The Sollatek **FF Evocool** Control System Firmware Specifications

User Instructions

Important: This manual contains important safety instructions.
Keep this manual handy for reference.

- Before using this product please read all instructions carefully.
- Keep these instructions for future reference.
- All specifications are subject to change without prior notice.

Sollatek™
Intelligent Controls

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The FFA contains lethal voltages. Only authorised personnel should work on it.

1.1 THE DANGERS FROM ELECTRICITY

Harm can be caused to any person when they are exposed to 'live parts' that are either touched directly or indirectly by means of some Conducting object or material. Voltages over 50 volts AC or 120 volts DC are considered hazardous.

Most electrical accidents occur because individuals:

- Are working on or near equipment which is thought to be dead but which is, in fact, live.
- Are working on or near equipment which is known to be live, but where those involved are without adequate training or appropriate equipment, or they have not taken adequate precautions.
- Misuse of equipment or use electrical equipment which they know to be faulty.

1.2 REDUCING THE RISK OF ELECTRIC SHOCK

To reduce the risk of electric shock:

- Install the FFA in an area free of conductive contaminants. Ambient temperature must not exceed 60°C.
- Isolate the power to the FFA before removal.
- Use tools with insulated handles.

1.3 FIRST-AID

Before commencing any work:

- Find out the location of a suitably stocked first-aid box
- Find out the arrangements that exist on site for first-aid, and who is responsible for taking charge of these.

2.1 DESCRIPTION

The FFA is the main base unit to which other modules can be connected. Equipped with up to 5 outputs depending on model

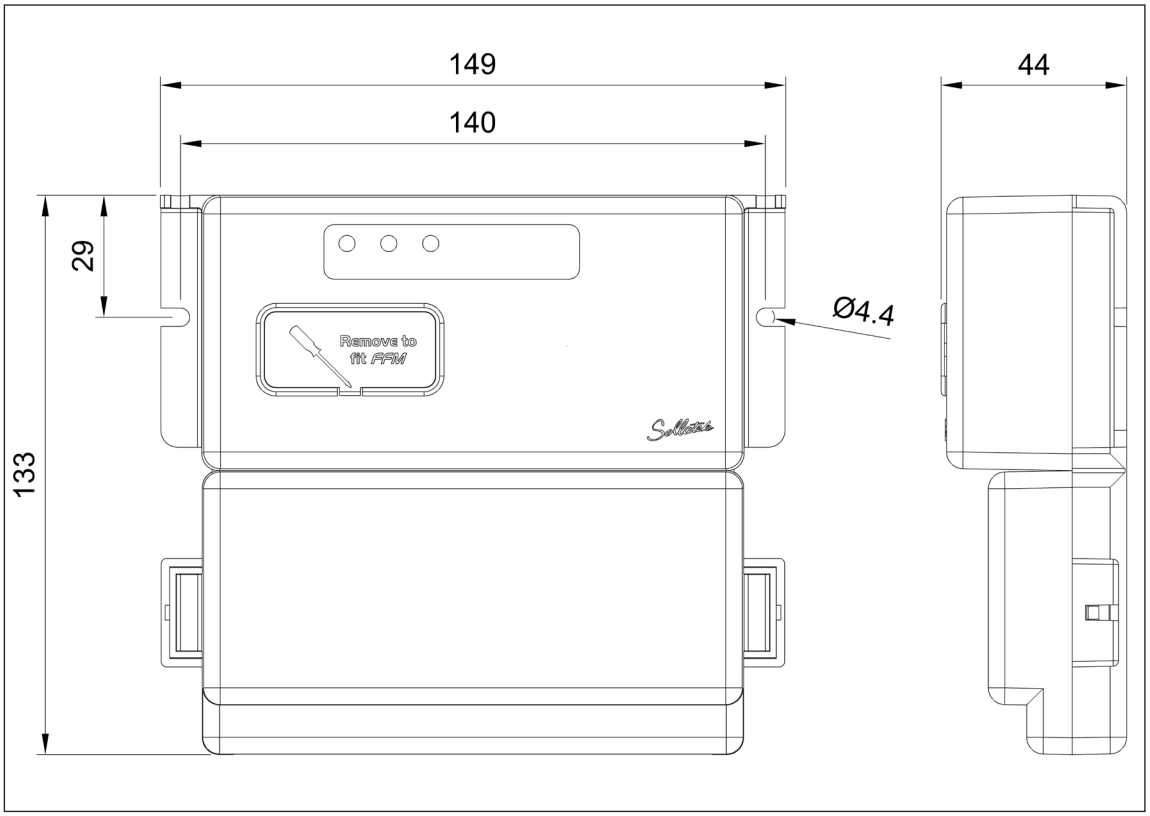
2.2 FEATURES:

- Temperature control
- Energy saving
- Voltage protection
- Display interface
- Connections to FFT, FFS
- Microcontroller controller
- Aperture for FFM plug-in module
- Conformal coated circuit board
- SELV isolation
- Wide input voltage range option

2.3 TECHNICAL SPECIFICATION

Nominal voltage	230 V AC
Operating voltage	230 V -26% to +22%
Voltage range	180V to 265 V AC
Withstand voltage	300 V
Frequency	45-65 Hz
Firmware features	Multiple, see separate firmware specification
Indicators	3 off LEDs
Probe inputs	4 x NTC 100K Ohm
Other inputs	Door switch, pressure switch
Outputs (x3 + 2)	Compressor, evap fan, lights, condenser fan*, heater*. AC and DC switching certified relay for lights, evap, and condenser fan*
Compressor relay (x1)	8(6) A, 240 V AC, 100,000 cycles
Evaporator fan relay (x1)	1(1) A, 240 V AC, 400,000 cycles. Or 2 A, 24 V Dc, 400,000 cycles
Lights relay (x1)	2(2) A, 240 V AC, 10,000 cycles. Or 4 A, 24 V DC (LED), 10,000 cycles
Condenser fan relay* (x1)	1(1) A, 240 V AC, 400,000 cycles. Or 2 A, 24 V Dc, 400,000 cycles
Heater relay* (x1)	x(x) A, 240 V AC, 100,000 cycles
Relays	HC compatible to IEC60079-15
Labels	Front label, serial label
Mounting	Chassis mount with two screws
Temperature range	-20 to +60ºC (To be tested and confirmed)
Size	149 x 133 x 44 mm
Weight	342 g
IP rating	IP24
Approvals	CE, EN 60529, IEC 60730-1: 2010, IEC 60730-2-9:2008 + A1

2.4 DIMENSIONS



2.5 ELECTRICAL WIRING CONNECTIONS

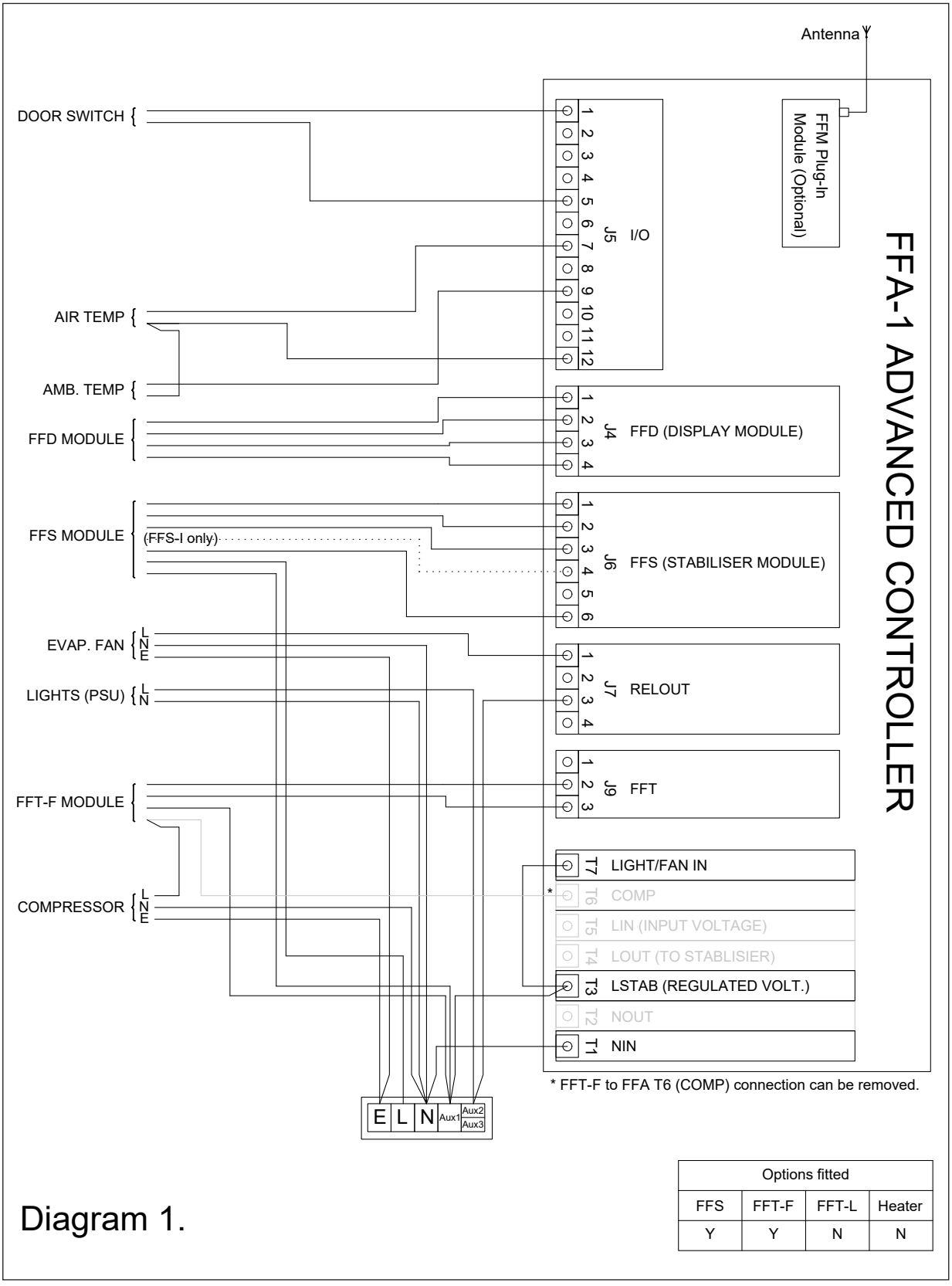
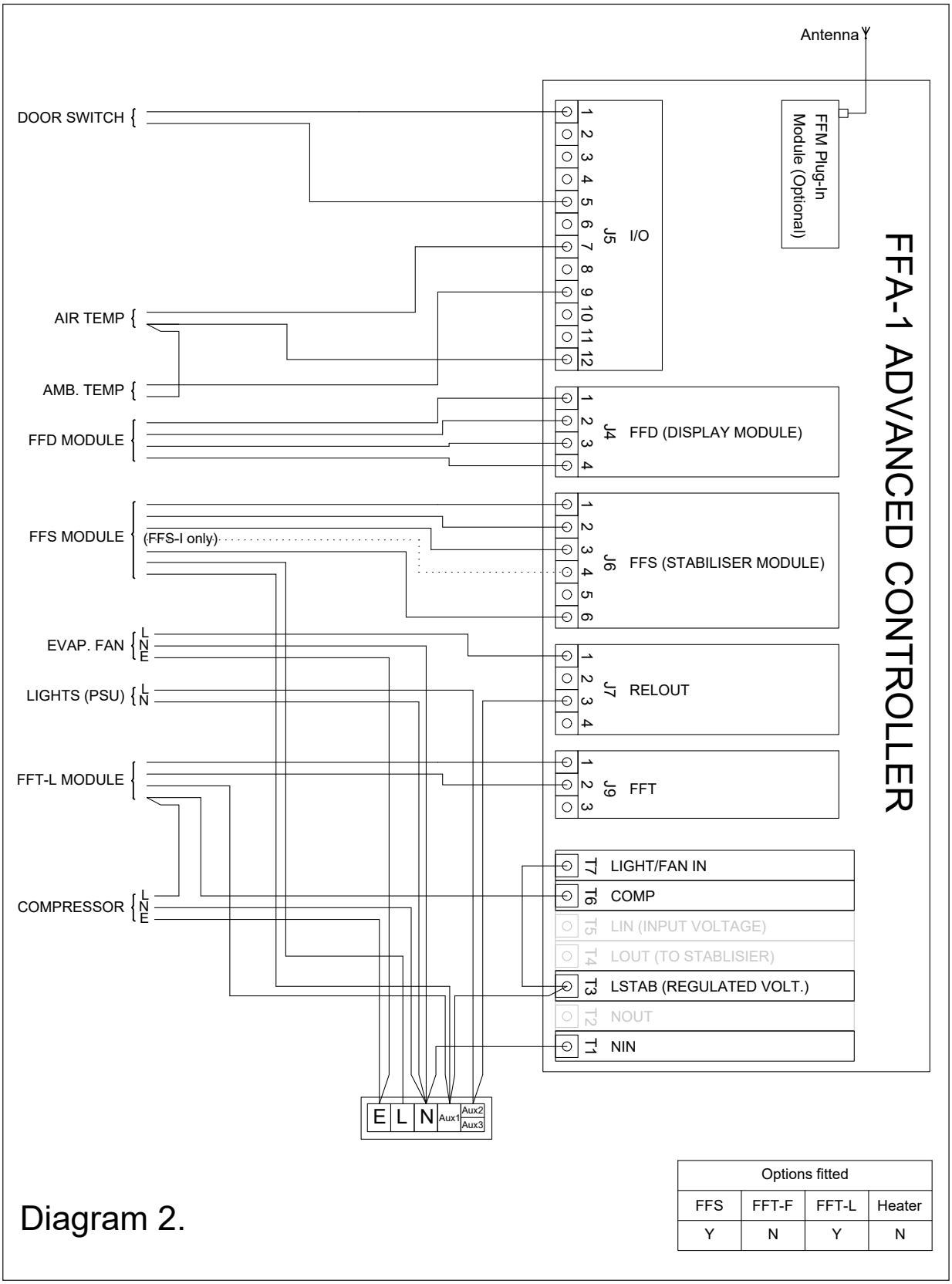


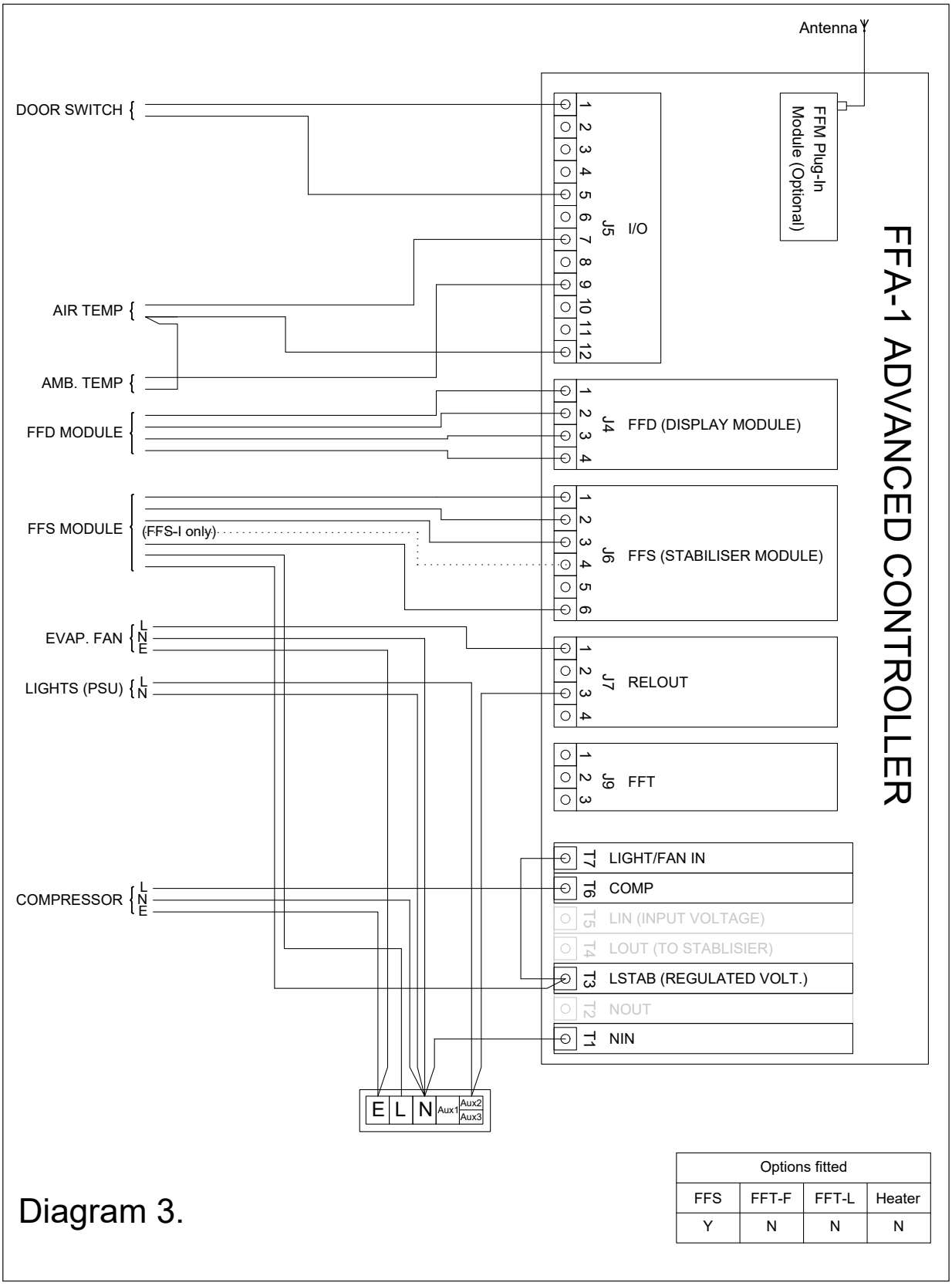
Diagram 1.

Options fitted			
FFS	FFT-F	FFT-L	Heater
Y	Y	N	N



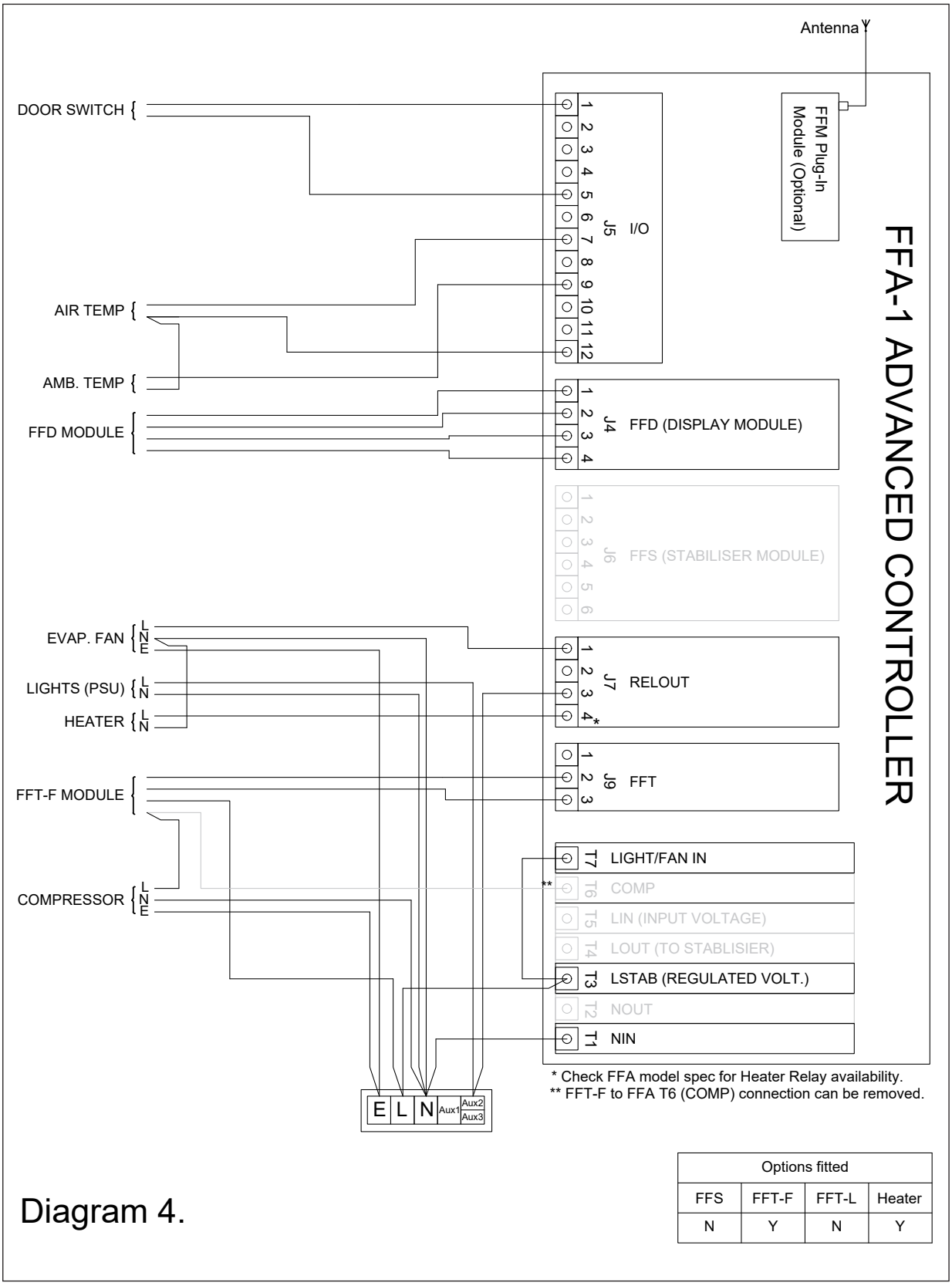
Options fitted			
FFS	FFT-F	FFT-L	Heater
Y	N	Y	N

Diagram 2.



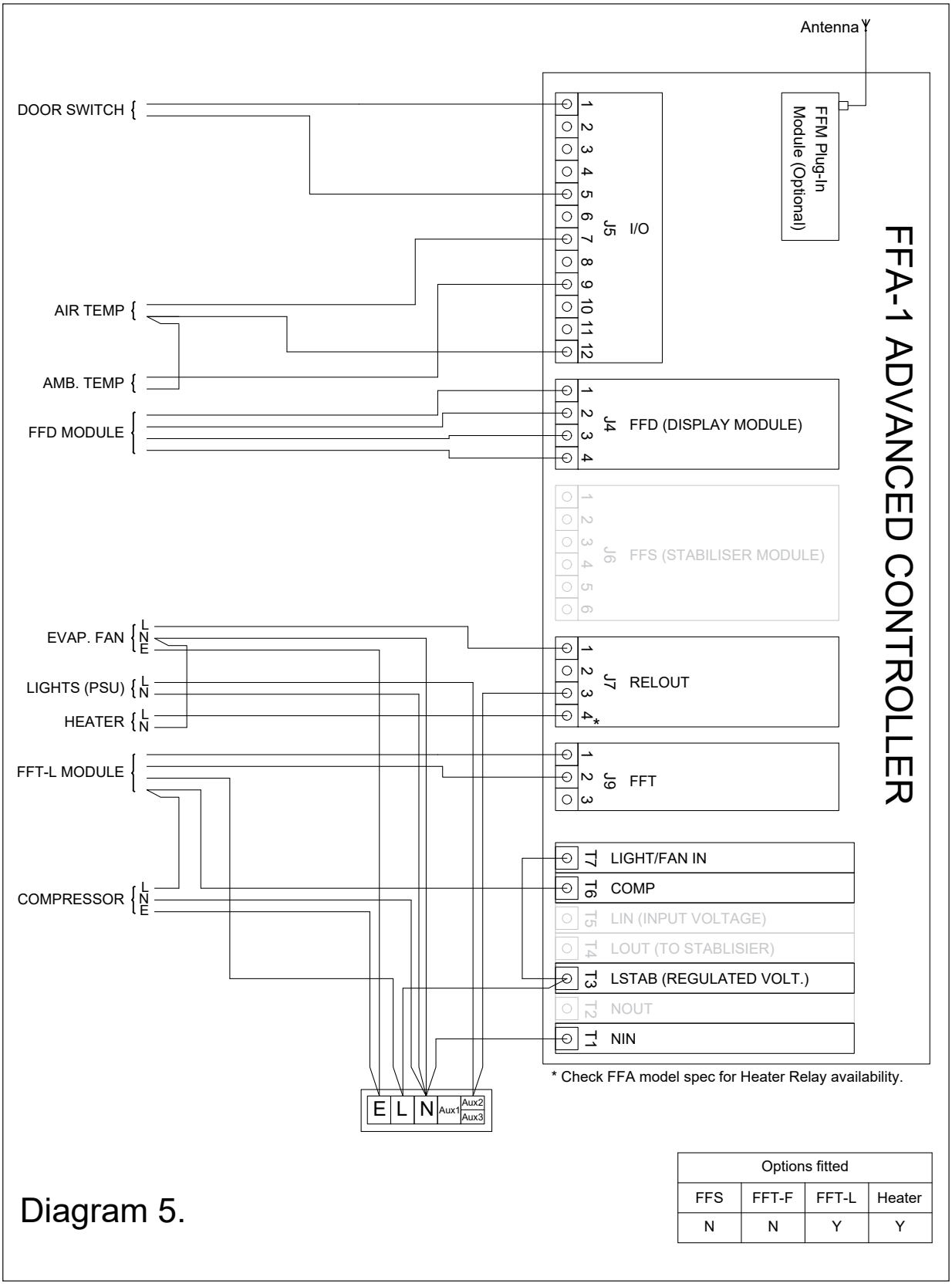
Options fitted			
FFS	FFT-F	FFT-L	Heater
Y	N	N	N

Diagram 3.



Options fitted			
FFS	FFT-F	FFT-L	Heater
N	Y	N	Y

Diagram 4.



Options fitted			
FFS	FFT-F	FFT-L	Heater
N	N	Y	Y

Diagram 5.

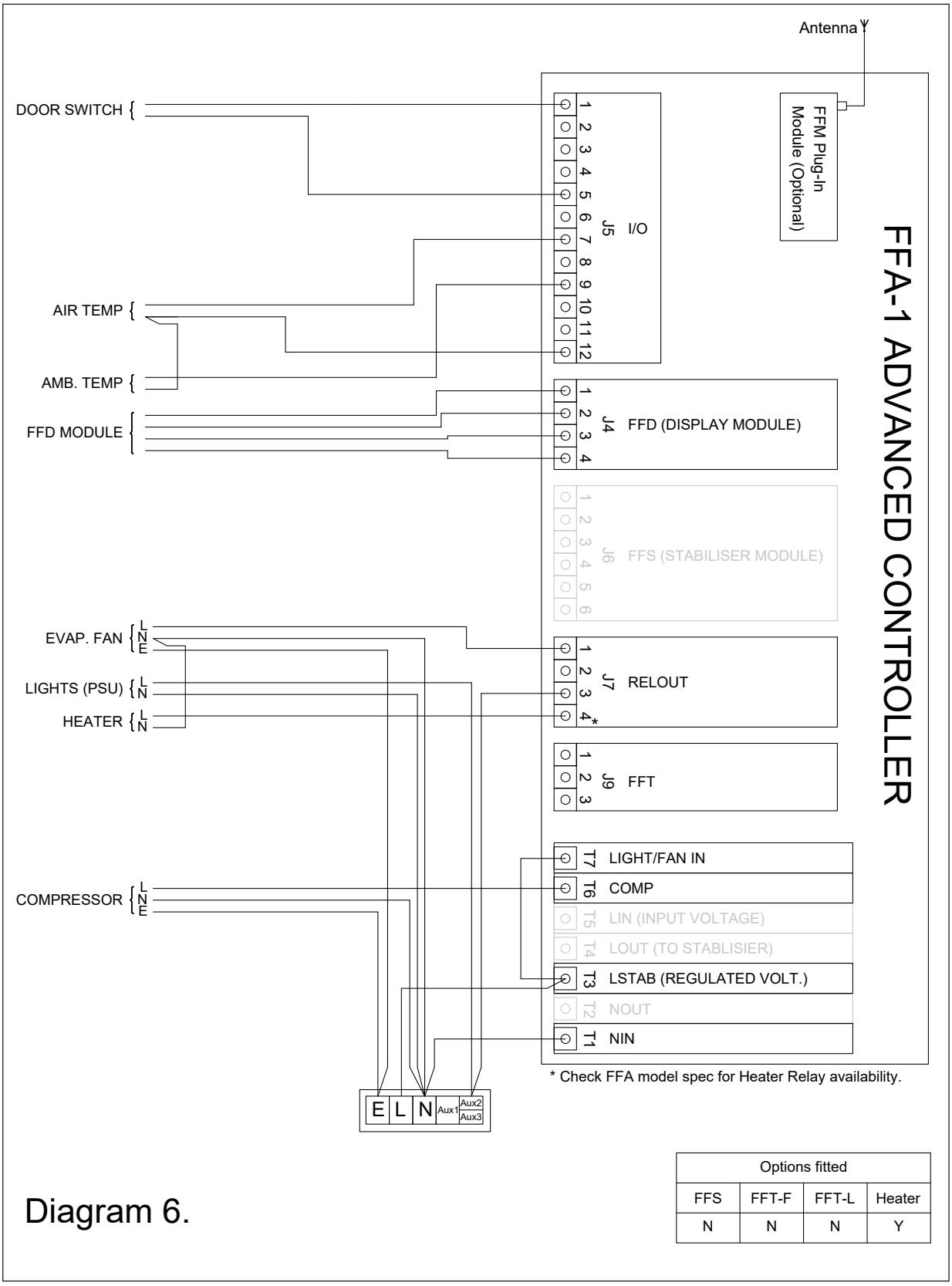


Diagram 6.

Options fitted			
FFS	FFT-F	FFT-L	Heater
N	N	N	Y

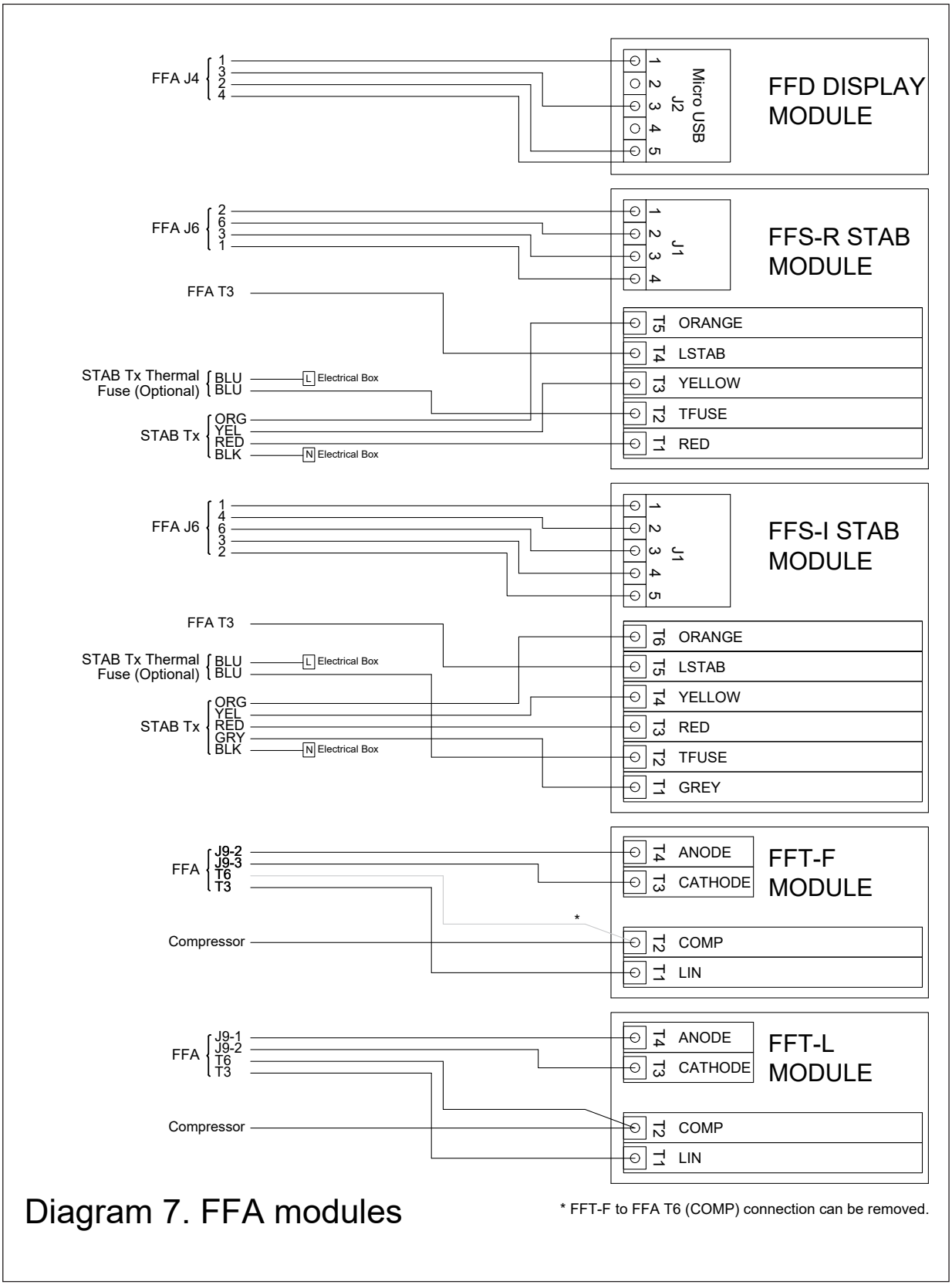


Diagram 7. FFA modules

* FFT-F to FFA T6 (COMP) connection can be removed.

2.6 CONTROLLER FUNCTIONALITY

2.6.1 PROBES SELECTION

Parameter	Description	Units	Min	Max
tPS	Select which temperature probe to be used for temperature regulation	1-4	N/A / 1	4
dPS	Select which temperature probe to be used for defrost operation	1-4	N/A / 1	4
cPS	Select which temperature probe to be used for condenser control	1-4	N/A / 1	4
aPS	Select which temperature probe to be used for ambient measurement	1-4	N/A / 1	4

From above parameters, the 4 different probes are activated and matched with FFA Inputs

2.6.2 TEMPERATURE REGULATION

Parameter	Description	Units	Min	Max
dnO	Normal Mode Cut-Out – DAY mode	°C	-40	40
dnI	Normal Mode Cut-In – DAY mode	°C	-40	40
dEO	ECO Mode Cut-Out – DAY mode	°C	-40	40
dEI	ECO Mode Cut-In – DAY mode	°C	-40	40
dSO	SUPERFROST Mode Cut-Out – DAY mode	°C	-40	40
dSI	SUPERFROST Mode Cut-In – DAY mode	°C	-40	40
nnO	Normal Mode Cut-Out – NIGHT mode	°C	-40	40
nnI	Normal Mode Cut-In – NIGHT mode	°C	-40	40
nEO	ECO Mode Cut-Out – NIGHT mode	°C	-40	40
nEI	ECO Mode Cut-In – NIGHT mode	°C	-40	40
nSO	SUPERFROST Mode Cut-Out – NIGHT mode	°C	-40	40
nSI	SUPERFROST Mode Cut-In – NIGHT mode	°C	-40	40

Operation explanation:

Depending on the current operational mode, the relevant Cut-Out & Cut-In values will be used for temperature regulation. This could be any of the following operational modes: Normal Mode, ECO Mode and SUPERFROST Mode at either DAY time or NIGHT time.

The Temperature Blind Time feature works as follow: Every time the compressor switches ON, then the unit will ignore the regulation probe reading for the duration of "tbt". This value can be set to any value between 0 (feature will be disabled) to 255 Secs.

2.6.3 DEFROST

Parameter	Description	Units	Min	Max
dF1	Defrost start timer type (real time, accumulated or continuous)		rEL / aCC / Cnt	
dF2	Threshold for enabling Defrost Function (defrost function stays disabled when regulation probe temperature > DF2)	°C	N/A, -40	40
dF3	Defrost start interval	Hrs	N/A, 1	255
dF4	Defrost end interval	Min	N/A, 1	255
dF5	Defrost start temperature (evaporator probe)	°C	N/A, -40	40
dF6	Defrost end temperature (evaporator probe)	°C	N/A, -40	40
dF7	Minimum defrost duration	Min	N/A, 1	255
dF8	Minimum duration between two consecutive defrost cycles	Hrs	N/A, 1	255
dF9	Temperature reading displayed during defrost (normal, frozen or "DEF")		nor/Frn/dEF	
dPd	Allow defrost during initial pull-down	0 / 1	0 = no	1 = yes
dPt	Defrost start interval during initial pull-down	Hrs	N/A, 1	255
dPS	Defrost end interval during initial pull-down	Min	N/A, 1	255
dtP	Defrost operation type (disabled, natural, active)		OFF / nAt / ACt	

Operation explanation:

- Menu item dF1 defines the type of defrost start timer as follow by setting to different values:
  - o rEL: Real Time: The defrost start time will continuously count regardless whether the compressor is On or Off and the defrost will start when the timer value exceeds the value of dF3 (if enabled).
  - o aCC: Accumulated Time: The defrost start timer will count only when the compressor is On and stops counting (not resetting) when the compressor is Off. In other word, the timer resumes counting every time the compressor is On, resulting in counting the accumulated durations during which the compressor has been On. The defrost will start when the timer value exceed the value of dF3 (if enabled).

- o Cnt: Continuous Timer: The defrost start timer will count only when the compressor is On and resets to zero whenever the compressor is Off. The defrost will start when the timer value exceed the value of dF3 (if enabled).

- Defrost can start either with time and/or with temperature, depending on the settings of dF3 and dF5. If both are enabled, then defrost will start depending on whichever happens first.
- Defrost can terminate either with time and/or with temperature, depending on the settings of dF4 and dF6. If both are enabled, then defrost will end depending on whichever happens first.
- dF7 is used to override dF4 and dF6 when it's enabled.
- dF8 is used to override dF3 and dF5 when it's enabled.
- dF5 and dF6 will only be respected if the evaporator probe is not faulty.
- During DEFROST cycles:
  - o Compressor: OFF
  - o Condenser fan: OFF
  - o Evaporator fan: ON
  - o Heater (SubZero only): ON (if dtP is set to ACt)
- When dtP = OFF, defrost function will be disabled. When set to nAt, then defrost heater will not operate (if it was fitted), and when it's set to ACt, then defrost heater will operate during defrost if it was fitted.
- Menu item dF9 is used to determine the value shown on the display when the unit is in defrost:
  - o nor: Normal: The display will continue displaying values as normal.
  - o Frn: Frozen: The display will show the regulation probe value just entering defrost mode.
  - o dEF: The display will show "dEF".

Note:

If winter mode is enabled and activated, then defrost function will be disabled until the winter mode is terminated.

2.6.4 VOLTAGE PROTECTION CONTROL

Parameter	Description	Units	Min	Max
UPt	Enable voltage protection feature		NO / YES	
UHo	High voltage disconnect	V AC	60	300
UHi	High voltage reconnect	V AC	60	300
ULo	Low voltage disconnect	V AC	60	300
ULi	Low voltage reconnect	V AC	60	300
Hbt	High voltage blind time	Sec	0	25
Lbt	Low voltage blind time	Sec	0	25

Operation explanation:

- UPt: If set to No, then the rest of the parameters involved are deactivated
- ULi: If Voltage is higher than ULi for Hbt time, then controller is switching off all the outputs
- UHi: For allowing switching on of all outputs voltage should drop below UHi for Hbt time again
- ULo: When voltage is lower than ULo for Lbt time, controller is switching off all outputs
- ULi: For allowing switching on of all outputs voltage should drop below ULi for Lbt time again

2.6.5 DELAYS & TIMERS

Parameter	Description	Units	Min	Max
Itd	Intelligent time delay	Sec	0	300
Cd0	First plug-in delay	Sec	0	255
Cd3	Minimum compressor OFF time	Min	0	255
Cd4	Minimum compressor ON time	Min	0	255
LAd	Loads activation delay (delay between consecutive loads to come ON)	Sec	0	255
Cd5	Maximum compressor ON time without temperature drop before initiating a forced defrost (with possible initiation of refrigeration fault mode)	Hrs	N/A, 1	50
Cd6	Maximum compressor ON time without temperature drop before initiating refrigeration fault mode	Hrs	N/A, 1	50
dCO	Compressor on-cycle duration when regulation probe is faulty - DAY mode	Min	N/A, -40	90
dCF	Compressor off-cycle duration when regulation probe is faulty - DAY mode	Min	1	255
nCO	Compressor on-cycle duration when regulation probe is faulty - NIGHT mode	Min	N/A, -40	90
nCF	Compressor off-cycle duration when regulation probe is faulty - NIGHT mode	Min	1	255

Operation explanation:

- On first plug-in of the cooler, loads must be activated after "Cd0" has elapsed, and after "Itd" has elapsed too for the compressor to come ON.
- Timer "Itd" is reset every time the compressor relay switches OFF, and it will not allow the compressor to come ON until this delay is over. This is Intelligent Time Delay with time-save feature - if the FFA unit has been OFF for longer than this duration, this delay will not be added before switching the compressor ON.
- If multiple loads are to be activated by regulation, then a delay of "Lad" must be respected between consecutive loads to come on
    - o Priority order: Lights → Fan → Compressor.
- If Compressor runs continually for more than Cd5 then
    - o Controller initiate normal DEFROST
    - o If 2 subsequent defrosts due to this reason would occur, initiate Refrigeration Failure Mode (RFM)
        - • Compressor: OFF
        - • Evaporator FAN: OFF
        - • Condenser FAN: OFF
        - • LIGHTS: OFF
        - • Display
            - o Master Alarm indicator: ON
            - o Main Display: Toggles between the Regulation Sensor and "rFF"
            - o Buttons: Disabled but menu item can still be accessed
    - o Alarm reset by cooler unplugging only.

- If Compressor runs continually for more than Cd6:
    - o Initiate Refrigeration Failure Mode (RFM) (see above)
- In case of Regulation probe failure, the controller shall regulate the compressor as per operation duty cycle define by respective parameters. This should be valid for Normal, ECO and SUPERFROST modes.
- Defrost and Fan management settings are enabled.

NOTE:

When the unit is in winter mode and regulation probe is faulty, then unit should exit winter mode (go back to normal mode by starting to operate the compressor relay as opposed to the heater relay) and operate as per normal mode under regulation probe faulty condition.

2.6.6 CONDENSER CONTROL

Parameter	Description	Units	Min	Max
OH	Condenser temperature high threshold	°C	N/A / -40	90
Ohd	Condenser temperature high differential	°C	1	255
SC	Condenser temperature low threshold	°C	N/A / -40	90
SCd	Condenser temperature low differential	°C	1	255

Operation explanation:

- If Condenser probe reading exceeds OH
  - o Compressor: OFF
  - o Compressor fan: ON (if applicable – version with condenser fan relay)
  - o Evaporator fan: ON (respecting the door switch status)

Note:

If three (3) consecutive OH events occurs → Initiate Refrigeration Failure Mode (RFM)

- If Condenser probe reading drops below SC
  - o Compressor: OFF
  - o Compressor fan: OFF (if applicable – version with condenser fan relay)
  - o Evaporator fan: ON (respecting the door switch status)

Note:

If three (3) consecutive SC events occurs → Initiate Refrigeration Failure Mode (RFM)

2.6.7 LIGHTS CONTROL

Parameter	Description	Units	Min	Max
L0	Lights regulated by Logic (0 = No, 1 = Yes)		NO / YES	
L1	Lights ON delay (NIGHT to DAY mode switch)	Min	0	255
L2	Lights OFF delay (DAY to NIGHT mode switch)	Min	0	255
L3	Lights switch enable / nO / YEs		NO / YES	

Operation explanation:

- If L0 = 0, then Lights will be ON all the time even during NIGHT mode unless on Refrigeration Failure Mode or when switched OFF manually with the Lights switch while L3 = 1
- If L0 = 0 and L3 = 0
  - o Light switch will no longer operate the lights, and they remains always ON unless on Refrigeration Failure Mode

2.6.8 DOOR OPERATION

Parameter	Description	Units	Min	Max
d1	Door Open Alarm Delay	Min	0	255
d2	Door Switch Malfunction delay Delta	Min	0	255
d3	Door close duration to switch the compressor back ON again (assuming all other relevant delays are over)	Min	0	255
d4	Door open duration to switch the fan OFF (assuming Fd = 1)	Sec	0	255
d5	Door close duration to switch the fan back ON again (assuming Fd = 1)	Sec	0	255

Operation explanation:

- If door open and Fd = 1 (see ref Paragraph Error! Reference source not found. above)
  - o Normal operation
    - • FAN: OFF (respecting d4)
    - • Door Open indicator: ON (solid)
  - o Defrost Operation
    - • FAN: ON
    - • Door Open indicator: ON (solid)

- If door remains open for more than d1
  - o Normal Operation
    - • Compressor: OFF
    - • FAN: OFF (respecting d4)
    - • Main display: Toggles between regulator probe temperature and "dOP"
    - • Door Open indicator: ON (solid)
  - o Defrost Operation
    - • FAN: ON
    - • Main display: Toggles between regulator probe temperature and "dOP"
    - • Door Open indicator: ON (solid)
- If d1+d2 has elapsed
  - o Door Switch is malfunctioning
  - o Master Alarm: ON (solid)
  - o Main display: Toggles between regulator probe temperature, "dOP" and "dSF"
  - o Unit resumes working normally (compressor coming ON when there is cooling demand)
  - o Unit switches to DAY mode if it was in NIGHT mode when the Door Switch Failure was observed.
  - o Unit stops updating the learning matrix and will not switch to NIGHT mode due to learning algorithm, and once the door switch is restored, then learning matrix will reset.

Door Alarm and Door Malfunctioning RESET:

- If switch restores proper operation, reset alarm and/or raise "Door Switch Failure Mode".
- Controller resumes normal operation
- Learning matrix will reset

2.6.9 POWER ON/OFF BUTTON

Parameter	Description	Units	Min	Max
POF	Enable power ON/OFF button		No - Yes	

Above parameter are valid only with the presence of remote display

Operation explanation:

- This parameter defines if ON/OFF – SET button can be used to switch OFF the.

Note:

Parameter can be reprogrammed manually.

2.6.10 INITIAL PULL DOWN

Parameter	Description	Units	Min	Max
Pdt	Initial pull-down initial temperature	°C	-40	40
Pt1	Time before initial pull-down cut-out (PdO) is activated	Hrs	0	255
PdO	Initial pull-down cut-out value	°C	-40	40

Operation explanation:

- Initial Pull Down Initiate Temperature (Pdt)
  - o If regulation probe reading > Pdt for more than Pt1
    - • Initiate Pull Down respecting PdO (not dnO)
    - • Do not allow Defrost until PdO is reached, unless dPd is set to YEs
      - o If dPd= YEs then defrost as regulated by dPt, dPs
    - • After PdO reached, resume dnO

2.6.11 EVAPORATOR FAN MANAGEMENT

Parameter	Description	Units	Min	Max
Fd0	Fan cycle with compressor		NO / YES	
Fd1	DAY Duty Cycle "ON" time Compressor cycles OFF	Min	0	255
Fd2	DAY Duty Cycle "OFF" time Compressor cycles OFF	Min	0	255
Fn1	NIGHT Duty Cycle "ON" time Compressor cycles OFF	Min	0	255
Fn2	NIGHT Duty Cycle "OFF" time Compressor cycles OFF	Min	0	255
FC1	Allow fan management during NORMAL operation		NO / YES	
FC2	Allow fan management during ECO mode		NO / YES	
FC3	Allow fan management during SUPERFROST mode		NO / YES	
Fd	Switch OFF fan on Door Opening Event		NO / YES	
FH	Fan Duty Cycle Override Temperature	°C	0.0	90.0
FHd	Fan Duty Cycle Override Temperature differential	°C	0	25
FSt	Fan minimum stop time	Sec	0	255

Operation explanation:

- If Fd0 = 0 then ignore Fd1/Fd2/Fn1/Fn2/FC1/FC2/FC3→fan stays ON when compressor cycles OFF (disable fan cycling in all modes)
- If Fd0 = 1 then fan cycles when compressor cycles OFF according to Fd1/Fd2/Fn1/Fn2/FC1/FC2/FC3
- If Fd1 = 0 then fan runs continuously during DAY mode when compressor cycles OFF (disable fan cycling during DAY mode)
- If Fd2 = 0 then fan runs continuously during DAY Mode when compressor cycles OFF (disable fan cycling during DAY mode)
- If Fn1 = 0 then fan runs continuously during NIGHT mode when compressor cycles OFF (disable fan cycling during NIGHT mode)
- If Fn2 = 0 then fan runs continuously during NIGHT Mode when compressor cycles OFF (disable fan cycling during NIGHT mode)
- Normal Mode
    - o DAY
        - If FC1 = 1, then cycle fan as regulated by Fd1 and Fd2
    - o NIGHT
        - If FC1 = 1, then cycle fan as regulated by Fn1 and Fn2
- ECO mode
    - o If FC2 = 1, then follow Normal Mode fan cycling
- SUPERFROST Mode
    - o If FC3 = 1, then follow Normal Mode fan cycling
- DOOR Open
    - o If Fd=1, then SWITCH OFF fan, respecting item "d4".
- DEFROST
    - o FAN = ON

IF Regulation Probe Reading > FH, then

Suspend any Fan Duty Cycle (Fan is always ON) until reading < (FH – FHd)

2.6.12 WINTER MODE

Parameter	Description	Units	Min	Max
Ht	Enable winter mode (heater control mode)		NO / YES	
HAt	Heater activation temperature threshold (using the regulation probe)	°C	-40	40
HAd	Heater activation delay	Min	0	255
HdF	Heater activation temperature differential	°C	0	25

Note:

Maximum value of HAt should be less than the SUPERFROST set point value, this is to prevent unpleasant compressor operation whereby both compressor and heater may come ON at the same time when the temperature drops below HAt for more than HAd. We have overcome this by keeping the compressor OFF when the winter mode (heater mode) is activated (in operation). This will give you more in setting HAt value.

Operation explanation:

- If regulation probe reading <HAt for more than HAd
    - o Compressor: OFF OK
    - o Heater: ON
    - o Display shows Set Point Value (stable)

o Evaporator Fan: ON (continuously – no duty cycle respected)

- If Regulation probe reading >= HAt + HdF
  - o Heat: OFF
  - o Resume normal operation
- If Winter mode is enabled and activated, then defrost function will be disabled until the winter mode is terminated.
- When unit is in Winter mode and Regulation Probe is detected to be faulty, then unit will exit Winter mode and resume working as normal mode.

2.6.13 AMBIENT CONDITION INTERACTION

Parameter	Description	Units	Min	Max
An	Nominal Ambient condition	°C	0	90
AnA	Ambient interaction Enabled: No, Yes		NO / YES	
An1	Ambient change threshold 1	°C	0	10
An2	Ambient change Threshold 2	°C	0	10
AS1	Regulation temperature limit change on An1	°C	-5	5
AS2	Regulation temperature limit change on An2	°C	-5	5
ALL	Lower Ambient Safety Limit	°C	-50	0
ALU	Upper Ambient Safety Limit	°C	0	80

Operation explanation:

- Ambient Sensor temperature reading < An
  - o Respective Set Point is used without any adjustment
- Ambient Sensor temperature reading > An and =< An + An1
  - o Respective Set Point (cut-out) and cut-in values (on any operational mode) are increased by AS1
- Ambient Sensor temperature reading > An + An1 and =< ALU
  - o Respective Set Point (cu-out) and cut-in values (on any operational mode) are increased by AS2
- If Ambient Sensor reading < ALL
  - o Compressor: OFF

- Evaporator fan resumes working according to section 2.5
  - o Defrost function will be disabled
- If Ambient Sensor reading >ALU
  - o Compressor: OFF
  - o Evaporator fan: Resumes working accordingly
  - o Defrost function will be disabled

2.6.14 LEARNING ALGORITHM

Parameter	Description	Units	Min	Max
dOt	Learning algorithm door operating duration	Sec	1	255

dOt: Accumulated time of door openings duration in order to register day mode operation.

Operation Explained:

The unit observes the usage behaviour of the cooler, and constructs a pattern or matrix that reflects or simulates the actual cooler's usage pattern by dividing each day into a number of slots, and then assigns a mode to each slot to be either a DAY-mode slot or a NIGHT-mode, depending on the cooler's usage level during that slot. Each day is represented by 48 slots, of 30-minute duration each. The overall learn pattern covers 7 days' worth of operation; that is a total of 336 slots to reflect or simulate one week worth of cooler's usage pattern.

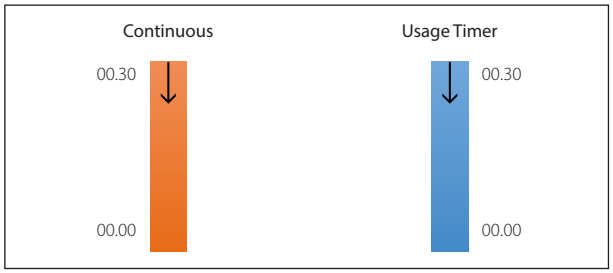
In order to determine the mode that will be assigned to each slot (whether DAY or NIGHT), two timers are used per each slot: 1) Continuous timer, 2) Usage timer.

Continuous Timer:

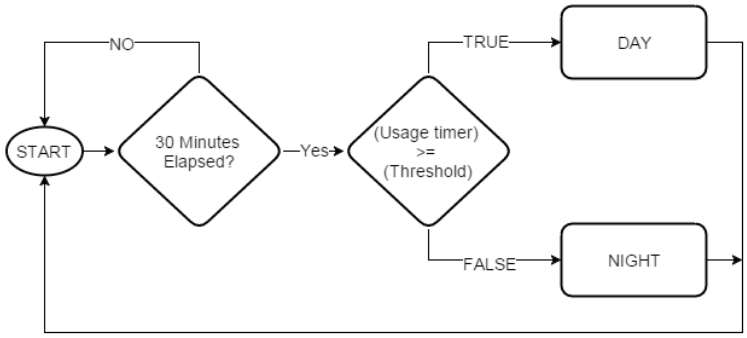
This timer down counts continuously from 30 minutes to zero (shown in red below). After the 30-minute duration is over, it resets back to 30 minutes and starts down-counting again.

Usage Timer:

This timer down counts from 30 minutes and stops down-counting whenever the door is open (shown in blue below). After 30-minute worth of operation (when Continuous Timer has reached zero), this timer resets back to 30 minutes and starts down-counting again. This value held by this timer at the end of each slot (before resetting back again to 30 minutes) provides an indication on the usage level during each slot.



When half an hour of cooler operation has elapsed (Continuous Timer has reached zero), the controller makes a decision which mode it assigns to the current slot, to be either a DAY or a NIGHT mode by comparing the Usage Timer value with a threshold value that is configured in the FFA controller. If the Usage Time value is higher than the threshold value, that means the usage level is high and DAY mode will be assigned to this slot, otherwise NIGH mode will be assigned. This threshold value "Learning Algorithm Door Open Duration Threshold (Secs)" is configurable via the FFA Interface Software. At the end of each slot, both timers will start down-counting again from reset values of 30 minutes in order to configure the following slot.



24 Hour

The Algorithm contains an Array that saves 24Hour operation in 30mins slots, meaning that the 24hour-Array will contain 48 slots; each slot will be configured as either DAY or NIGHT mode. The following example is using a cooler's busy time from 8AM to 9PM.

Slot:1-2	Slot:3-4	Slot:5-6	Slot:7-8	→	Slot:29-30	Slot:31-32	Slot:33-34	Slot:35-36
NIGHT	NIGHT	DAY	DAY	→	DAY	DAY	NIGHT	NIGHT
6AM	7AM	8AM	9AM	→	8PM	9PM	10PM	11PM

Note:

After the very first 24hours of learning, the 1st day operation pattern is learned and copied to the rest of the week (the remaining 6 days). The unit will start switching between DAY & NIGHT mode from the 2nd day of operation. (Using the data learned from 1st day)

Week

When 24hour elapses, the 24hour array will be transferred to a Week-Array which contains 336 slots that cover a whole week of operation in 30mins slots.

2.6.15 ENERGY SAVING ALGORITHM

All what is listed below is the operation of the cooler after it has learned the pattern of cooler's usage:

Break-out of Learning:

The break-out of learning pattern is the ability to adapt to cooler's stocking period (filling the cooler with products before shop opening time).

If the Door was open for more than 3 Minutes, then this specific door opening is ignored by the learning timers and scheme. This is introduced to ignore times when the cooler is refilled. If further activity occurs over this period ([Door open > Twice] & [Door open >= Threshold Time in GUI]) then the controller will start learning again and will save that particular period as DAY.

Look-Ahead:

The Look-ahead is added in order to allow setting the temperature of the cooler products in order for the products to reach the correct temperature at the shop opening time. The LookAhead value cannot be less than 2 hours (4 slots).

The Look-ahead value is currently manually inserted in the firmware to 3 hours (6 slots) as requested by FrigoGlass.

Software Irregularities Filtration:

A software filter is added to change periods of NIGHT less than LookAhead value to DAY in order to overcome irregularities.

For example, if LookAhead = 4, then if the 24hour array is found to be [D D D D N N N N D D D] this will be changed to [D D D D D D D D D D D]. Every 24hour the filter will be applied to the 24hour array elements that have been saved.

ECO Button Press:

If the Eco button is pressed for more than 3 Seconds, the unit will switch the current DAY/NIGHT mode to the opposite mode. The unit will stay in the new mode until the controller is due to change modes from the current/new mode to the opposite mode.

Example: If the ECO button is pressed for more than 3 seconds at slot#1 with the following existing learnt pattern:

Slot#1	Slo#2	Slot#3	Slot#4	Slot#5	Slot#6	Slot#7	Slot#8	Slot#9	…
DAY	DAY	DAY	DAY	NIGHT	NIGHT	NIGHT	DAY	DAY	…

Then the controller will change from DAY to NIGHT mode immediately (the current mode now is set to NIGHT mode) and stay in NIGHT mode until the unit is due to change modes to the opposite one (i.e. the unit is due to change to DAY mode), which happens at slot#8.

Note:

The unit will not save this change of modes in its learning pattern.

Door Switch Failure

Upon detection of door switch failure, then the unit will stop updating its learning pattern based on the cooler usage as it cannot trust the reading obtained from the door switch. The unit will stay in DAY mode and never revert to NIGHT mode based on the content of its learning pattern whilst the door switch is faulty.

However, the unit can still switch the current DAY/NIGHT mode to the opposite mode by pressing the ECO Button for more than 3 seconds (as indicated in section#4 above), and as a result, then unit will stay in this mode until the ECO Button is pressed again for more than 3 seconds as it no longer relies on the learning pattern to change modes.

After the door switch operation is restored (failure has been rectified), then the unit will reset its learning pattern and will start the learning process from the beginning.

2.6.16 LED INDICATIONS

RED LED	YELLOW LED	GREEN LED	STATUS
X	x	ON	FFA Power Supply running
OFF	ON	ON	Compressor ON (unit in On Mode)
ON	ON	ON	Compressor ON (unit in On Mode) but in under or over voltage blind time (voltage is momentarilly low or high)
OFF	Flashing (One Second ON/One Second OFF)	ON	Compressor ON by shorting Y-G test pins
Flashing twice (500mSec ON/One 500mSec) every 8 seconds	OFF	ON	Compressor OFF due to door opening or delays after compressor switched OFF due to door operation
Flashing three times (500mSec ON/500mSec OFF) every 8 seconds	ON	ON	Compressor ON (unit in On Mode), door is malfunctioning (door open longer than D1+D2)
Flashing (250mSec ON/250mSec OFF)	Flashing (250mSec ON/250mSec OFF)	ON	Refrigeration Fault
Fashing (500mSec ON/500mSec OFF)	OFF	ON	OFF Mode (mains voltage is bad)
Cycling (500mSec ON/500mSec OFF)	Cycling (500mSec ON/500mSec OFF)	ON	OFF Mode (mains frequency is bad)
Flashing (One Second ON/One Second OFF)	OFF	ON	Wait Mode (temperature above cut-in, waiting for time delay)
Flashing (Two Seconds ON/Two Seconds OFF)	OFF	ON	Wait Mode (temperature still below cut-in)
Flashing (Two Seconds ON/500mSec OFF)	OFF	ON	Ambient Extreme Temperature Mode
Flashing (Four Seconds ON/Four Seconds OFF)	OFF	ON	Defrost Mode
Flashing once (50mSec ON) every 4 seconds	OFF	ON	Probe#1 faulty
Flashing twice (50mSec ON/250mSec OFF) every 4 seconds	OFF	ON	Probe#2 faulty
Flashing three times (50mSec ON/250mSec OFF) every 4 seconds	OFF	ON	Probe#3 faulty
Flashing four times (50mSec ON/250mSec OFF) every 4 seconds	OFF	ON	Probe#4 faulty
Flashing twice (Two Seconds ON/500mSec OFF) every 10 seconds	OFF	ON	Condenser High or Low Temperature Mode
Flashing three times (Two Seconds ON/500mSec OFF) every 10 seconds	OFF	ON	Heater Control Mode (Winter Mode)
Flashing once (50mSec ON) every 500mSec	OFF	ON	Shut-down mode

2.7 PROGRAMMING

There are two ways of programming FFA controller

1. Programming using ST-LINK/V2
   (Please refer to FFA Programming Procedure manual)

2. Programming using Sollatek SPP03 Programmer
   This is a preferable way of programming FFD as it doesn't require connection to a PC. In this method program is copied from PC to SPP03 once and then it is stored in the SPP03. FFA is programmed on a button press.
   (Please refer to "SPP03 User Guide" for more details)

3.1 DESCRIPTION

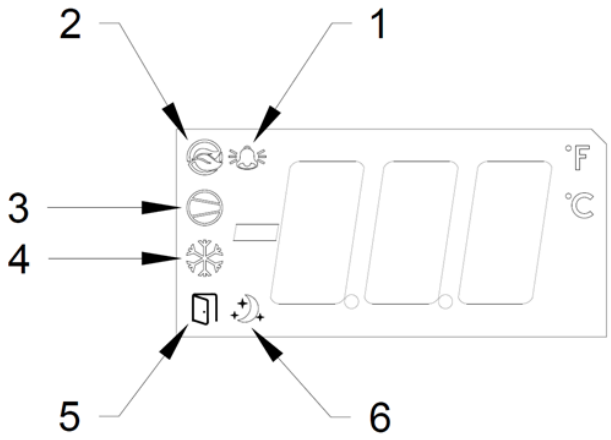
The FFD-R is a digital display which connects via a cable to the FFA

3.2 FEATURES

- Three digit LED, 7-segment display
- 4 buttons
- 8 additional indicators
- Conformal coated circuit board.
- Low profile, panel mount

3.3 DISPLAY INDICATORS

1. Master Alarm Indication
2. ECO Indication: On when the unit is in ECO mode and Off when the unit is not in ECO mode.
3. Compressor ON indication: On when the compressor is On and Off when the compressor is Off.
4. SUPERFROST or Evaporator Fan ON indication (depending on configuration): On when the unit is in SUPERFROST mode, which happens upon pressing the SUPERFROST button. For coke configuration, the SUPERFROST button does not exist and the indication indicates the evaporator fan operation.
5. Door Open Indication: On when the door is open and Off when the door is closed.
6. NIGHT mode indication: On when the unit is in NIGHT mode and Off when the unit is not in NIGHT mode (in DAY mode).



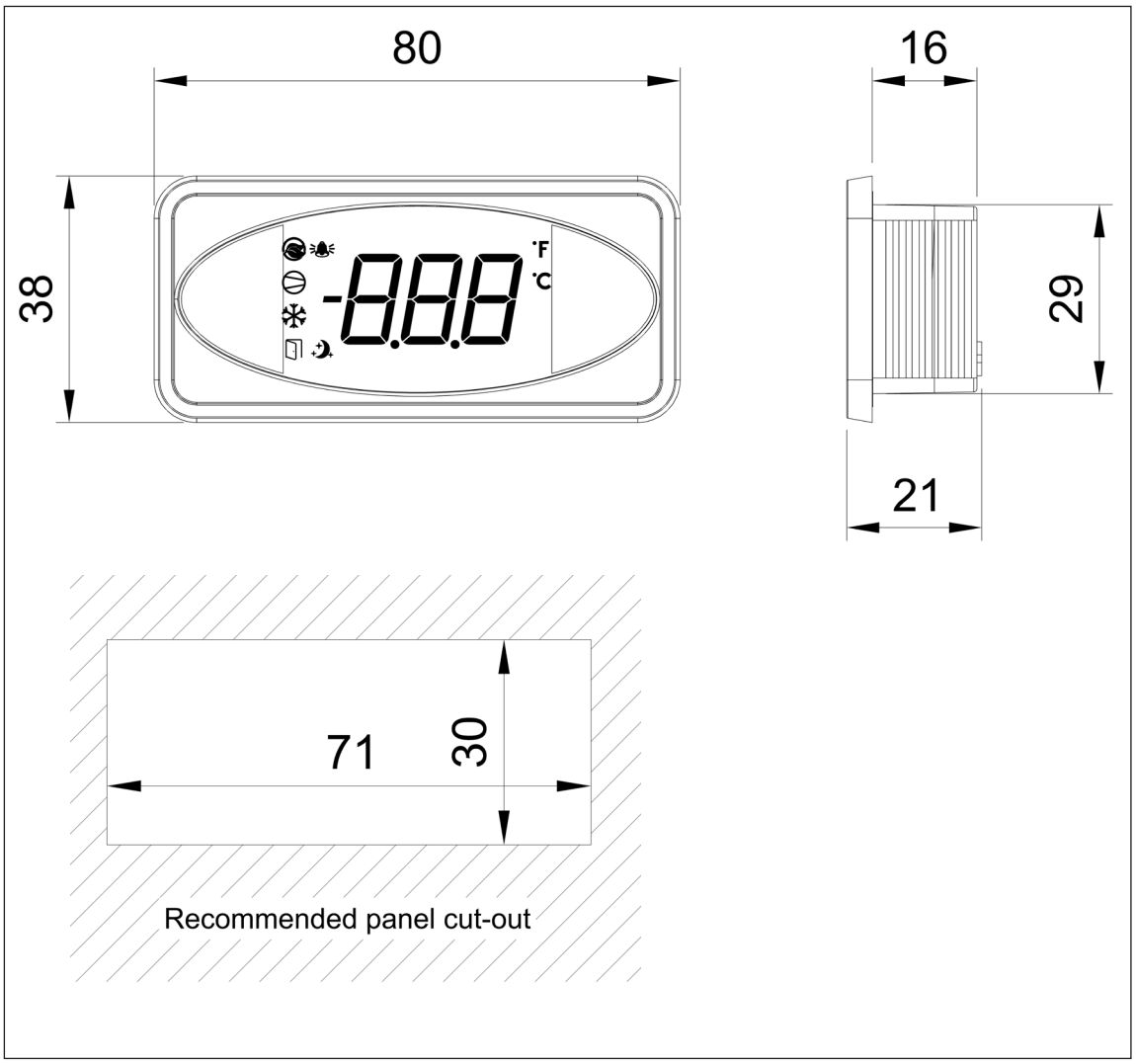
Notes:

- ECO mode can be considered the same as normal mode but using different cut-in and cut-out values. Therefore, there should be cut-in, cut-out values for DAY mode and cut-in, cut-out values for NIGHT mode.
- SUPERFROST mode can be considered the same as normal mode but using different cut-in and cut-out values. Therefore, there should be cut-in, cut-out values for DAY mode and cut-in, cut-out values for NIGHT mode.

3.4 TECHNICAL SPECIFICATION

LED colour	Red
Voltage	Supplied from FFA
Connection	Micro USB to FFA, custom cable
Temperature range	-20 to +60ºC
Size	80 x 38 x 21mm, 27mm deep incl. clips
Weight	37g
IP rating	IP65 (front), IP24 (rear)
Approvals	CE, EN 60529

3.5 DIMENSIONS & PANEL CUT OUT



3.6 OPERATION

3.6.1 DAY MODE

- Temperature Reading of the Regulator Sensor (the probe connected to PRB#1 terminals).

3.6.2 NIGHT MODE

- Temperature Reading of the Regulator Sensor.
- NIGHT indication lit (stable).

3.6.3 ECO MODE

- Temperature Reading of the Regulator Sensor
- ECO indicator lit (stable)

3.6.4 SUPERFROST MODE

- Temperature Reading of the Regulator Sensor.
- SUPERFORST indicator lit (stable).

3.6.5 DOOR OPEN

- Temperature Reading of the Regulator Sensor
- Door Open indicator lit (stable)
- If door remains open for more than d1 in mins, it is considered as Door Open Alarm Event:
    - o Main display toggles between the Regulator Sensor and "dOP"
    - o Door Open indicator stays lit (stable)
- If door remains open for longer than (d1+d2) in Mins, it is considered as Door Malfunctioning Event:
    - o Main display cycles between the Regulation Sensor, "dOP" (Door Open) and "dSF" (Door Switch Failure).
    - o Door Open indicator stays lit (stable).
    - o Master Alarm indication lit (stable).

3.6.6 COMPRESSOR "ON"

- Compressor ON indicator lit during "ON" cycles (stable). This indicator is On whenever the compressor is On.

3.6.7 BUTTONS FUNCTIONALITY

3.6.7.1 POWER ON/OFF – SET button

- SET function is triggered by momentarily press
- Power ON/OFF function is triggered by continuous press of 3 sec

On button momentarily press during any mode:

- Display shows: PAS
    - o If ON/OFF-SET button pressed again → Resume Normal operation
    - o If 10 seconds has elapsed with no button press → Resume Normal Operation
- Controller expects Passcode entering
    - o Passcode consists of a number of digits entered as subsequent key presses. Example: passcode 3154 will be registered as:
        - 3 presses of left top button
        - 1 press of left bottom button
        - 5 presses of right upper button
        - 4 presses of right bottom button
- If PASSCODE not valid
    - o Controller reverts to previous mode; display reverts to previous mode
- If PASSCODE entered correctly
    - o The first menu item will be displayed "tPS".
    - o Upper right and bottom right buttons are used for moving between individual parameters
        - To change the value of a parameter
            - o SET button activates Parameter and show its value
            - o Right UPPER and BOTTOM buttons are used to manipulate parameter value. The software will react based on the newly updated value but it will not save it unless the SET button is pressed. This

allows testing the unit's behavior upon changing some of the parameters values without needing to save the values. If the menu item is exited without being saved, then the original value will be reverted.

o SET Button is pressed to register new value.

• To EXIT Parameter Listing and go back to normal display mode:

o Press upper left button. The unit will go back to the normal display mode from any menu levels (ESC function).

o No button press for 30 Secs. If menu item value changes and no button is pressed afterwards for 30 Secs, then the unit goes back to normal display mode without saving the previously altered value (ESC function).

On Button continuous press (more than 3 sec)

- Display shows: OFF (flashing)
  - o If ON/OFF-SET button pressed → enter OFF Mode:
    - • Compressor: STOPS
    - • Lights: ON (operational by the Lights button).
    - • Fans: OFF
    - • HEATER (if present): OFF
    - • Display: OFF (solid)
    - • Buttons Disabled apart from ON/OFF
  - o No key press for 3 seconds → Exit OFF Mode
    - • Resume Normal Operation

To EXIT OFF mode: Press ON/OFF button momentarily.

3.6.7.2 LIGHTS BUTTON OPERATION

- Lights Switching OFF: Press LIGHTS button momentarily
- Lights Switching ON: Press LIGHTS button momentarily

3.6.7.3 ECO BUTTON (MOMENTARILY PRESS FUNCTION)

IMPORTANT:

- if ECO is activated through keypress, door opening shall NOT deactivate it.

If Controller in NORMAL or SUPERFROST mode

- Display shows "ECO" flashing 5 times; then reverts to Temperature indication
- ECO indicator lit (stable)
- Controller switches to ECO mode settings
- dEI/dEO and nEI/nEO will be used as cut-in/cut-out values for DAY and NIGHT modes respectively

If Controller in ECO mode (will stay on if ON, or remain OFF at night mode)

- Display shows "NOR" flashing 5 times; then reverts to Temperature indication
- ECO indicator switches OFF
- Controller switches to NORMAL mode settings
- dnI/dnO and nnI/nnO will be used as cut-in/cut-out values for DAY and NIGHT modesrespectively

If Controller in WINTER MODE (HEATER operation)

- Display shows "ECO" flashing 5 times; then reverts to Temperature indication
- ECO indicator lit (stable)
- Controller switches to ECO or back to NORMAL mode settings
- CONTOLLER CONTINUES WINTER MODE OPERATION

3.6.7.4 ECO BUTTON (LONG PRESS FUNCTION)

This functionality is applicable for ALL operation modes (NORMAL, ECO and SUPERFORST)

If ECO button is pressed for more than 3 Secs, then this will toggle the unit between the DAY mode and NIGHT mode:

If controller in any mode (NORMAL, ECO, SUPERFROST) except NIGHT mode

- Controller switches to NIGHT mode operation. This is to force a NIGHT Mode, and the unit should learn this, and therefore next week it should go to NIGHT Mode at the same time.

If controller in any mode (NORMAL, ECO, SUPERFROST) except DAY mode

- Controller switches to DAY mode operation. This is to force a DAY Mode, and the unit should learn this, and therefore next week it should go to DAY Mode at the same time.

3.6.7.5 SUPERFROST BUTTON (MOMENTARILY PRESS FUNCTION)

If Controller in NORMAL or ECO mode

- Display shows "SFR" flashing 5 times; then reverts to Temperature indication
- SUPERFROST indicator lit (stable)
- Controller switches to SUPERFROST mode settings
- dSI/dSO and nSI/nSO will be used as cut-in/cut-out values for DAY and NIGHT modes respectively

If Controller in SUPERFROST mode

- Display shows "NOR" flashing 5 times; then reverts to Temperature indication
- SUPERFROST indicators switches OFF
- Controller switches to NORMAL mode settings
- dSI/dSO and nSI/nSO will be used as cut-in/cut-out values for DAY and NIGHT modes respectively

If Controller in WINTER MODE (HEATER operation)

- Display shows "SFR" flashing 3 times; then reverts to Temperature indication
- SUPPERFROST indicator lit (stable)
- Controller switches to SUPERFORST or back to NORMAL mode settings
- CONTROLLER CONTINUES WINTER MODE OPERATION

3.6.7.6 LEARNING ALGORITHM RESET

Learning Algorithm reset operation is needed in order to reset the learning algorithm timers. It does NOT change any of the registered parameter values.

- Menu items "LrS" is used to reset the Learning Algorithm matrix.
- Go to the menu list, navigate to item "LrS" and preset SET button, the displayed value will be "no".
- Change to "yes", and then press "SET" to confirm.

3.6.7.7 PARAMETERS RESET

- Menu items "PrS" is used to reset the parameters settings back to the default (factory-set) value.
- Go to the menu list, navigate to item "PrS" and preset SET button, the displayed value will be "no".
- Change to "yes", and then press "SET" to confirm.

3.6.8 DISPLAY ALARMS

Different alarms indications will be shown on the display when various faults are detected by the unit:

Alarm	Displayed Code
Probe1 Faulty	PF1
Probe2 Faulty	PF2
Probe3 Faulty	PF3
Probe4 Faulty	PF4
Door Switch Alarm	dOP
Door Switch Failure/Malfunction	dSF
Refrigeration Failure	rFF
Condenser Over Temperature	COt
Condenser Under Temperature	CUt
Ambient Over Temperature	AOt
Ambient Under Temperature	AUt

- The display will cycle between the Regulation Temperature and any of the currently existing alarms. For example, if the current temperature is 3.3, and both probe#1 & 2 are faulty, then the display will cycle between the following codes: "3.3", "P1" and "P2".

3.7 PROGRAMMING

There are two ways of programming FFD

1. Programming using ST-LINK/V2
   (Please refer to FFA Programming Procedure manual)

2. Programming using Sollatek SPP02 Programmer
   This is a preferable way of programming FFD as it doesn't require connection to a PC. In this method program is copied from PC to SPP02 once and then it is stored in the SPP02. FFA is programmed on a button press.
   (Please refer to "SPP02 User Guide" for more details)

4.1 FFM-2, 2G GSM CONNECTIVITY MODULE

4.1.1 DESCRIPTION

The FFM-2 plugs into the FFA and provides connection to the GSM mobile phone network to share data from the cooler to a portal.

4.1.2 FEATURES

- Plug-in module
- Micro SIM card holder
- Battery
- 2G connectivity
- Conformal coated circuit boardpanel mount

4.1.3 TECHNICAL SPECIFICATION

Power	From FFA base unit
Internal battery	470 mA.Hr lithium polymer
Autonomy	10hrs
Indicators	2x LEDs
Main connector	16 way for FFA
RF Connector	SMA socket
Temperature range	-20 to +60ºC
Size	42 x 56 x 19mm
Weight	30g
IP Rating	IP24
Approvals	CE, CB, IEC 60730-1: 2011. IEC 60730-2-9: 2010. IEC 60950-1: 2005+A1+A2. EN 301 489-1 V1.9.2. EN 301 489-7 V1.3.1

Battery

The battery of the FFM-2 is designed to provide power to the FFM-2 and the FFA when mains power is lost, and enters charging mode when mains power is on. The battery capacity accommodates connectivity when mains power is lost; the FFM-2 battery can last up to 10 Days when the FFM-2 is transmitting data once every 24 hours.

SIMCARD slot

The FFM-2 contains a sim-card slot that allows inserting Micro-Sim (15mm x 12mm x 0.76mm),

There is a print on the back of the FFM-2 that illustrates in which orientation the sim-card should be inserted.

Antenna (fitted with or without a cable)

An Antenna slot is available on the FFM where a can be connected to the FFM in order to connect to 2G/3G mobile networks, the antenna can be connected to the FFM via a coaxial extension cable to allow flexibility.

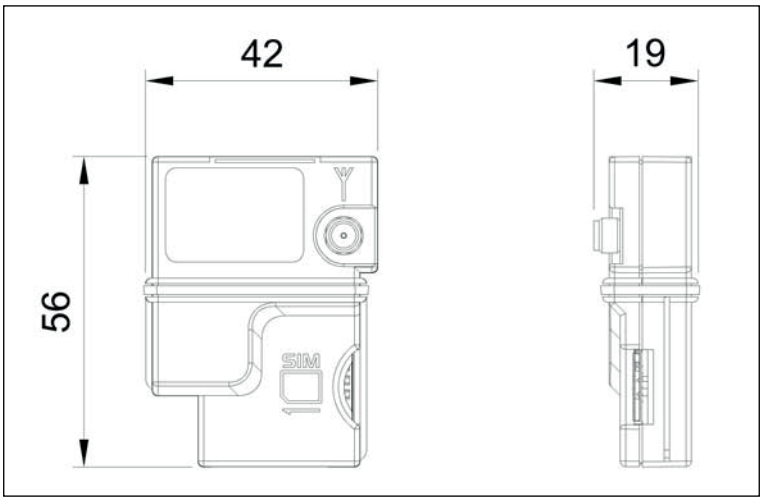
Accelerometer

An Integrated accelerometer chip that measures static acceleration, which is movement. The FFM-2 can detect the movement of the cooler and will ensure reliable connectivity operation while the cooler is on movement.

Memory Chip

Information can be stored in an internal memory chip that is integrated within the FFM-2. The memory space is mainly used for OTA (Over-The-Air) FFA Firmware Update.

4.1.4 DIMENSIONS

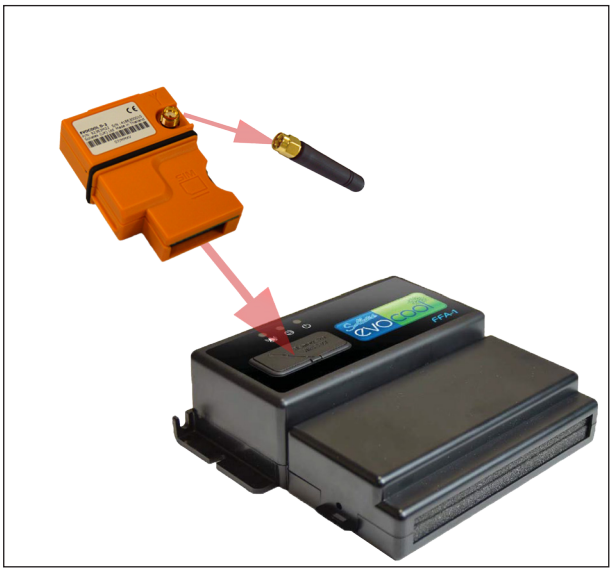


4.1.5 CONNECTING TO FFA-1

The FFM-2 can be connected to the FFA-1 via a connecter slot in the FFA-1, Please follow the simple steps below:

1) Remove the "Remove to fit FFM" connector cover.

2) Plug in the FFM-2 in the connector slot (can be connected via only one orientation)



4.1.6 OPERATION

4.1.6.1 LED INDICATORS

Type	Green	Red	Status
1	OFF	OFF	FFM Powered Down
2	ON	OFF	FFM Powered Up
3	ON	Flashing (120mSecond ON/120m-Second OFF)	Registering to the mobile network and GPRS carrier
4	ON	Flashing (Half Second ON/Half Second OFF)	Connecting to the internet
5	ON	Flashing (One Second ON/One Second OFF)	Connecting to the server (location or data)
6	Flashing (One Second ON/One Second OFF)	ON	Communicating with locations server
7	Flashing (100mSecond ON/100m-Second OFF)	ON	Communicating with data server

Notes:

- The operation of the FFM-2 goes from sequence#1 to 7.
- If the unit is running on Mains power, then after finishing sending data, it goes to sequence#2 until it's time to send data again.
- If the unit is running on battery, then after finishing sending data, it goes to sequence#1 until it's time to send data again.

4.1.6.1 LED ERROR CODES

Green LED #blinks	Red LED #blinks	Error Description
0	1	GSM module not responding (at1 error)
0	2	GSM module not shutting down (smso1 error)
0	3	GSM module not responding (at2 error)
0	4	GSM module cannot be configured (cmee equ1 error)
0	5	Unable to obtain IMSI number (cimi error)
0	6	Unable to obtain the SIM card number (scid error)
0	7	Unable to obtain the IMEI number (cgsn error)
0	8	Unable to obtain product identification details (ati error)
0	9	Unable to obtain product identification details (ati1 error)
1	0	Unable to obtain product identification details (atcgmr error)
1	1	n/a
1	2	Unable to configure network registration with profile#0 (creg = 0 error)
1	3	Unable to register to the network with profile#0 (creg = 0 error)
1	4	Unable to set GPRS attachment with profile#1 (cgatt = 1 error)
1	5	Unable to attached to GPRS carrier (cgreg_qst error)
1	6	Unable to obtain network details (moni error)
1	7	Unable to configure the TCP parameters (scfg error)
1	8	Unable to setup internet connection with GPRS (sics contype error)
1	9	Unable to setup the inactivity time-out (sics inactto error)
2	0	Unable to setup the user details (sics user error)
2	1	Unable to setup the password details (sics password error)
2	2	Unable to setup the APN details (sics apn error)
2	3	Unable to setup DNS1 details (sics dns1 error)
2	4	Unable to setup DNS2 details (sics dns2 error)
2	5	Unable to obtain internet connection status with profile#0 (sici = 0 error)
2	6	Unable to setup TCP client socket on service profile#0 using connection profile#0 (siss equ0 conid error)
2	7	Unable to configure the server type (siss equ0 sertype error)
2	8	Unable to configure the server IP address and port number (siss equ0 address error)
2	9	Unable to connect to the inetnet using profile#0 (host server) (siso = 0 error)
3	0	Unable to connect to the host server with profile#0 (sist = 0 error)
3	1	Wrong response from the server (server response error)
3	2	Unable to activate AT commands with the module (act at cmd error)
3	3	Unable to close internet connection with profile#0 (sisc = 0 error)
3	4	Unable to set GPRS attachment with profile#0 (cgatt = 0 error)
3	5	GSM module not shutting down (smso2 error)
3	6	Unable to hang up the received wake-up call (ath error)
3	7	Unable to close internet connection with profile#1 (sisc = 1 error)
3	8	Technical fault #0 with network registration with profile#0 (creg tech fault 0 error)
3	9	Network registration denied with profile#0 (creg reg denied 3 error)
4	0	Technical fault #0 with GPRS attachment (cgreg tech fault 0 error)
4	1	GPRS attachment denied (cgreg reg denied 3 error)
4	2	Unable to obtain network and neighbouring cells details (smonc error)
4	3	Unable to connect to the internet using profile#1 (location server) (siso = 1 error)
4	4	Unable to connect to the location server with profile#1 (sist = 1 error)
4	5	Unable to read the number of rings before auto-reply on data calls (ats0?)
4	6	Unable to set the number of rings before auto-reply on data calls (ats0=1)
4	7	Unable to read how the unlabelled received calls are treated as (csns?)
4	8	Unable to configure all the unlabelled incoming calls as data calls (csns = 4 error)

4.2 FFM-B & FFM-BB, BLUETOOTH CONNECTIVITY MODULE

4.2.1 DESCRIPTION

The FFM-B & FFM_BB plugs directly into the FFA and provides connection to a Smart Phone/Tablet App via Bluetooth (BLE)

4.2.2 FEATURES

- The FFM-B & FFM-BB receives and transmits a wide array of data collected from the FFA controller's multiple inputs
- Bluetooth low energy (BLE) connectivity to host device
- FFM-B module plugs directly into the FFA energy management device
- FFM-BB has a built-in Primary battery with expected stand by lifetime of over 5yrs
- On board serial Flash with 16Mbit of data storage
- Ultra-low-power design

4.2.3 TECHNICAL SPECIFICATION

	FFM-B	FFM-BB
Power	From FFA base unit	
Internal battery		Lithium-polymer 3.7V 470mAh with Protection Circuit
Indicators	2x LEDs	
Main connector	16 way for FFA	
Temperature range	-40 to +80 ºC	-20 to +60 ºC
Size	42 x 56 x 19mm	
Weight	30g	
IP Rating	IP24	
Approvals	CE, FCC, Complies with Bluetooth v4.1	

BlueTooth

The FFM-B and FFM-BB are fitted with BLE 4.1 to transmit and recieved a wide aray of data from the FFA Controller to a host devive.

Memory

Information can be stored in an internal memory chip that is integrated within the FFM-B & FFM-BB. The memory space allows up to 13,000 events to be stored.

Mobile App

The FFM-B & FFM-BB connects to an Intuitive App to display the current status of the cooler: Temperatures, Relays, Alarms, Door and Voltage. The app is available for Android and IOS phones and allows users to view controller settings, readouts, make modifications and OTA (Over-The-Air) FFA Firmware Update.

For Dimension and connecting details refer to section 4.1.4 & 4.1.5.

4.2.6 OPERATION

4.2.6.1 LED INDICATIONS

Green LED	Red LED
Blink only on Power Up once for less than 500 msec	Blink on Power Up for less than 500 msec Blink at rate of 1 second during connection over BLE

4.2.6.2 FFM-B & FFM-BB FUNCTIONALITY

All other operations are controlled by connecting the FFM-B to the mobile App. Using the App you can:

- Configure FFM-B parameters
- View logged events
- Configure FFA parameters
- Update firmware

Please refer to the FFM-B phone app manual for instructions on using the app.

5.1 DOOR SWITCH FAILURE

- Display
  - o Activated when door is open for longer than (d1 + d2).
  - o Door Open Indicator: ON (solid)
  - o Master Alarm Indicator: ON (solid)
  - o Main Display: Toggling between "dOP" (Door Open) and "dSF" (Door Switch Failure).
  - o FAN operation: As per Duty Cycle defined in "Evaporator FAN Management".
- Unit resumes working normally (compressor coming ON when there is cooling demand) and evaporator fan should cycle accordingly.
- Unit switches to DAY mode if it was in NIGHT mode when the Door Switch Failure was observed.
- Unit stops updating the learning matrix and will not switch to NIGHT mode due to learning algorithm, and once the door switch is restored, then learning matrix will reset. However, pressing the ECO button for more 3 Secs will still force the unit to toggle manually between DAY and NIGHT modes.
- During Door Switch Failure, the lights remain always ON and cannot be switched OFF manually.

5.2 REGULATION PROBE FAILURE

- Display
  - o Master Alarm Indication: ON (solid)
  - o Main Display: Toggling between "PF1" and the active set point
- Compressor cycles ON/OFF according Duty Cycles on Delays and timers control items (see ref Paragraph Error! Reference source not found.)
- If unit is in Winter Mode, it will exit this mode back to normal mode and cycle the compressor according to Duty Cycles on Delays and timers control items (see ref Paragraph Error! Reference source not found.)
- All other operations as nominal.

5.3 EVAPORATOR PROBE FAILURE

- Display
  - o Master Alarm Indication: ON (solid)
  - o Main Display: Toggling between "PF2" and regulation temperature
- All functions using the Evaporator Probe will be deactivated.
- All defrost start and end temperatures (if enabled) will be disabled (see ref Paragraph Error! Reference source not found.).
- dF2 is not respected (Defrost function is not suspended even if regulation temperature above dF2).
- All other operations as nominal.

5.4 CONDENSER PROBE FAILURE

- Display
  - o Master Alarm Indication: ON (solid)
  - o Main Display: Toggling between "PF3" and regulation temperature
- Controller resumes normal operation (condenser protection feature will be disabled)

4.5 AMBIENT SENSOR FAILURE

- Display
  - o Master Alarm Indication: ON (solid)
  - o Main Display: Toggling between "PF4" and regulation temperature
- Controller resumes normal operation
  - o The Set Point values used are the programmed ones (not adding the offsets due to ambient conditions).

5.6 AMBIENT SENSOR FAILURE

Refrigeration Failure Mode will be initiated if any of the following events take place:

- Compressor has been running continuously for longer than "Cd6"
- 2 consecutive defrost cycles due to "Cd5"
- Condenser temperature (when condenser probe is enabled and not faulty) exceeds "OH" over 3 consecutive events
- Condenser temperature (when condenser probe is enabled and not faulty) drops below "SC" over 3 consecutive events

When the unit is in Refrigeration Failure Mode:

- Compressor: OFF
- Evaporator FAN: OFF
- Condenser FAN: OFF
- LIGHTS: OFF
- Display
  - o Master Alarm indicator: ON (solid)
  - o Main Display: Toggles between the Regulation Sensor and "rFF"
- Buttons: Disabled but menu item can still be accessed

Note:

Alarm is reset by cooler unplugging only.

Intelligent Controls

SOLLATEK UK LTD.

Tel: +44 (1753) 214 500
sales@sollatek.com
www.sollatek.com

Sollatek (UK) Ltd. Sollatek House, Waterside Drive, Langley, Slough SL3 6EZ UK

ISO9001: 2008 accredited company

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