ELECTRA

Service Manual

KN Cassette R410A Series

Indoor Units	Outdoor Units
KN 24 RC	OU7-24 RC
KN 24 RC 3PH	OU7-24T RC

REFRIGERANT	
R410A	COOLING ONLY HEAT PUMP
SEPTEMBER - 2005	

CONTENT

1. INTRODUCTION

1.1 General

The cassette (900X900) split celling mounted range comprise the ST (cooling only) and RC (heat pump) models, as follows:

- **Cooling Only** KN24ST, KN30ST , 1PH & 3PH units
- **Heat Pump** KN24RC, KN30RC, 1PH & 3PH units

1.2 Main Features

The (900X900) Cassette series benefits from the most advanced technological innovations, namely:

- R410A units
- Microprocessor control.
- Indoor spacial centrifugal fan for low noise opration
- High COP.
- Easy access to interconnecting tubing and wiring connections,
- Integral condensate water pump.
- Automatic treated air sweep.
- Easy installation and service.

1.3 Indoor Unit

The indoor unit is celling mounted, and can be easily fitted to many types of residential and commercials applications.

It includes:

- Square bended coil with hydrophilic aluminum fins.
- A large diameter centrifugal fan
- Motorized flaps
- Advanced electronic control box assembly.

1.4 Filtration

The Cassette series presents with easily accessible, and re-usable pre-filters (mesh)

1.5 Control

The microprocessor indoor controller, and an infrared remote control, supplied as standard, provide complete operating function and programming. For further details please refer to the Operation Manual, Appendix A.

1.6 Outdoor Unit

The Cassette outdoor units can be installed as floor or wall mounted units by using a wall supporting bracket. The metal sheets are protected by anti- corrosion paint work allowing long life resistance. All outdoor units are pre-charged. For further information please refer to the Product Data Sheet, Chapter 2.

It includes :

- A **Rotary** Compressor mounted in a soundproofed compartment
- Axial fan.
- Outdoor coil with hydrophilic louver fins for RC units.
- Outlet air fan grill.
- Service valves" flare" type connection.
- Interconnecting wiring terminal block.
- Integra Electrical phase protector (on 3PH models).
- Advanced TYPHOON PCB

1.7 Tubing Connections

Flare type interconnecting tubing to be produced on site.
For further details please refer to the Installation Manual, Appendix A.

1.8 Accessories

ASK (All Season Kit):

For low ambient working conditions in cooling, an ASK can be installed.This kit allows cooling operation down to outdoor temp of -10 ºC by gradually controlling the outdoor fan speed motor.

RCW Wall Mounted Remote Control

The RCW1/ RCW2 remote control is a wall mounted remote controler, for multi indoor unit aplications and functioning
For further details please refer to Optional Accessories, Chapter 18.

1.9 Inbox Documentation

Each unit is supplied with its own installation and operation manuals.

2. PRODUCT DATA SHEET

2.1 R410A

Model Indoor Unit				**KN-24**		
Model Outdoor Unit				**OU7-24**		
Installation Method of Pipe				Flared		
Characteristics			**Units**	**Cooling Only**	**Cooling**	**Heating**
Capacity (1)			Btu/hr	23100	23100	24150
			kW	6.77	6.77	7.08
Power input (1)			kW	2.25	2.25	2.33
EER (Cooling) or COP(Heating) (1)			W/W	3.01	3.01	3.04
Energy efficiency class				B	B	D
Power supply			V/Ph/Hz	220-240V/Single/50Hz		
Rated current			A	9.6	9.6	9
Starting current			A	63		
Circuit breaker rating			A	20		
INDOOR	Fan type & quantity			Centrifugal x 1		
	Fan speeds	H/M/L	RPM	570/510/460		
	Air flow (2)	H/M/L	m3/hr	910/800/690		
	External static pressure	Min-Max	Pa	N/A		
	Sound power level (3)	H/M/L	dB(A)	54/50/48		
	Sound pressure level(4)	H/M/L	dB(A)	44/41/38		
	Moisture removal		l/hr	2.5		
	Condensate drain tube I.D		mm	32		
	Dimensions	WxHxD	mm	840x230x840 (Unit) / 950x46x950 (Frame)		
	Weight		kg	36 (unit) / 6 (Frame)		
	Package dimensions	WxHxD	mm	1011x333x931 (Unit) / 1013x145x1013(Frame)		
	Packaged weight		kg	40 (unit) / 7 (Frame)		
	Units per pallet		units	5(Unit) / 15(Frame)		
	Stacking height		units	5 Levels (unit) / 15 Levels (Frame)		
OUTDOOR	Refrigerant control			Capillary tube restrictor for heating)		
	Compressor type, model			Rotary, Mitsubishi NN27VBAMT		
	Fan type & quantity			Propeller(direct) x 1		
	Fan speeds	H/L	RPM	850		
	Air flow	H/L	m3/hr	3100		
	Sound power level	H/L	dB(A)	67		
	Sound pressure level(4)	H/L	dB(A)	58		
	Dimensions	WxHxD	mm	900x680x340		
	Weight		kg	78		
	Package dimensions	WxHxD	mm	985x730x406		
	Packaged weight		kg	82		
	Units per pallet		Units	6		
	Stacking height		units	2 Levels		
	Refrigerant type			R410A		
	Refrigerant chargless distance		kg/m	2.16kg/12.5m		
	Additional charge per 1 meter		g/m	25		
	Connections between units	Liquid line	In.(mm)	3/8"(9.53)		
		Suction line	In.(mm)	5/8"(15.88)		
		Max .tubing length	m.	Max.30		
		Max .height difference	m.	Max.15		
Operation control type				Remote control		
Heating elements			kW			
Others				ASK – Factory Option		

(1) Rating conditions in accordance with ISO 5151 and ISO 13253 (for ducted units) and EN 14511.
(2) Airflow in ducted units; at nominal external static pressure.
(3) Sound power in ducted units is measured at air discharge.
(4) Sound pressure level measured at 1 meter distance from unit.

Model Indoor Unit				**KN-24**		
Model Outdoor Unit				**OU7-24T**		
Installation Method of Pipe				Flared		
Characteristics			**Units**	**Cooling Only**	**Cooling**	**Heating**
Capacity (1)			Btu/hr	23100	23100	24150
			kW	6.77	6.77	7.08
Power input (1)			kW	2.25	2.25	2.33
EER (Cooling) or COP(Heating) (1)			W/W	3.01	3.01	3.04
Energy efficiency class				B	B	D
Power supply			V/Ph/Hz	400V/3PH/50Hz		
Rated current			A	3 X 7.4	3 X 7.4	3 X 7.6
Starting current			A	55		
Circuit breaker rating			A	3 X 16		
INDOOR	Fan type & quantity			Centrifugal x 1		
	Fan speeds	H/M/L	RPM	570/510/460		
	Air flow (2)	H/M/L	m3/hr	910/800/690		
	External static pressure	Min-Max	Pa	N/A		
	Sound power level (3)	H/M/L	dB(A)	54/50/48		
	Sound pressure level(4)	H/M/L	dB(A)	44/41/38		
	Moisture removal		l/hr	2.5		
	Condensate drain tube I.D		mm	32		
	Dimensions	WxHxD	mm	840x230x840 (Unit) / 950x46x950 (Frame)		
	Weight		kg	36 (unit) / 6 (Frame)		
	Package dimensions	WxHxD	mm	1011x333x931 (Unit) / 1013x145x1013(Frame)		
	Packaged weight		kg	40 (unit) / 7 (Frame)		
	Units per pallet		units	5(Unit) / 15(Frame)		
	Stacking height		units	5 Levels (unit) / 15 Levels (Frame)		
OUTDOOR	Refrigerant control			Capillary tube (restrictor for heating)		
	Compressor type, model			Rotary, Mitsubishi NN27VDAMT		
	Fan type & quantity			Propeller(direct) x 1		
	Fan speeds	H/L	RPM	850		
	Air flow	H/L	m3/hr	3100		
	Sound power level	H/L	dB(A)	67		
	Sound pressure level(4)	H/L	dB(A)	58		
	Dimensions	WxHxD	mm	900x680x340		
	Weight		kg	78		
	Package dimensions	WxHxD	mm	985x730x406		
	Packaged weight		kg	82		
	Units per pallet		Units	6		
	Stacking height		units	2 Levels		
	Refrigerant type			R410A		
	Refrigerant chargless distance		kg/m	2.16kg/12.5m		
	Additional charge per 1 meter		g/m	25		
	Connections between units	Liquid line	In.(mm)	3/8"(9.53)		
		Suction line	In.(mm)	5/8"(15.88)		
		Max .tubing length	m.	Max.30		
		Max .height difference	m.	Max.15		
Operation control type				Remote control		
Heating elements			kW			
Others				ASK – Factory Option		

(1) Rating conditions in accordance with ISO 5151 and ISO 13253 (for ducted units) and EN 14511.
(2) Airflow in ducted units; at nominal external static pressure.
(3) Sound power in ducted units is measured at air discharge.
(4) Sound pressure level measured at 1 meter distance from unit.

3. RATING CONDITIONS

Standard conditions in accordance with ISO 5151, ISO 13253 (for ducted units) and EN 14511.

Cooling:
Indoor: 27°C DB 19°C WB
Outdoor: 35 °C DB

Heating:
Indoor: 20°C DB
Outdoor: 7°C DB 6°C WB

3.1 Operating Limits

		Indoor	Outdoor
Cooling	Upper limit	32°C DB 23°C WB	46°C DB
	Lower limit	21°C DB 15°C WB	10°C DB
Heating	Upper limit	27°C DB	24°C DB 18°C WB
	Lower limit	10°C DB	-9°C DB -16°C WB
Voltage	1PH	198 – 264 V	
	3PH	360 - 440 V	

4. OUTLINE DIMENSIONS

4.1 Indoor Unit: KN 24, 30

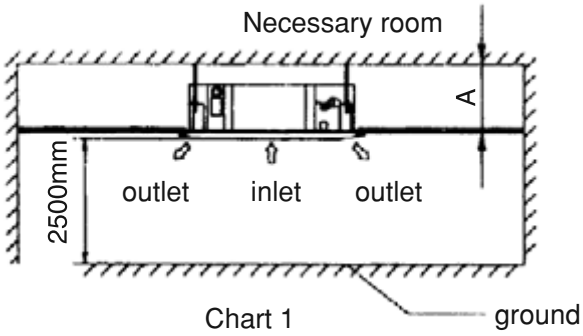
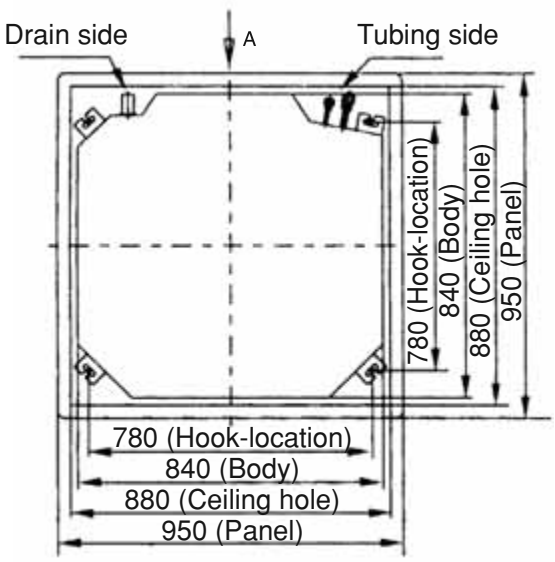


Chart 1

Note: 24/27/30 Series A 260mm
36/45 Series A 330mm



(Unit: mm)

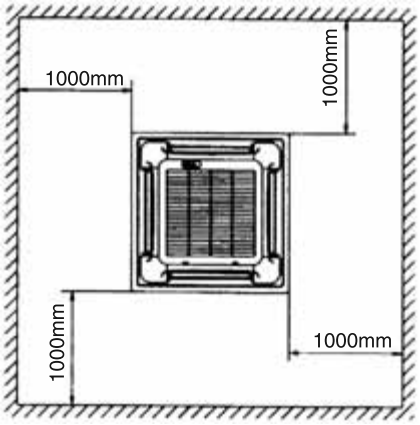


Chart 2

Chart 3

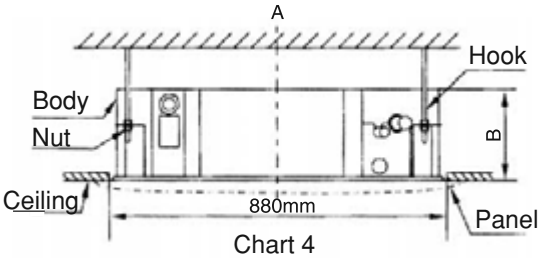


Chart 4

Note: 24/27/30 Series B 240mm
36/45 Series B 310mm

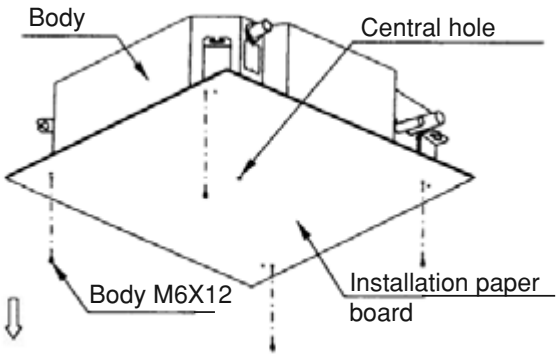


Chart 7

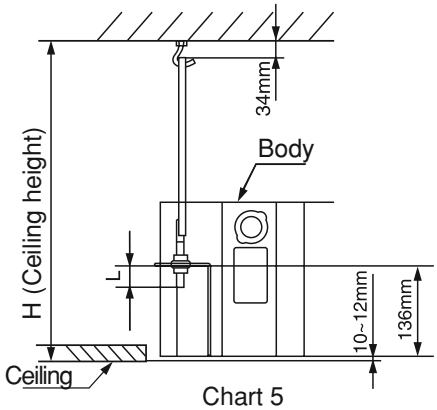


Chart 5

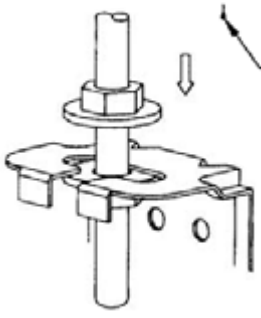
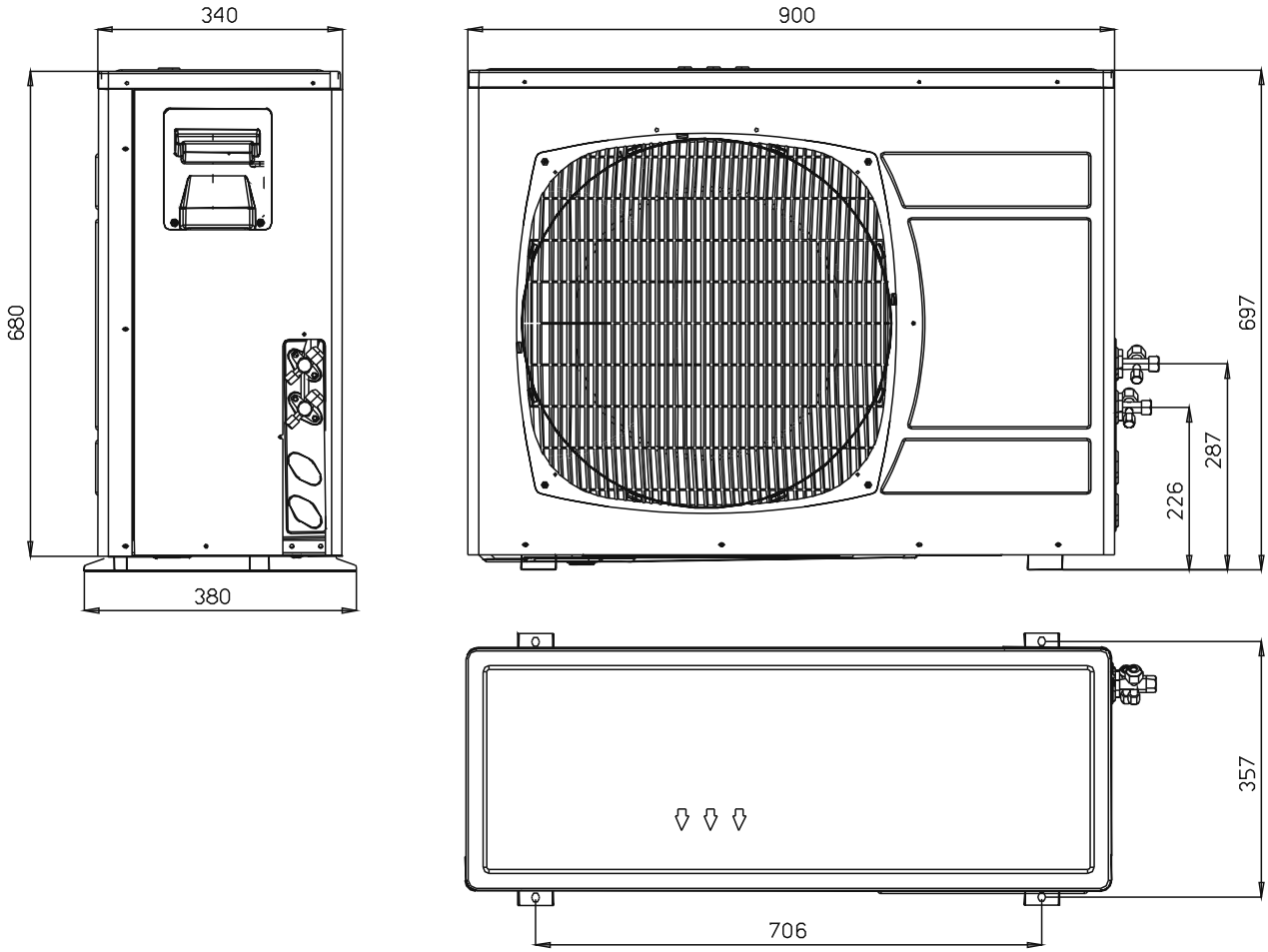
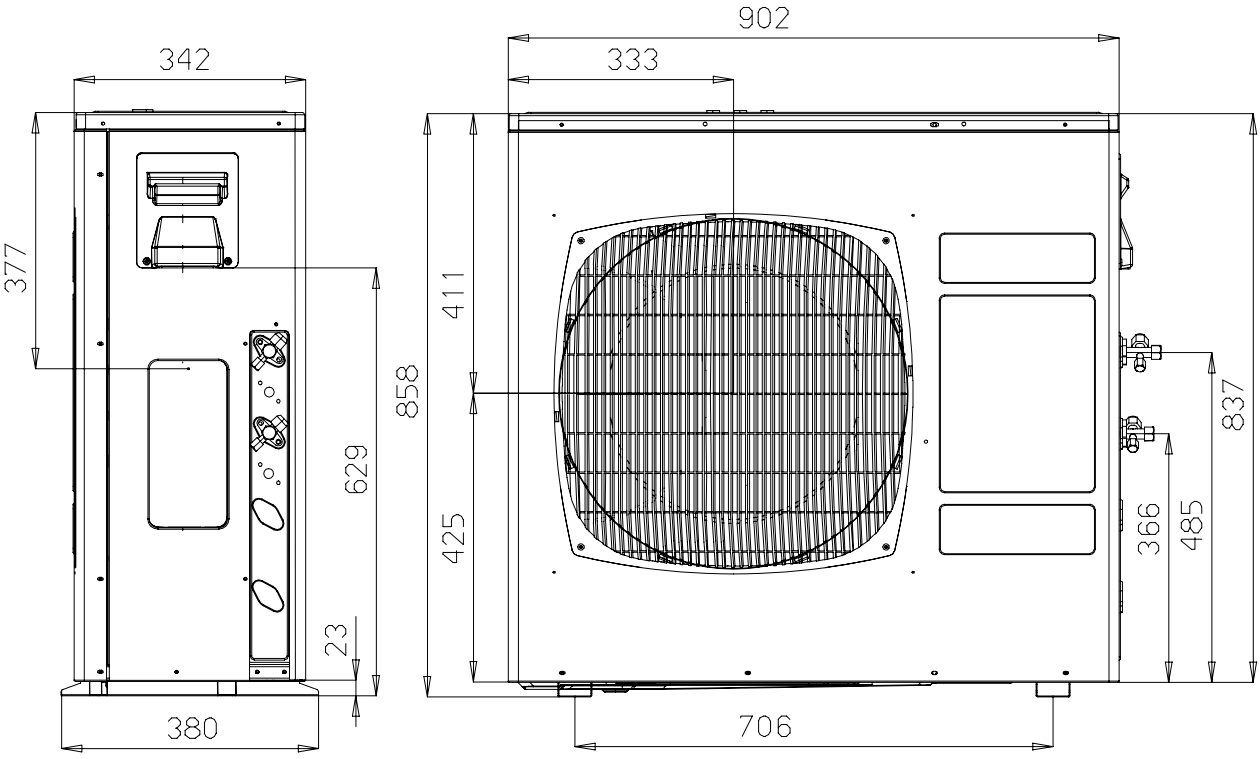


Chart 6

4.2 Outdoor Unit: OU7-24



4.3 Outdoor Unit: OU8-30



5. PERFORMANCE DATA

5.1 KN24 / OU7-24 R410A 1PH/3PH

5.1.1 Cooling Mode at 7.5m Tubing Connection.

230V : Indoor Fan at High Speed.

ENTERING AIR DB OD COIL (°C)	DATA	ENTERING AIR WB/DB ID COIL (°C)				
		15/21	17/24	19/27	21/29	23/32
15(1)	TC	7.14	7.39	7.57	7.74	7.86
	SC	4.80	5.00	5.20	5.33	5.43
	PI	1.60	1.60	1.60	1.60	1.61
20(1)	TC	6.90	7.28	7.51	7.68	7.82
	SC	4.70	4.96	5.17	5.31	5.41
	PI	1.73	1.74	1.74	1.75	1.76
25	TC	6.53	7.05	7.42	7.64	7.83
	SC	4.58	4.86	5.13	5.28	5.37
	PI	1.87	1.88	1.90	1.91	1.92
30	TC	6.11	6.65	7.19	7.44	7.66
	SC	4.44	4.72	5.02	5.16	5.26
	PI	2.02	2.05	2.07	2.08	2.10
35	TC	5.66	6.14	6.77	7.11	7.45
	SC	4.22	4.52	4.90	5.04	5.14
	PI	2.18	2.21	2.25	2.27	2.28
40	TC	5.14	5.60	6.11	6.68	7.02
	SC	3.98	4.28	4.64	4.78	4.88
	PI	2.35	2.39	2.43	2.46	2.48
46	TC	4.46	4.88	5.37	5.93	6.39
	SC	3.66	3.93	4.23	4.37	4.47
	PI	2.57	2.60	2.66	2.70	2.73

LEGEND

TC – Total Cooling Capacity, kW
SC – Sensible Capacity, kW
PI – Power Input, kW
WB – Wet Bulb Temp., (°C)
DB – Dry Bulb Temp., (°C)
ID – Indoor
OD – Outdoor

(1) Marked area is below standard operating limits. For operating in low ambient conditions, refer to Optional Accessories (Chapter 15).

5.1.2 Heating Mode at 7.5m Tubing Connection.

230V : Indoor Fan at High Speed.

	ENTERING AIR DB ID COIL (°C)					
	15		20		25	
ENTERING AIR WB OU COIL (°C)	TH	PI	TH	PI	TH	PI
-10	4.09	1.86	3.93	1.99	3.78	6.34
-7	4.40	1.91	4.24	2.02	4.09	6.46
-2	4.67	1.93	4.52	2.05	4.36	6.58
2	5.69	2.03	5.45	2.16	5.22	6.94
6	7.29	2.18	**7.08**	**2.33**	6.83	7.52
10	7.93	2.30	7.72	2.46	7.50	7.99
15	8.57	2.40	8.35	2.59	8.14	8.35
20	9.03	2.47	8.81	2.68	8.57	8.78

* the above chart includes the weighted deicing infleuence.

LEGEND

TH – Total Heating Capacity, kW
PI – Power Input, kW
WB – Wet Bulb Temp., (°C)
DB – Dry Bulb Temp., (°C)
ID – Indoor
OU – Outdoor

5.2 Capacity Correction Factor Due to Tubing Length (One Way)

TOTAL TUBING LENGTH								
4m	**7.5m**	10m	15m	20m	25m	30m	40m	50m
1.01	**1**	0.98	0.97	0.96	0.95	0.94	---	---

* Minimum recommended tubing length between indoor and outdoor units is 4m.

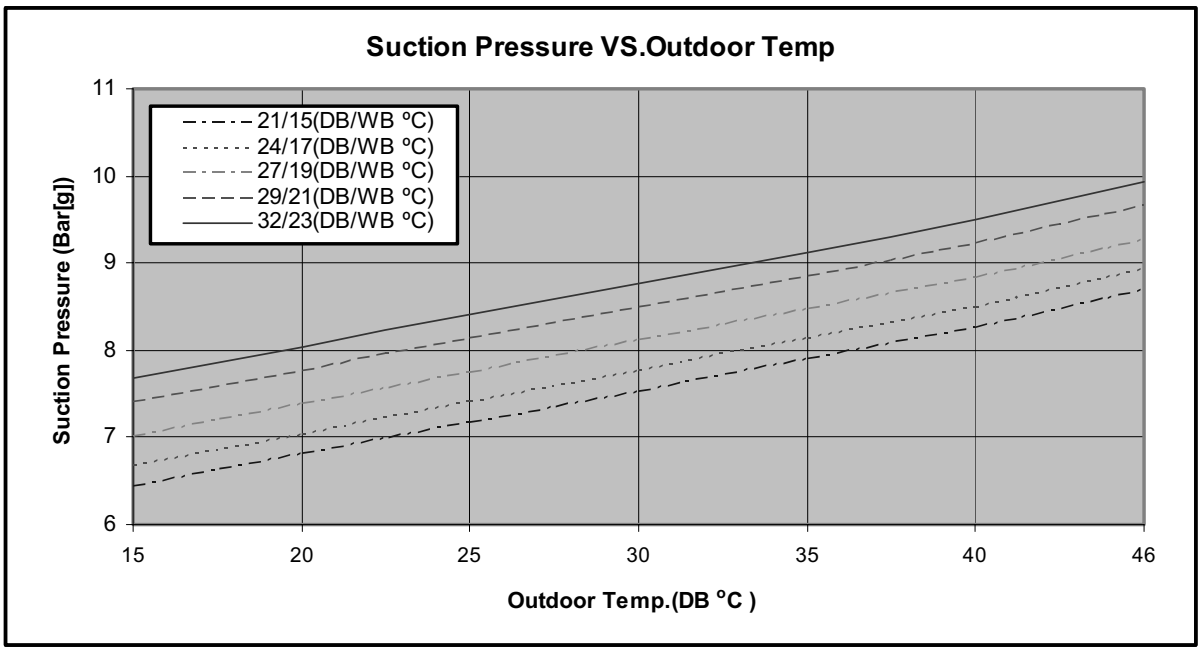
5.2.1 Heating

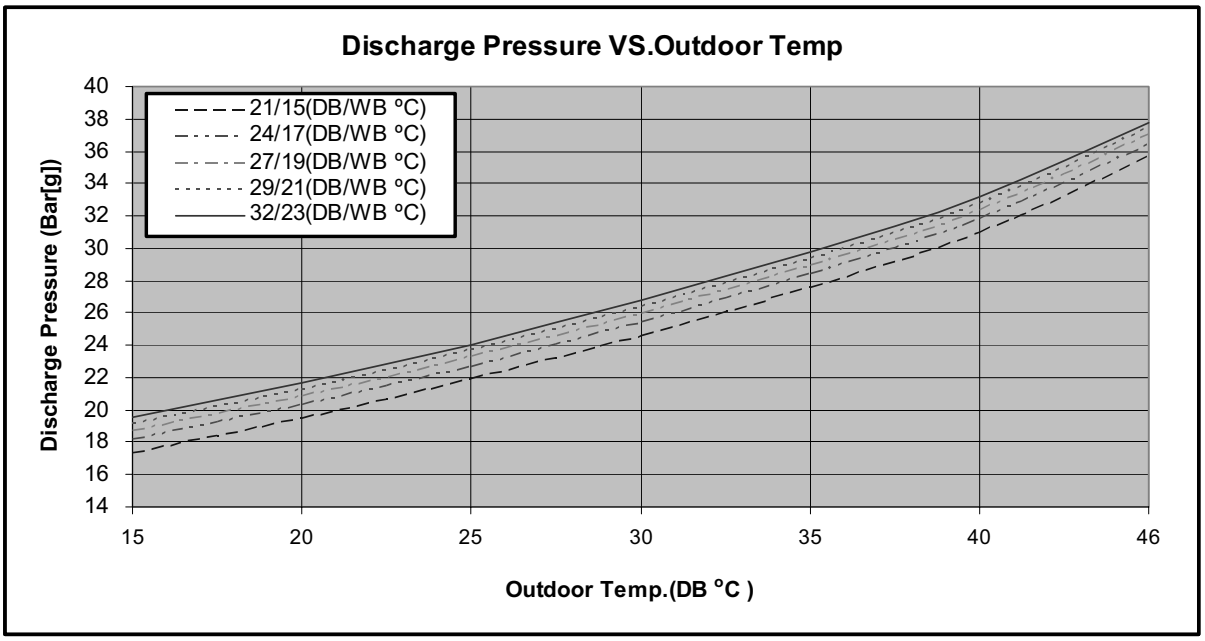
TOTAL TUBING LENGTH								
4m	**7.5m**	10m	15m	20m	25m	30m	40m	50m
1.02	**1**	0.99	0.99	0.98	0.97	0.97	---	---

* Minimum recommended tubing length between indoor and outdoor units is 4m.

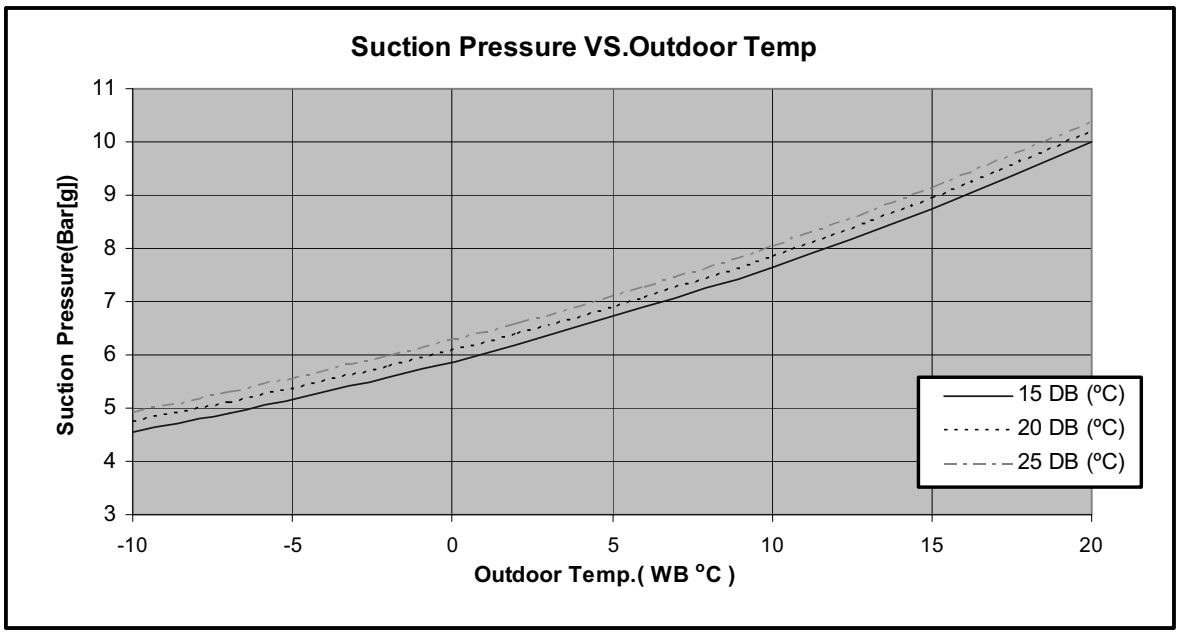
5.3 Pressure Curves.

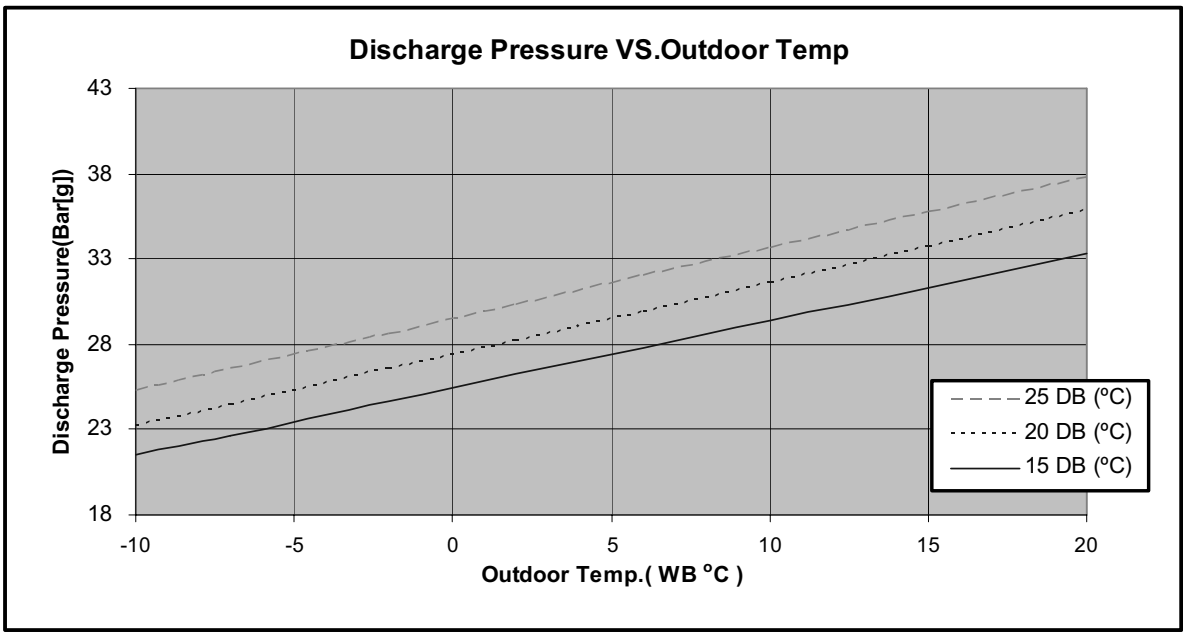
5.3.1 Cooling.





5.3.2 Heating.


Suction Pressure VS.Outdoor Temp
Suction Pressure(Bar[g])
11
10
9
8
7
6
5
4
3
-10
-5
0
5
10
15
20
Outdoor Temp.(WB °C)
15 DB (ºC)
20 DB (ºC)
25 DB (ºC)


Discharge Pressure VS.Outdoor Temp
Discharge Pressure(Bar[g])
43
38
33
28
23
18
-10
-5
0
5
10
15
20
Outdoor Temp.(WB °C)
25 DB (ºC)
20 DB (ºC)
15 DB (ºC)

11. CONTROL SYSTEM

11.1 Electronic Control

11.1.1 Introduction

The electronic control information is designed for service applications, and is common to the following groups of air-conditioners:

- **ST/RC** group -Cooling only / cooling and heating by heat pump.
- **SH group** -Cooling and heating by heat pump and supplementary heater.
- **RH group** -Cooling, heating by heaters only.

11.1.2 Remote Control DIP Switch Settings

SETTING SWITCH STATUS				DEFINITION	
SW. NO. 1	SW. NO. 2	SW. NO. 3	SW. NO. 4	RC3	RC4
OFF	OFF	--	--	RC-ALL MODES OF OPERATION	
ON	OFF	--	--	STD-COOL, FAN, DRY, ACTIVE	
OFF	ON	--	--	HEAT-COOL, FAN, DRY, ACTIVE	
ON	ON	--	--	AUTO FAN (AF)	
--	--	OFF	--	TEMP. DISPLAY IN °C DEGREES	VERTICAL SWING ONLY
--	--	ON	--	TEMP. DISPLAY IN °F DEGREES	HORIZONTAL & VERTICAL SWING FUNCTIONS TOGETHER
--	--	--	OFF	TIMER & CLOCK 12H AM, PM	DISABLE LCD & KEY ILLUMINATION
--	--	--	ON	TIMER & CLOCK 24H	ENABLE LCD & KEY ILLUMINATION

Reset operation **-** Press the 4 buttons simultaneously: “CLEAR “, “SET”, "HR +", ”HR -” for 5 seconds

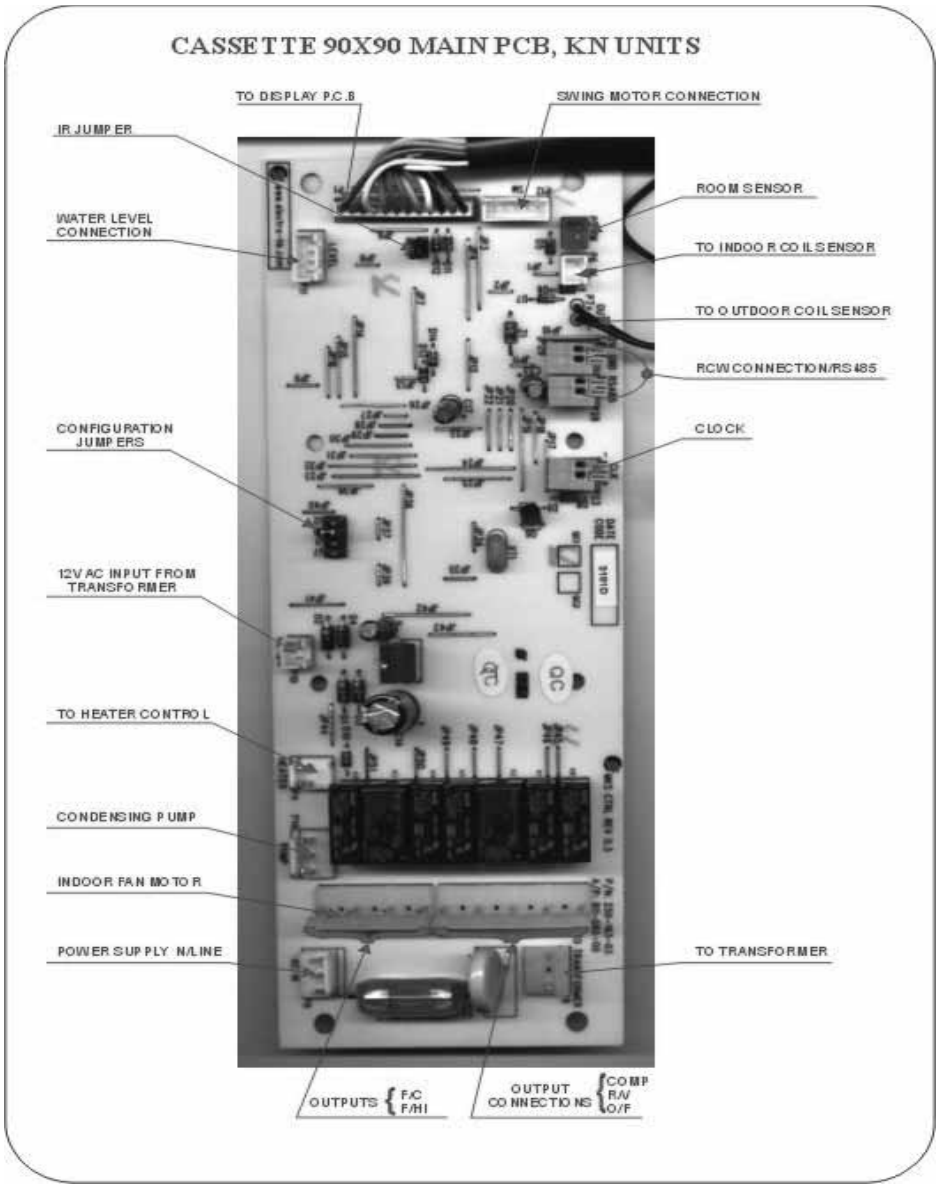
LEGEND

SW1, SW2 - Selection of RC/ST
SW3 – Selection of Display °C or °F in RC3 or swing function in RC4
SW4 – Selection of Time Display 12H AM/PM or 24H in RC3 or illumination in RC4
OFF = 0
ON = 1

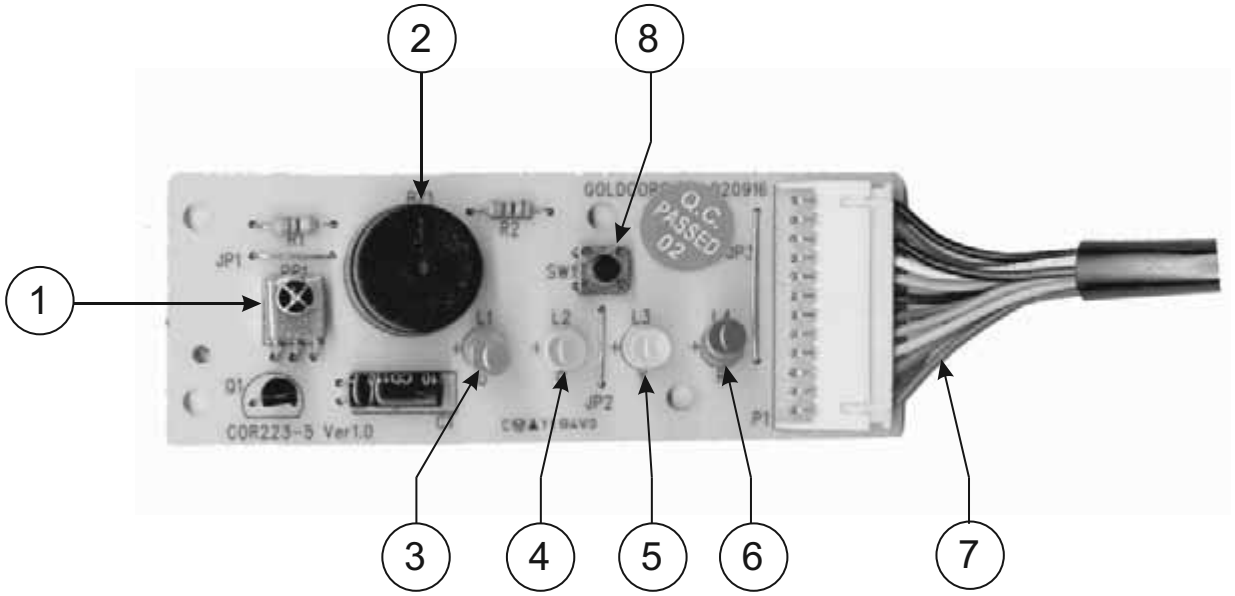
NOTE

After setting the DIP switches perform reset operation.

11.1.3 Main PCB Controller



11.1.4 Display Board PCB



Legend

1. IR Receiver
2. Buzzer
3. STBY LED
4. Operation LED
5. Timer LED
6. Heating LED
7. Display Port Connection
8. Push Button (Mode)

11.2 Control Function

11.2.1 Abbreviations

AC	- Alternate Current
A/C	- Air-Conditioner
ANY	- ON or OFF status
CLOCK	- ON/OFF Operation Input, (dry contact)
COMP	- Compressor
CPU	- Central Processing Unit
CTV	- Compensation Temperature Value
HE	- Heating Element
HPC	- High Pressure Control
H/W	- Hardware
ICP	- Indoor Condensation Pump
ICT	- Indoor Coil Temperature (RT2) sensor
IF, IFAN	- Indoor Fan
IR	- Infrared
LEVEL1	- Normal Water Level
LEVEL2/3	- Medium/High Waterlevel
LEVEL4	- Overflow Level
Max	- Maximum
Min	- Minimum
min	- Minute (time)
NA	- Not Applicable
OCP	- Outdoor Condensation Pump
OCT	- Outdoor Coil Temperature (RT3) sensor
OF, OFAN	- Outdoor Fan
OPER	- Operate
Para.	- Paragraph
RAT	- Return Air Temperature (RT1) sensor
RC	- Reverse Cycle (Heat Pump)
R/C	- Remote Control
RCT	- Remote Control Temperature
RH	- Resistance Heater
RT	- Room Temperature (i.e. RCT in IFEEL mode, RAT otherwise)
RV	- Reversing Valve
SB, STBY	- Stand-By
sec	- Second (time)
Sect	- Section
SH	- Supplementary Heater
SPT	- Set Point Temperature
ST	- Standard (Model with Cooling Only)
S/W	- Software
TEMP	- Temperature
W/O	- Without
ΔT	- The difference between SPT and RT. in Heat Mode: $\Delta T = SPT - RT$ in Cool/Dry/Fan Mode: $\Delta T = RT - SPT$

11.3 General Functions

11.3.1 COMP Operation

a. For each Mode including POWER OFF & SB, a Min time delay of 3 min before COMP restarting, excluding DEICING Mode.

b. The Min operation time of COMP under different operating conditions is:

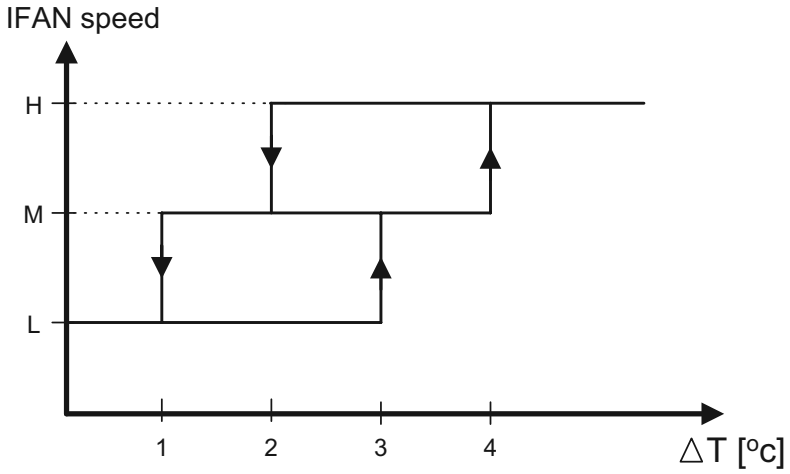
Operation Mode	Min Operation Time of COMP
Heat, Cool, HP protection or Auto Modes	3 min.
Fan, Dry, Overflow, Protection Modes, or Mode Change	Ignored

11.3.2 IFAN operation

a. Min time interval between IFAN speed change in AUTOFAN Mode is 30 sec.

b. Min time interval between IFAN speed change in H/M/L Mode is 1 sec.

c. IFAN speed in Heat/Cool AUTOFAN Mode is determined according to the following chart:



Where in Heat Mode: $\Delta T = SPT - RT$
in Cool Mode: $\Delta T = RT - SPT$

11.3.3 OFAN Operation

Min time interval between OFAN ON/OFF state changes is 30 sec.

11.3.4 HE Operation

a. Min Heaters ON or OFF time is 30 sec.

b. Heaters can never be in operation while IFAN is OFF.

c. In RH group, HE-1 and HE-2 will be activated only when COMP is not operating, except in Dry Mode.

11.3.5 Protections

a. High pressure protection is applicable to all operating modes.

b. Deicing control is valid in Heat and Auto Heat Modes only.

c. Defrosting control is valid in Dry, Cool, and Auto Cool Modes.

11.3.6 Thermistors Operation

a. Return air Temp. is detected by RAT in normal Mode, or by RCT (R/C sensor) in I-FEEL Mode.

b. Indoor Coil Temp. is detected by ICT.

c. Outdoor Coil Temp. is detected by OCT.

d. Definition of thermistor faults:

1) Thermistor is disconnected - the thermistor reading is below – 30^{O}C.

2) Thermistor is shorted - the thermistor reading is above 75^{O}C.

3) Thermistor Temp reading doesn't change -

a) This test is performed only once after a unit is switched from OFF/STBY to operation. At the first occurrence of 10 min continuous COMP operation, the current ICT are compared with those when the COMP was switched from OFF to ON 10 min before. If the ΔT is less than 3^{O}C, the thermistor is regarded as defective.

b) The ICT no-change error can be disabled together by connecting a 4.7kΩ resistor (5%) to the ICT connector. These resistors are equivalent to a thermistor 48+/-1^{O}C.

e. Cases for disabling ICT thermistor disconnected detection:

1) The detection of thermistor faults a. and b. above is disabled when Deicer Protection is started. The detection will be enabled again only after (1) the deicing is completed, and (2) COMP has been restarted and operated for 30 sec.

2) When all the following conditions are fulfilled:

a) 4.7kΩ resistor is connected to the OCT.

b) IFAN is OFF.

c) Compressor is ON.

d) ICT < -30 (disconnected).

11.3.7 RV Fault

This test is applied only in compressor units where 4.7kΩ resistor is not connected to the OCT.
The test is performed every time the unit is switched from OFF/STBY to OPER in Heat mode or changes operation mode from COOL/DRY to HEAT or (this applies also in AUTO COOL/HEAT mode).
If ICT is lower than 35°C at the time of mode change, then at the first occurrence of 15 min continuous COMP operation, ICT is compared with ICT reading when the COMP was switched from OFF to ON 15 min before. RV fault is defined when ICT decreases more than 5°C.
In this case, the COMP will stop and the SB LED will blink. The fault is reset after switching to SB or after mode change.

11.3.8 General Features

a. Allowed (control target) range for RAT is SPT +/-1ºC.

b. Whenever the unit is changed from COOL/DRY/STBY mode to HEAT mode or vice versa, the procedures below are followed:
Stop COMP for 3 min → Change RV state → Start COMP if necessary.

11.4 Cooling Mode

11.4.1 Cooling Mode – General

a. Mode Definition

Mode: COOL, AUTO (at Cooling)

Temp: Selected desired temperature.

Fan: HIGH, MED, LOW, AUTO.

Timer: Any

I-FEEL: ON or OFF

b. Room Temperature, RT, is detected by:

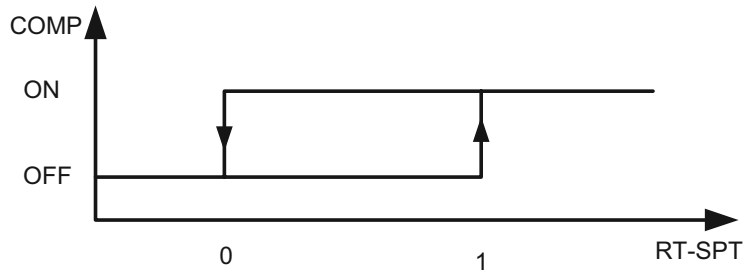
- RAT in normal operation, or
- RCT (R/C sensor) in I-FEEL mode.

c. Indoor Coil Temp is detected by ICT.

d. Outdoor Coil Temp is detected by OCT.

11.4.2 Control Functions

a. COMP Operation



b. OFAN Operation

- In normal operation OFAN operates together with the COMP.

c. IFAN Operation

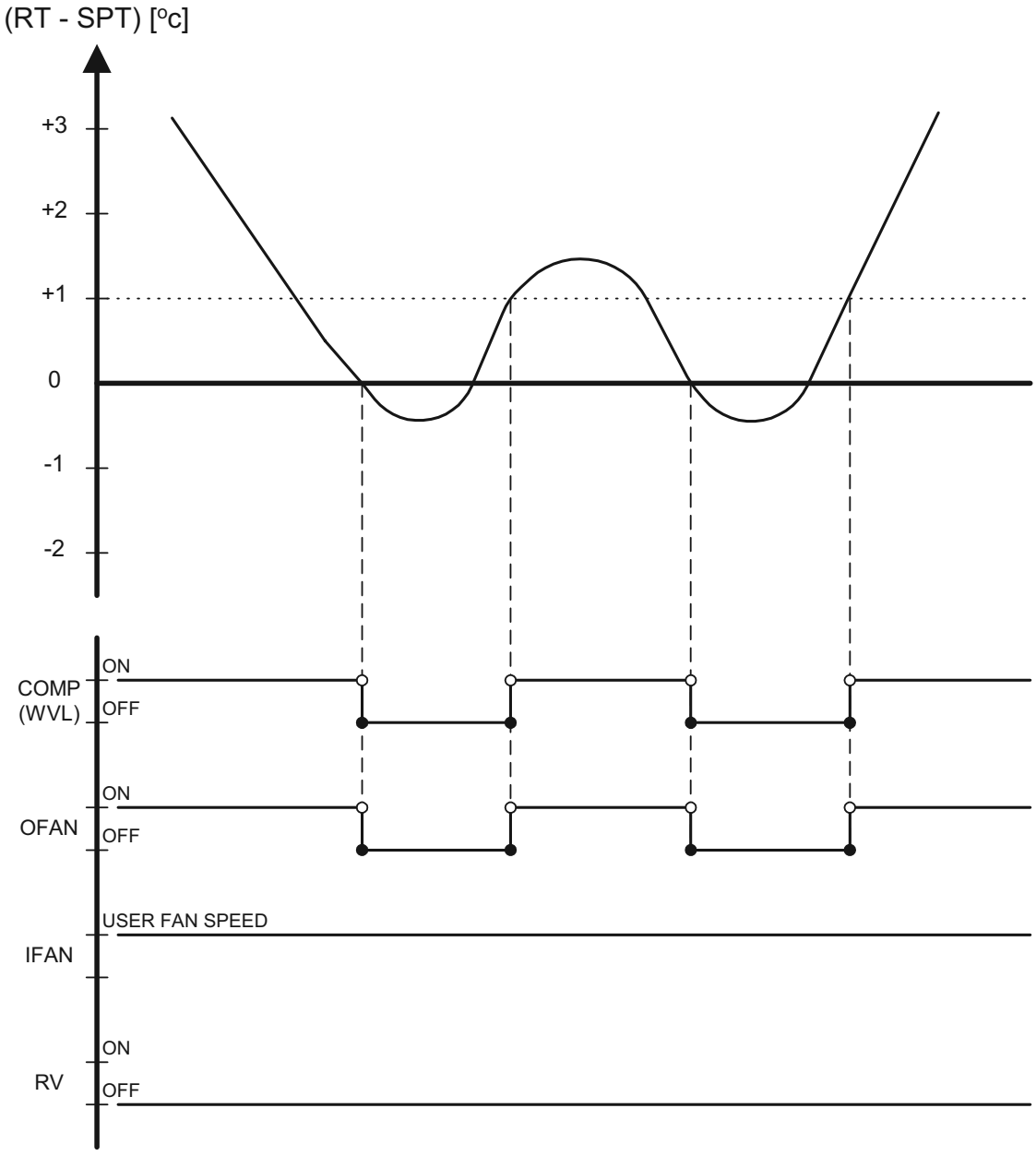
- IFAN will operate in ANY speed regardless the ICT or COMP state.
- IFAN speed will be determined according to user selection or AUTO-FAN logic

d. RV and HEATERS outputs

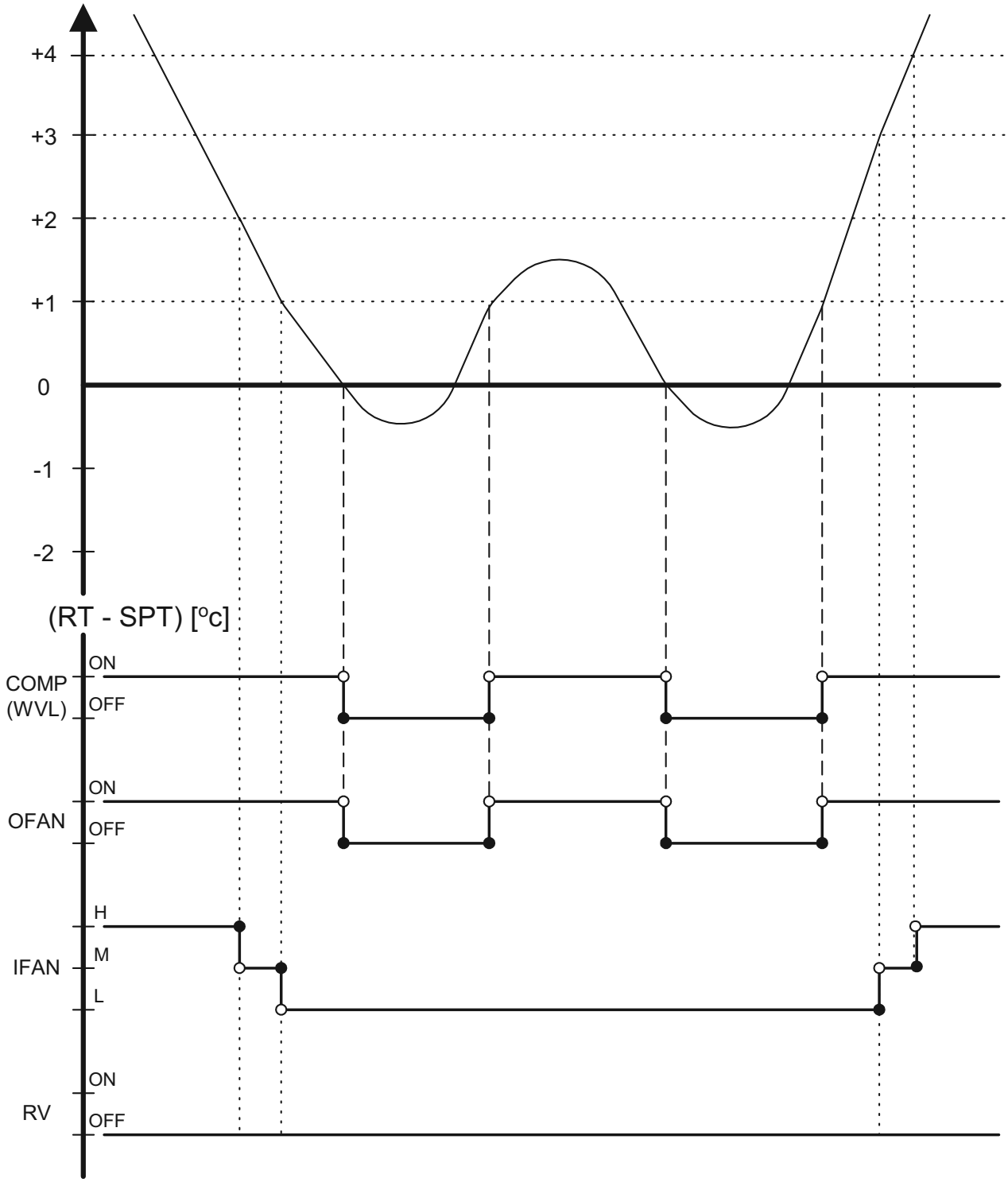
- RV and HEATERS are in OFF state in COOL mode.

11.4.3 Sequence Diagrams

a. Maintaining room temp at desired level by comparing RT and SPT with user defined IFAN speed.



b. Maintaining room temp at desired level by comparing RT and SPT with AUTO-IFAN.



11.5 Heating Mode

11.5.1 Heating Mode - General

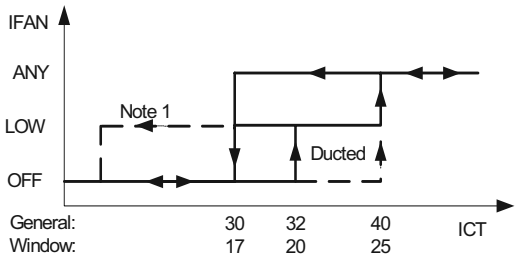
a. Compensation Procedure
When I-FEEL is OFF during HEAT mode: RT= RAT – CTV.
When I-FEEL is ON during HEAT mode: RT= RCT.

Type of Indoor	CTV
Wall Mounted	+3 °C
Mobiles / Floor Ceiling	+0 °C
Square /Window	+2 °C
Ducted	+4 °C
Cassettes	+4 °C

No compensation will be activated in Forced operation modes

b. IFAN operation rules for RC and SH groups:

1) As a general rule for **RC and SH groups,** IFAN will be switched ON according to the following graph:



NOTE 1

When COMP is ON (except WAX Model), IFAN will change from LOW to OFF either when:

a) ICT<28 and IFAN is on for 5 min or longer.

Or,

b) ICT<20

NOTE 2

When ICT is faulty:
When the compressor switches from OFF to ON (excluding deicing), IFAN will be on in ANY speed.
When the compressor switches from ON to OFF, the IFAN will change to LOW speed for 30 seconds and then it will be off.

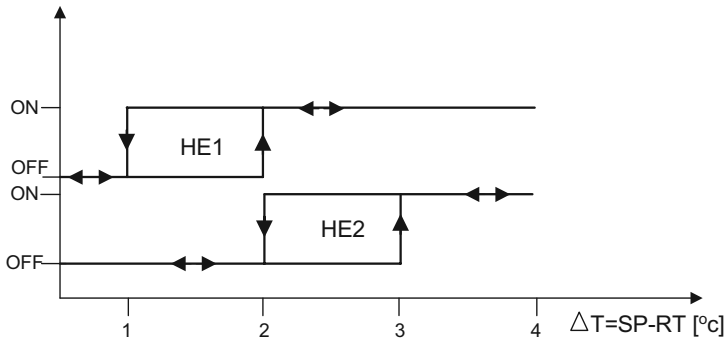
2) In SH or RC group, IFAN will operate for Min 30 sec according to 1) above after HEs are turned off, where in a case it has to be OFF, it will be forced to LOW speed.

c. IFAN operation rules for RH group

1) In RH group, IFAN starts when HE starts. When HE switches to OFF, IFAN switches to LOW for 30 sec and then stops.

d. Heaters operation rules for RC and SH groups:

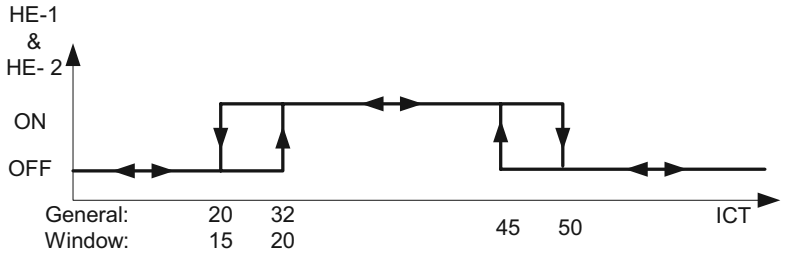
1) For both RC and SH groups, Heaters versus ΔT is as follows:



2) Operation rules for Heaters in RC group:

a) Heaters can be enabled only if IFAN is ON.

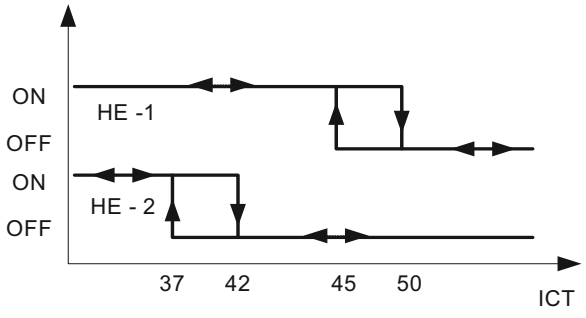
b) Heaters will operate according to ΔT **and** the following graph:



3) Rules for Heaters operation in SH group:

a) When heaters are to be ON and IFAN is to be OFF according to d. 1) above, IFAN will be forced to LOW speed.

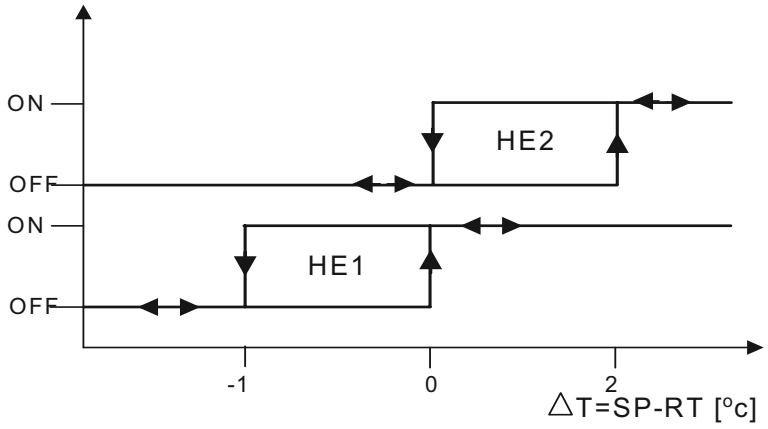
b) Heaters will operate according to ΔT and the following graph:



4) For both RC and SH groups, excluding deicing, HE1 and HE2 can be ON only when the compressor is ON.

e. Heaters operation rules for RH groups:

1) In RH group, HE operation is according to the difference between RAT and SPT.



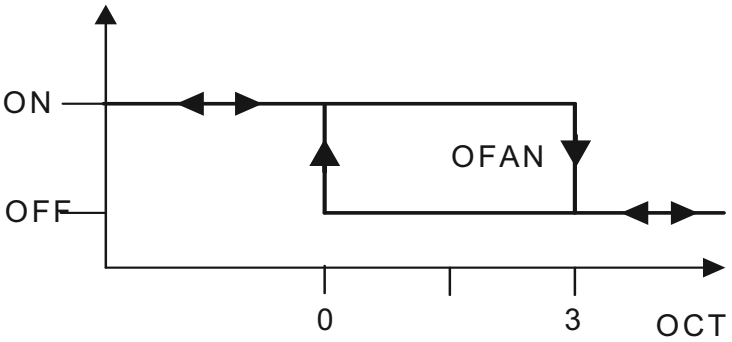
f. OFAN Operation for RC and SH groups

1) As a general rule for RC and SH groups, excluding protection modes, OFAN starts with the compressor.

2) When OFAN is ON it will operate according to the following conditions:

a) OFAN operates together with the compressor.

b) When $(RT \geq SPT - 2)\ and\ ICT \geq 50$ and the 4.7kΩ resistor is not connected to the OCT, OFAN will operate according to the following curve:



11.6 Heating, RC or SH Group

Mode: HEAT, AUTO (at heating)

Temp: Selected desired temperature

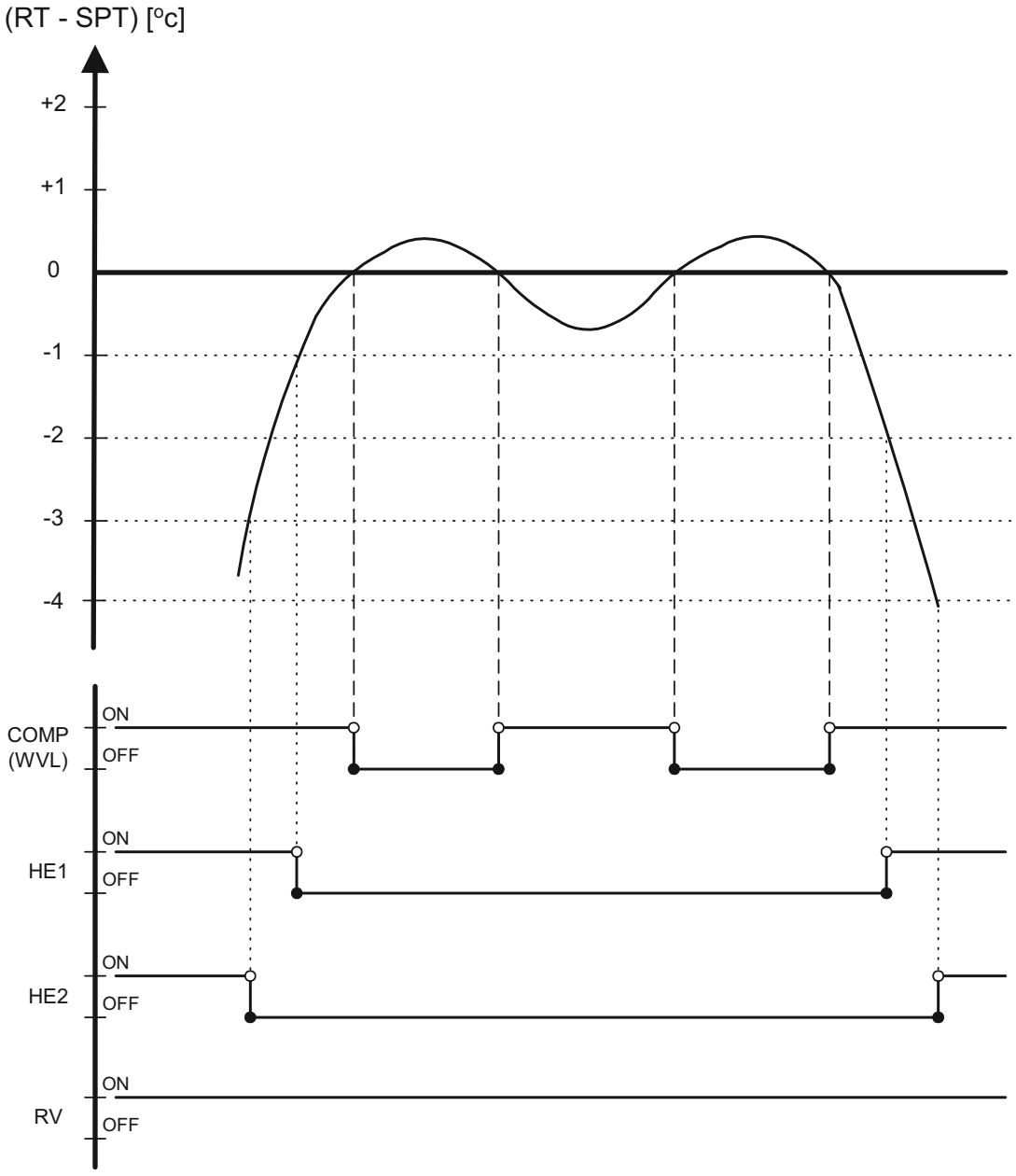
Fan: HIGH, MED, LOW

Timer: Any

I-FEEL: ON or OFF

11.6.1 Sequence Diagram

Maintains room temp. at desired level by comparing RAT or RCT to SPT.



11.7 Heating, RC or SH Group with Autofan

Mode: HEAT, AUTO (at heating)

Temp: Selected desired temperature

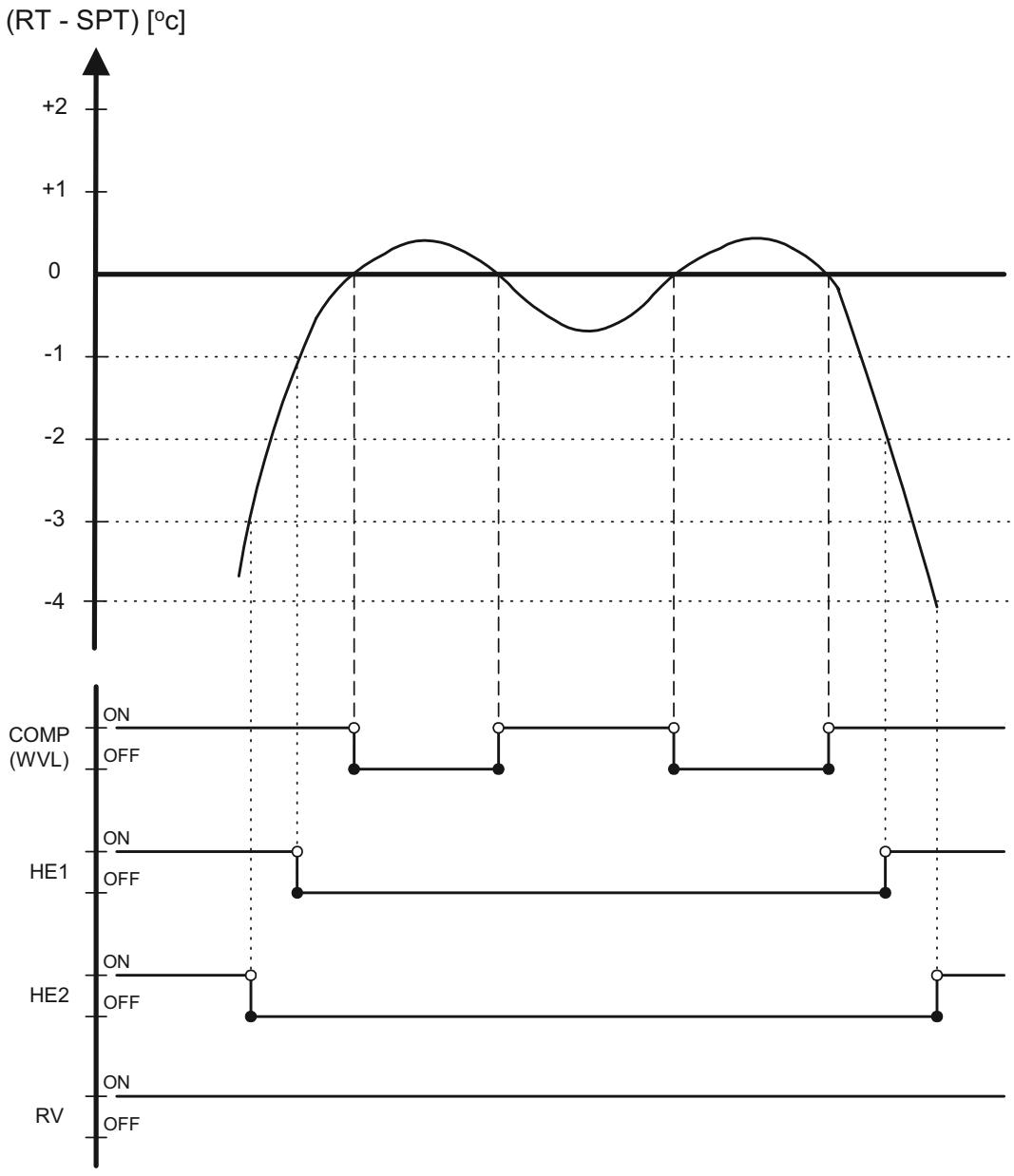
Fan: AUTO

Timer: Any

I-FEEL: ON or OFF

11.7.1 Sequence Diagram

Maintains room temp at desired level by controlling COMP, IFAN and OFAN.



11.8 Heating, RH Group

Mode: HEAT, AUTO (at Heating)

Temp: Selected desired temperature

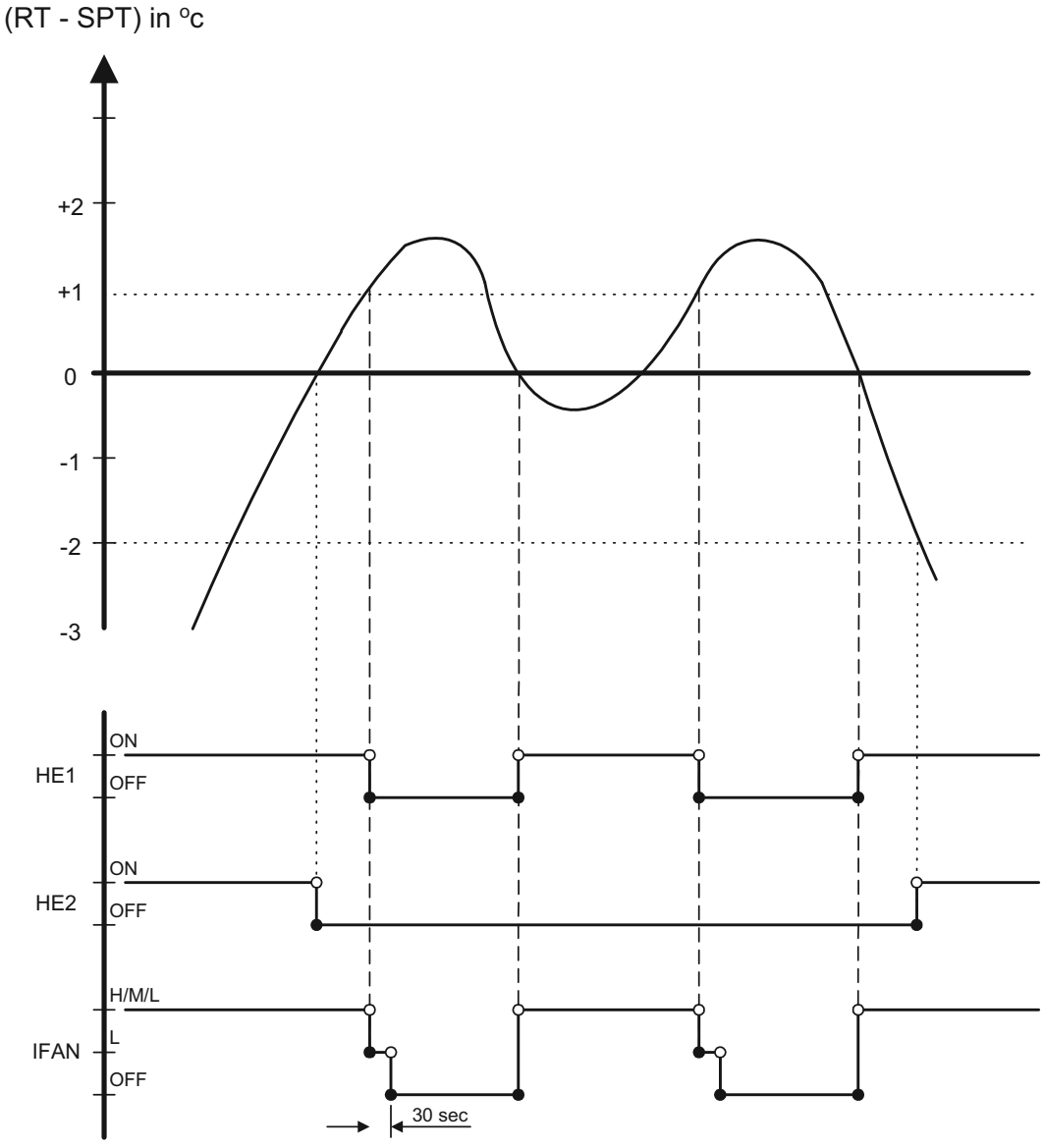
Fan: HIGH, MED, LOW

Timer: Any

I-FEEL: ON or OFF

11.8.1 Sequence Diagram

Maintains room temp at desired level by controlling Heating Elements: HE1 or HE2.



11.9 Heating, RH Group, with AUTOFAN

Mode: HEAT, AUTO (at Heating)

Temp: Selected desired temperature

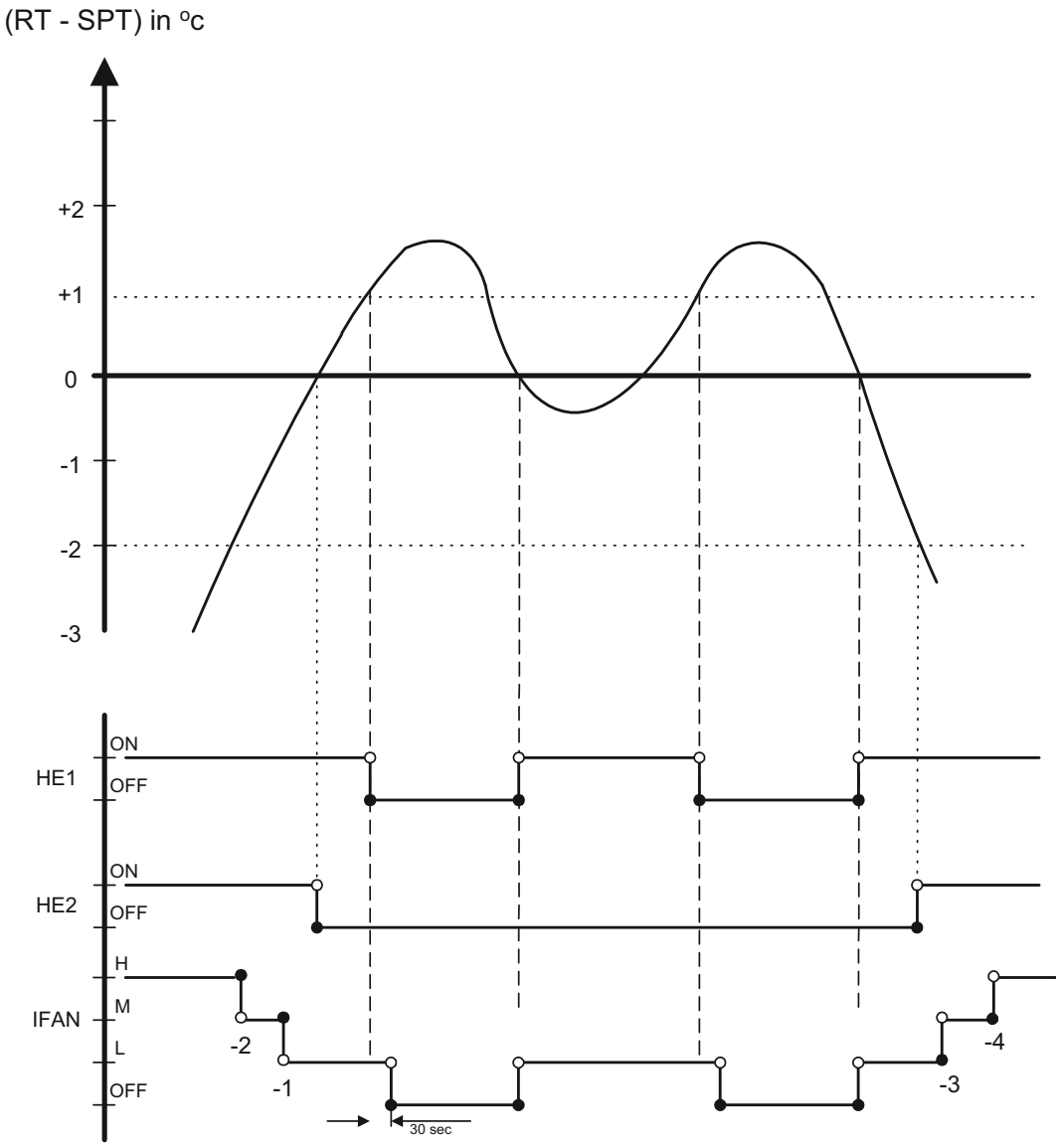
Fan: AUTO

Timer: Any

I-FEEL: ON or OFF

11.9.1 Sequence Diagram

Maintains room temp. at desired level by controlling the 2-Stage Electric Heaters.



11.10 Automatic Cooling or Heating

11.10.1 Automatic Cooling or Heating - General

The AUTO Mode is for models with compressor and the WVL-RH only. The WVL-ST, RC and SH units do not work in AUTO Mode.

a. Mode Definition

Mode: AUTO

Temp: Selected desired temperature

Fan: Any

Timer: Any

I-FEEL: ON or OFF

b. Switching-temperature between Cooling and Heating is SPT $\pm$ 3^{O}C.

c. When the AUTO Mode is started with SPT +/-0 ^{O}C, the unit will not select Auto Heat or Auto Cool mode immediately. Instead, the unit will be in a temporary FAN Mode with IFAN operating at low speed. The proper Auto Heat mode or Auto Cool will be started whenever the RT reaches SPT-1^{O}C or SPT+1^{O}C respectively.

d. For RC & SH units, Mode change between Auto Heat & Auto Cool Modes is possible only after the COMP has been OFF during the last T minutes.

Mode Change	Time, T
Auto Cool to Auto Heat	3 min
Auto Heat to Auto Cool	4 min

e. For RH and WVL-RH units, Mode change between Auto Heat & Auto Cool Modes is possible after the COMP/HEs have been OFF during the last T minutes.

Mode Change	Time, T
Auto Cool to Auto Heat	COMP off for 3 min
Auto Heat to Auto Cool	HEs off for 3 min

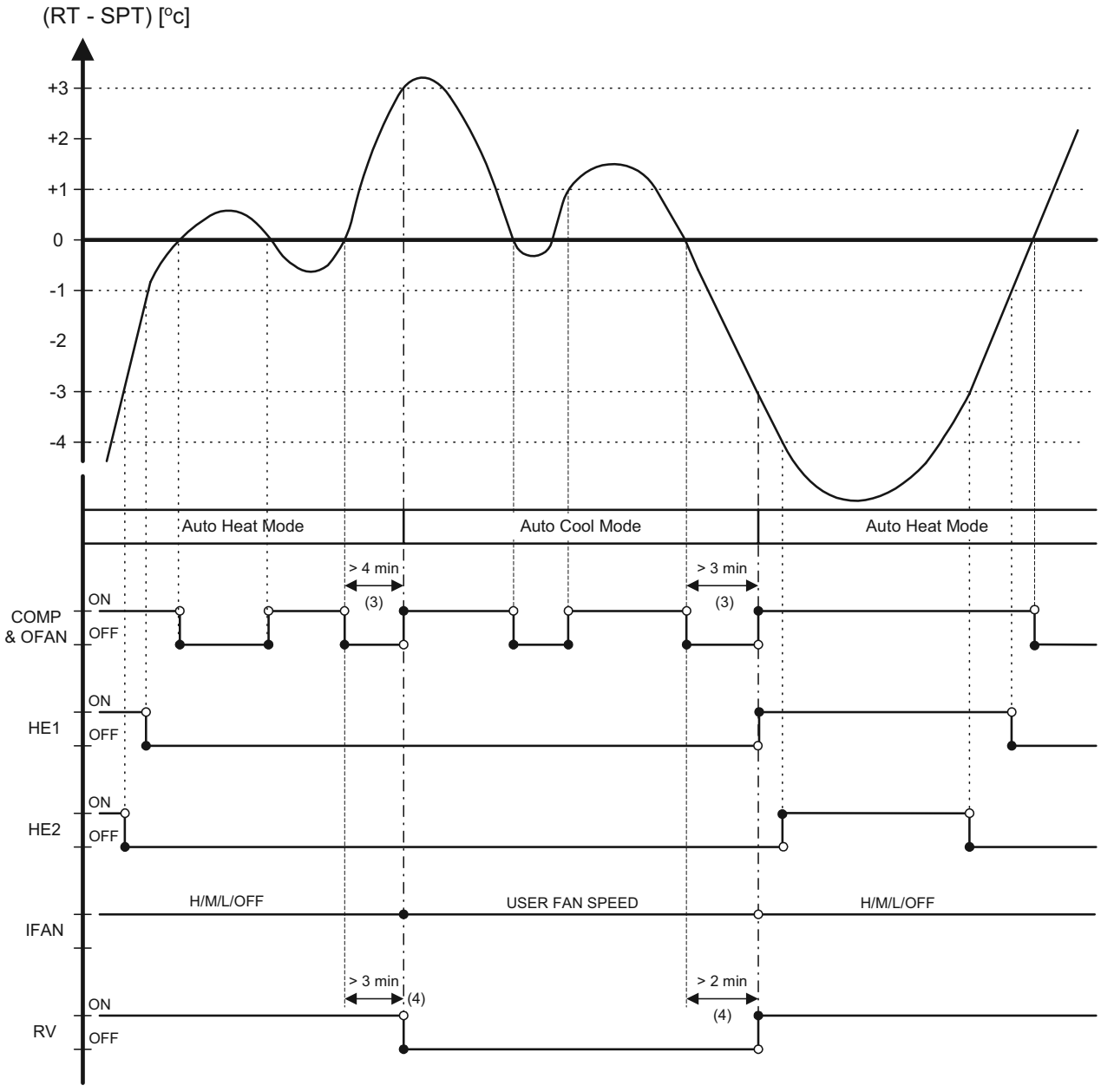
f. When unit is changed form Cool/Dry Mode to Auto Mode, the unit will continue to operate in (Auto) Cool Mode until the conditions for switching from Auto Cool to Auto Heat are satisfied.

Similarly, when unit is changed from Heat Mode to Auto Mode, the unit will continue to operate in (Auto) Heat Mode until the conditions for switching from Auto Heat to Auto Cool are satisfied.

11.10.2 Sequence Diagrams

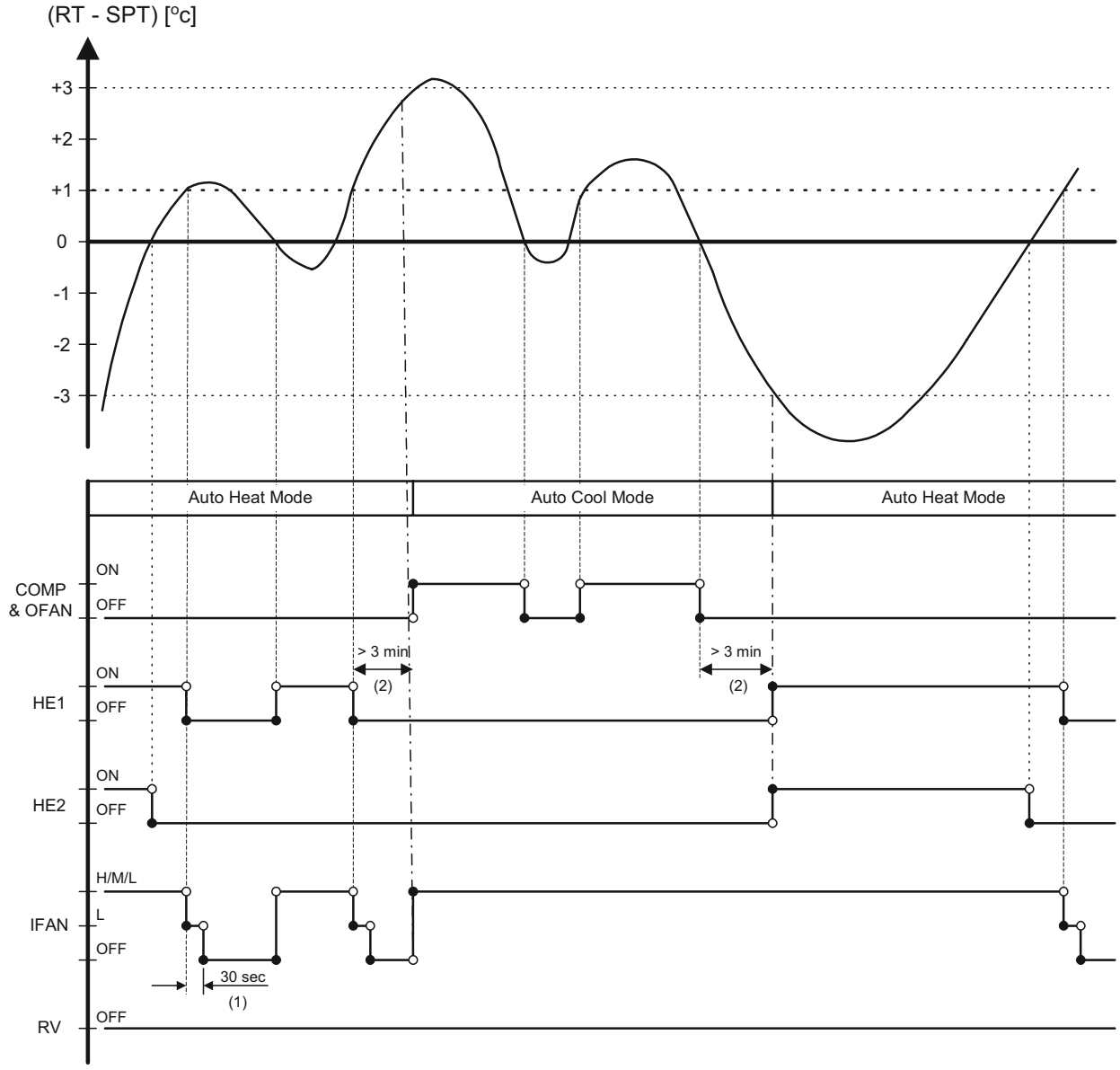
a. Auto Cooling or Heating, RC or SH Groups

Maintains room temp. at desired level by selecting between cooling and heating modes.



b. Auto Cooling or Heating RH Group

Maintains room temp. at desired level by selecting between Cooling or Heating Modes.

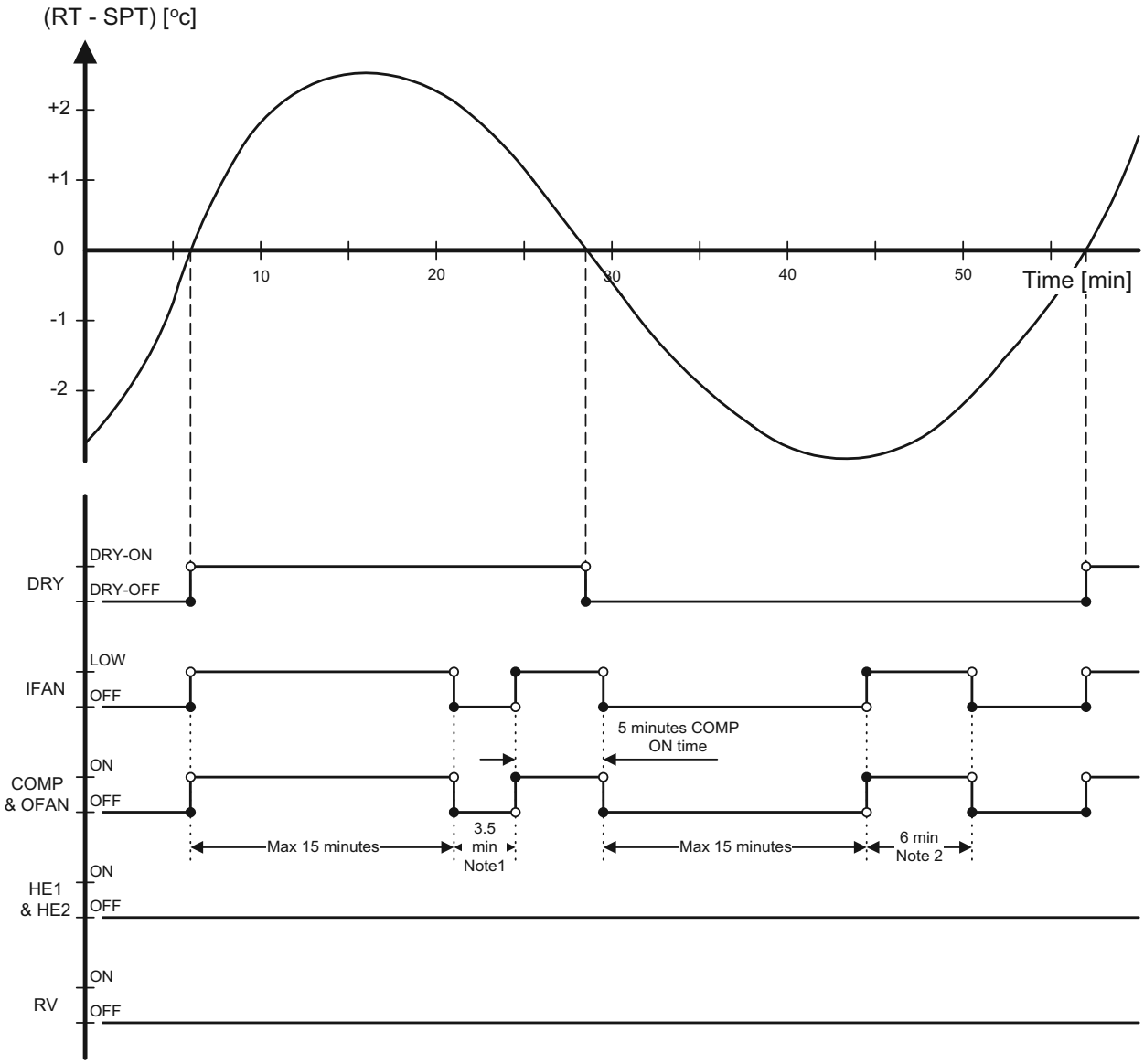


11.11 Dry Mode

11.11.1 Dry, ST or RC Group or P2000 Model with Any Group Settings

Mode: DRY
Temp: Selected desired temperature
Fan: LOW (automatically selected by software)
Timer: Any
I-FEEL: Any

Control function
Reduce room humidity with minimum temp. fluctuations by operating in Cool Mode with LOW speed IFAN.



NOTES

1. **When DRY is ON, the COMP is forced OFF for 3.5 min (longer than the 3 min Min COMP- OFF time) after every 15 min of continuous COMP operation.**
2. **When DRY is OFF, the COMP is forced ON for 6 min (longer than the 3 min Min COMP- ON time) after every 15 min of continuous COMP OFF time.**
3. **When DRY is changed from ON to OFF or vice versa, the limits mentioned in (1) & (2) are ignored. The COMP operation is only controlled by the 3 min Min OFF time and 1 min Min ON time.**
4. **In DRY Mode, IFAN is LOW when COMP is ON, and is OFF when COMP is OFF.**
5. **HEs are always OFF in DRY Mode.**

11.11.2 DRY, SH or RH group

Mode: DRY

Temp: Selected desired temperature

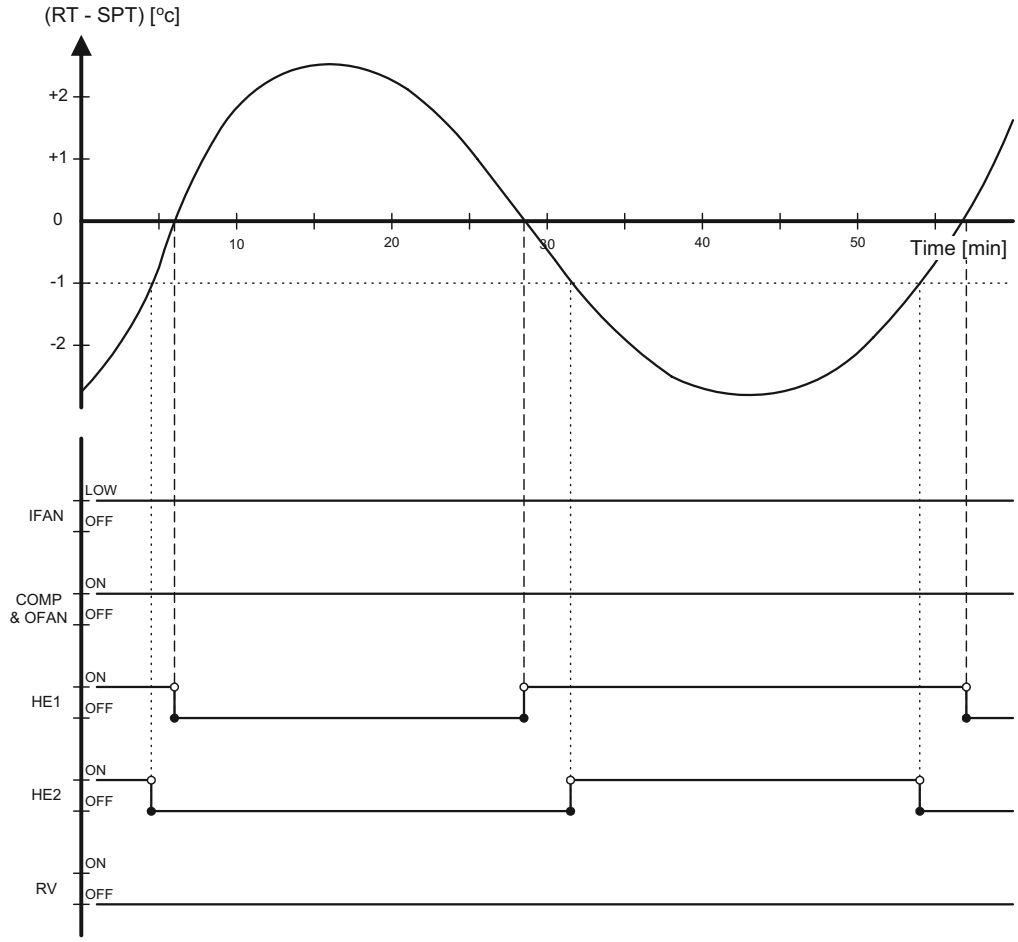
Fan: LOW (automatically selected by software)

Timer: Any

I-FEEL: Any

Control function

Reduces room humidity with minimum temp. fluctuations by operating in Cool Mode with LOW speed IFAN and HE.



11.12 Protection

11.12.1 Cooling Mode Protections

a. Indoor Coil Defrost

Mode: COOLING, DRY, AUTO

Temp: Selected desired temp.

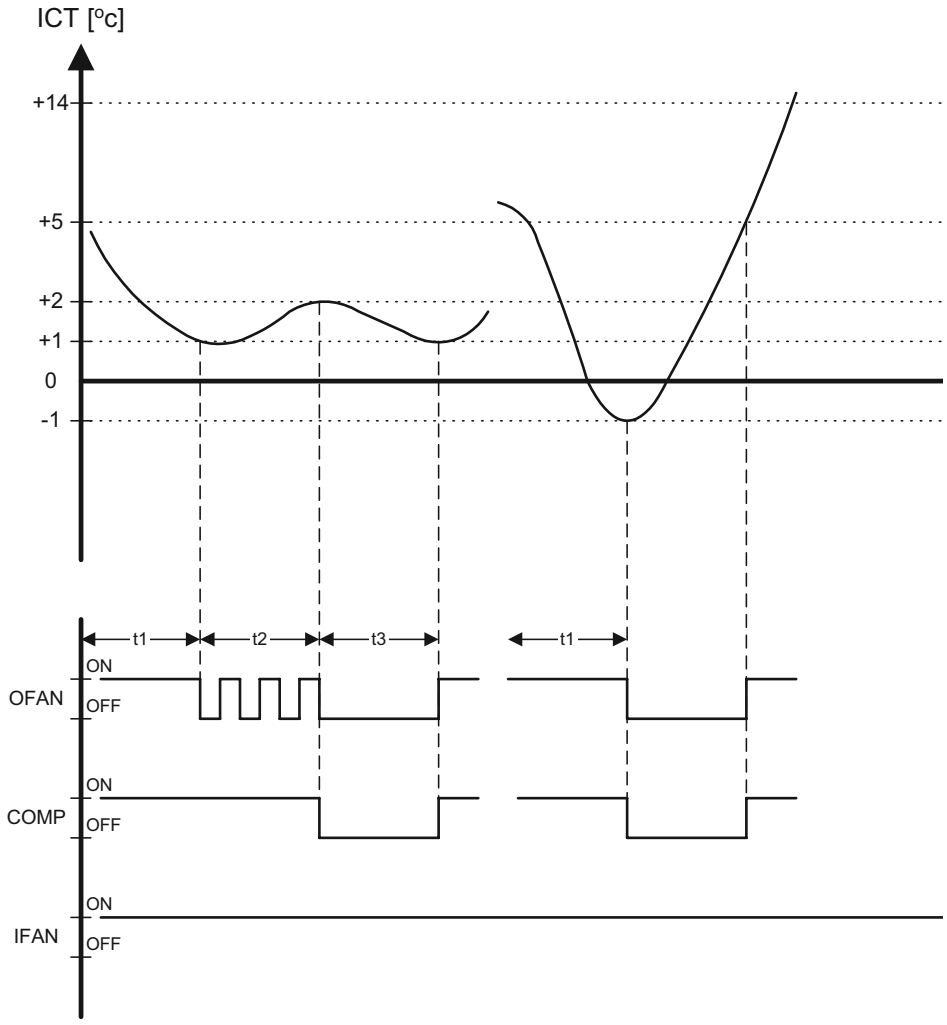
Fan: Any

Timer: Any

I-FEEL: ON or OFF

Control Function

Protects the indoor coil from ice formation at low ambient temperatures.



t1 = 5 min minimum for each COMP starting.
t2 = OFAN cycling (alternate between ON and OFF every 30 sec) for 20 min maximum.
t3 = COMP and OFAN stops for 10 min minimum.

b. High Pressure Protection

Mode: (AUTO) COOLING or DRY

Temp: Selected desired temperature

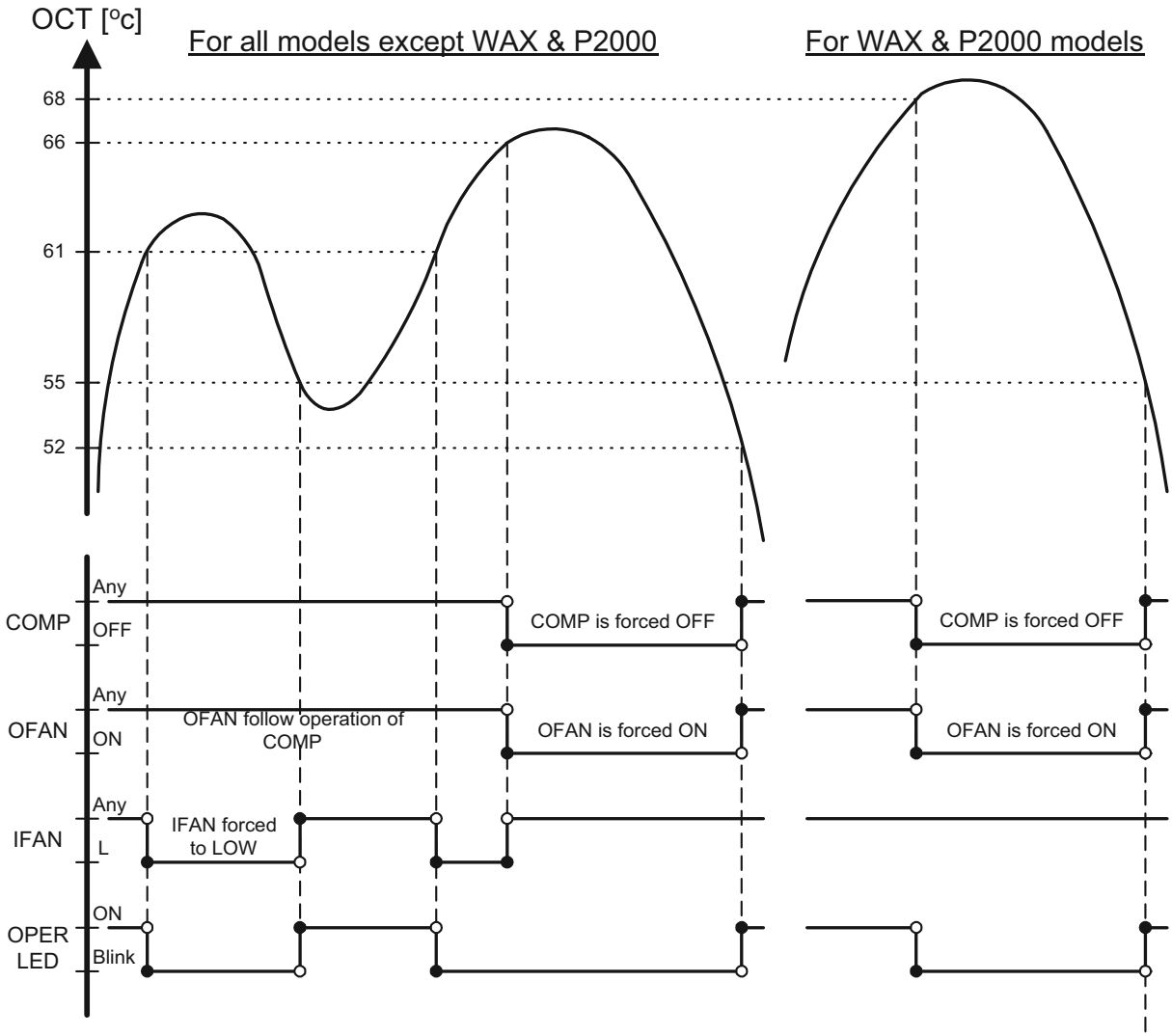
Fan: Any

Timer: Any

I-FEEL: ON or OFF

Control Function

To protect the COMP from the high pressure build-up in the outdoor coil during normal cooling operation, by switching OFF the IFAN and COMP.



NOTE

The ICT is also monitored during COOL and DRY modes, in case the RV control circuit is faulty. Whenever ICT reaches 70°C, which indicates a high pressure in the indoor coil, the COMP will be forced OFF automatically. The COMP can be turned ON again only after the ICT is under 70°C again and after the 3 min COMP ON delay time. The OPER LED will not blink in this case.

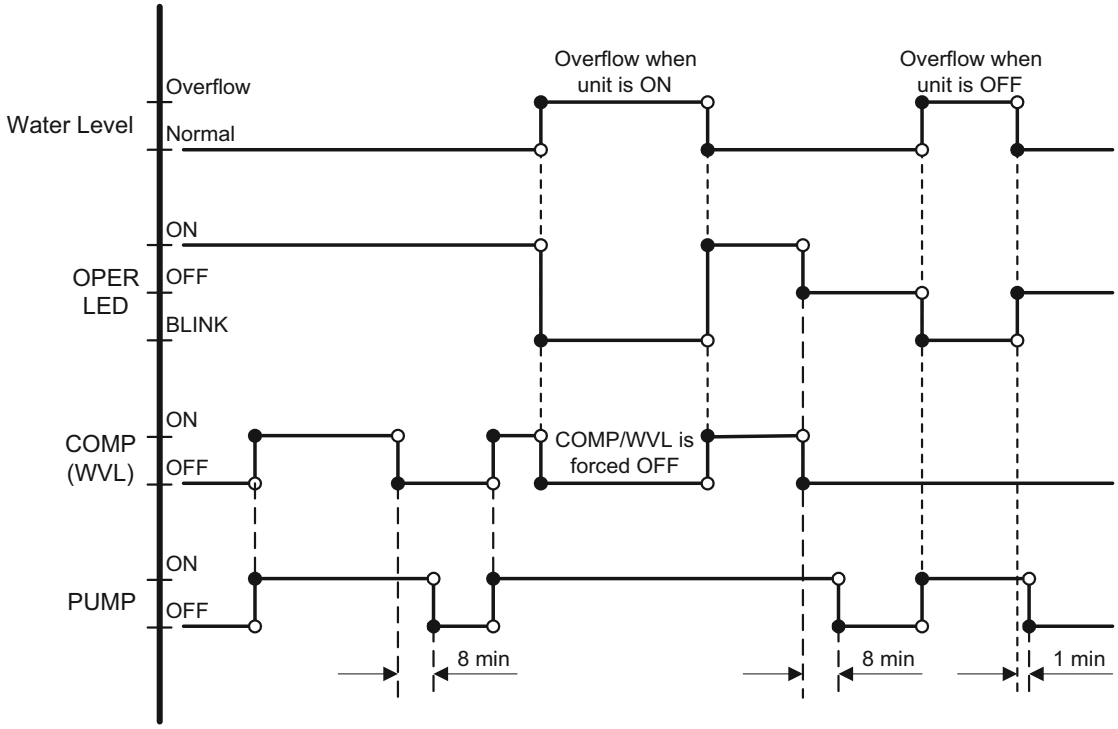
11.12.2 Condensation Pump.

Mode: Cool, Dry, Auto

Temp: Selected desired temperature
Fan: Any
Timer: Any
I FEEL: Any

Control function:

Prevent Condensed water from Overflowing.



Notes:

1. The switch used for water level detection is closed under normal condition, and is open when water overflow.
2. For the NEC version of MCU, the "Over Flow" & “Normal” condition are indicated by logic “0” & “1” at the LEVEL4 input pin respectively.
3. For the Fujitsu version of MCU, the "Over Flow" & “Normal” condition are indicated by logic “1” & “0” at the LEVEL4 input pin respectively.
4. The “Overflow” condition can activate the water pump in SB and operating modes.

11.12.3 Heating Mode Protections

a. Outdoor Coil Deicing (excluding RH Group)

Mode: HEATING, AUTO (at heating)

Temp: Selected desired temperature

Fan: Any

Timer: Any

I-FEEL: Any

Control function

To protect the outdoor coil from ice formation by controlling COMP & RV operation.

1) Deicer Activation Algorithm

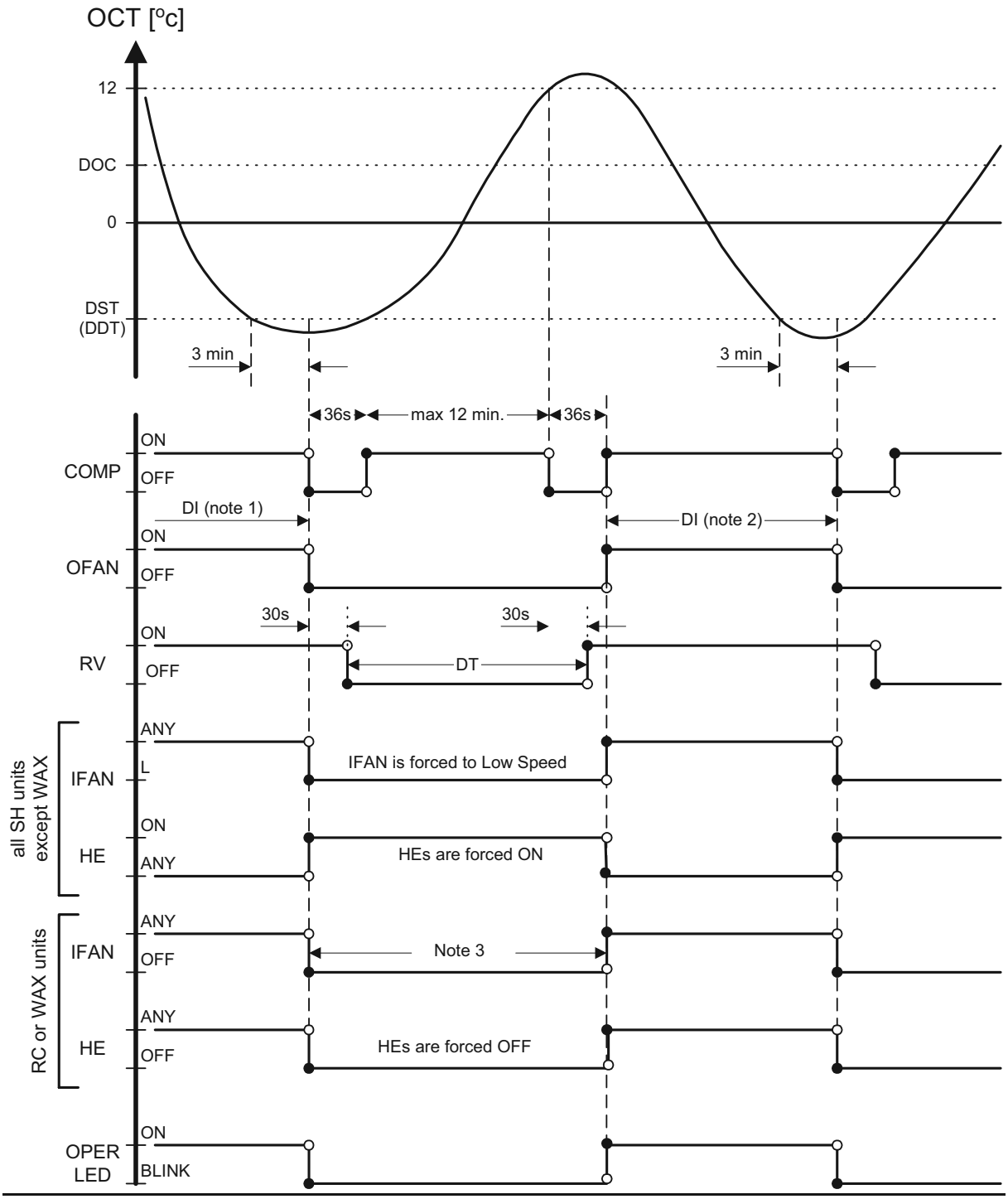
a) Static deicer threshold is -5°C

b) Dynamic deicer threshold changes of 3°C in 3 minutes in the OCT temperature

c) In first COMP activation (after SB or OFF), if OCT < 0°C, min time to first deicer is 10 min else 40 min.

d) In a case of reading 3 successive OCT values below –10°C and previously 3 successive OCT values of 43°C (4.7 K) , the unit will activate deicing procedure.

2) Deicing procedure



NOTES

1. **In the following Deicing cycles, the time interval between two Deicing cycles activation is between 30 to 80 min.**
2. **For RC group, IFAN is forced OFF.**
3. **For SH group, HEs are forced ON and IFAN is forced to operate at LOW speed, regardless of the ICT and difference between RAT & SPT.**
4. **When jumper J7 is set, the DST value is -2°C.**

b. High Pressure Protection (excluding RH Group)

Mode: (AUTO) HEATING

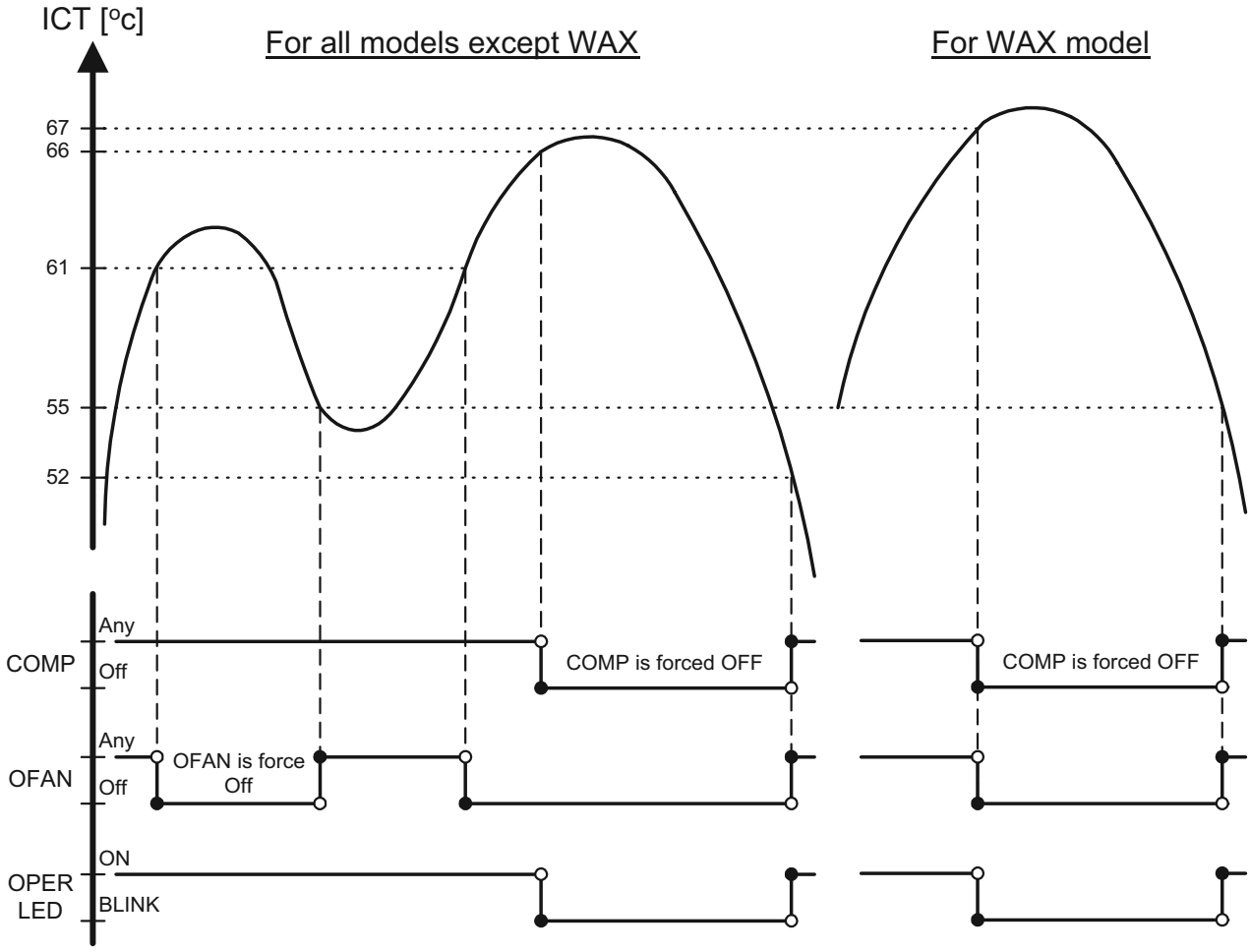
Fan: Any

Timer: Any

I-FEEL: ON or OFF

Control Function

Protects the compressor from high pressure by switching OFF the OFAN and COMP.



11.13 Forced Operation (Excluding PRX & PXD Models)

a. Forced operation allows units to start, stop and operate in cooling or heating in preset temp. according to the following table:

Forced Operation Mode	Pre-set Temp for : MBX, P2000, PX Models	Pre-set Temp for : FCD, RWK ,ELD, ECC, WAX, WNX, WMN Models
Cooling	20 ºC	22 ºC
Heating	25 ºC	28 ºC

NOTES

1. **While under the forced operation, the temperature compensation schedule is disabled.**
2. **The forced operation is activated when the mode button on the Display Board is used to switch the unit to COOL or HEAT mode.**
3. **The IFAN is always set to Autofan Speed in forced operation.**

Temp: Set – desired temperature selected

Fan: Any

Timer: Interact with Sleep Timer

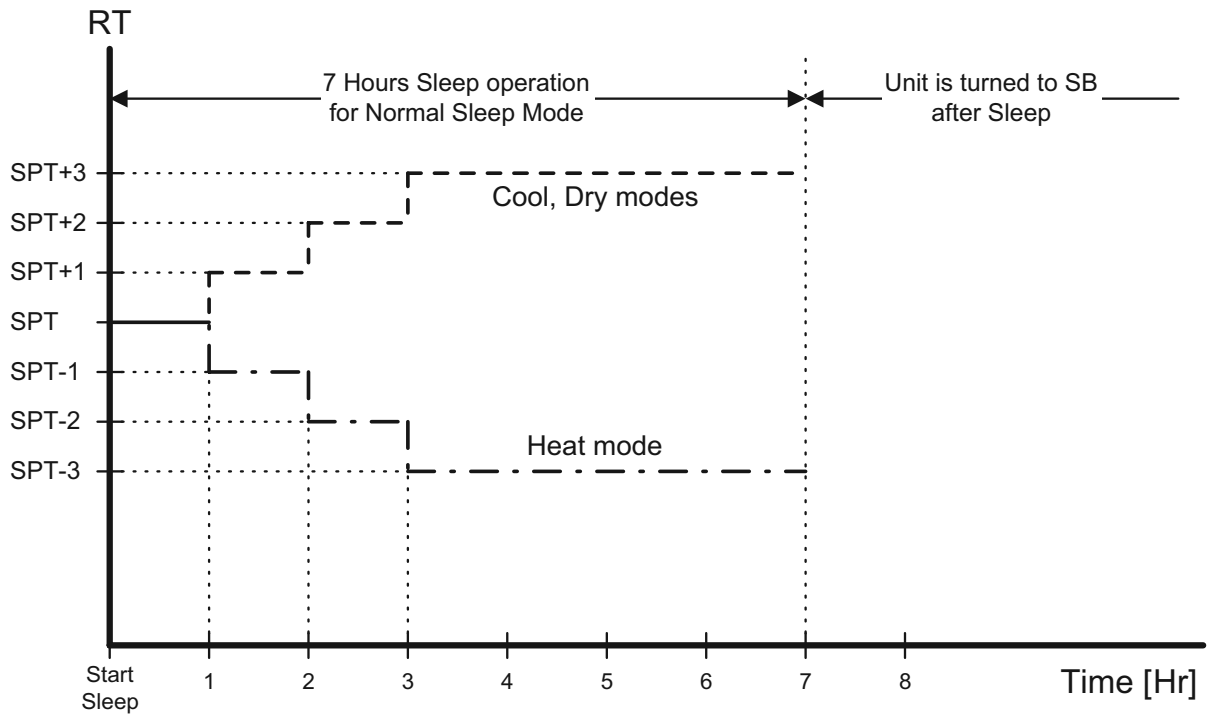
I-FEEL: ON or OFF

The Sleep mode is activated by using the SLEEP button on the R/C. In Sleep Mode, the unit will automatically adjust the SPT to turn up/down the room temperature (RT) gradually to provide maximum comfort for the sleeping user.

Sleep is treated as TIMER function. Therefore, the TIMER LED is activated similar to TIMER function.

11.14 SPT Adjustment in Sleep Mode

- In COOL, AUTO COOL or DRY modes, the SPT adjustment is positive (from 0 to +3°C).
- In HEAT or AUTO HEAT modes, the SPT adjustment is negative (from 0 to -3°C).
- In other modes, there is no SPT adjustment.
- The SPT adjustment is cancelled when the Sleep mode is cancelled.



NOTE

If OFF-timer is active, the unit may go to SB before or after 7 hours of sleep operation.

11.14.1 Time Adjustment in SLEEP Mode

In 10V4, the user can make use of the Off-Timer to extend the Sleep Time from 7 hours to 12 hour (max). The operation of the new “Extended Sleep Mode” is illustrated by the graphs below.

Case 1 is the Standard Sleep Mode, which is the only sleep mode in the previous version of MCU. The A/C unit simply works for 7 hours, then goes to SB.

Case 2 is the new Extended Sleep Mode. If an active Off-Timer is set to turn off the A/C between 7-12 hour, relative to the starting of Sleep, the Sleep time is extended. And, instead of going to SB at the 7th hour, the A/C will work until reaching the Off-time.

Case 3 is an exception to case 2. The Sleep Mode will not be extended to the Off-Time when the Off-Timer is preceded by an On-Timer, which is also between 7-12 hour.