the display indicates that the set point has not been reached during the time period set in parameter Ct.

Supply Low. The line voltage has dropped to a level that may cause damage to the compressor. The EMS will not restart the compressor until the voltage reaches a safe level again.

Supply High. The line voltage has increased to a level that may cause damage to the compressor. The EMS will not restart the compressor until the voltage reaches a safe level again.

A probe failure alarm indicates that the EMS has lost communication with the temperature sensor(s). This may be caused by a loose connection at the terminal block connection or the probe itself may be faulty.

THE CONTROL SETTINGS

The EMS has the following parameter values:

EMS-55 Parameter Default Settings

Parameter	Description	Degrees C Range	Units
SP	Set Point	See US & LS	°C
US	Upper Set Point	0-10	°C
LS	Lower Set Point	0-10	°C
DIF	Differential	0.0-9.9	°C
CAL	Calibration	+/-9.9	°C
RT	Minimum Rest Time	1-30	Minutes
DS	Delay to Stand-by	0-120	Minutes
LD	Light Switch Off Delay	0-120	Minutes
SR	Stand-by Restart Period	0-240	Minutes
CT	Refrigeration System Time Elapse	1-100	Hours
CF	Display in °C or °F	0 or 1	Number
SSP	Stand-by Set Point	0.0-9.9	°C
SD	Stand-by Differential	0.0-9.9	°C
IPD	Uninterrupted Pull Down Activation Temperature	0-80	°C
DTT	Activation Temperature for Freeze Up Protection Mode	-10-50	°C
DE	Defrost Interval	1-199	Hours
DD	Defrost Duration	1-199	Minutes
DT	Defrost Termination	1-80	°C
FCO	Evaporator Fan Cycle On Time	1-30	Minutes
FCF	Evaporator Fan Cycle Off Time	1-30	Minutes
FSP	Fan Set Point	0-80	°C
HT	Blocked Condenser Temperature Alarm	50-250	°C
D2	Display Stability	1-254	Units
HI	Over Voltage Protection	90-250	Units
LO	Under Voltage Protection	90-250	Units
BO	Buzzer Enable/Disable	0 or 1	Off/On
B1	Alarm Buzzer Sounding Time	1-254	Seconds
AD	Alarm Delay	1-30	Minutes
AF	Activity Frequency	0= Low 1=Medium 2=High 3= Auto	Unit
PER	Perishable mode	0 or 1	Off/on

HOW TO ENTER THE PARAMETER LIST

The parameters can only accessed with a special and unique sequence. The sequence is as follows:

Step 1 Switch the power to the control off
Step 2 Push and hold the set button
Step 3 Switch the power to the control back on
Step 4 Keep the set button pressed until the word “PAS” appears on the display
Step 5 Release the set button
Step 6 Push the set button 3 times
Step 7 Push the value down button (second button from the left) once
Step 8 Push the value up button (third button from the left) twice
Step 9 Push the defrost button (fourth button from the left) 4 times

The first parameter “US” will now appear on the display, which means that you have entered the parameters. If the display does not show the letters US then follow the procedure again from the start (step 1)

CHANGING PARAMETER SETTINGS

Once the parameters have been entered the following button functions are applicable:

- Set button. Scroll from parameter to parameter
- Down button. To reduce the value of the current parameter.
- Up button. To increase the value of the current parameter.

In parameter mode, the display will show firstly the parameter and then the current value.

Scroll through the parameter list until the desired parameter is shown. Then alter the value by pressing up or down button. Once the desired values are set allow the EMS to show the temperature again.

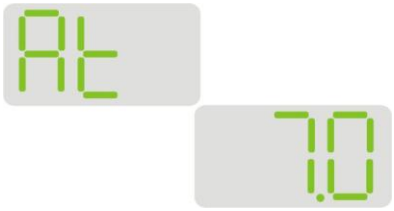
EMS-55 PARAMETERS

Parameter	Description
SP	This parameter sets the compressor cut out temperature during operational mode. This is accessed by pressing the SET button and is not present in the parameter scroll.
US	Upper set point. Sets the upper limit of the operational set point i.e. the user will not be able to set the control to a temperature higher than this value.
LS	Sets the lower limit of the operational set point i.e. the user will not be able to set the control to a temperature below this value.
dIF	Differential. Added to the operational set point to give the compressor cut in temperature during normal cycling.
CAL	Calibration. Can be used to calibrate the appliance sensor or to add an offset to aid in positioning of the sensor.
Rt	Compressor rest time. The minimum time the EMS will wait, after reaching the set point, before allowing the compressor to restart regardless of whether the cut in temperature has been reached.
dS	Delay to stand by. The time period that the EMS will wait after the outlet has closed, before going into its standby mode. Must be set to a multiple of 30
Ld	Light delay. The time the control will wait after the time set in parameter dS has expired, before switching off the cabinet lights. Must be set to a multiple of 30.

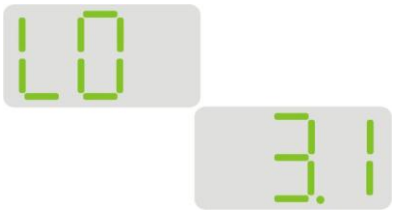
Sr	Stand-by restart. To ensure that the product is at the correct temperature when the outlet opens, the EMS will switch to operational mode before hand. This parameter sets this period. Must be set to a multiple of 30.
Ct	Refrigeration System Failure. This parameter sets the maximum continuous compressor run time without the set point being reached. If the set point temperature is not reached then the EMS will switch off the refrigeration system and give a warning.
CF	The EMS can be set to display the temperature in either ^{o}C or ^{o}F
SSP	Stand-by set point. This value is added to the operational set point to give the cut out temperature during stand by.
Sd	Stand-by differential. This parameter, when added to the operational and standby set point, will give the cut in temperature, when the EMS is in standby.
IPd	Uninterrupted Pull Down. When the temperature in the cabinet exceeds the value set in this parameter the EMS will automatically perform an uninterrupted pull-down. This means that no defrost cycle will be performed and is to ensure that after a re-load the temperature of the product is brought down as quickly as possible.
Dtt	Freeze up protection. If the appliance probe temperature drops below the value set in this parameter then the EMS will inhibit the refrigeration system until the temperature rises above the set point.This sets the activation temperature for freeze up protection mode.
DE	Defrost intervals. This parameter sets the period between defrost cycles.
Dd	Defrost duration. This parameter sets the maximum time a defrost cycle can be.
Dt	Defrost termination. When the temperature in the cabinet rises above the value set in this parameter then the EMS will terminate the defrost cycle.
FCO	Fan cycle ON time. During the off cycle of the compressor, the evaporator fan will cycle. This parameter sets the fan ON time.
FCF	Fan cycle OFF time. As above but for the OFF time.
FSP	Fan Set Point. If the cabinet temperature rises above the value set in this parameter then the evaporator fan run continuously even if the door is opened. Once the set point has been reached, the fan will then switch off during door openings.
HT	High Temperature. This parameter sets the maximum allowable temperature of the discharge line.
D2	Display stability. This should not be altered for normal operation.
HI	High Voltage. The EMS monitors the mains line voltage for fluctuation. This parameter sets the maximum limit for over voltage. (see table)
LO	As above but for the minimum limit for under voltage. (see table)
B0	Buzzer enable/disable.
B1	Buzzer duration. If the cabinet door is left open then the buzzer will sound for this period of time before the EMS disables the refrigeration system.
AD	Alarm Delay. This sets the delay between a door open alarm occurring and the buzzer activating.
AF	Activity Frequency This parameter sets the number of door openings/motion counts to signal an active 30 minute period. If the is set to 3 then the EMS will automatically learn whether the cabinet is situated in a low, medium or high traffic location.
PER	Perishable mode. This allows the EMS to keep the operational set point and differential during standby periods.

ACTIVATING A STATISTICS SCROLL

To activate a statistics scroll press the UP and DOWN buttons simultaneously. During a statistics scroll the display firstly shows the statistic and then its reading. Each reading is displayed for approx. 20 seconds to enable the user to write the values down. After the control has completed the statistics scroll the display will automatically return to its standard duties.

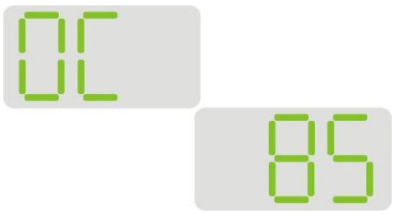


Average temperature

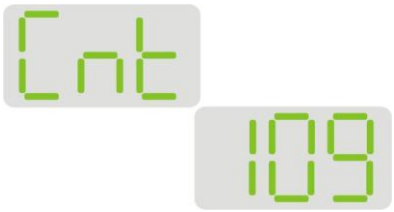


Lowest registered temperature

Highest registered temperature



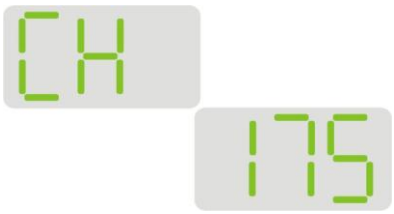
Door opening counts



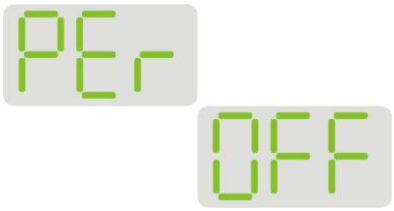
Motion counts (passers by)

Traffic density setting

Compressor cycles



Compressor running hours



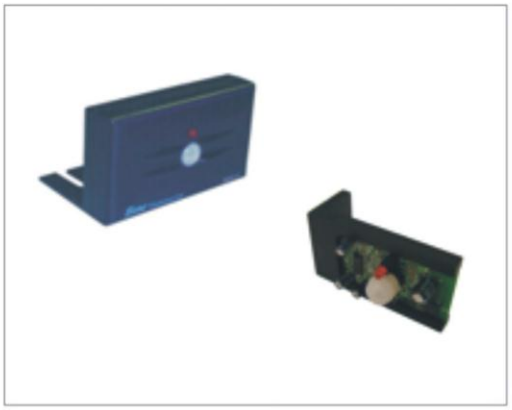
Perishable mode (on/off)

Statistic	Reporting period	Description
Average temperature	24 hours	Continuously calculated from the highest and lowest registered temperature.
Lowest registered temperature	24 hours	The lowest temperature for the last 24-hour period.
Highest registered temperature	24 hours	The highest temperature for the last 24-hour period.
Door opening counts	7 days	This is a daily moving average over a seven-day period. The display will report the count as follows:1 – 999 door openings: The display will show 1 to 999 1,000 – 99,999 door openings: The display will show 1.0 for 1000 to 1049 cnts 1.1 for 1,050 to 1,099 cnts 1.2 etc. The maximum count therefore is 99,999
Motion counts (passers by)	7 days	As door opening counts
Traffic density setting	0 – 1 – 2 or 3	The system recognises low, medium or high traffic but can also manually be set at one of these values. This statistic shows the current automatically or manually chosen setting.
Compressor cycles	24 hours	As per motion counts.
Compressor running hours	Running total	This will be a running total unless a factory reset is applied which will erase ALL data in the control. When the memory is erased in the field the compressor running hours remain but all other statistical values are erased. The total maximum count is 99,999, which equals (calculated at 10 running hours/day) 9,999.9 days, which equals 27.4 years.
Perishable mode	0 or 1	Mode off or on

THE PRODUCTS

EMS55

EMS55-R



Remote Motion Detectors

Transformer

Sensor wire

Reed Switches

TECHNICAL DATA

Input voltage	12 Volt AC (from Elstat transformer)
Maximum switch capacity per UL rating (120VAC/230VAC)	Compressor 16 A FLA, 96 A LRA 0.4 – 0.5 p.f. Fan relay 4.4 A FLA Light relay 2.2 A FLA
Maximum switch capacity per VDE rating (120VAC/230VAC)	Compressor 12 A , p.f. 0.6 Fan relay 6 A , p.f. 0.6 Light relay 2.08 A , p.f. 0.3 (fluorescent lamps 500 W)
Accuracy	Appliance sensor 0.5 ^{O}C Condenser sensor +/- 5 ^{O}C
Resolution	0.1^{O}C
Display	15 mm – 7 segment – LED
LED/display colour	Green
Sensor(s)	Thermistor (NTC)
Sensor wire length	1 @ 1.5 mtr +/- 2.5 % 1 @ 2.5 mtr +/- 2.5 % *Different lengths available upon request.
Step down transformer	230Vac/ 12 Vac 120Vac/12Vac 100Vac/12Vac (Japan only)
Housing material	Black Polycarbonate (Lexan-940)
Maximum ambient operating temperature	65^{O}C. (55 ^{O}C in USA)
IP rating	Front 65 / Rear 10
Motion detection range	5 metres in front of detector
Connections: Line voltage Low voltage	Spade terminal 6.35 x 0.8 mm. Screw terminal connections

APPROVALS

CE	European Low Voltage Directive
VDE	Verband der Elektrotechnik
UL	Underwriters Laboratories Inc.

Please note that this manual is based upon EMS firmware version E46. Please see supplement sheet which states the differences between E46 and the older firmware version E43.

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SUPPLEMENT

E43 AND E46 FIRMWARE DIFFERENCES

Standard EMS firmware version has been updated from E43 to E46, for which the following changes have been made:

1. The display will show the cabinet temperature during operational mode rather than showing USE.
2. The set point, differential, standby set point and standby differential can be set in 0.1 degree increments.
3. A new parameter PER (perishable mode) has been introduced which means the operational set point and differential are used during standby mode. This parameter is now listed in the statistics scroll.
4. The standby set point is now added to the operational set point to give the cut out temperature during standby.
5. The HT alarm must now be reset manually by pressing the DOWN button.
6. The display stability (parameter D1) has been altered so that it changes only in 0.1 degree steps.