ADVANCE 2 AND AIRES

Split Ducted Unit

Operation Details

Advance 2
Model Numbers

Single Phase	Three Phase
CRV13AS / EVV13AS	CRV13AT / EVV13AS
CRV15AS / EVV15AS	CRV15AT / EVV15AS
CRV17AS / EVV17AS	CRV17AT / EVV17AS

Split Fan-Coil

EAA13AS and EFV13AS
EAA15AS and EFV15A
EAA17AS and EFV17AS

Aires
Model Numbers

Single Phase	Three Phase
CRS10AS / EVA10AS	CRS13AT / EVA13AS
CRS13AS / EVA13AS	CRS15AT / EVA15AS
CRS15AS / EVA15AS	CRS17AT / EVA17AS
CRS17AS / EVA17AS	CRS20AT / EVA20AS
	CRS23AT / EVA23AS

Split Fan-Coil

ECA13AS and EFA13AS	ECA20AS and EFA20AS
ECA15AS and EFA15AS	ECA23AS and EFA23AS
ECA17AS and EFA17AS	

IMPORTANT NOTE:
Please read this manual carefully before installing or operating your air conditioning unit.

ActronAir

Table of Contents

Table of Contents

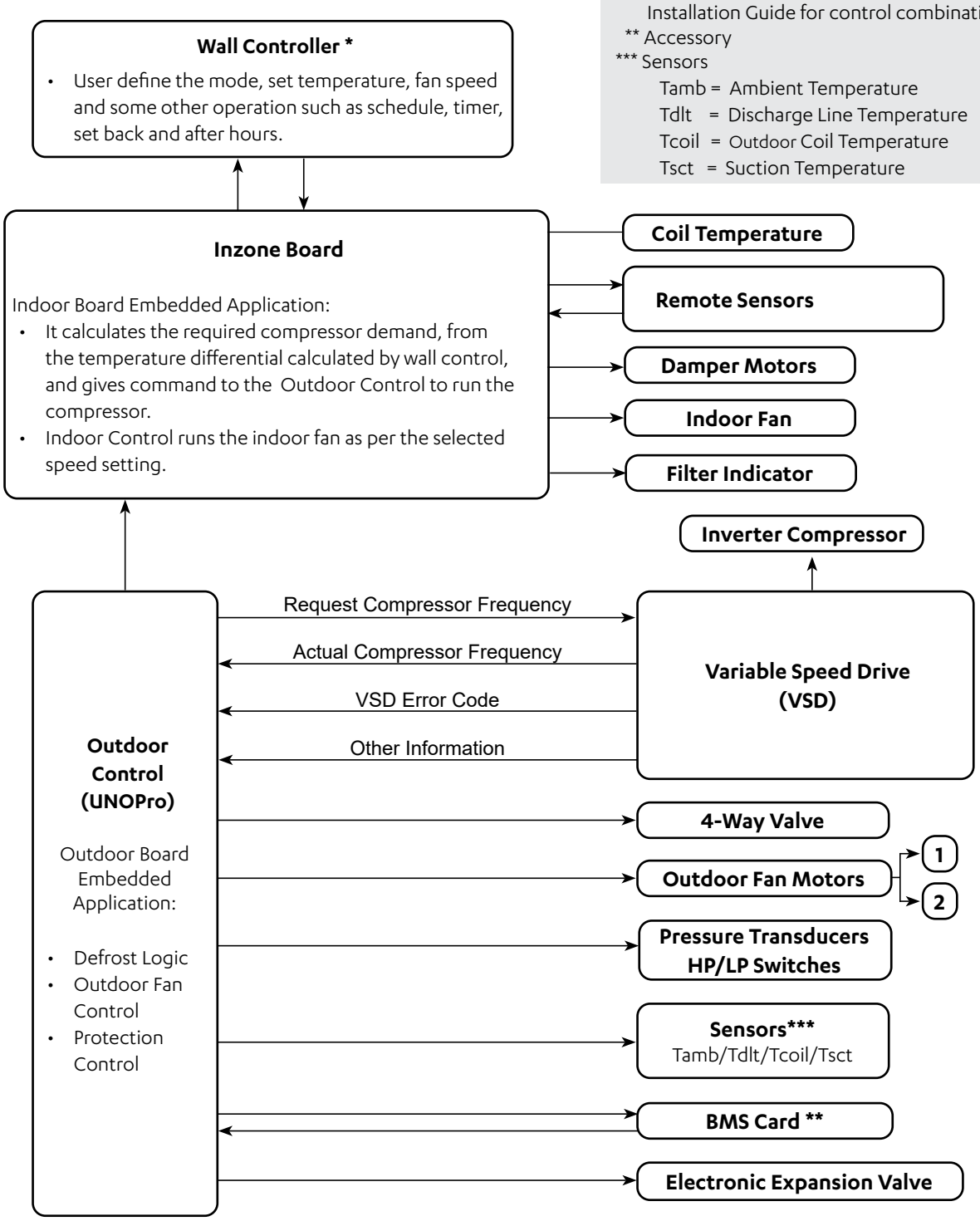
01. System Control Flow Chart / Normal Operation Table And Important Register Default Values

01.01. Advance 2

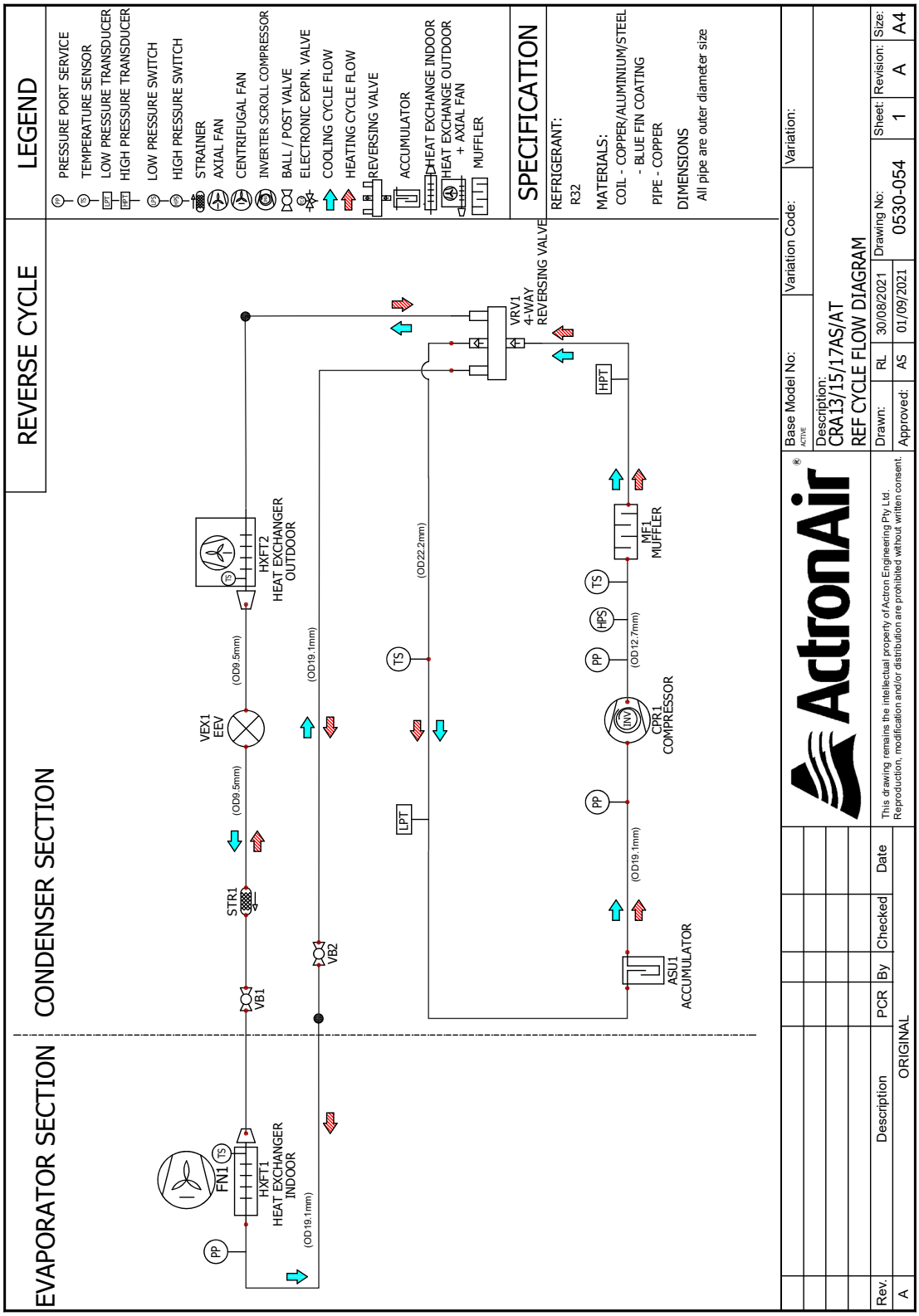
System Control Flow Chart

NOTES

* Maximum of 3 Controls per system. See Installation Guide for control combinations.
** Accessory
*** Sensors
Tamb = Ambient Temperature
Tdlt = Discharge Line Temperature
Tcoil = Outdoor Coil Temperature
Tsct = Suction Temperature



System Refrigeration Circuit

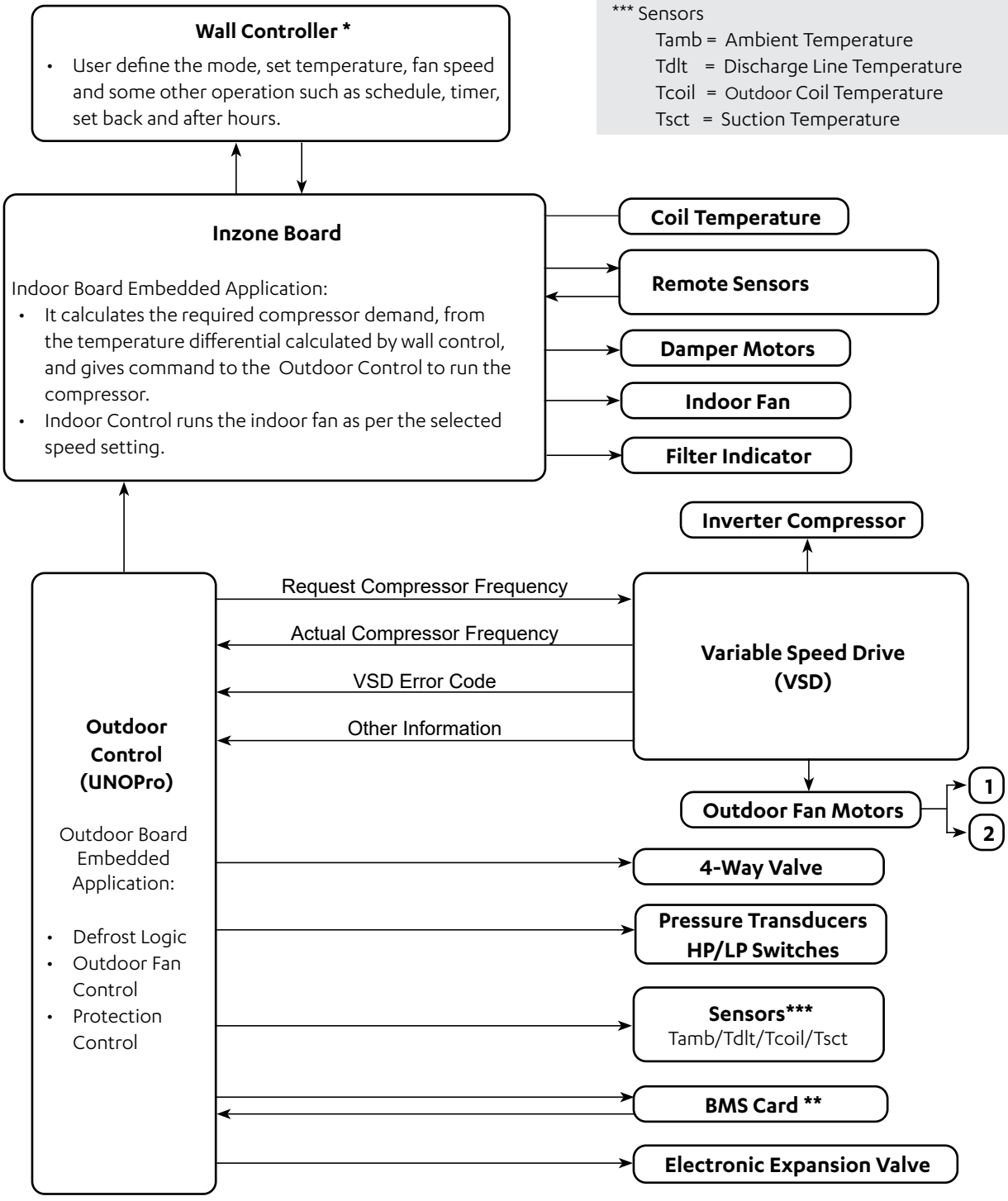


01.02. Aires

System Control Flow Chart

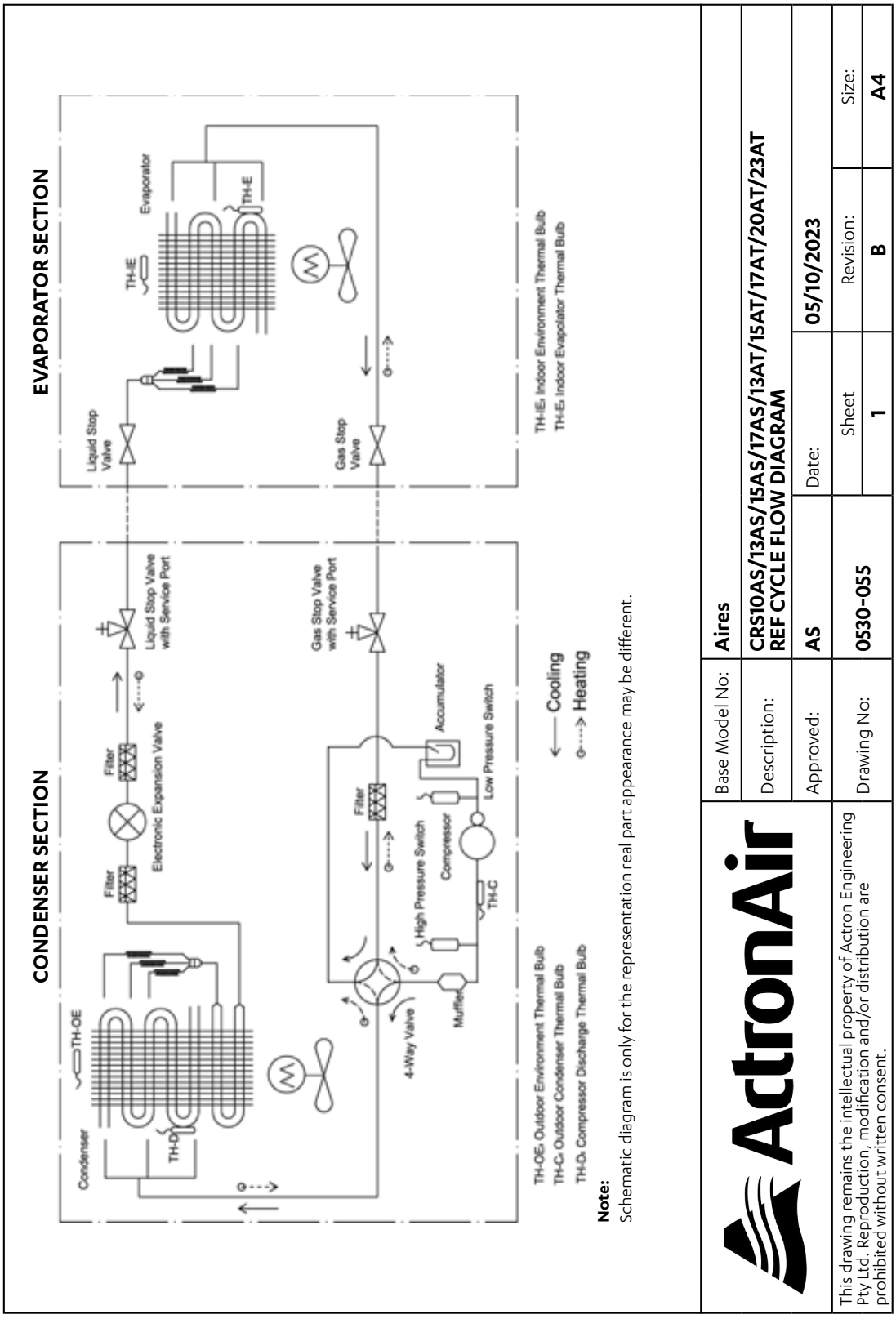
NOTES

* Maximum of 3 Controls per system. See Installation Guide for control combinations.
** Accessory
*** Sensors
Tamb = Ambient Temperature
Tdlt = Discharge Line Temperature
Tcoil = Outdoor Coil Temperature
Tsct = Suction Temperature



System Refrigeration Circuit

REFRIGERATION CIRCUIT



Note:
Schematic diagram is only for the representation real part appearance may be different.

ActronAir	Base Model No:	**Aires**		
	Description:	**CRS10AS/13AS/15AS/17AS/13AT/15AT/17AT/20AT/23AT REF CYCLE FLOW DIAGRAM**		
	Approved:	**AS**	Date:	**05/10/2023**
	Drawing No:	**0530-055**	Sheet: **1**	Revision: **B**
				Size: **A4**

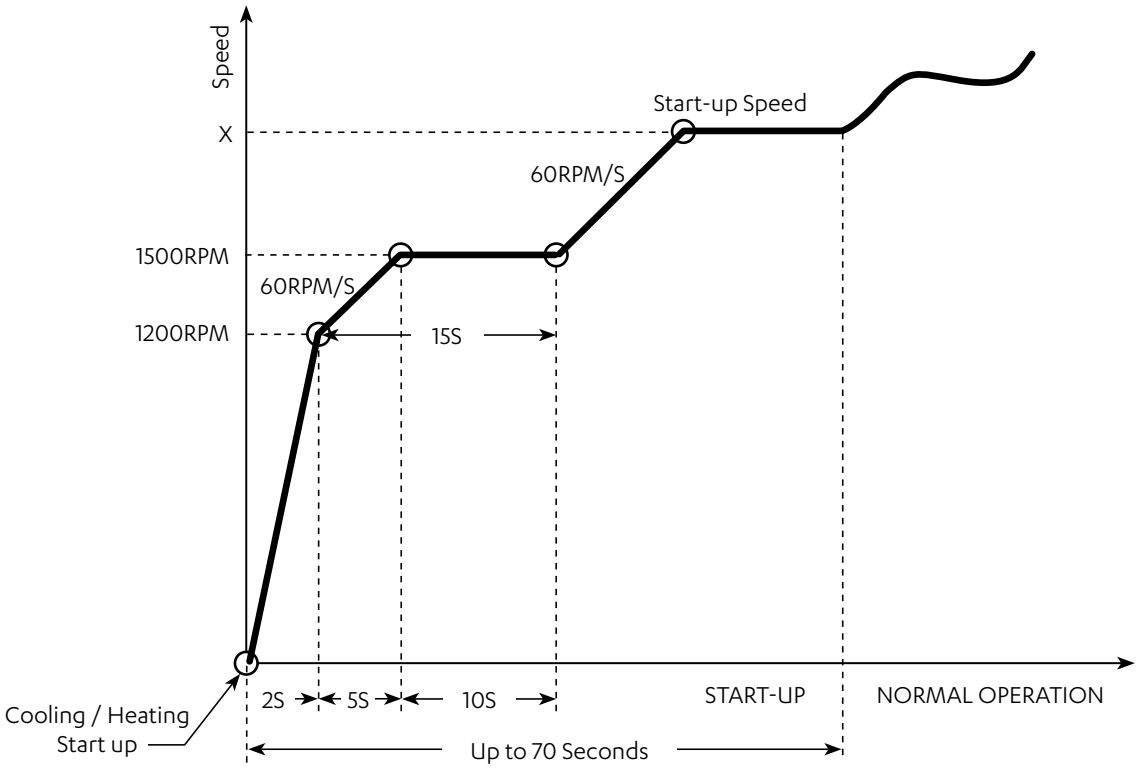
02. Compressor Capacity Control

Start-up sequence: Initial start-up

When the compressor starts up from idle, the VSD follows a startup sequence which is controlled by VSD internal logic for first 17 seconds. After completing the first 17 seconds, the VSD starts to run the compressor as per the UNOPro board start-up control.

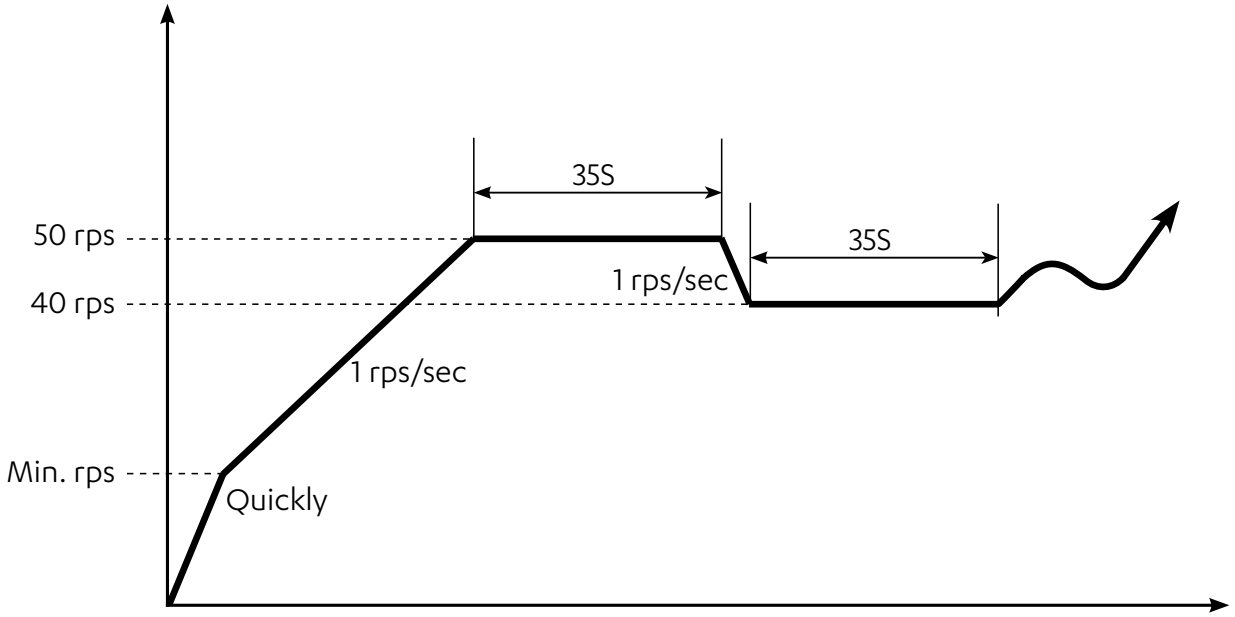
Compressor start-up speed: When the compressor starts up from idle, the compressor follows a start-up sequence as shown in the above RPM-Time curve and the UNOPro board will run the compressor on start-up speed. Start -up speed maximum duration can be up to 70sec.

A. Advance 2



Model	Start-Up Speed (RPM)	
	Cool	Heat
CRV13AS	1500	1500
CRV15AS	1500	1500
CRV17AS	1500	1500
CRV13AT	1500	1500
CRV15AT	1500	1500
CRV17AT	1500	1500

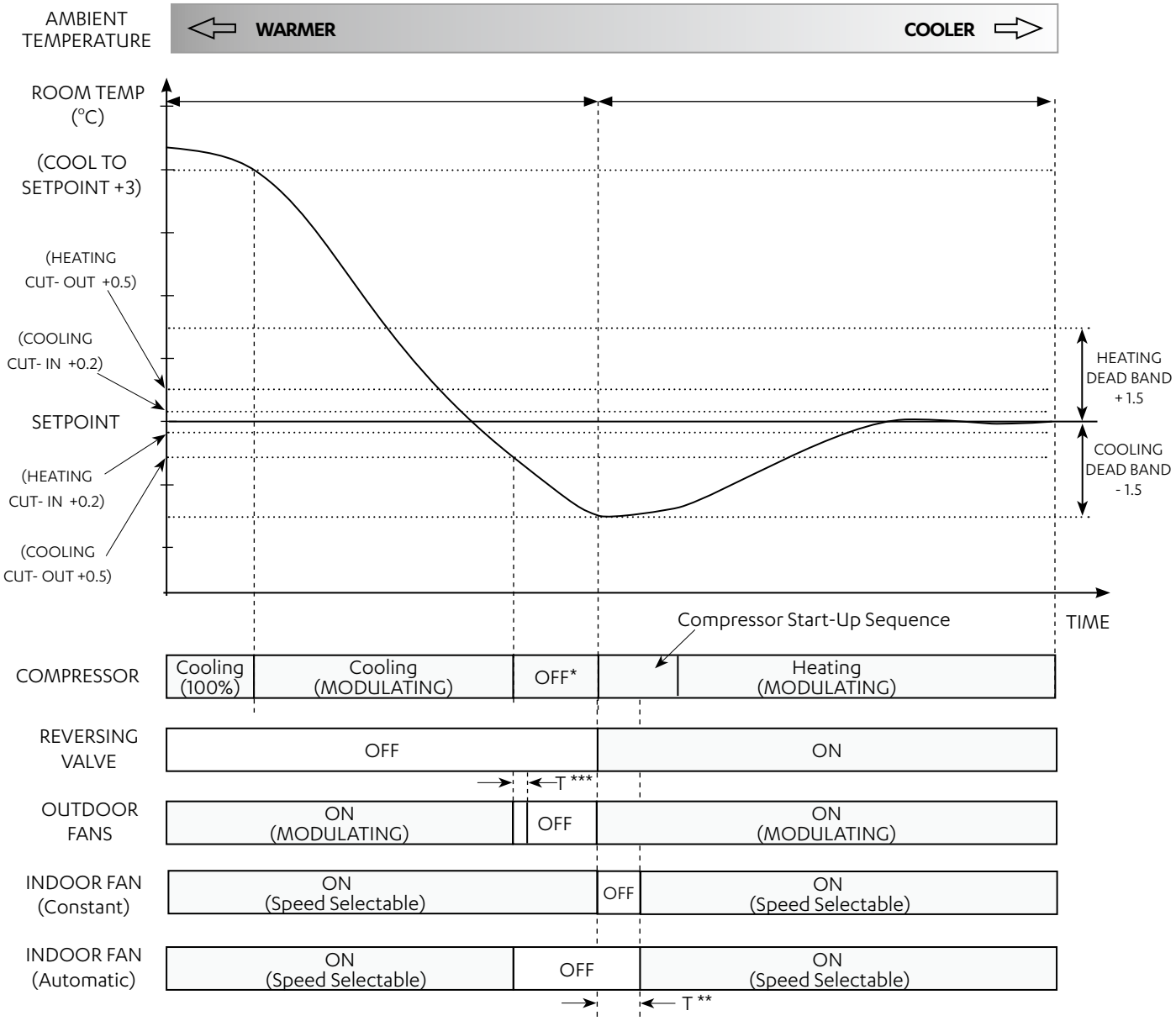
B. Aires



Family Code (8 and 9)				
Model Number	**Speed (rps)**	**Hold-time (Sec)**	**Speed (rps)**	**Hold-time (Sec)**
CRS10AS	50	30	40	60
CRS13AS / CRS13AT	35	30	40	60
CRS15AS / CRS15AT	50	30	40	60
CRS17AS / CRS17AT	50	30	40	60
CRS20AT	35	30	40	60
CRS23AT	35	30	40	60

03. Description of Basic Operation

03.01. Auto Cool - Auto Heat Mode Operation Time Chart



NOTE : Above diagram only applicable for internal control.

Default values for Cut In and Cut Out: VAV Cut Out 0, Cut In 0.5 and NON-VAV Cut Out 0.5, Cut In 0.5

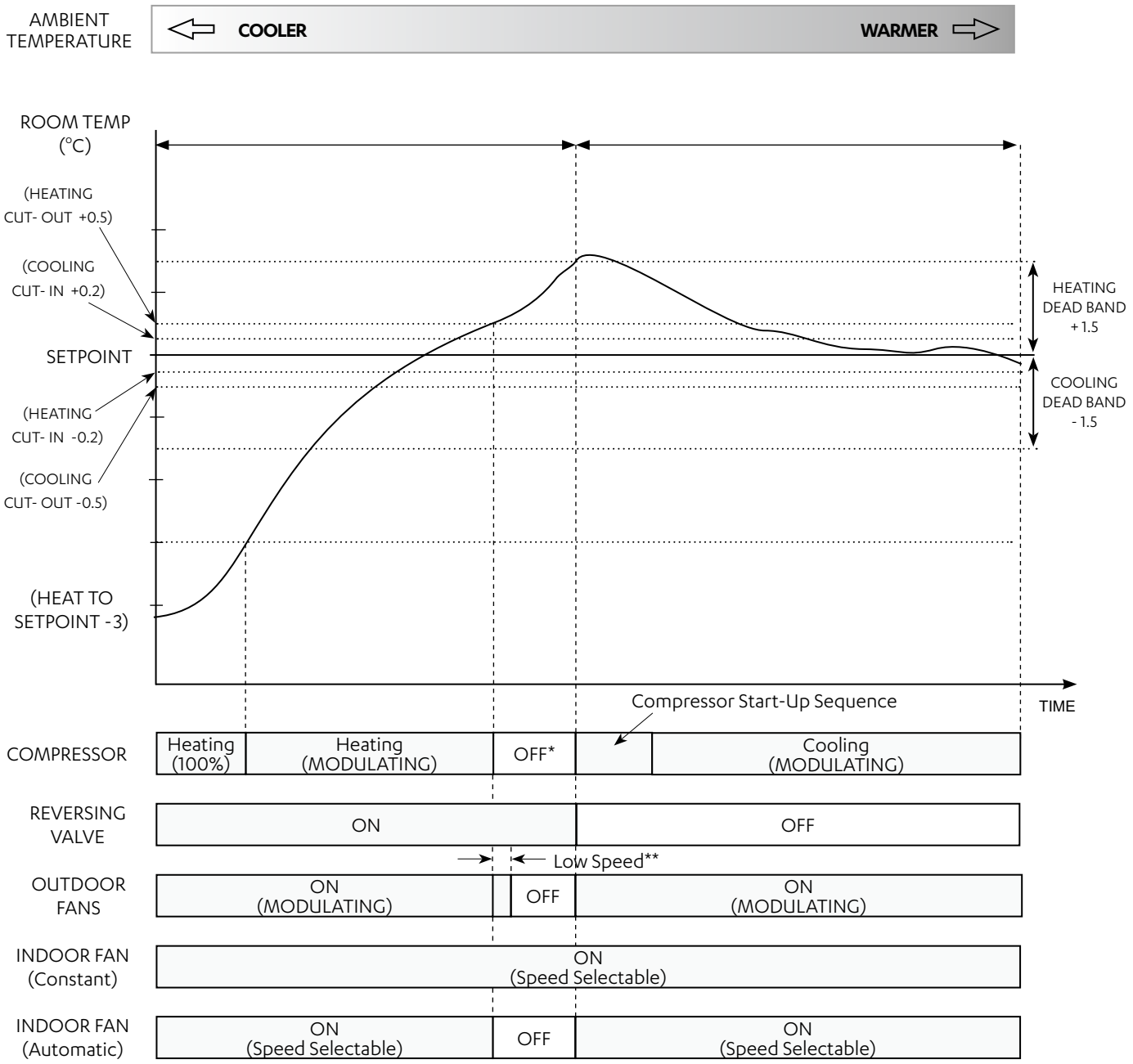
* Minimum Off time is applicable (3 minutes).

** Waits for either 30 seconds or until the Indoor Coil reaches 25°C, which ever occurs first.

*** The outdoor fan speed has a 16-second delay from the time the compressor has stopped.

In Auto Heat Mode, when the compressor is running at low capacity, the unit may turn off occasionally. This is due to a built-in 16-minute timer, which is activated when the capacity drops below 50%. If the capacity remains less Than 50% for longer than 16 minutes, the unit will cycle off. The unit will remain off for a minimum of 3 minutes or until the room temperature is 0.2°C away from the set point temperature. If during the 16 minute period the capacity increases to above 50% the 16-minute timer is reset. This function has been included to save energy by cycling the unit off and allowing the temperature to swing slightly when The capacity demand is minimal.

03.02. Auto Heat - Auto Cool Mode Operation Time Chart

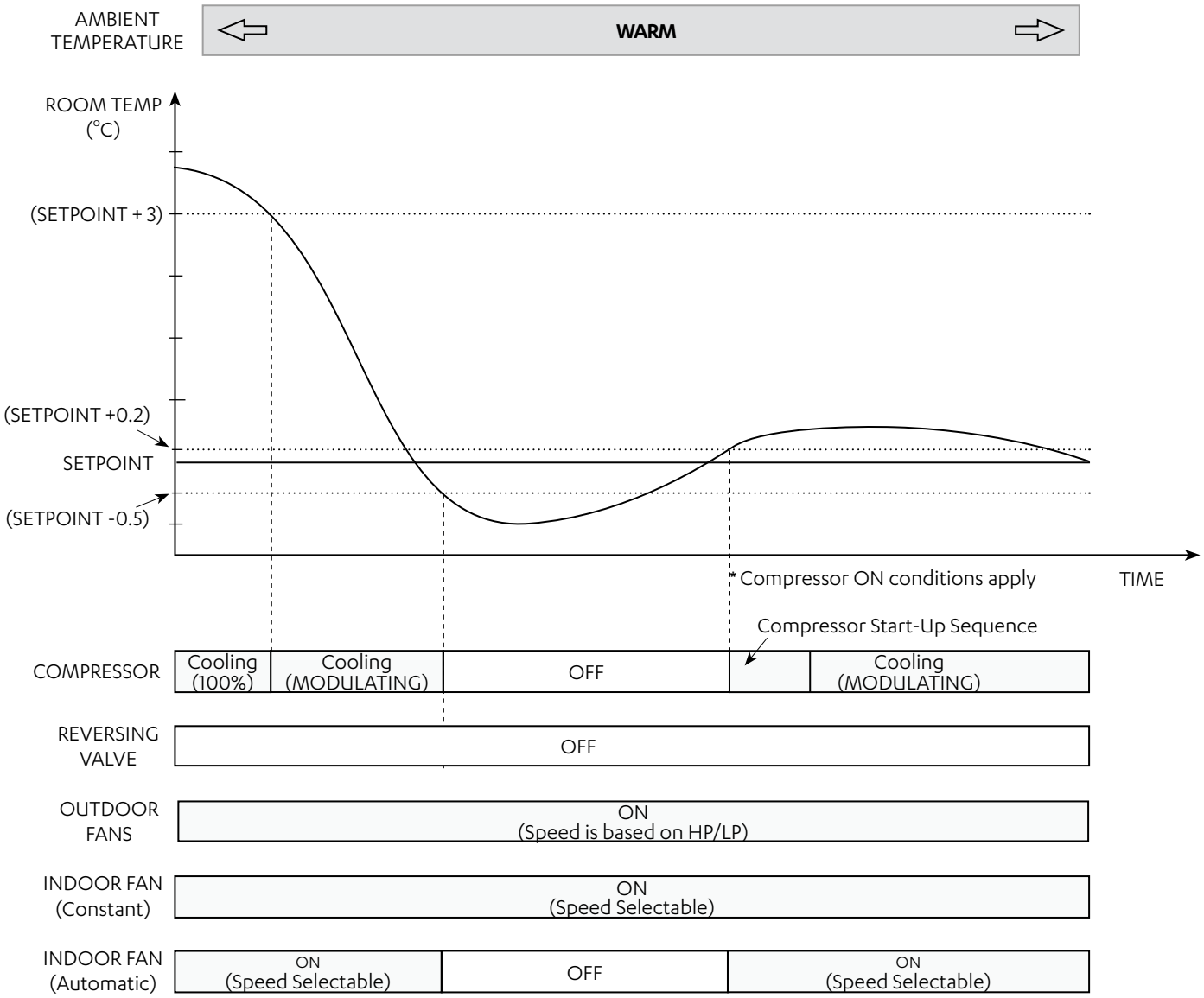


NOTE : Above diagram only applicable for internal control.
Default values for Cut In and Cut Out: VAV Cut Out 0, Cut In 0.5 and NON-VAV Cut Out 0.5, Cut In 0.5

* Minimum Off time is applicable (3 minutes).

** The outdoor fan speed has 16 seconds delay from the time the compressor has stopped.
Auto Heat Mode, when the compressor is running at low capacity, the unit may turn off occasionally. This is due to a built-in 16-minute timer, which is activated when the capacity drops below 50%. If the capacity remains less than 50% for longer than 16 minutes, the unit will cycle off. The unit will remain off for a minimum of 3 minutes or until the room temperature is 0.2°C away from the set point temperature. If during the 16 minute period the capacity increases to above 50% the 16-minute timer is reset. This function has been included to save energy by cycling the unit off and allowing the temperature to swing slightly when the capacity demand is minimal.

03.03. Cooling Cycle Time Chart



NOTE : Above diagram only applicable for internal control.

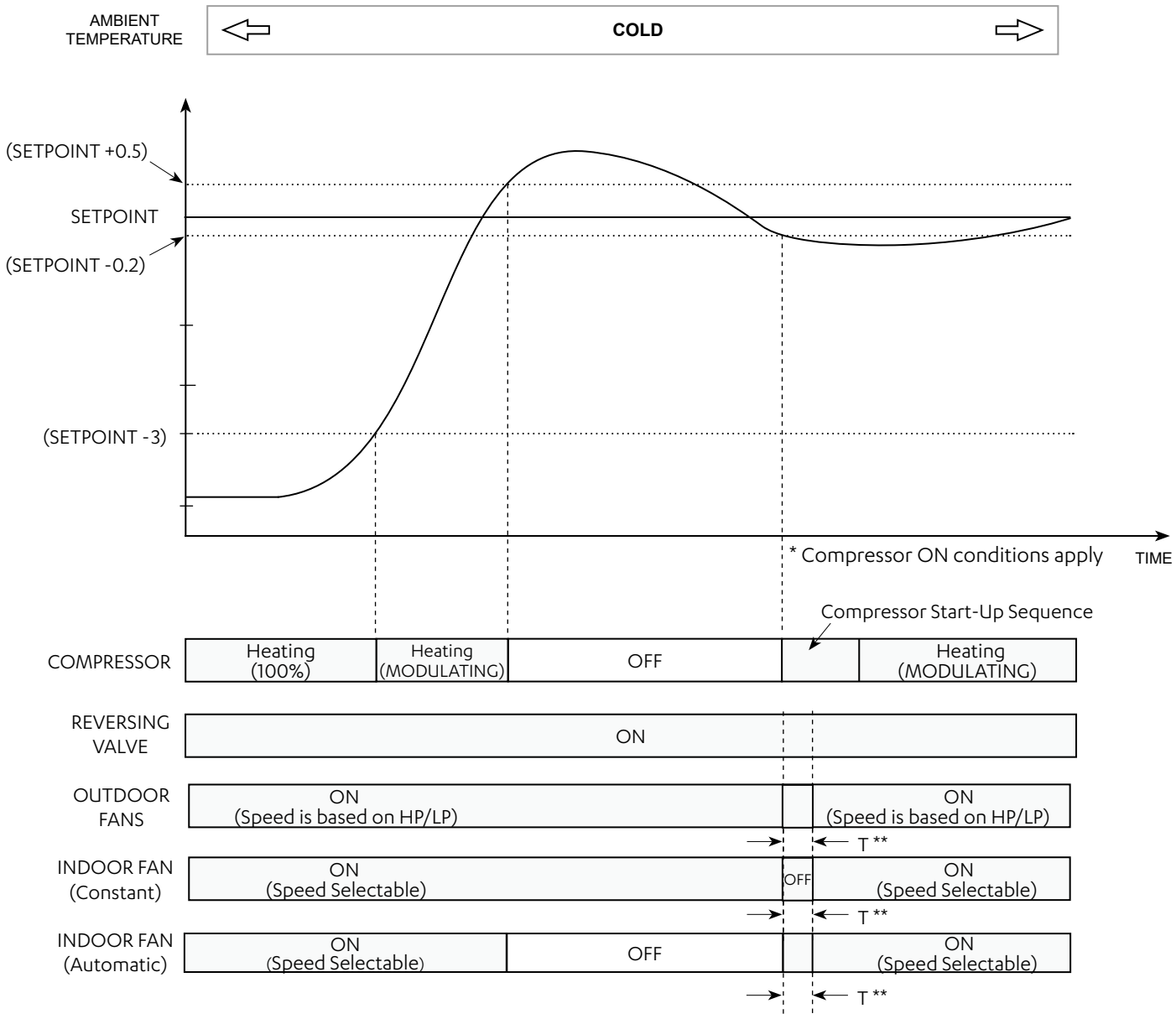
* The compressor will recommence cooling when both of the following conditions are met:

- Compressor OFF timer (3 minutes) has finished
- VAV Cut out 0, Cut In +0.5
- NON VAV Cut Out -0.5, cut in +0.5

** The outdoor fan speed has 16 seconds delay from the time the compressor has stopped.

In Cool Only Mode, when the compressor is running at low capacity, the unit may turn off occasionally. This is due to a built-in 16-minute timer, which is activated when the capacity drops below 50%. If the capacity remains less than 50% for longer than 16 minutes, the unit will cycle off. The unit will remain off for a minimum of 3 minutes or until the room temperature is 0.2°C away from the set point temperature. If during the 16 minute period the capacity increases to above 50% the 16-minute timer is reset. This function has been included to save energy by cycling the unit off and allowing the temperature to swing slightly when the capacity demand is minimal.

03.04. Heating Cycle - Hot Start Operation Time Chart



NOTE : Above diagram only applicable for internal control.

* The compressor will recommence cooling when both of the following conditions are met:

- Compressor OFF timer (3 minutes) has finished
- VAV Cut out 0, Cut In +0.5
- NON VAV Cut Out -0.5, cut in +0.5

** Waits for either 60 seconds or until the Indoor Coil reaches 25°C, which ever occurs first.

*** The outdoor fan speed has 16 seconds delay from the time the compressor has stopped.

In Heat Only Mode, when the compressor is running at low capacity , the unit may turn off occasionally. This is due to an in-built 16-minute timer, which is activated when the capacity drops below 50%. If the capacity remains less than 50% for longer than 16 minutes, the unit will cycle off. The unit will remain off for a minimum of 3 minutes or until the room temperature is 0.2°C away from the set point temperature. If during the 16 minute period the capacity increases to above 50% the 16-minute timer is reset. This function has been included to save energy by cycling the unit off and allowing the temperature to swing slightly when the capacity demand is minimal.

04. Outdoor Fan Control

UNO-Pro controller follows internal control which adjusts its control strategy as the operating mode, it can be cooling or heating. Controller adjusts outdoor fan speed to control high pressure during cooling mode and low pressure in heating mode.

Mode	Control method
Cooling	High pressure
Heating	Low pressure

Outdoor fan control the high pressure during the cooling mode & low pressure in the heating mode. The UNO-Pro outdoor board can be configured to control fan either with system pressures or coil temp. Outdoor coil temp. control strategy is not very ideal because in few conditions system outdoor coil temp. is not a true indicator of system pressure but slow rate of change make it ideal for control loop. System default setting will be pressure control strategy.

04.01. Advance 2 Outdoor Fan Configuration

Model Number	No. of ODU Fan	Connection	Control Output
CRV13AS / EVA13AS	2	UNO-PRO	0 - 10VDC
CRV13AT / EVA13AS	2	UNO-PRO	0 - 10VDC
CRV15AS / EVA15AS	2	UNO-PRO	0 - 10VDC
CRV15AT / EVA15AS	2	UNO-PRO	0 - 10VDC
CRV17AS / EVA17AS	2	UNO-PRO	0 - 10VDC
CRV17AT / EVA17AS	2	UNO-PRO	0 - 10VDC

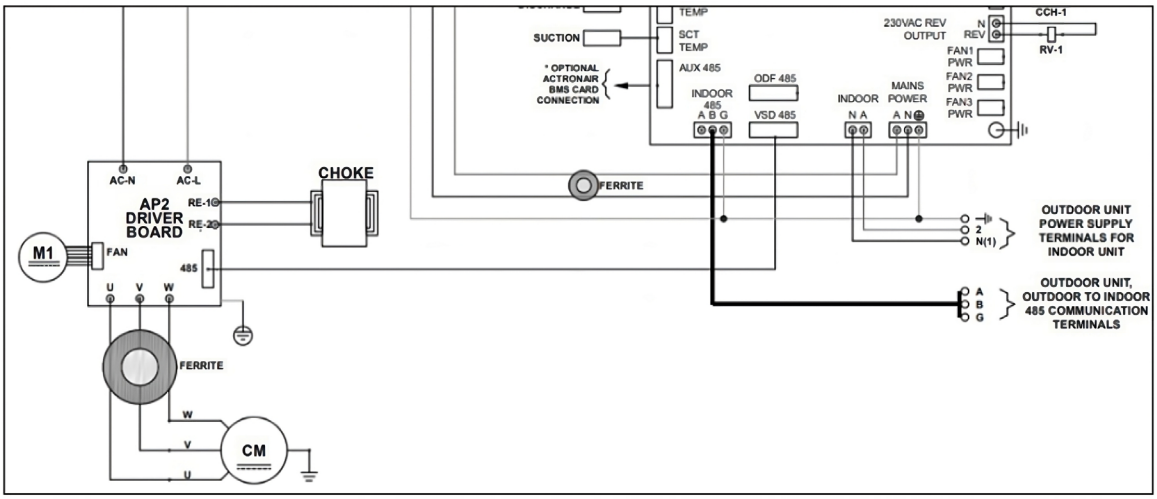
04.02. Aires 2 Outdoor Fan Configuration

Model Number	No. of ODU Fan	Connection	Control Output	Control By
CRS10AS / EVA10AS CRS13AS / EVA13AS CRS13AT / EVA13AS	1	Fan connected to Comp-drive	Write RPM on Comp-drive	UNO-PRO
CRS15AS / EVA15AS CRS15AT / EVA15AS CRS17AS / EVA17AS CRS17AT / EVA17AS	2			
CRS20AT / EVA20AS CRS23AT / EVA23AS	2	Fan-drive connected to UNO-PRO and Comp-drive		

04.02.01. Aires Fan Set-Up:

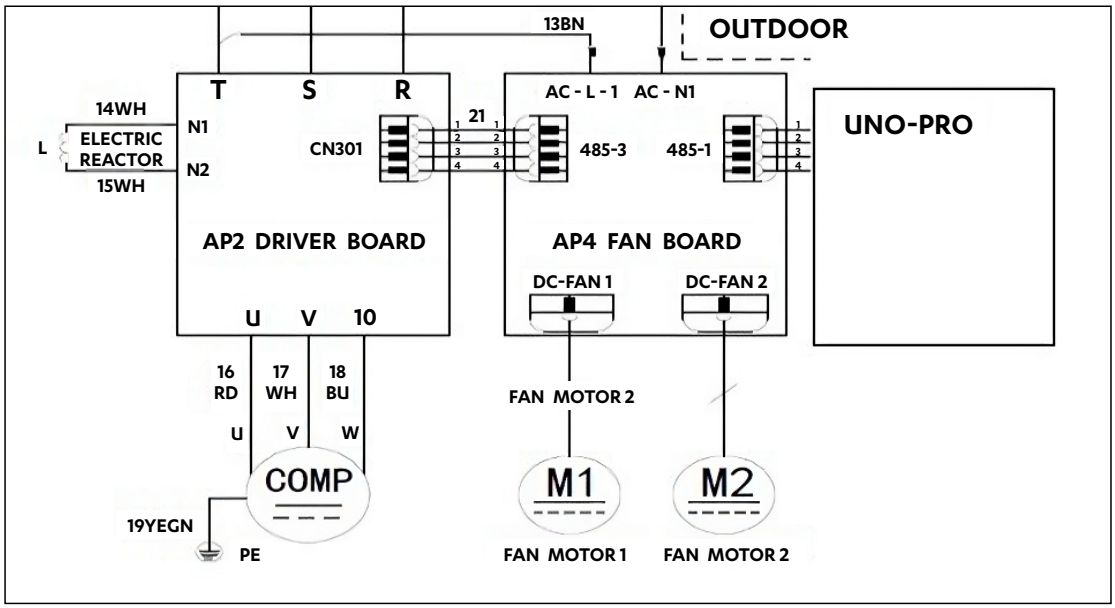
CRS10AS/T CRS13AS/T CRS15AS/T/ CRS17AS/T

The outdoor fan is connected to the VSD (Variable Speed Drive) and the UNO Pro Board will require the drive to run the outdoor fan.



CRS20AT/ CRS23AT

The outdoor fan is connected to the fan drive and UNO-PRO is directly talking to the fan drive.



04.03. Cooling Start-Up Speed

Whenever system starts in cooling or heating, then outdoor fan must start with a start-up speed of 4 vdc for 5 sec.

A. Advance 2

Family Code	10					
Model Number	**CRV13AS**	**CRV15AS**	**CRV17AS**	**CRV13AT**	**CRV15AT**	**CRV17AT**
Start-up Speed (VDC)	4	4	4	4	4	4

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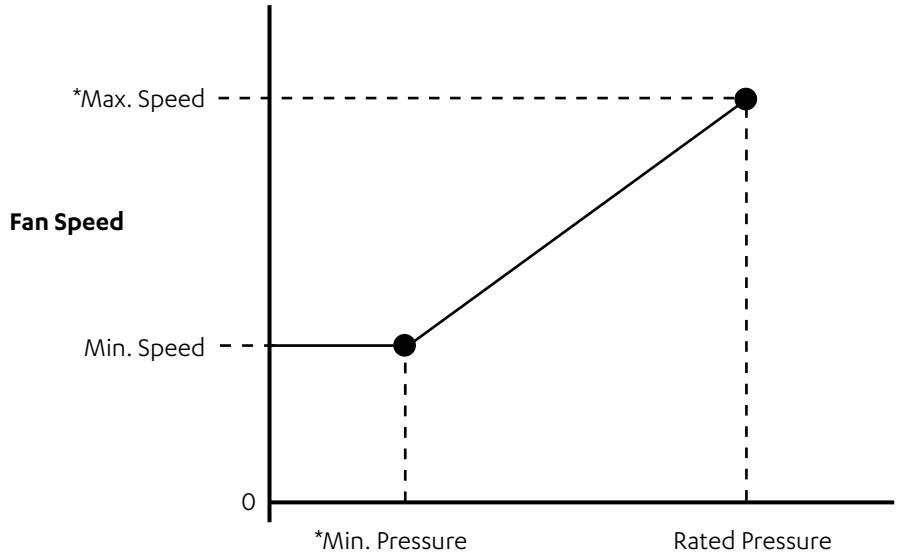
Family Code	9					
Model Number	**CRS10AS**	**CRS13AS/AT**	**CRS15AS/AT**	**CRS17AS/AT**	**CRS20AT**	**CRS23AT**
Start-up Speed (RPM)	400	400	400	400	400	400

04.04. Cooling Normal Operation

After completing the start-up step controller follows linear relationship between speed and pressure to control the outdoor fan speed.

A. Advance 2



High Pressure

Min pressure (Pa) = 1850Pa
Max pressure (Pa) = 2800Pa
Min speed (vdc) = 1.5
Max speed (vdc) = as per below table

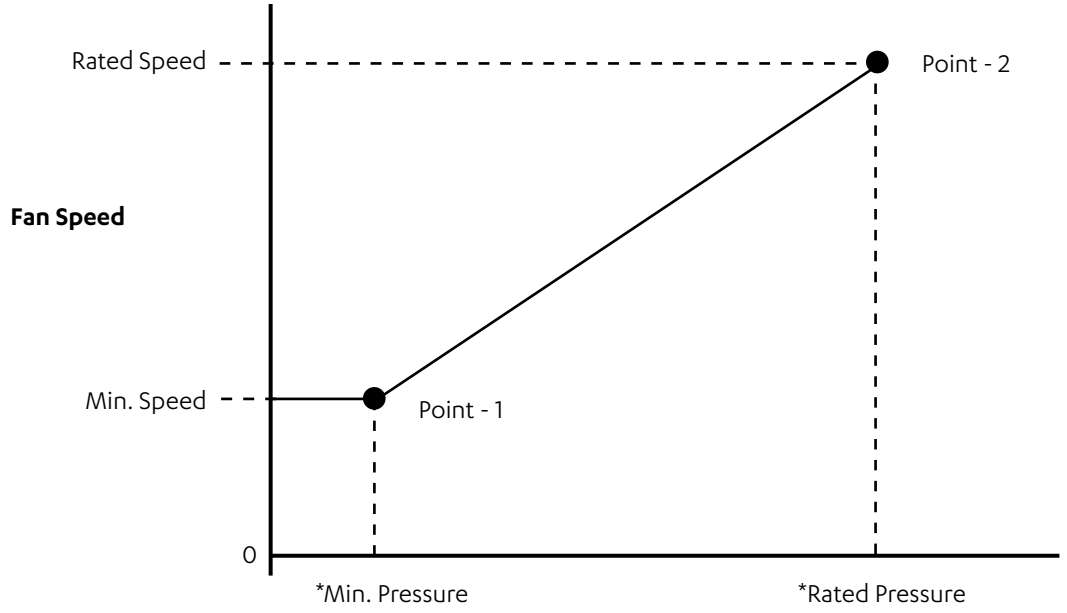
Model Number	CRV13AS/AT	CRV15AS	CRV15AT	CRV17AS/AT
****Max. Speed (VDC)**	6.3 @ 39°C	6.5 @ 33°C	6.5 @ 39°C	6.5 @ 33°C
	7 @ 41°C	7.5 @ 35°C	7.5 @ 41°C	7.5 @ 35°C

*Maximum speed are subjective to be changed by ambient temp, refer above table.
**vdc follow hysteresis to change value between temperature changes.
Above values are for Fan-1 and fan-2 = Fan-1 + 0.5v.

04.04.01. Control logic

- If High pressure ≤ 1850kPa, then run the outdoor fan with 1.5v.
- If Maximum pressure ≥ High pressure > 1850kPa, follow the speed and high pressure linear equation to define the target outdoor fan speed.
- If High pressure > Maximum high, then controller will run the outdoor fan on max. speed.

B. Aires



Point -1						
Model Number	**CRS10AS**	**CRS13AS/AT**	**CRS15AS/AT**	**CRS17AS/AT**	**CRS20AT**	**CRS23AT**
Min. Speed (RPM)	200	200	200	200	220	220
Min. Pressure (Kpa)	1850	1850	1850	1850	1750	1750

Point -2						
Model Number	**CRS10AS**	**CRS13AS/AT**	**CRS15AS/AT**	**CRS17AS/AT**	**CRS20AT**	**CRS23AT**
Rated Speed (RPM)	860	860	860	860	850	850
Rated Pressure (Kpa)	2800	2800	2800	2800	2800	2800

04.05. Low Ambient Cooling

When the outdoor ambient temperature < 12°C and the system requests for cooling, the system will undergo a special startup sequence. Startup will take place as normal, except the outdoor fans and compressor start-up speed will be different.

04.05.01. Compressor Start-Up Speed

During low ambient cooling compressor start-up speed will be 40% instead of 25%. This speed will help to put the system as earlier as possible inside the envelope.

04.05.02. Outdoor Fan Delay In The Start-Up

During low ambient start-up outdoor fan will only start to run when HP ≥ Min. Pressure.

04.05.03. Heating Start-Up Speed

Whenever the system starts in heating or cooling, the outdoor fan must start with start-up speed for 5sec, will not follow any pressure difference condition like cooling.

A. Advance 2

Family Code	10					
Model Number	**CRV13AS**	**CRV15AS**	**CRV17AS**	**CRV13AT**	**CRV15AT**	**CRV17AT**
Start-up Speed (VDC)	4	4	4	4	4	4

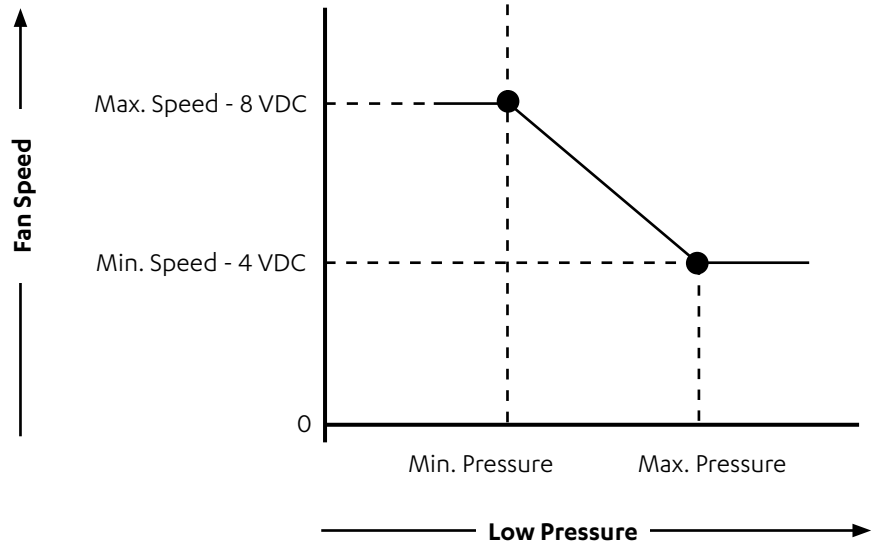
B. Aires

Family Code	9					
Model Number	**CRS10AS**	**CRS13AS/AT**	**CRS15AS/AT**	**CRS17AS/AT**	**CRS20AT**	**CRS23AT**
Start-up Speed (RPM)	400	400	400	400	400	400

04.06. Heating Normal Operation

After completing the start-up outdoor logic outdoor fan follow linear relationship between Speed and pressure

04.06.01. Advance 2



Min pressure (Pa) = 744 for 13kw & 700 for 15/17kw
Max pressure (Pa) = 840
Min speed (vdc) = 4
Max speed (vdc) = as per below table

04.06.02. Rated Speed Selection Table (Heating mode)

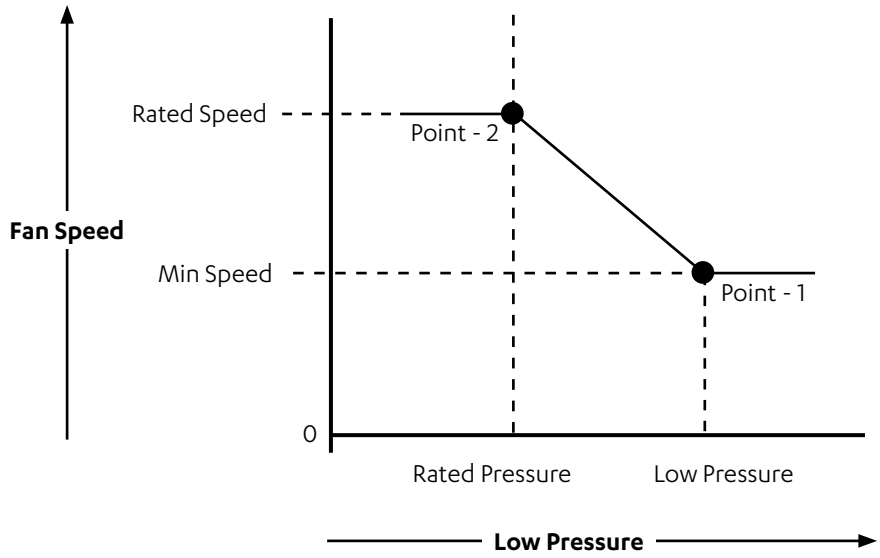
Model Number	CRV13AS	CRV15AS	CRV15AS	CRV17AS/AT
Max. Speed (vdc)	6.5 @4°C	6.5 @ 9°C	6.5 @ 7°C	6.5 @ 9°C
	7 @ 2°C	7.5 @ 7°C	7.5 @ 5°C	7.5 @ 7°C

Maximum speed are subjective to be changed by ambient temp, refer above table.
vdc follow hysteresis to change value between temperature changes.
Above values are for Fan-1 and fan-2 = Fan-1 + 1v.

04.06.03. Control logic

- If Low pressure > Max. low pressure, then run the outdoor fan with locked min. speed.
- If Max. low pressure ≥ Low pressure ≥ Min. low pressure, follow the speed and low pressure linear equation to define the target outdoor fan speed.
- If low pressure < Min. low pressure, then controller will run the outdoor fan on max. speed.

04.06.04. Aires



NOTES

Fan speed will change in every 10 seconds.
Low Pressure is the suction or low pressure of the system.

Point -1						
Model Number	**CRS10AS**	**CRS13AS/AT**	**CRS15AS/AT**	**CRS17AS/AT**	**CRS20AT**	**CRS23AT**
Locked Min. Speed (RPM)	300	300	300	300	300	300
High low Pressure (Kpa)	840	840	840	840	840	840

Point -2						
Model Number	**CRS10AS**	**CRS13AS/AT**	**CRS15AS/AT**	**CRS17AS/AT**	**CRS20AT**	**CRS23AT**
Rated Speed (RPM)	860	860	860	860	850	850
Rated Pressure (Kpa)	700	700	700	700	700	700

04.06.05. Ambient Temp Speed Restriction

In few product families outdoor fan speed can be restricted on the basis of ambient temperature which is mainly to drop the noise level of outdoor unit during mild ambient temp. condition. Default settings will be available on the seven segment **odFS** Menu which can be customized as per customer requirement.

Below table is applicable for family 9.

diS (Display)	Display system's status and settings		Default Value	Range
SEt	Service use only			
	odFS	Pc = Pressure control	1	0 - 1
		tc = Temperature control	0	0 - 1
		CrS = Cooling rated speed.	As per table	0 - 10
		CHS = Cooling max. speed.	As per table	CRS - 10
		CtrS = Temp. restricted speed.	As per table	6 - (CRS-1)
		Ctr1 = Cooling restricted temp.	As per table	36 - 45
		Ctr2 = Cooling restricted temp.	As per table	36 - 45
		Ctr3 = Cooling restricted temp.	As per table	36 - 45
		HrS = Heating rated speed.	As per table	0 - 10
		HHS = Heating max. speed.	As per table	HRS - 10
		HtrS = Heating temp. restricted speed.	As per table	6 - (CRS-1)
		Hrt1 = Heating restricted temp.	As per table	5 - 10
		Hrt2 = Heating restricted temp.	35	35 - 40
		Hrt3 = Heating restricted temp.	10	5 - 10

Hysteresis: Temp ± 1°c and Voltage ± .5v across the above selected value and follow below logic for cooling and heating.

05. Quiet Mode

When the quite mode is selected the unit operates the outdoor unit more quietly during cooling/heating operation. Quite mode has no effect on the indoor fan. Objective of this mode is to drop the outdoor unit sound power by 4 to 5 dB.

The effectiveness of quite mode depends on the outdoor ambient temperature.

The limitations are:

- If the unit is in heating and outdoor temp. < 10°C, then quite mode will have no effect.
- If the unit is in cooling and outdoor temp. > 35°C, then quite mode will have no effect.

Platinum 3-phase compressor speed

Advance Unit	Compressor Quiet Mode Speed	Compressor Speed Range	Quiet Mode Outdoor Fan Speed (VDC/RPM)
CRV13AS / CRV13AT	3100	3000 to 3500	6V/600RPM
CRV15AS / CRV15AT	3500	3000 to 3500	6V/600RPM
CRV17AS / CRV17AT	4100	3000 to 4200	6V/600RPM

Aires Compressor Speed at Quiet Mode

Aires Unit	Compressor (RPM)	ODU Fan (RPM)
CRS10AS	3600	600
CRS13AS / CRS13AT	2640	600
CRS15AS / CRS15AT	2856	600
CRS17AS / CRS17AT	3230	600
CRS20AT / CRS23AT	2460	600

- As the outdoor board receive the night mode request from the indoor. It drops the compressor and outdoor fan speed to the predefined operated speed.
- Oil return cycle has the highest priority and during the oil return cycle compressor & outdoor fan works normally.
- User can configure the night mode compressor speed form the outdoor seven segment navigation. Configured value will be within the range (Currently function is not available).
- Low/High pressure protection in Cooling mode has highest priority.

06. Customization

Need to develop a menu in the UNO-PRO board seven segment **SEt**

Refer below table for customization.

Main Menu	Sub menu 1		Sub menu 2		Details		UOM
	Display	Description	Display	Description	Display	Description	
SEt	qS	Quiet Mode setting"	CCS	Compressor speed	3500 (Default)	User can change between 3000 to 4200 rpm with **MENU** Button.	RPM
			HCS	Compressor speed	3500 (Default)	User can change between 3000 to 4200 rpm with **MENU** Button.	RPM
			CCT	Cooling mode critical temp condition	35°C (Default)	User can change between 35°C to 40°C with **MENU** Button.	°C
			HCT	Heating mode critical temp condition	10°C (Default)	User can change between 5°C to 10°C with **MENU** Button.	°C

07. Turbo Mode

Turbo mode can be operated in below conditions.

Condition 1: Unit is ON condition.

Condition 2: Mode can be AUTO/Heat/ Cool

Activation: Press mode button for 3 seconds.

Turn off turbo mode:

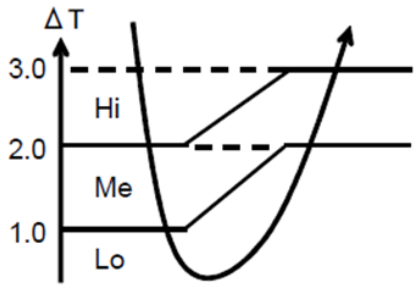
- Press mode button for 3 seconds.
- Press on/off button to turn off the AC, the turbo mode will reset.
- There is a 30min turbo mode timer in indoor board, system will automatically exit after 30min.

Turbo mode operation

- During turbo mode indoor fan speed is control by ΔT, ΔT = Room Temp – Set Temp.

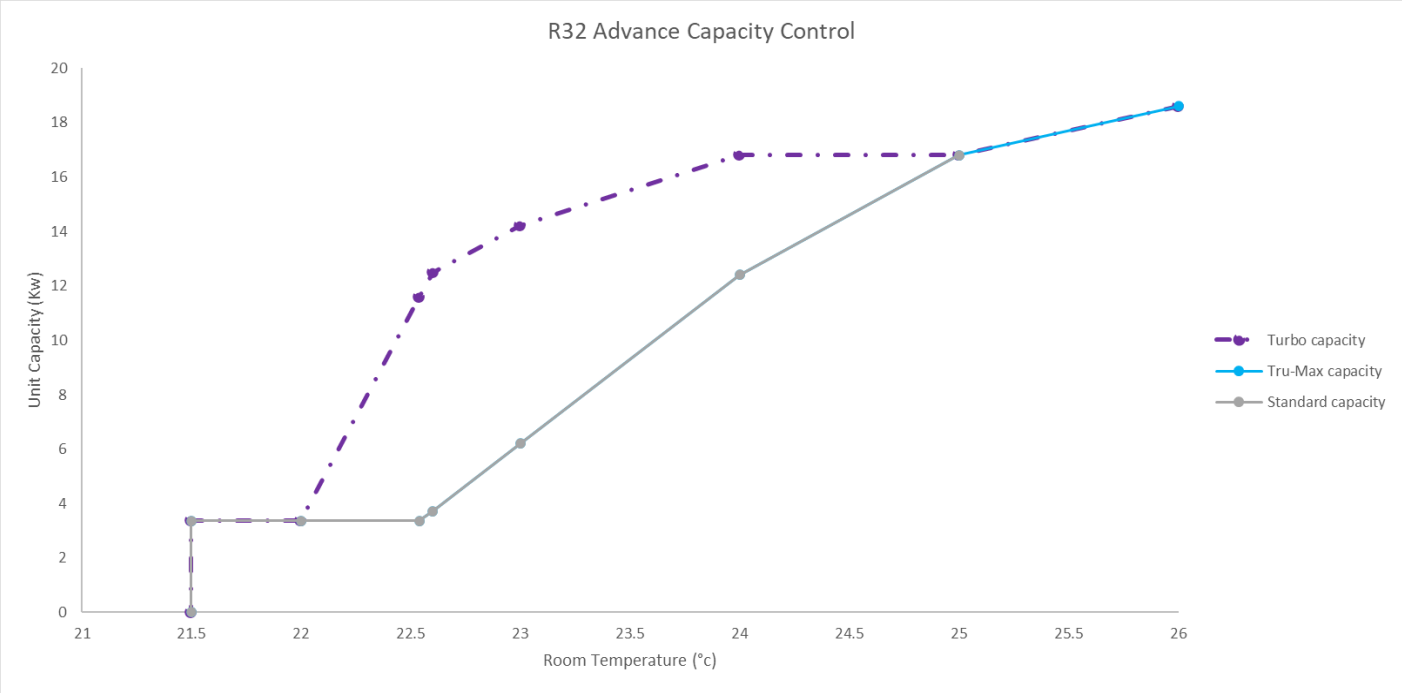
Initial indoor fan speed

When ΔT is located in overlap area of below diagram at the beginning of Switch ON, the higher speed should be adopted.



Mode of Operation	Current fan speed	ΔT	Change fan speed
Cooling/Heating	High	ΔT < 1	Low
		1 ≤ ΔT ≤ 2	Med
	Medium	ΔT ≥ 3	High
		ΔT < 1	Low
	Low	ΔT ≥ 3	High
		ΔT ≥ 2	Med

Difference between Turbo and Tru-Max



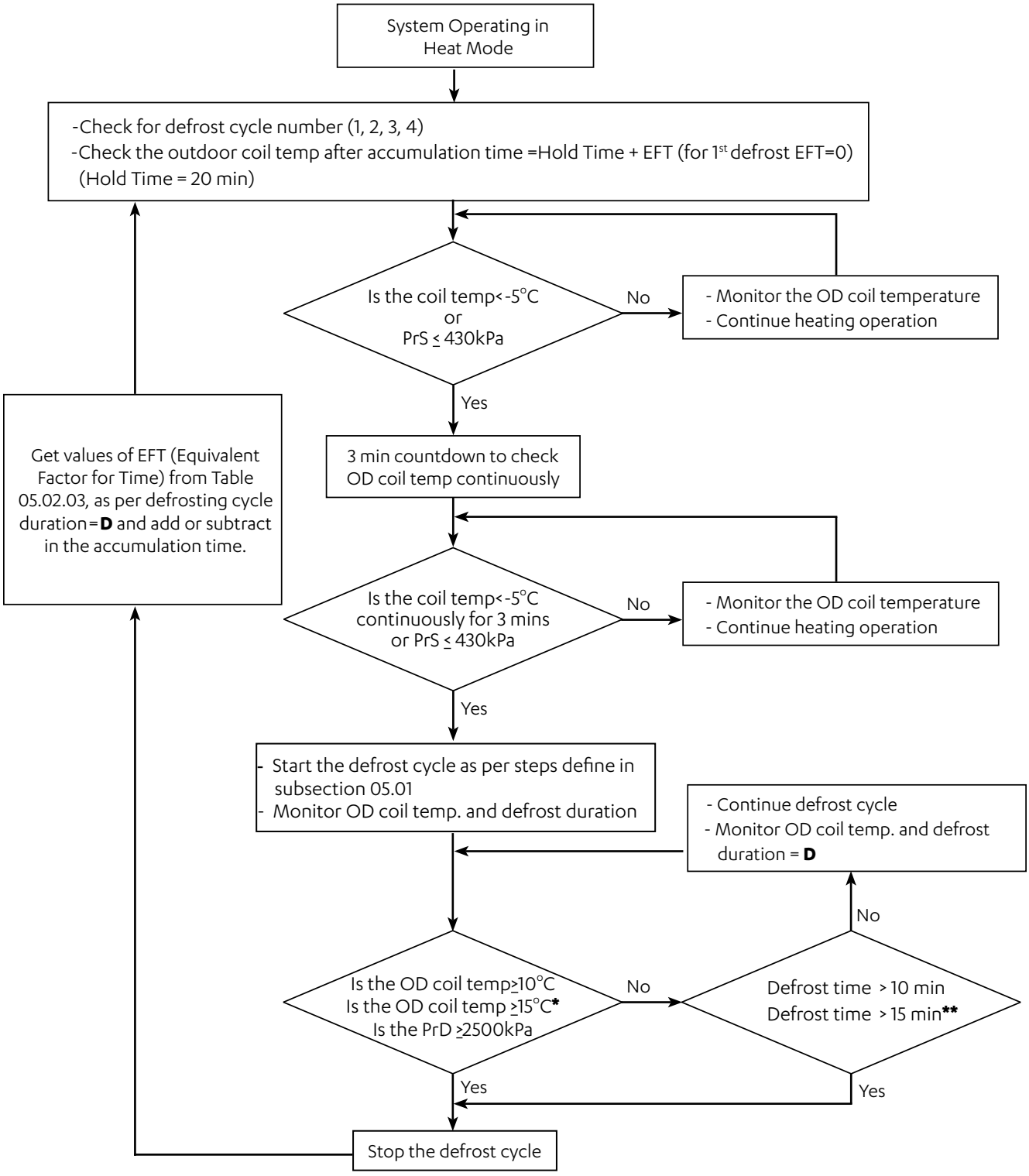
Turbo

Offering customers the option to cool or heat a space quickly and effectively by operating at a span of 30 minutes before switching back to the previous settings.
This will be delivered by increasing the compressor and indoor fan speed in order to achieve this.

Tru-Max

Tru-Max provides customers with a system that delivers continuous superior capacity when demand is greater than the systems rated capacity.
Tru-Max will operate over and above the rated capacity, when required, without intervention from the customer.

08. Adaptive Demand Defrost Logic - Advance 2

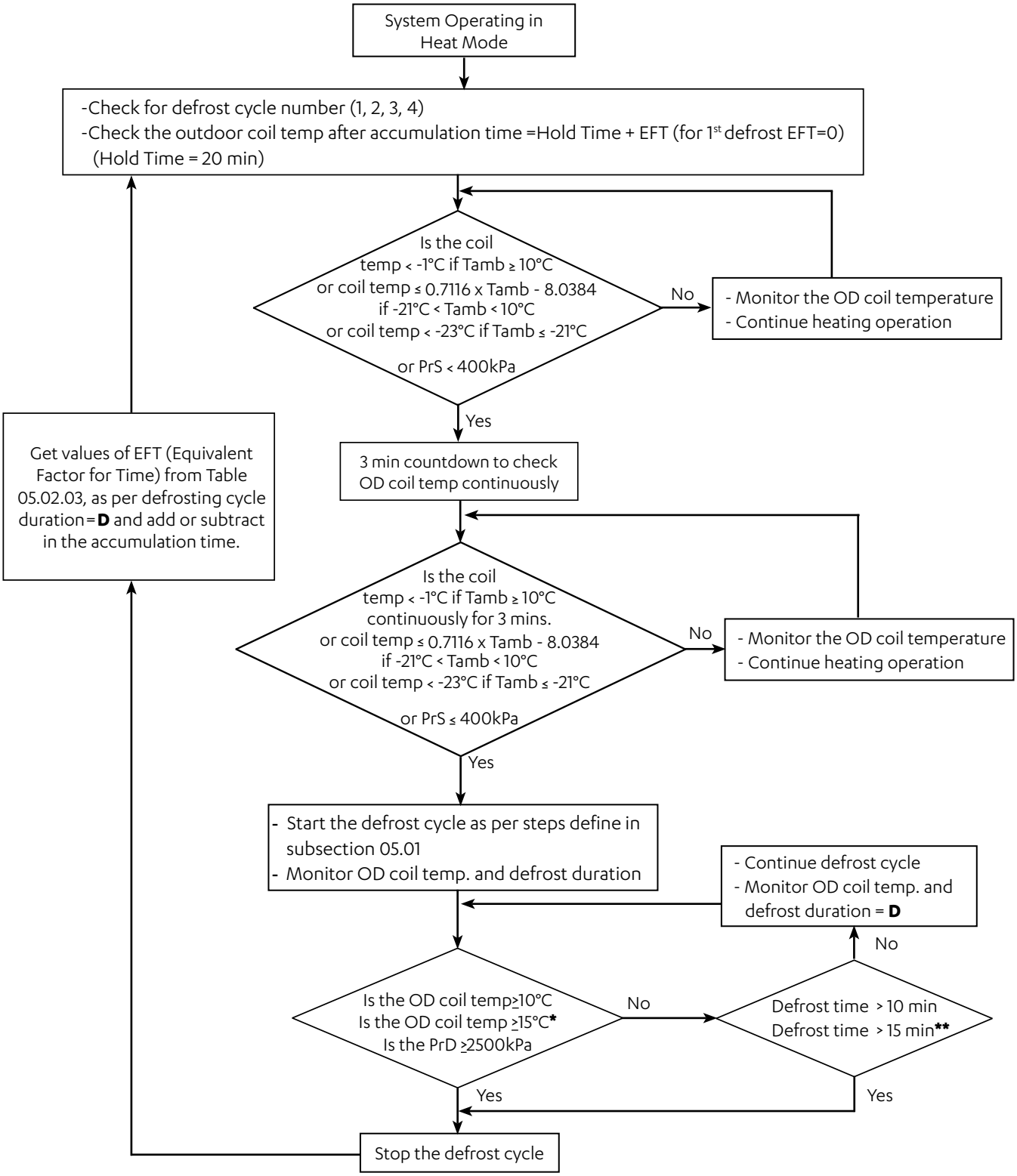


****** Applicable only for 4th cycle. After 4th defrost, the accumulating time (Hold Time ± EFT) will continuously accumulate onto the next cycle (First cycle), but the accumulation time cannot be less than the minimum and greater than the maximum defrost hold time.

Following are the parameters which control the defrost cycle:

1. Defrosting cycle confirm time = 3 min
2. Defrosting cycle maximum time = 10 min
3. 4th defrosting cycle maximum time = 15 min
4. -15°C will call for defrosting cycle after 1 minute confirmation time.
5. -5°C will call for defrosting cycle, confirmation time is required.
6. Defrosting end condition, +10°C or PrD > 2500kPa or 10min, whichever is earlier.
7. 4th cycle defrost end condition = +15°C or PrD > 2500kPa or 15min, whichever is earlier.
8. Defrost EFT as per defrost cycle duration time D for next cycle
   - Defrost time 1 min = +10 min EFT
   - Defrost time 2 min = +5 min EFT
   - Defrost time 3 min = +3min EFT
   - Defrost time 4 min = +2 min EFT
   - Defrost time 5 min = 0 min EFT
   - Defrost time 6 min = 0 min EFT
   - Defrost time 7 min = -1 min EFT
   - Defrost time 8 min = -4 min EFT
   - Defrost time 9 min = -6 min EFT
   - Defrost time 10 min= -10 min EFT
9. Defrost min. wait or hold time = 20 min
10. Defrost max. wait or hold time = 40 min
11. After the hold time, system will start 3 minutes countdown to monitor OD coil temperature and confirm if defrost is required. If during 3 min period, the temperature and low pressure rises above -5°C and 430kPa, countdown timer will reset. Countdown timer will only re-start when the temperature once again drops to -5°C or below.
12. Defrost duration D: The time that the compressor is in reverse cycle (cooling mode)

09. Adaptive Demand Defrost Logic - Aires



****** Applicable only for 4th cycle. After 4th defrost, the accumulating time (Hold Time ± EFT) will continuously accumulate onto the next cycle (First cycle), but the accumulation time cannot be less than the minimum and greater than the maximum defrost hold time.

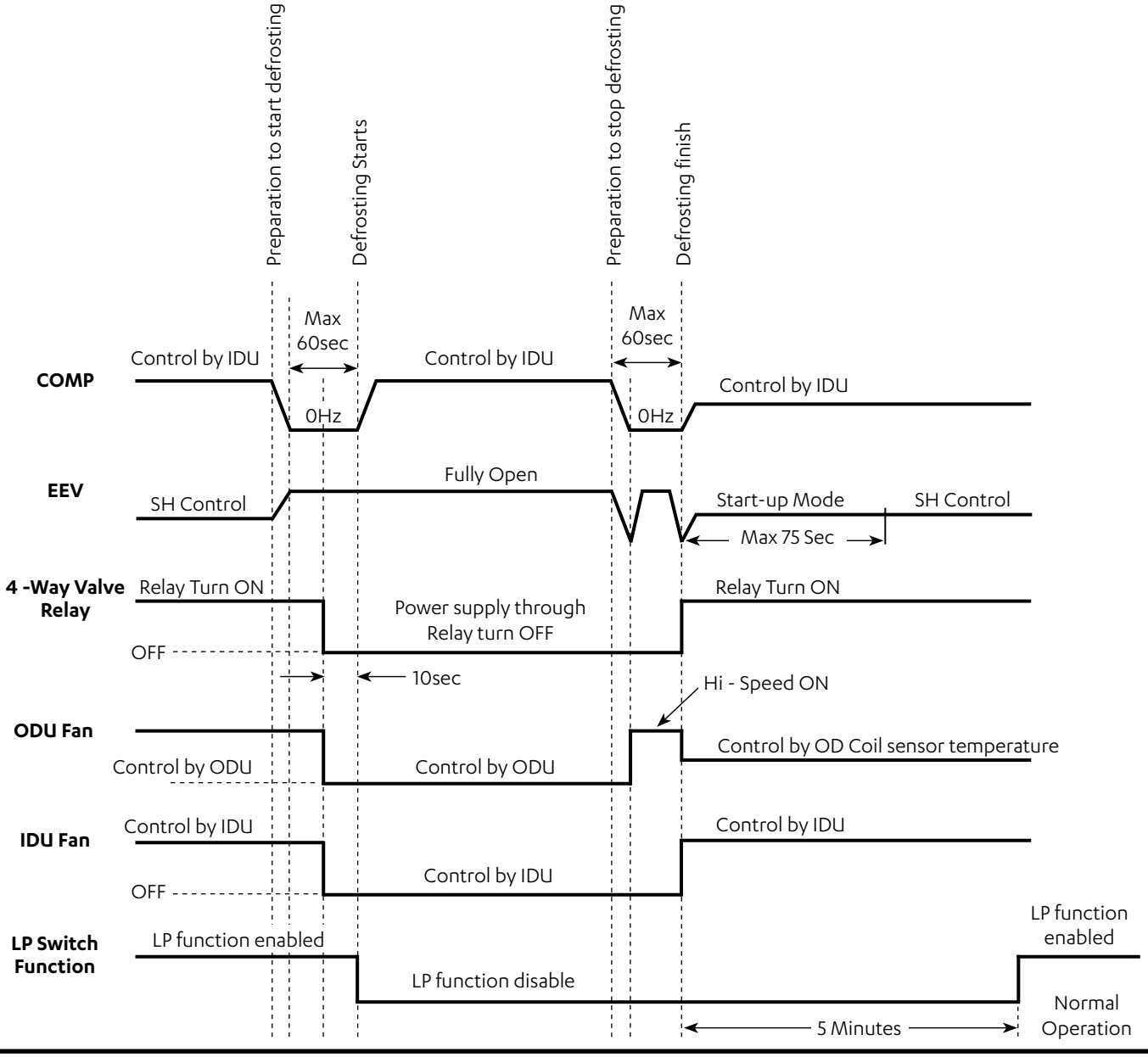
Following are the parameters which control the defrost cycle:

1. Defrosting cycle confirm time = 3 min
2. Defrosting cycle maximum time = 10 min
3. 4th defrosting cycle maximum time = 15 min
4. -16°C will call for defrosting cycle after 1 minute confirmation time.
5. -5°C will call for defrosting cycle, confirmation time is required.
6. Defrosting end condition, +10°C or PrD > 2500kPa or 10min, whichever is earlier.
7. 4th cycle defrost end condition = +15°C or PrD > 2500kPa or 15min, whichever is earlier.
8. Defrost EFT as per defrost cycle duration time D for next cycle
   - Defrost time 1 min = +10 min EFT
   - Defrost time 2 min = +5 min EFT
   - Defrost time 3 min = +3min EFT
   - Defrost time 4 min = +2 min EFT
   - Defrost time 5 min = 0 min EFT
   - Defrost time 6 min = 0 min EFT
   - Defrost time 7 min = -1 min EFT
   - Defrost time 8 min = -4 min EFT
   - Defrost time 9 min = -6 min EFT
   - Defrost time 10 min= -10 min EFT
9. Defrost min. wait or hold time = 20 min
10. Defrost max. wait or hold time = 40 min
11. After the hold time, system will start 3 minutes countdown to monitor OD coil temperature and confirm if defrost is required. If during 3 min period, the temperature and low pressure rises above -5°C and 430kPa, countdown timer will reset. Countdown timer will only re-start when the temperature once again drops to -5°C or below.
12. Defrost duration D: The time that the compressor is in reverse cycle (cooling mode)

09.01. Defrost Cycle Steps

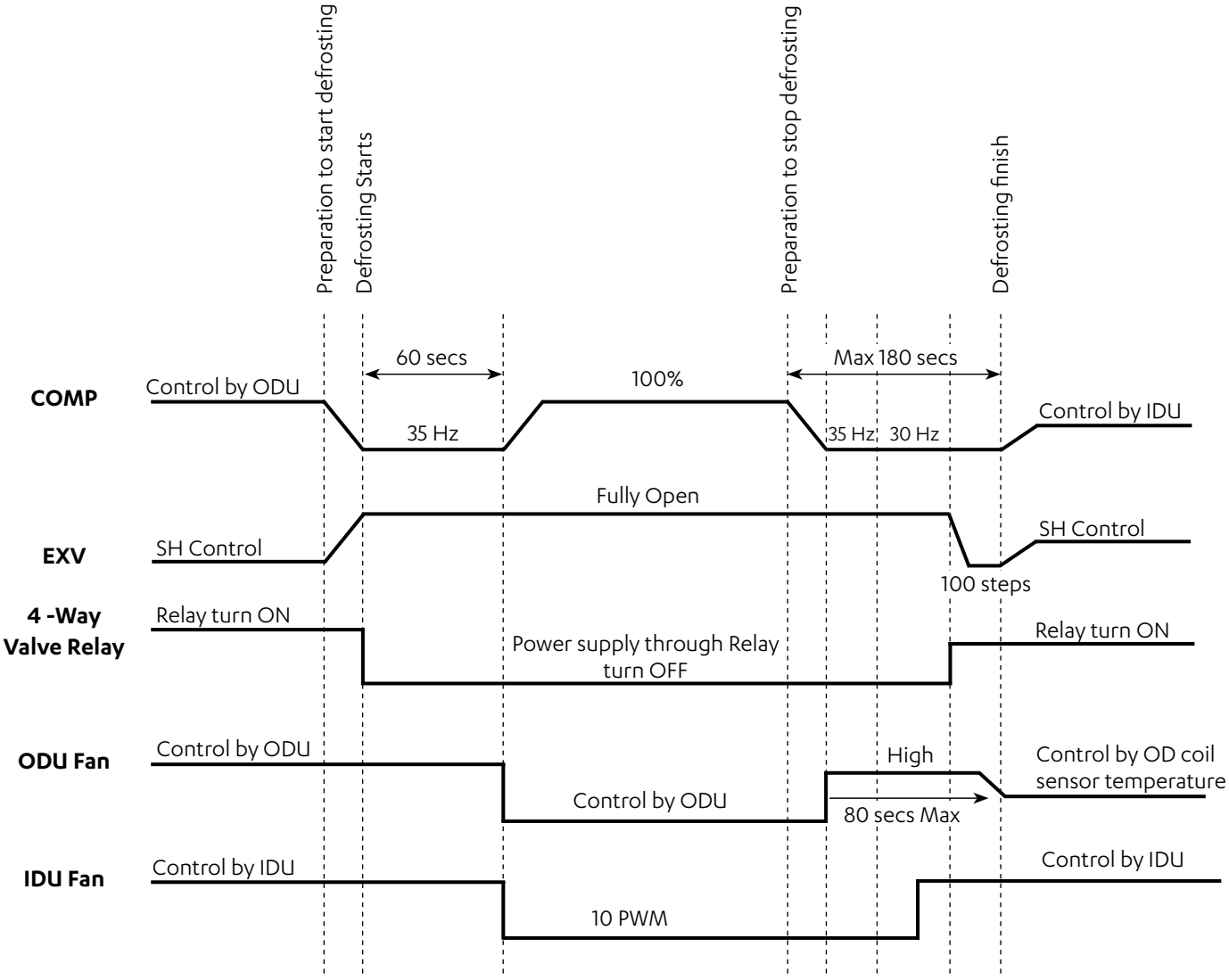
09.01.01. Advance 2

Component / Timing	Preparation to Start the Defrosting Operation	Defrost Operation	Preparation to Stop the Defrosting Operation
Compressor	Start to ramp down to stop	Control by ODU	Start to ramp down to stop
Outdoor Fan	Control by Outdoor Coil Sensor Temperature	Fan **OFF**	Fan **Hi-Speed ON**
4 -Way Valve	ON	OFF	ON
EEV	Control by Superheat	Fully Open	EEV Start-up Mode
LP Bypass relay	OFF	ON	On for 300 sec then turn OFF
Time Duration	Max 60 Sec when the compressor starts to ramp down	As per defrost duration	Max 60 Sec
Indoor Fan	Controlled by IDU	Controlled by IDU	Controlled by IDU



09.01.02. Aires

Component / Timing	Preparation to Start the Defrosting Operation	Defrost Operation	Preparation to Stop the Defrosting Operation
Compressor	Drop to 35 Hz	100%	Drop to 35Hz and to 30Hz
Outdoor Fan	Keep on	Stop	Hi-Speed on for 60 sec.
4 -Way Valve	As per heating mode	Off	As per heating mode
EEV	Control by ODU	Fully Open	Fully open then drops to 100 steps
Time Duration	60 sec.	Dependent on exit conditions	Max 180 sec
Indoor Fan	Normal IDU speed	IDU defrosting speed	Normal IDU speed



NOTES

- If the de-ice coil sensor fails, system will complete its accumulation time first. After that, follow the suction pressure condition to perform the defrost operation.
- If the Defrost duration for the fourth cycle is more than 10 min, EFT will be -10 min for the next cycle (First cycle).
- Accumulation time will not be affected by thermostat ON-OFF and Oil return cycle.
- When the system starts again, it will continue with the old accumulating time. But, if the system gets turned OFF from Master Wall Control accumulation time becomes zero. At any time during the defrost, if the system turns off , the system will stop the defrosting and reset back to first cycle, but during thermostat ON-OFF, the system will complete the defrosting cycle.
- At any instant, if ODU gets the request for Defrosting and Oil return at the same time, Defrost has higher priority.

09.02. Adaptive Demand Defrost

The "Adaptive Demand Defrost" offers better defrost performance by having "AIT" (Adaptive Interval Time. The adaptive interval time can increase or decrease the interval time (time between defrosts) automatically to suit the local conditions. This prevents the unit to activate unnecessary defrost, which improves the heating performance of the system.

NOTE

*Only Advance has a -5°C or below OD Coil Temp while for Aires, the trigger temperature is based on ambient temperature.

09.02.01. Definition

Interval Time - minimum time set by the controller before the system will proceed to 3 minutes confirmation time if OD temperature falls to -5°C* or below.

1. Interval Time during start up (initial interval time)
   Interval Time (1st Cycle) = 30 minutes (default)
2. Second Cycle Interval Time
   Interval Time (2nd Cycle) = 30 minutes +/- algorithm of cycle 1st defrost duration
3. Third Cycle Interval Time
   Interval Time (3rd Cycle) = 30 minutes +/- algorithm of cycle 1st defrost duration +/- algorithm of cycle 2nd defrost duration
4. Fourth Cycle Interval Time
   Interval Time (4th Cycle) = 30 minutes +/- algorithm of cycle 1st defrost duration +/- algorithm of cycle 2nd defrost duration +/- algorithm of cycle 3rd defrost duration

Confirmation Time = 3 minutes countdown timer to monitor if OD coil temperature is still -5°C*. If Pressure condition, PrS < 510kPa, countdown timer is not applicable.

Defrost Duration = the period where the system switch to cooling mode until the OD coil temperature registers +10°C or if 10 minutes maximum defrost period has elapsed.

09.02.02. Example of R-32 Defrost Cycles

1st Defrost Cycle

30 mins + 3 mins (if OD Coil Temp is -5°C*) = **defrost**

10 mins or + 10 ˚ C (OD Coil Temp) = **defrost termination**

2nd Defrost Cycle

30 mins +/- algorithm of 1st defrost duration + 3 mins (-5°C) = **defrost**

10 mins or + 10°C (OD Coil Temp) = **defrost termination**

3rd Defrost Cycle

30 mins +/- algorithm of 1st defrost duration +/- algorithm of 2nd defrost duration + 3 mins (-5°C) = **defrost**

10 mins or + 10°C(OD Coil Temp) = **defrost termination**

4th Defrost Cycle

30 mins +/- algorithm of 1st defrost duration +/- algorithm of 2nd defrost duration +/- algorithm of 3rd defrost duration+ 3 mins (-5°C*) = **defrost**

15 mins or + 15°C (OD Coil Temp) = **defrost termination**

Cycle goes back to 1st cycle and repeats (interval time will be continuously accumulated).

NOTES

- During interval period (any cycle), if the coil temperature drops to -15°C or below, the system will check the remaining interval time.
  - If the remaining interval time is > 20 minutes, it will be reduced to 20 minutes and proceed to 3 minutes confirmation time.
  - If the remaining interval time is < 20 minutes, the remaining interval time will be kept.
- Maximum accumulated interval duration is 90 minutes.
- Maximum accumulated interval duration is 20 minutes.

09.02.03. Adaptive Demand Defrost - Ice Clearing Cycle

Sometimes, after extended cold weather operation, solid ice may form on the outdoor coil that can not be removed by the standard defrost termination of 10 minutes or +10°C. To help get rid of this ice, the defrost termination could be lengthened and the temperature raised. But this would mean the system will remain in defrost operation longer than what is required on most occasions.

The Ice Clearing Cycle built into the adaptive demand defrost logic applies a longer defrost time and temperature termination of 15 min. and +15°C respectively on every 4th defrost cycle. The benefit of this feature is, it helps prevent solid ice building up after multiple defrost cycles.

Adaptive Demand Defrost Algorithm Table

Adaptive Demand Defrost System additional interval time before next defrost operation, as shown in table below.

Recorded Defrost Duration (mins.)	Additional Time on Next Defrost Interval (mins.)
1	+10
2	+5
3	+3
4	+2
5	0
6	0
7	-1
8	-4
9	-6
10	-10

Examples:

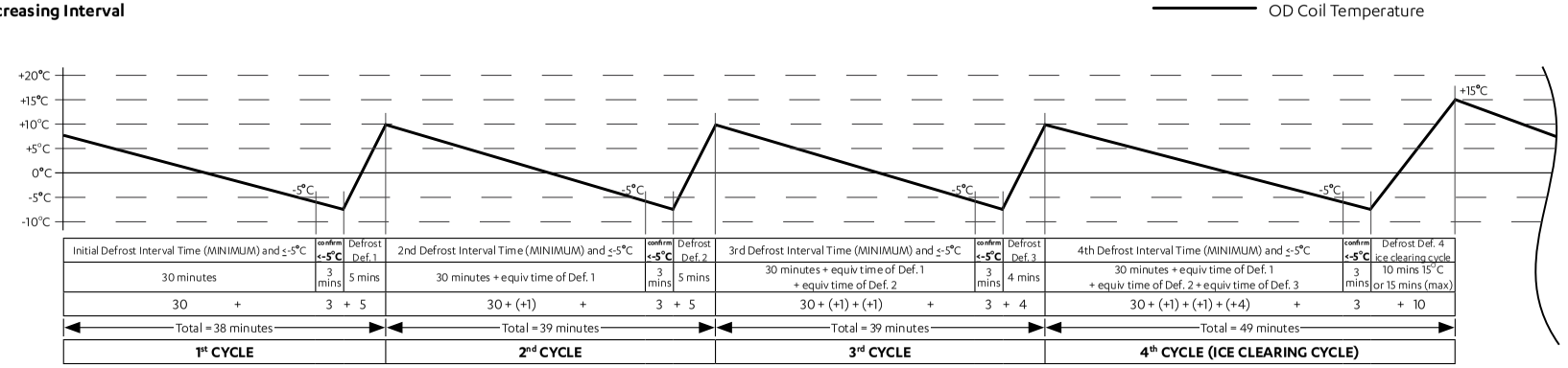
- If the duration of defrost is 3 minutes (column 1), the system will add 3 minutes to the next interval time before proceeding to 3 minutes confirmation time.
- If duration of defrost is 9 minutes (column 1), the system will deduct 6 minutes to the next interval time before proceeding to 3 minutes confirmation time.

NOTES

- The Interval time will continuously accumulate.
- The maximum accumulated time is 40 minutes and the minimum is 20 minutes.
- When the unit is turned Off, the system will stop counting the accumulation time. The system will only start counting the accumulation time again when it is switched back into Heating mode.

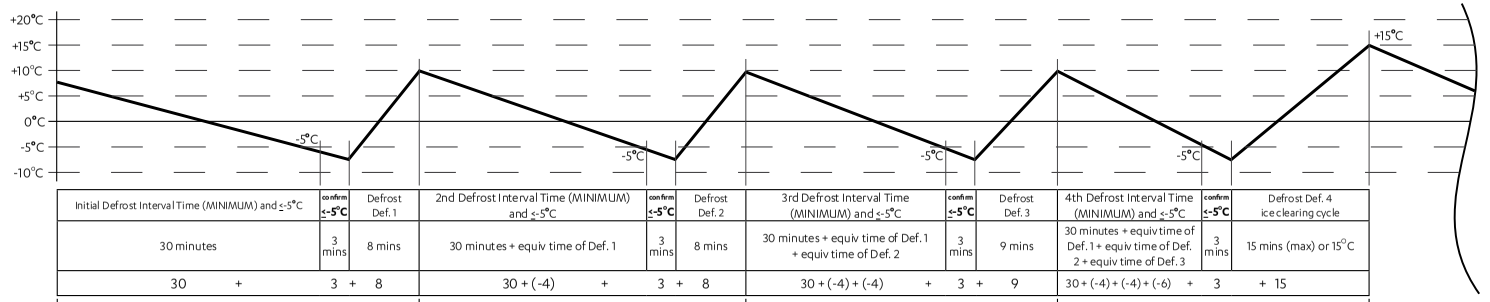
Example of Adaptive Demand Defrost Cycle

Increasing Interval



Initial Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 1	2nd Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 2	3rd Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 3	4th Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 4 ice clearing cycle
30 minutes	3 mins	5 mins	30 minutes + equiv time of Def. 1	3 mins	5 mins	30 minutes + equiv time of Def. 1 + equiv time of Def. 2	3 mins	4 mins	30 minutes + equiv time of Def. 1 + equiv time of Def. 2 + equiv time of Def. 3	3 mins	10 mins 15°C or 15 mins (max)
30 +	3	+ 5	30 + (+1) +	3	+ 5	30 + (+1) + (+1) +	3	+ 4	30 + (+1) + (+1) + (+4) +	3	+ 10
Total = 38 minutes			Total = 39 minutes			Total = 39 minutes			Total = 49 minutes		
1st CYCLE			2nd CYCLE			3rd CYCLE			4th CYCLE (ICE CLEARING CYCLE)		

Decreasing Interval



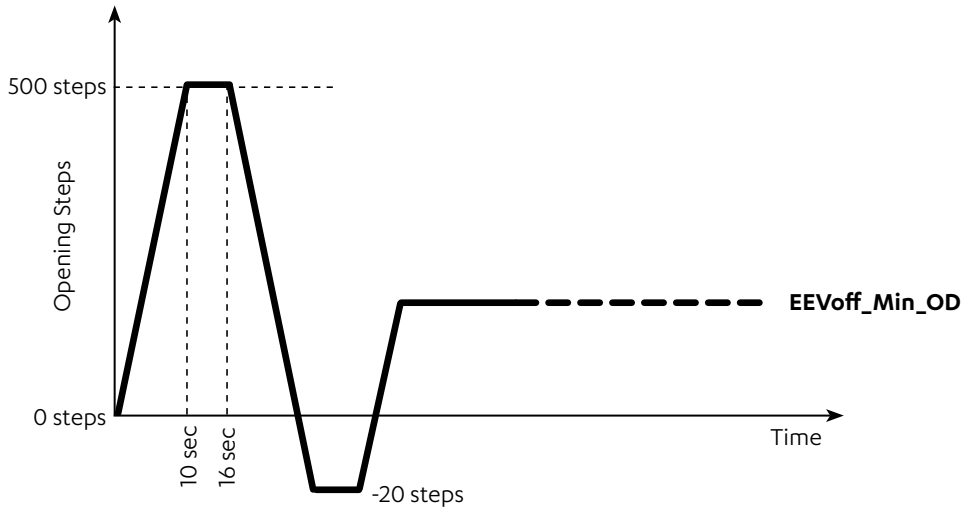
Initial Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 1	2nd Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 2	3rd Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 3	4th Defrost Interval Time (MINIMUM) and ≤-5°C	confirm ≤-5°C	Defrost Def. 4 ice clearing cycle
30 minutes	3 mins	8 mins	30 minutes + equiv time of Def. 1	3 mins	8 mins	30 minutes + equiv time of Def. 1 + equiv time of Def. 2	3 mins	9 mins	30 minutes + equiv time of Def. 1 + equiv time of Def. 2 + equiv time of Def. 3	3 mins	15 mins (max) or 15°C
30 +	3	+ 8	30 + (-4) +	3	+ 8	30 + (-4) + (-4) +	3	+ 9	30 + (-4) + (-4) + (-6) +	3	+ 15
Total = 41 minutes			Total = 37 minutes			Total = 34 minutes			Total = 34 minutes		
1st CYCLE			2nd CYCLE			3rd CYCLE			4th CYCLE (ICE CLEARING CYCLE)		

NOTE: To obtain the equivalent time, use Adaptive Demand Defrost Algorithm Table.

10. EEV Operation

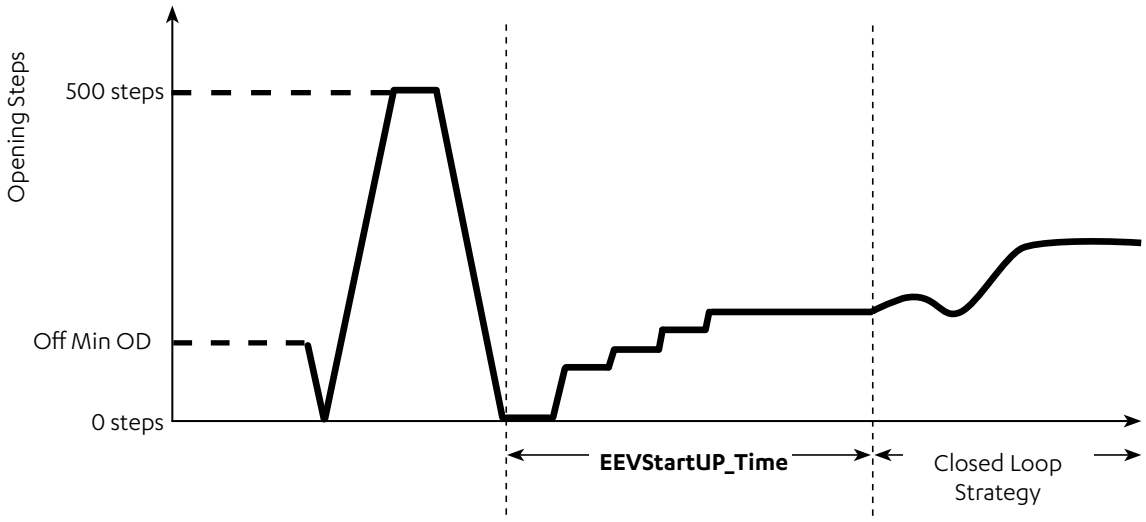
10.01. Initialise Or Lost Step Compensation

- After power reset or reboot, EEV will first open to 500steps then close to -20steps. Controller will assume this - 20 steps as a zero position.
- When the unit is set to OFF mode, the valve will be set to the EEVOff_Min_OD. This value is 125steps.



10.02. EEV Start-Up Characteristics

Start-up characteristics are defined by these two variables:
EEVStartup_Time: As the unit starts in heating or cooling mode, the controller will open the EEV to 500 steps. The EEV will remain open at 500 steps and wait until the pressure in the system stabilizes (differential of 50kPA between HP and LP). Once stabilized, the controller will close the EEV and begin the start-up sequence. The ***EEVStartup_Time*** maximum duration time is predefined, unless a discharge superheat to the pre-defined value is achieved – the controller will enter close loop control.



EEVStartUp_Time: Equivalent to compressor start up time.

EEVStartup_Steps: As the system starts it opens the EEV in steps, opening steps are linked with pre-defined conditions and EEV start up maximum duration time is pre-defined. As the start-up sequence will be finished then SH closed loop control will start.

10.03. EEV Port Assignment

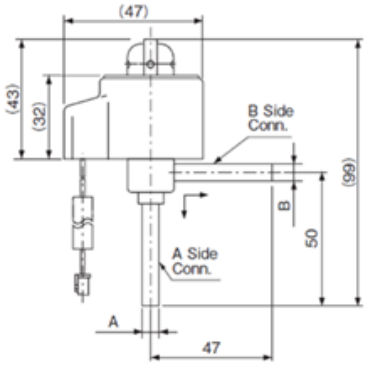
EEV Flow Characteristics: It has been observed during R&D testing when the refrigerant flow from the B to A, then only EEV produce refrigerant burning noise or flow noise. Refrigerant flow direction from A to B is quiet.

We observed this issue in the UKV Type EXV.

NOTE

The dimensions are for illustration purposes only.

Type UKV



Above issue has been countered by putting two EXV in the advance series product but VCC 15/17KW is still going with single EXV (it is a package unit so interconnected pipes are inside the package unit).

10.03.01. Advance 2

CRV13AS / CRV13AT

UNO-PRO board has two EEV port which will work separately during the cooling / heating mode like below:

- During the cooling mode, EEV-1 port will change the EEV steps to maintain target SH and DSH and EEV-2 will remain open to 500 steps.
- During the heating mode, EEV-2 port will be change the EEV steps to maintain target SH and DSH and EEV-1 will remain open to 500 steps.

As the UNO-Pro board will receive the cooling request, then EEV-1 will perform the initialization and EEV-2 will be open to 500 and stay there, once the compressor stop both EEV will move to stand-by steps.

CRV15AS / CRV17AS / CRV15AT / CRV17AT

- During cooling and heating mode EEV-1 and EEV-2 port will be changing the EEV steps to maintain target SH and DSH.

10.03.02. Aires

CRS10AS /CRS13AS / CRS15AS / CRS17AS / CRS13AT / CRS15AT / CRS17AT

UNO-PRO board has two EEV port which will work separately during the cooling / heating mode like below:

- During the cooling mode, EEV-1 port will change the EEV steps to maintain target SH and DSH and EEV-2 will remain open to 500 steps.
- During the heating mode, EEV-2 port will be change the EEV steps to maintain target SH and DSH and EEV-1 will remain open to 500 steps.

As the UNO-Pro board will receive the cooling request, then EEV-1 will perform the initialization and EEV-2 will be open to 500 and stay there, once the compressor stop both EEV will move to stand-by steps.

CRS20AT / CRS23AT

- During the cooling and heating mode, EEV-1 and EEV-2 port will change the EEV steps to maintain target SH and DSH.

10.03.03. VCC 15/17

- During cooling and heating mode EEV-1 and EEV-2 port will change the EEV steps to maintain target SH and DSH.

NOTE

With the help of seven segment menu user can change EEV output. Single and dual port functionality.

Summary Table

Model Name	Model Number	EEV Functionality at Ports
Aires	CRS10AS	
	CRS13AS / CRS13AT	
	CRS15AS / CRS15AT	
	CRS17AS / CRS17AT	
	CRS20AT	
	CRS23AT	
Advance 2	CRV13AS / CRV13AT	Double**
	CRV15AS / CRV15AT	Single
	CRV17AS / CRV17AT	Single
VCC	PRV15AT	Single *
	PRV17AT	Single

NOTES

- EEV default setting will be single (system is not configured for any family & model no).
- Once the family & model number is selected then only it will configured as per above table.
- Manually EEV functionality can be changed at any time (save in permanent memory).

  *EEV control logic will give same output at port1 & port2.

  **EEV control logic will give different output at port1 & port2.

10.04. Target Superheat: Define By Discharge Superheat

- System target superheat is defined by discharge superheat. Controller should maintain a pre-defined minimum allowable discharge superheat for cooling/heating separately.
- This logic is available in the SH control loop and starts to operate after **EEV Startup_Time**. If the discharge superheat < Predefined min. allowable DSH, then raise the target superheat value which will be capped by its max limit.

Tabulated below are the Target SH for the corresponding models

Model Number	Cooling Max. Target Superheat	Heating Max. Target Superheat	Target DSH for Cooling	Target DSH for Heating
CRV13AS / CRV15AS / CRV17AS	4k to 9k	2.5k to 6k	19k to 26k	26k
CRV13AT / CRV15AT / CRV17AT				
CRS10AS CRS13AS / CRS15AS / CRS17AS	4k to 9k	1k to 6k	18k to 20k	20k
CRS13AT / CRS15AT / CRS17AT				
CRS20AT / CRS23AT				

As the unit starts, the controller will configure the above values as per the running models.

11. Oil Return

The compressor needs oil in order to be protected against wear. When operating, oil leaves the compressor together with the refrigerant. The rate of oil loss is estimated based upon the compressor speed which can be seen from the outdoor unit dashboard (Menu→Dashboards→Outdoor unit).

These are the three key control parameters which help to define the oil return cycle in the system.

- THERMO_SETUP_OIL_LOSS_TRIG_TIME_SEC : (**Time**) The oil return is executed if the speed stays below the oil return speed for a defined time.
- THERMO_SETUP_OIL_RETURN_SPEED : (**%**)The optimum defined oil return speed that can help again to maintain a proper oil level in the compressor.
- THERMO_SETUP_OIL_RETURN_HOLD_TIME_SEC : (**time**) The optimum time duration in which oil return back to compressor.

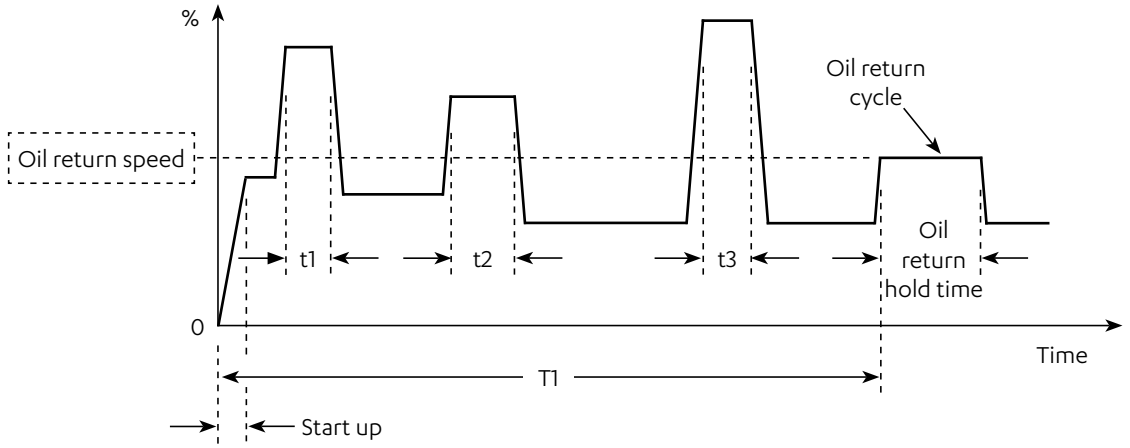
NOTES : During the oil return

- All connected zone dampers will be open (irrespective to ON/OFF zone status).
- Controller will hold the Indoor fan PWM value and release once the oil return cycle is finished.
- Minimum Indoor fan PWM is ≥ 30% for oil return, if its lower then controller will raise it to 30% during the oil return. After completing the oil return it will resume to its previous PWM values.

Oil Return Speed

Unit Code	10			9					
Model Number	Advance 2			Aires					
	13	15	17	10	13	15	17	20	23
Cooling Mode Speed (RPM)	3600	3600	3600	3000	3000	3000	3000	2500	2500
Heating Mode Speed (RPM)	3600	3600	3600	3000	3000	3000	3000	2500	2500

Oil Return Cycle: Example 1



T1 = 30 min

Oil return speed = 40%

t1 + t2 + t3 = if above 30 minutes no oil return if below 30 minutes unit will go into oil return

12. Compressor Safety Protection

12.01. Anti-Freeze Protection (AFP)

To prevent the indoor coil from freezing, anti-freeze protection logic has been designed into the system. If during normal operation the indoor coil temperature falls to 5°C, Anti-Freeze Protection is activated.

During Anti-Freeze Protection

- The indoor coil temperature is monitored continuously and if it is below 5°C the compressor (Hz / Steps) is reduced.
- During the anti-freeze protection mode the control adjusts the compressor speed to maintain 7°C indoor coil temperature. Compressor speed can be reduced to 20%.
- If the indoor coil is less than -3°C for 4 minutes, unit will turn off.
- For the unit to switch back on again, the indoor coil temperature has to be greater than 15°C.
- When the unit turns off due to anti-freeze the wall control will flash the **COOL** and **LOW** speed light in every 30second.

12.02. Over Heat Protection Logic (Heating cycle)

Over Heat Protection Logic: Its only applicable for heating mode.

As the unit starts in heating mode, the controller will compare the compressor operating point against the OHP activation line.

OHP Activation

OHP logic can be activated by either of the two conditions below:
Condition-1: Once the compressor operating point crosses the OHP activation line, Controller starts the OHP logic.
Condition-2: If the IDU fan PWM < 40%.

OHP Mode

Once the OHP mode will be activated, the outdoor control will adjust the compressor speed to run the operating pressures closer to target operating line.

If compressor trips by envelope protection (error code E42, E43 or E44) whilst maintaining the floating point close to target line 1, the system remains in OHP mode. Thus, when compressor then restarts the controller will operate the compressor to run on target operating line 2. If compressor trips once again by above define error code then it shifts to the next line 3, then 4.

NOTE

Once the OHP mode is activated, the seven segment display will change the state to **ohP** on the outdoor board.

OHP Mode Rules

When the unit will be in OHP mode, it will look after for these following rules:
Current compressor speed ≤ Indoor compressor speed request.

Line Shifting Rules

If the indoor compressor speed request > current compressor speed continuously for 240 seconds and IDU fan PWM > 40%, then controller will shift the target line no 4 to 3.

OHP Exit

In the instance that any of the below conditions takes place, the Outdoor logic will then exit from the OHP logic. These conditions include:

- Exit Condition-1: If the compressor operating points < OHP activation points and IDU fan PWM > Pre-defined indoor fan PWM limits for more than 5 minutes, this condition is only applicable when unit is running on line 3 and 4.
- Exit condition-2: Unit will be in off mode or compressor trip by any error code (Except E42, E43, E44).
- Exit condition-3: Thermostat or cycle off by indoor means when indoor request is 0%.
- Error code management during the OHP logic:

  E42, E43, E44 will follow a different rule to display on the wall controller during the OHP Mode.

  Error will only display when the system is running on line-4 and 4 number of times (back to back) the compressor stops by the above error codes.

OHP Navigation on UNO Pro Board

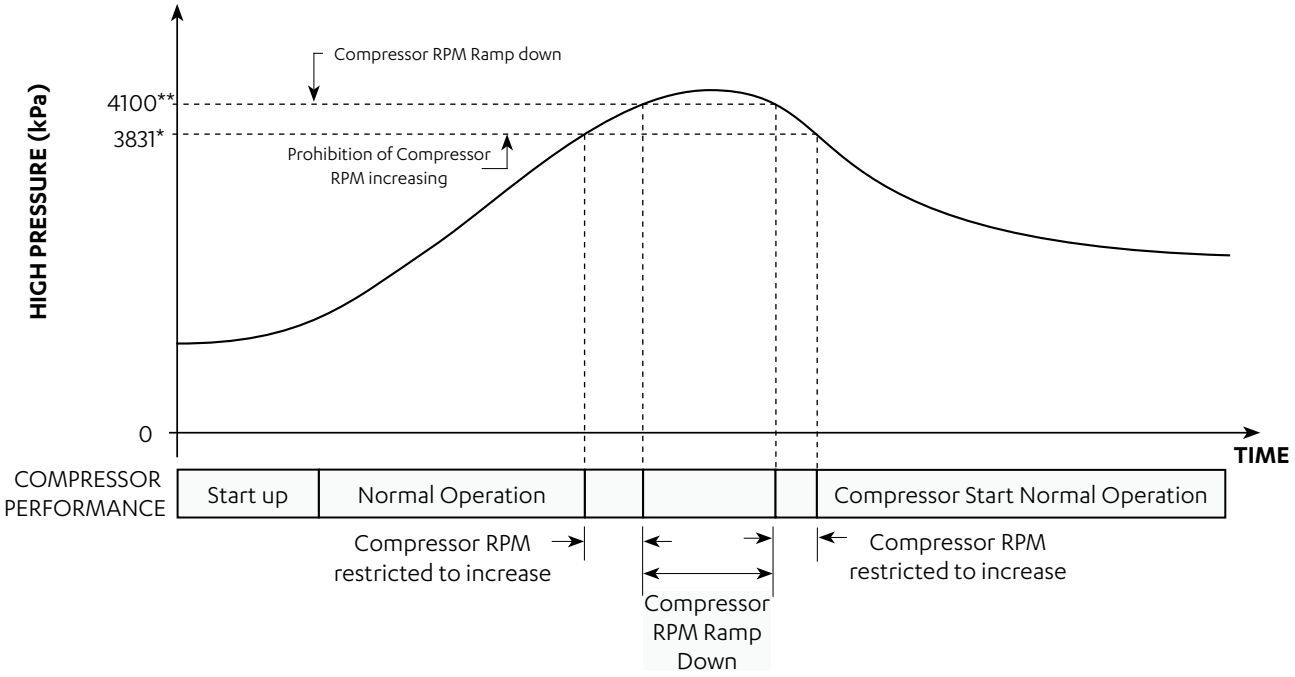
Sub-Menu Level 1		Sub-Menu Level 2			
Display	**Description**	**Display**	**Description**	**UOM**	**Range**
ohPS	OHP Status	ohPL	OHP Control Line Number	Number	0- 4
		ohPc	OHP Target Condensing Temp	°C X 10	107 to 615
		odcP	Outdoor Unit Condensing Temp	°C X 10	400 to 700
		ohPn	OHP Activation Value	°C X 10	226 to 590

12.03. High Pressure Protection Control

High pressure transducer continuously checks the system's high pressure during compressor operation on cooling and will control ramp-down or hold the compressor speed to ensure the compressor is safe and operating within the envelope area.
Compressor High Pressure Protection control operates as follows:

- Normal compressor operation at Discharge Pressure less than 3840kPa.
- No increase in compressor RPM if Discharge Pressure is greater than 3840kPa.
- Decrease compressor RPM if Discharge Pressure is greater than 4100kPa.

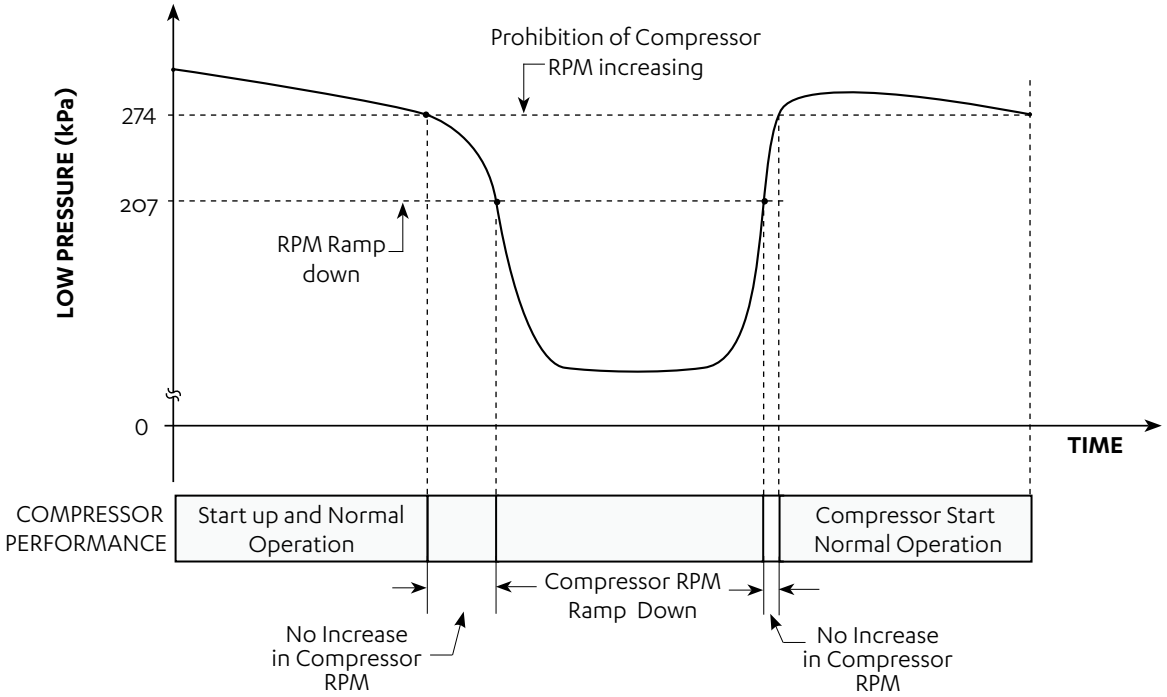
Outdoor board seven segment will display the **cPP** when the controller will operate the unit in this protection mode.



12.04. Low Pressure Protection Control

Low pressure transducer continuously checks the system's low pressure during compressor operation and will control ramp-down or hold the compressor speed to ensure the compressor is safe and operating within envelope area. Outdoor board seven segment will display the "cPP" when the controller will operate the unit in this protection mode.

Low Pressure Range (kPa)	Compressor Operation
$207 < P_s \leq 274$	Compressor will stop increasing the RPM value
$P_s \leq 207$	Compressor will ramp down the RPM until the pressure goes back to > 207Pa.



12.05. High Suction Pressure Protection

Low pressure transducer continuously checks the system's low pressure during compressor operation. If the low pressure crosses the maximum suction pressure region and stays there for 20sec, then controller will ramp-up or hold the compressor speed to ensure the compressor is safe and operating within envelope area.

Outdoor board seven segment will display the "hSP" when the controller will operate the unit in this protection mode.

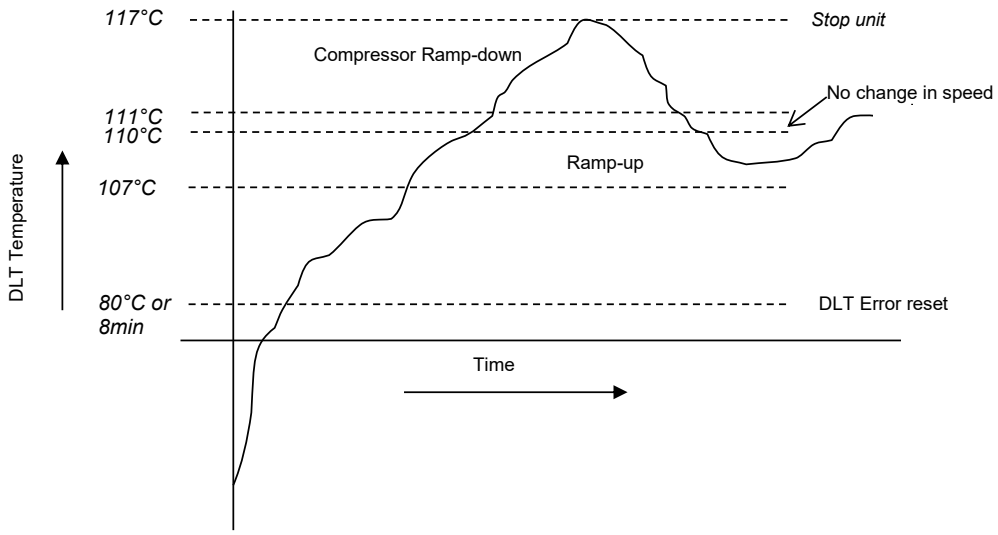
NOTE

During this mode compressor speed will be greater than indoor compressor demand.

12.06. High DLT (Discharge Line Temperature) Protection

Outdoor board seven segment will display the **dtP** when the controller will operate the unit in this protection mode.

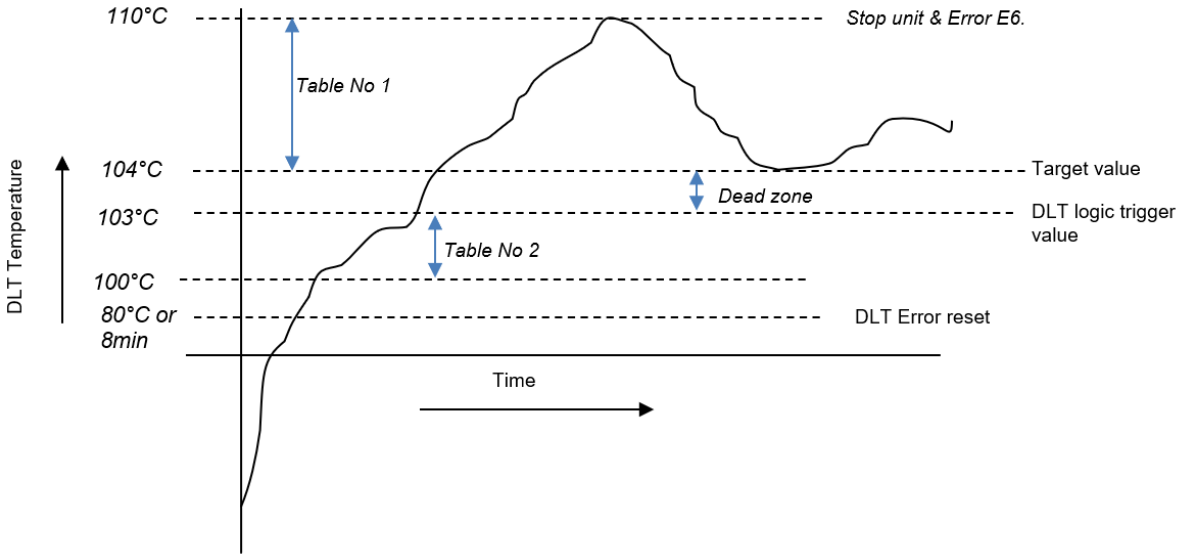
Advance 2



Error Management:

DLT: As the DLT ≥ 117°C, then outdoor unit will trip and raise the E6 error code. Error code reset: As the DLT = 80°C or 8 min which ever occurs first. Note: First two times in an hour it will not give any error code to IDU, 3rd time onwards it will be displayed on the controller. After an hour, above cycle will reset.

Aires



Error Management:

Error code start: As the DLT = 110°C, then outdoor unit will trip and raise the E6 error code.
Error code reset: As the DLT = 80°C or 8 min which ever come earlier.

12.07. Outdoor Coil Sensor

If the Outdoor Coil Sensor fails, the system will keep operating and an (E7) error code will be displayed on the on the Outdoor seven segment display and E7 error code on the Master Wall Control.

12.08. Indoor Coil Sensor

If the indoor coil inlet sensor fails (open/short circuit), the Master Wall Control will display an (E4) error code and the system will remain ON.

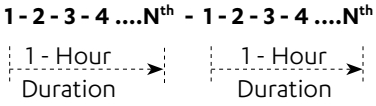
12.09. Ambient Sensor

If the Ambient sensor fails (Open/Short Circuit), the outdoor unit will keep operating and the outdoor seven segment display and Master Wall Control will show an (E22) error code.

12.10. High Pressure

Outdoor unit Control Board will Turn-OFF the system if any of the HP is activated. The system will restart if the HP switch resets and the delay time (see table below) has passed. If HP switch reset time > delay time, the system will keep on checking the HP switch and will start only when the switch has reset.

Item	Trip Count	Starting Delay	Error Code Display Location	Time Duration
1	First Trip	Minimum 5 minute starting delay	Error Code - only on Outdoor seven segment display	1 hour for this cycle, then the counter resets
2	Second Trip	Minimum 5 minute starting delay	Error Code - only on Outdoor seven segment display	1 hour for this cycle, then the counter resets
3	Third Trip	Minimum 15 minute starting delay	Error Code - on Wall Control and on Outdoor seven segment display	1 hour for this cycle, then the counter resets
4	Fourth Trip	Minimum 5 minute starting delay	Error Code - on Wall Control and on Outdoor seven segment display	1 hour for this cycle, then the counter resets
N	Nth Trip	Minimum 5 minute starting delay	Error Code	1 hour for this cycle, then the counter resets



Nth = Last trip count within the 1-Hour duration.

NOTES

If HP resets earlier than the delay time, the Outdoor unit will continue giving an indication to indoor that, just because of HP delay outdoor is not able to run the compressor. As the delay time completes, indication will turn off. As the system starts once again, the HP trip retry time is reset to zero.

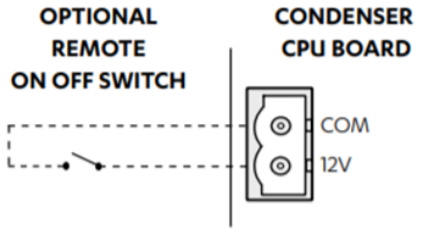
Wall controller and outdoor seven segment will display E11 for HP trip.
There is no LP switch connected. E09 is not applicable.

12.11. Remote on/off

To activate, the unit must be wired as illustrated below. This will enable the unit to be turned ON and OFF from the Outdoor board.

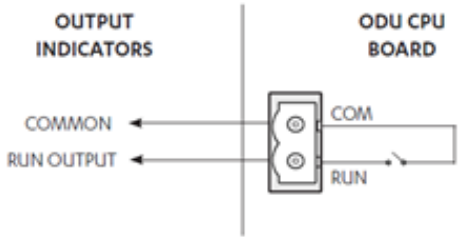
NOTE

The system must be operating in Wall Controller only (control mode 1) or BMS + Wall Controller (control mode 3) for this function to work.



Turning the system On and Off by remote method	
Turning the system On	Status 1: The system is Off and the remote switch/relay has been left in the open position. 1. Close remote switch/relay. 2. System will start in approximately 1 minute.
	Status 2: The system is Off and the remote switch/relay has been left in the closed position. 1. Open remote switch/relay for a minimum of 5 seconds. 2. Close remote switch/relay. 3. System will start in approximately 30 seconds.
Turning the system Off	Status 3: The system is On and the remote switch/relay has been left in the closed position. 1. Open remote switch/relay. 2. System will turn Off in approximately 1 minute.
	Status 4: The system is On and the remote switch/relay has been left in the open position. 1. Close remote switch/relay for a minimum of 5 seconds. 2. Open remote switch/relay. 3. System will turn Off in approximately 30 seconds.

12.12. Run Status:



Run Output is configurable to indicate that the unit is running. There are two configurations in which system can be set:

- Either the compressor or the Indoor Fan only is running
- Only Compressor is running.

By default, this is set to turn on when either indoor fan or compressor is operating. To set up to compressor run indication only, in OD Board Menu follow below steps.

1. Using the MENU and the ENTER Buttons on the outdoor PCB, navigate to SEt (Settings) ~~r~~un (Unit Operation Indicator Settings).
2. If required, press MENU to navigate to YES

12.13. Crankcase Heater

As the compressor stops, the controller will turn on/off the crankcase heater relay with respect to the ambient temperature value.

Conditions	Crank-Case heater relay	Compressor Status
Tambient ≤ 24°c	ON	OFF for 10 mins.
Tambient > 25°c	OFF	ON

NOTE

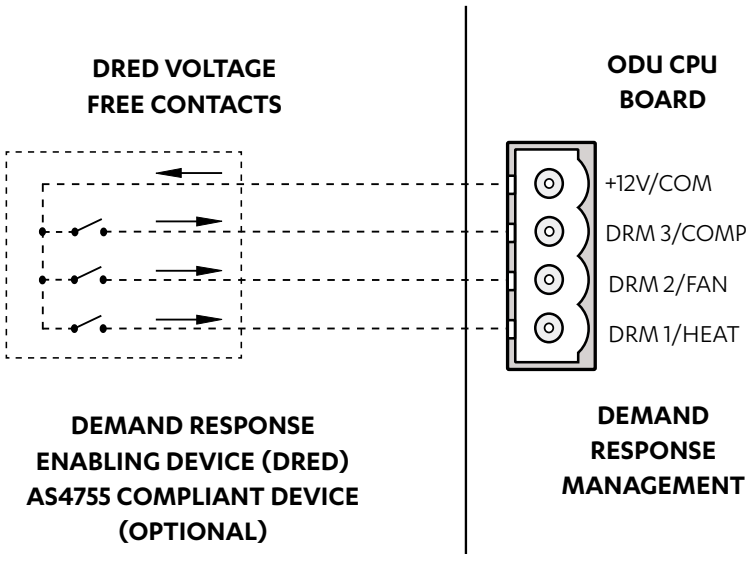
There will be a minimum time delay of 5 sec for change over (ON to OFF and OFF to ON).

12.14. Low speed heating protection:

During the heating mode the outdoor board may increase the compressor RPM up to 1800RPM to maintain the predefined suction superheating value. The outdoor board adjusts the compressor RPM automatically to maintain the desirable system refrigeration condition.

13. Demand Management

Optional Demand Response Management Circuit Diagram:



DEMAND RESPONSE ENABLING DEVICE CIRCUIT DIAGRAM

Optional Demand Response Management Operation

On board connections are available on outdoor board, which will detect the Demand Management Signal from power supply authorities. The outdoor board will detect the request for reduced demand when it is received.

DRM1: If signal is applied to the DRM1 terminal, the Compressor will remain off until the signal goes away.

DRM2: Must limit the total input power of the system to < 50%.

DRM3: Must limit the total input power of the system to < 75%.

If a signal is sent to the DRM terminals, the compressor will limit it's maximum operating speed as per the table below.

Advance 2

Unit Code	Single Phase			
Unit Capacity	Cool		Heat	
	DRM2 (RPM)	DRM3 (RPM)	DRM2 (RPM)	DRM3 (RPM)
CRV13AS / EVV13AS	1983	3102	1867	2770
CRV15AS / EVV15AS	2157	3398	2437	3674
CRV17AS / EVV17AS	2521	3946	3005	4373

Unit Code	Three Phase			
Unit Capacity	Cool		Heat	
	DRM2 (RPM)	DRM3 (RPM)	DRM2 (RPM)	DRM3 (RPM)
CRV13AT / EVV13AS	2072	3146	1947	2728
CRV15AT / EVV15AS	2007	3334	2157	3735
CRV17AT / EVV17AS	2891	4150	3446	4830

Aires

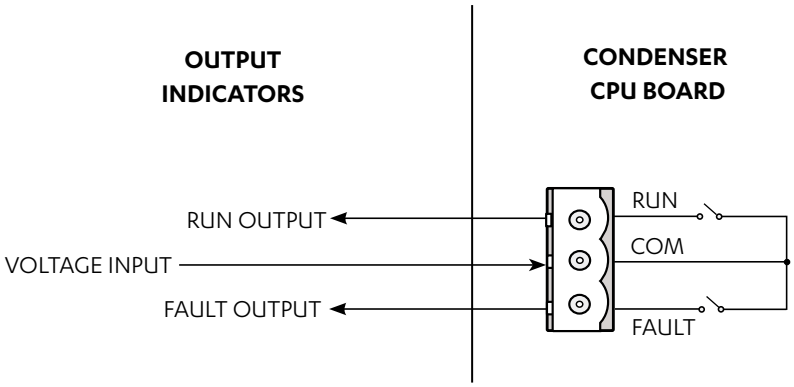
Unit Code	Single Phase			
Unit Capacity	Cool		Heat	
	DRM2 (RPS)	DRM3 (RPS)	DRM2 (RPS)	DRM3 (RPS)
CRS10AS / EVA10AS	33	50	32	46
CRS13AS / EVA13AS	28	41	31	45
CRS15AS / EVA15AS	20	45	29	44
CRS17AS / EVA17AS	34	51	31	50

Unit Code	Three Phase			
Unit Capacity	Cool		Heat	
	DRM2 (RPS)	DRM3 (RPS)	DRM2 (RPS)	DRM3 (RPS)
CRS13AT / EVA13AS	26	40	29	40
CRS15AT / EVA15AS	30	45	29	44
CRS17AT / EVA17AS	34	51	31	50
CRS20AT / EVA20AS	27	38	33	48
CRS23AT / EVA23AS	27	38	33	48

DRM1/DRM2/DRM3 are always on higher priority with respect to other parts of the specification, except the Oil Return and Defrosting Modes.

14. Fault Indication - Installer

To indicate any fault on the system, the ODU will provide a signal through the Fault Indication relay. An installer can use the outputs to Turn-On an indicator designated to specific fault. The installer will get the signal through the indicator only when the fault occurs in the system.



15. Reversing Valve Time Out

- Change over from Heating to Off Mode :

  When ever system will get change over from heating to OFF Mode, the reversing valve will remain energized for 5 minutes and 30 seconds. During this period the 4-way valve waits for the system to be restarted again in heating mode. If the system doesn't start in heating then the reversing valve relay will Turn Off after timeout.
- Cooling mode : During Cooling mode, the reversing valve will remain OFF.
- Heating mode: When heating mode starts, the 4-way valve relay will Turn On and will Turn OFF after 330 seconds.

The 4-way valve delay logic is tabulated below:

Ambient condition	4-way valve off-delay
Tamb ≤ 20°c	Remain on during heating mode when:
Tamb > 20°c	It will turn-off after 60 min

NOTES

- If Tamb temp. sensor or is faulty, then 4-way reversing valve will turn off after 60min.
- Refer reversing valve coil specification prior to adjust the ambient temperature setting. 20°c is a default value.

16. Communication Failure

If during system operation, the outdoor board loses communication with the IDU, it will turn off 15 secs after losing the communication. This is to protect the system from running uncontrolled. An error code (E51) will be displayed on the outdoor board display and Master Wall Control.

17. Service Test Mode

Service test mode can be activated from the outdoor board seven segment. This mode gives the ability to run the unit in cooling/heating mode from the outdoor board. Service technicians can use this feature for fault finding.

Activation/Deactivation:

It can be activated or deactivated from the outdoor seven segment. Once activated then unit will run for 60 minutes. Unit will move to normal operation after completing the 60 minutes.

Unit Operation:

Once the service cooling/heating test mode has been activated the outdoor unit will give a relevant flag to the indoor PCB and Indoor will operate the system with the below command.

Indoor	Command
Indoor Fan	High Speed
Mode	Cool / Heat as per request
Compressor request	100%
Zone Dampers	Fully Open

NOTE

Safety logic will be applicable during the service test mode.

18. System Operation

18.01. Indoor Capacity Control

Indoor software calculates the indoor demand based on the difference between room and set temperature. The PI (Proportional and Integral) control algorithm, differentials and dead band help to maintain the room temperature as close as possible to set temperature.

18.02. Differentials

Differential is defined as the difference between the control Setpoint and Room Temp at an instant of time. Differentials give a system accurate control of Cooling/Heating, to keep the temperature within a set band (difference) from the Set temp.

Cooling differential = (Room temp- Set Temp for Cooling)
Heating differential = (Set Temp – Room Temp for Heating)

NOTES

During Auto mode, the control algorithm will decide the mode based upon differential. After this it will follow the dead-band to restrict the unnecessary change over from Heat to Cool or Cool to Heat.

18.02.01. Compressor Cut-In

Controller will cut-in the compressor when the differential will be 0.2°C during the Cool\ Heat and Auto thermostat off condition.

Range = 0.2°C to 2°C (settable through the Wall Control)
Default value = 0.2°C

18.02.02. Compressor Cut-Out

Controller will cut-out the compressor when the differential will be 0.5°C during the Cool \ Heat and Auto mode.

Range = 0°C to 0.5°C (settable through the Wall Control)
Default value = 0.5°C

18.03. Dead Band

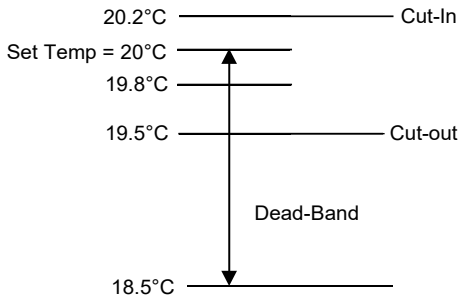
Dead band prevents the system frequently shifting the mode of operation between heat and cool during the Auto mode.

Range: 1°C- 9.9°C, settable through the Wall Control.
Default value: 1.5 °C

18.04. Compressor Minimum Value

Compressor minimum speed can be 20%.

The below diagram explains the dead band and cut-out:



NOTES

- Once the unit stops because of zero demand request, it must then complete the must off time of 3min before checking for mode and compressor request. This is applicable in all modes including auto. After completing the must-off-timer controller will check the mode and speed request.

18.05. Economy Cycle (Outside Air Damper 0-10V)

Based on settings from the Wall Control or BMS, a fixed 0-10V ECON voltage output can be set. This fixed voltage value can be set through the LC7-2/LR7-1 Wall Control's Service Menu - 10

Range:0 to 10VDC
0=> Closed (0%)
10VDC => Fully open (100%)
Default setting: 2.0VDC

18.06. Indoor Fan Filter

The filter clean alarm can be enabled, disabled or reset based on settings from the wall control or BMS. The filter alarm timer counts down only when the indoor fan is operating. Upon countdown to zero, the wall control will indicate the filter alarm along with the filter notification relay output in the indoor board PCB. Filter related settings can be set through the LC7-2/LR7-1 Wall Control's Service Menu - 8

Default: 200 hrs
Setting range: 100 - 990 Hour

NOTE

Above function can be disable with wall control or outdoor 7 segment navigation.

19. Last zone protection:

- VAV system -By default last zone is enabled. if the Last zone protection is turned off then the user can turn off all the zones, in this case user will not be able to run the system with all the zones off.
- NON- VAV system - By default last zone is enabled. if the Last zone protection is turned off then the user can turn off all the zones in this case, it can run the system with all the zones off.

20. Min airflow operation:

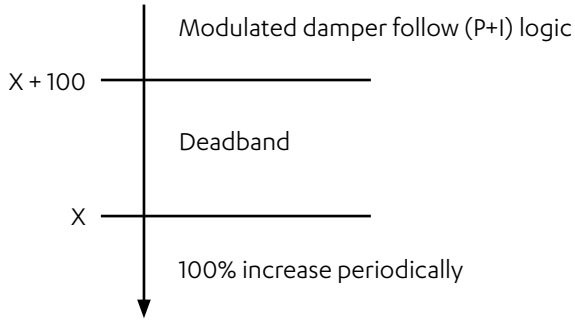
Based on the below capacity-min airflow table controller maintain minimum airflow requirement for the system.

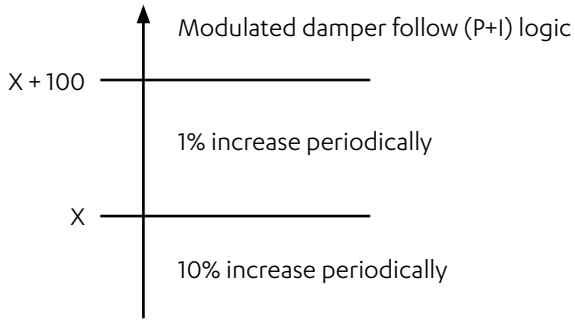
NOTE

Minimum airflow is only applicable to VAV systems.

Advance

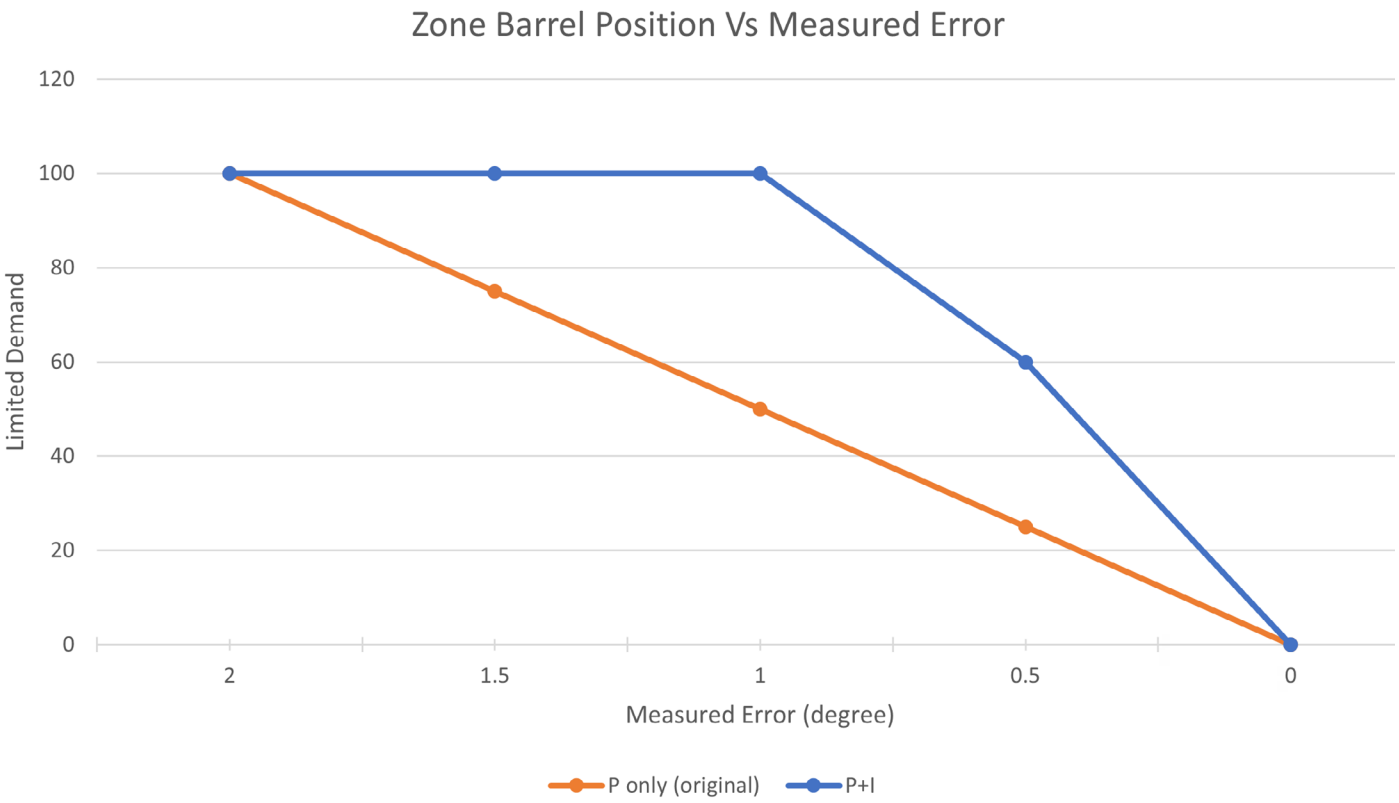
Capacity (kw)	X = Min Airflow (l/s)
EVV13AS	230
EVV15AS	270
EVV17AS	300
EVV210AS	350
EVV240AS	400





21. Zone barrel position control:

Damper will change in every 30sec, current algorithm will follow P+I method to control the zone barrel position to minimise the error (Room temp -set temp).



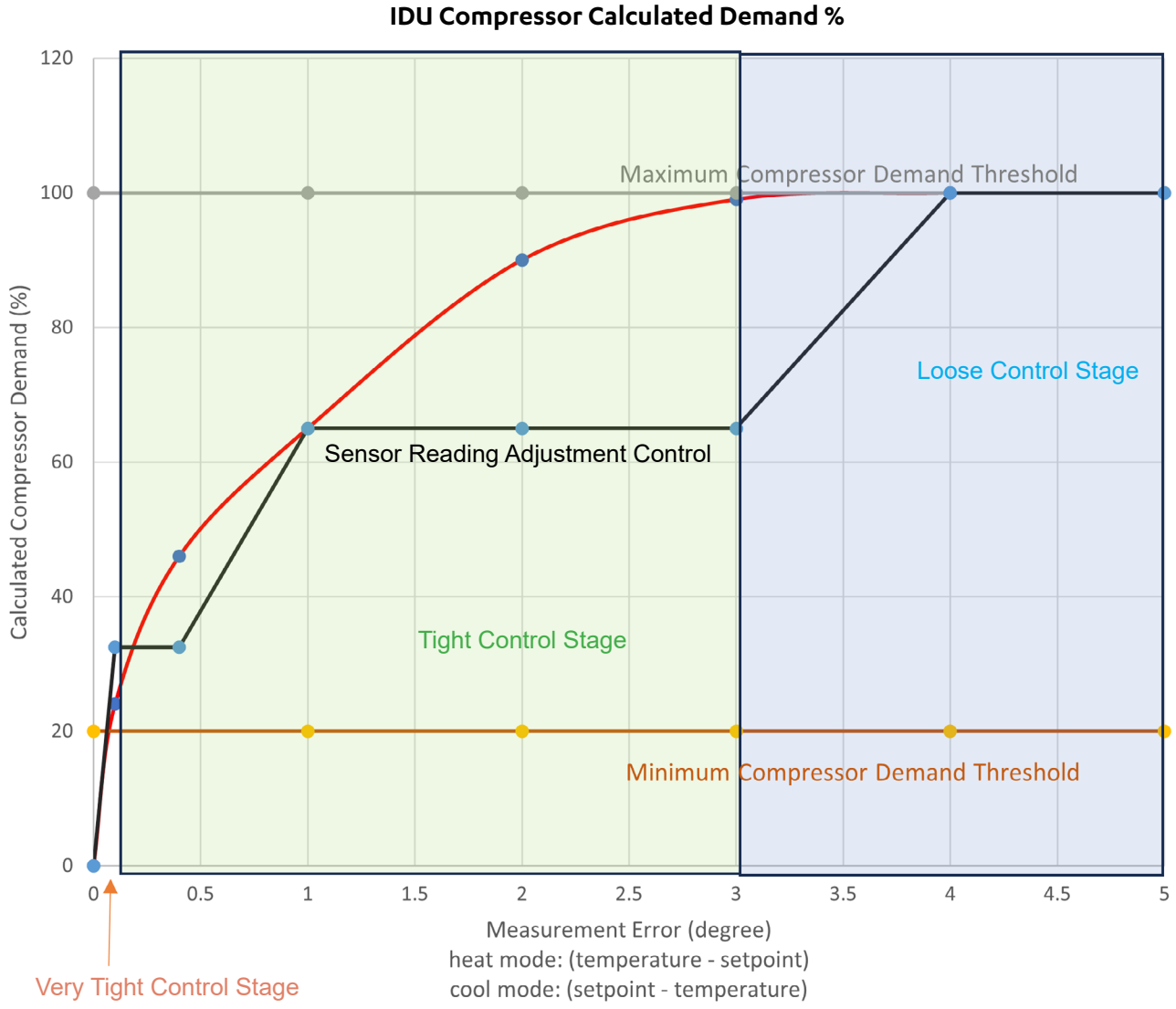
22. Compressor demand calculation:

The compressor calculation process can go through up to 3 stages:

- Loose Control Stage: error > 3 degree
- Tight Control Stage: error < 3 degree
- Super-tight control stage: when risk of having zero-bias is detected

If sensor reading sluggishness is detected, "Sensor Reading Adjustment Control "will be applied (black line), otherwise, the normal 3 stages control (introduced above) will be applied (Red line).

If delta T is not dropping by .2*c in 1min then controller will follow black line.



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