

AHU CONVERSION KIT APPLICATION GUIDE

LG Air Conditioning Technologies



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AHU Conversion Kit Application Guide

The purpose of this application guide is to provide an overview of the components and considerations required to integrate Third-Party air handling units (AHUs) with LG's Variable Refrigerant Flow (VRF) systems. Using LG's Multi V™ inverter compressor condensing units instead of conventional condensing in direct expansion (DX), split systems can offer significant energy savings.

Other necessary documents such as engineering manual, installation manual and control integration approach should be carefully reviewed by the design engineer to ensure that the system operates according to customer requirements.

LG Air Conditioning Technology is NOT responsible for the selection of any third-party product (AHU) installed using this guide. Refer to the third-party product selected for pertinent manufacturers' documentation for, but not limited to, proper sizing, coil selection, material selection, installation guidance, startup, warranty terms and conditions.

This guide is a supplement to the engineering, installation and product manuals and in case of any discrepancy between this document and the manuals, the manuals shall take precedence. For more information or to obtain product documentation, please visit www.lghvac.com.

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Why use LG's AHU Conversion Kit?

LG's AHU Conversion Kit can offer energy savings over conventional condensing units used with DX split systems. It allows connection of an LG Multi V™ inverter compressor condensing unit to compatible Third-Party Air Handling Unit (AHU).

Purpose:

The purpose of this application guide is to provide an overview of the components and considerations required to integrate Third-Party air handling units (AHUs) with LG's Variable Refrigerant Flow (VRF) systems. Using LG's Multi V™ inverter compressor condensing units instead of conventional condensing in direct expansion (DX), split systems can offer significant energy savings.

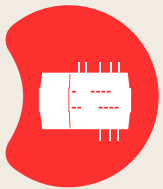
Other necessary documents such as engineering manual, installation manual and control integration approach should be carefully reviewed by the design engineer to ensure that the system operates according to customer requirements.

LG Air Conditioning Technology cannot take responsibility for systems designed outside the given values presented in this document and the following engineering and installation manuals.

Basic Configuration:

AHU communication kit (Communication and EEV Kit) controls DX coil capacity for Third-Party AHU. AHU Communication Kit controller receives temperature values from Refrigerant Pipe In and Refrigerant Pipe Out Sensors and controls the Electronic Expansion valve by also measuring the return air temperature to provide desired space temperature control.

The LG EEV Kit, available in four models to accommodate a variety of capacity ranges, controls the amount of refrigerant flowing into the DX coil, managing superheat for cooling and sub-cooling in heating mode to match the specific application and capacity of the designed DX coil.



Compatible AHU Manufacture

Flexibility: Allows for most air handling unit to connect with LG's outdoor units.

Combination with Third-Party AHU

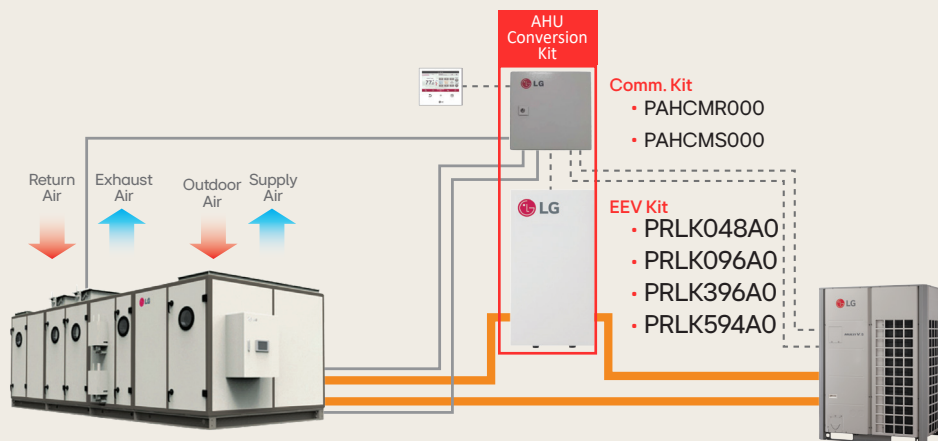


Figure 1 - Third-Party Combination

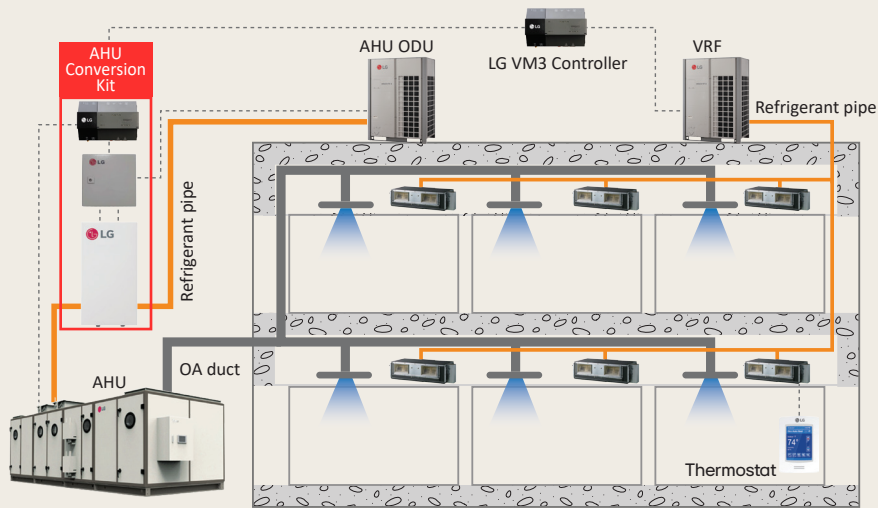


Figure 2 - Third-Party AHU with LG Outdoor Unit

The AHU Conversion Kit allows communication between the AHU and LG's VRF Systems. Depending on the application, the AHU Conversion Kit consists of a combination of the following:

- EEV Kit - Models PRLK048A0, PRLK096A0, PRLK396A0 and PRLK594A0
- Communication Kit (Return Air) - Model PAHCMR000
- Communication Kit (Supply Air) - Model PAHCMS000

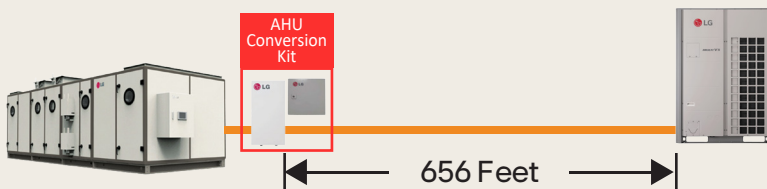


Figure 3 - Maximum allowable piping length

Piping Limitations



Maximum horizontal piping length: 656 Feet

Maximum elevation piping: 360 Feet

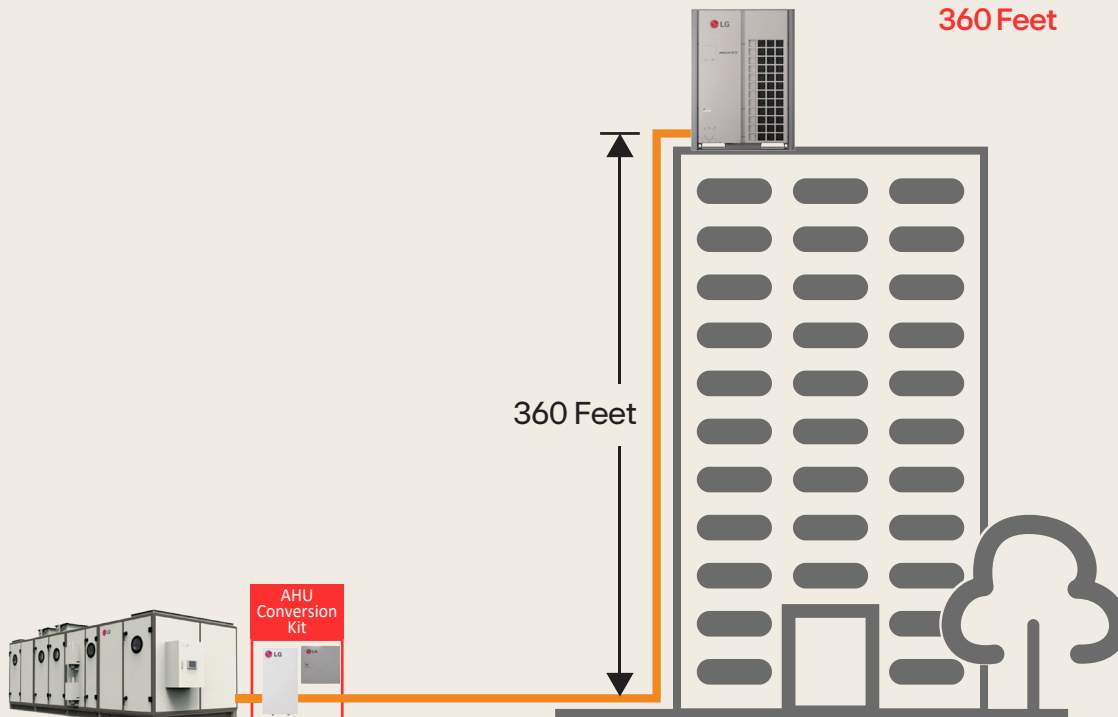


Figure 4 - Vertical Piping Distance

Components and Features: EEV Kits



EEV Kits

Standard Features:

- Controls refrigerant flow between Multi V™ air or water source units and a Third-Party AHU
- Designed for indoor installations (field supplied water-proof enclosure must be used when installing outdoors)

Specifications	PRLK048A0	PRLK096A0	PRLK396A0	PRLK594A0
Max Ton Capacity	8 Tons	16 Tons	32 Tons	48 Tons
Btu Capacity	12 – 96 MBH	115 – 192 MBH	216 – 384 MBH	408 - 576 MBH
Minimum coil entering air temperature in heating mode ¹	41°F	41°F	41°F	41°F
Maximum distance between EEV and Comm. Kit	32 feet	32 feet	32 feet	32 feet
Maximum distance between EEV and coil	20 feet	20 feet	20 feet	20 feet
Maximum number of EEV kits that can be connected to Comm. Kit	1	1	1	1
System Compatibility Available Communication Control Kit Options/EEV Kit Model: HP (Heat Pump) or HR (Heat Recovery)	PAHCMR000 (HP or HR) PAHCMS000 (HP only)	PAHCMR000 (HP or HR) PAHCMS000 (HP only)	PAHCMR000 (HP) PAHCMS000 (HP only)	PAHCMR000 Not Available PAHCMS000 ¹ (HP only)

Each EEV Kit comes with item below:

Installation Manual				
Pipe In Temperature Sensor				
Pipe Out Temperature Sensor				

Table 1 - EEV Kits Tonnage and Content

¹PRLK594A0 Kit comes with additional EEV Module (PAEEVA020) which requires field installation inside the PAHCMS000 controller enclosure.
See "Guide for application which AHU coil Entering Air Temperature is Lower than 41°F" on page 47.
MBH = thousand BTU's per hour

Capacity Index and Third-Party Coil Volume Range



EEV Model	Coil Volume Range (in3)				
	Tube Dia.	0.375 inch		0.5 inch	
	Capacity (MBH)	Min.	Max.	Min.	Max.
PRLK048A0	12	29.0	59.0	36.5	74.0
	15	36.2	73.8	45.6	92.5
	18	43.4	88.5	54.7	111.0
	24	57.9	118.0	73.0	148.0
	28	67.6	137.7	85.1	172.7
	36	86.9	177.0	109.4	222.1
	42	101.4	206.5	127.7	259.1
	48	115.9	236.0	145.9	296.1
	54	130.3	265.5	164.1	333.1
	76	183.4	373.7	231.0	468.8
	96	231.7	472.0	291.8	592.2
PRLK096A0	115	277.6	565.5	349.6	709.4
	134	323.4	658.9	407.3	826.6
	153	369.3	752.3	465.1	943.8
	172	415.2	845.7	522.8	1061.0
	192	463.5	944.1	583.6	1184.4
PRLK396A0	216	521.4	1062.1	656.6	1332.4
	240	579.3	1180.1	729.5	1480.5
	264	637.2	1298.1	802.5	1628.5
	288	695.2	1416.1	875.4	1776.6
	312	753.1	1534.1	948.4	1924.6
	336	811.0	1652.1	1021.3	2072.7
	360	869.0	1770.1	1094.3	2220.7
	384	926.9	1888.1	1167.2	2368.7
PRLK594A0	408	984.8	2006.1	1240.2	2516.8
	432	1042.8	2124.1	1313.1	2664.8
	456	1100.7	2242.2	1386.1	2812.9
	480	1158.6	2360.2	1459.0	2960.9
	504	1216.6	2478.2	1532.0	3109.0
	528	1274.5	2596.2	1604.9	3257.0
	552	1332.4	2714.2	1677.9	3405.1
	576	1390.4	2832.2	1750.8	3553.1

Table 2 - Third-Party DX Coil Min/Max Volume per EEV Model

MBH = thousand BTU's per hour

Components and Features: Communication Kits



Communication Kits

The AHU Communications Kit bridges LG's air conditioning outdoor unit to a Third-Party Air Handling Unit (AHU). Its function is based on Return, Space or Supply/ Discharge Air temperature control. In installations where the AHU is designed with Direct Expansion (DX) Coil, the comm kit will control the supply air temperature or return air temperature by measuring the inlet and outlet temperatures of the DX coil and changing the operation of the outdoor unit and the expansion unit.

Standard Feature:

- Function: Allows communication between Third-Party air handling units and LG air source or water source units.
- Control Options: LG Wired Remote Controller, LG Central Controller, Multi-site controller (MS8000 - Edge 10), and Third-Party AHU Controller.
- Increases heating comfort by applying sequential defrost logic and simultaneous defrosting prevention logic of the outdoor unit (only with PAHCMS000).
- The AHU Communications Kit consists of a chassis, communication module and room (return) air thermistor.
- Steel case with NEMA 4 (weather proof enclosure)
- Requires 208-230 VAC, 1 phase power
- It controls the Electronic Expansion Valve (EEV, required, sold separately)

Models PAHCMR000 and PAHCMS000



Specifications	PAHCMR000	PAHCMS000
Can Connect with	Multiple AHU's with indoor units	One AHU (one DX Coil) and cannot connect with indoor units
Control Options	LG Wired Controller (required for LG controls), LG Central Controller, Third-Party AHU Controller	LG Wired Controller (required for LG Controls), LG Central Controller, Third-Party AHU Controller
System Compatibility	Heat Pump or Heat Recovery	Heat Pump only
AHU Coil Capacities	12 – 384 MBH for Multi V™ (41°F minimum entering air temp)	12 – 594 MBH for Multi V™ (41°F minimum entering air temp)
Return air thermistor Length	16.4 ft.	16.4 ft.
Controls	AHU Fan Control ¹ H/M/L EEV Control ^{2,3}	EEV Control

Table 3 - Communication Kits

¹Can control 3 speed or single speed Third-Party fan motor (requires relays or motor starter)

²PAHCMS000 should only be used with PRLK594A0 EEV Kit or Multi V™ S

³When PAHCMR000 is used with Multi V™ 5, I/O controller (PRVC2) is recommended for ODU to accept the 0-10 volt capacity control signal.

When PAHCMR000 is used with Multi V WATER® 5, I/O controller (PWFCN000) is recommended for ODU to accept the 0-10 volt capacity control signal.

Communication Kit Features



- Dry contact function is embedded in the communication kits
- Modbus Communication is possible without applying extra devices
- Multiple DX coil installation is possible for discharge air control

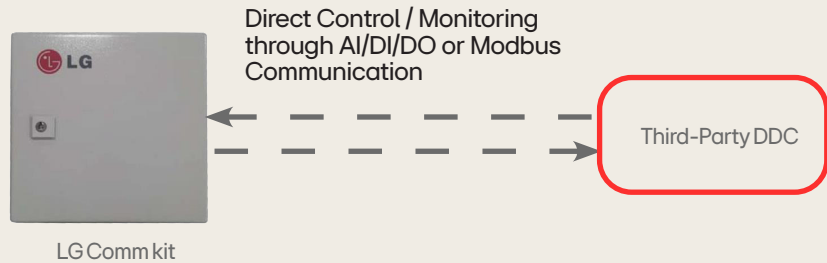


Figure 5 - Control & Monitoring

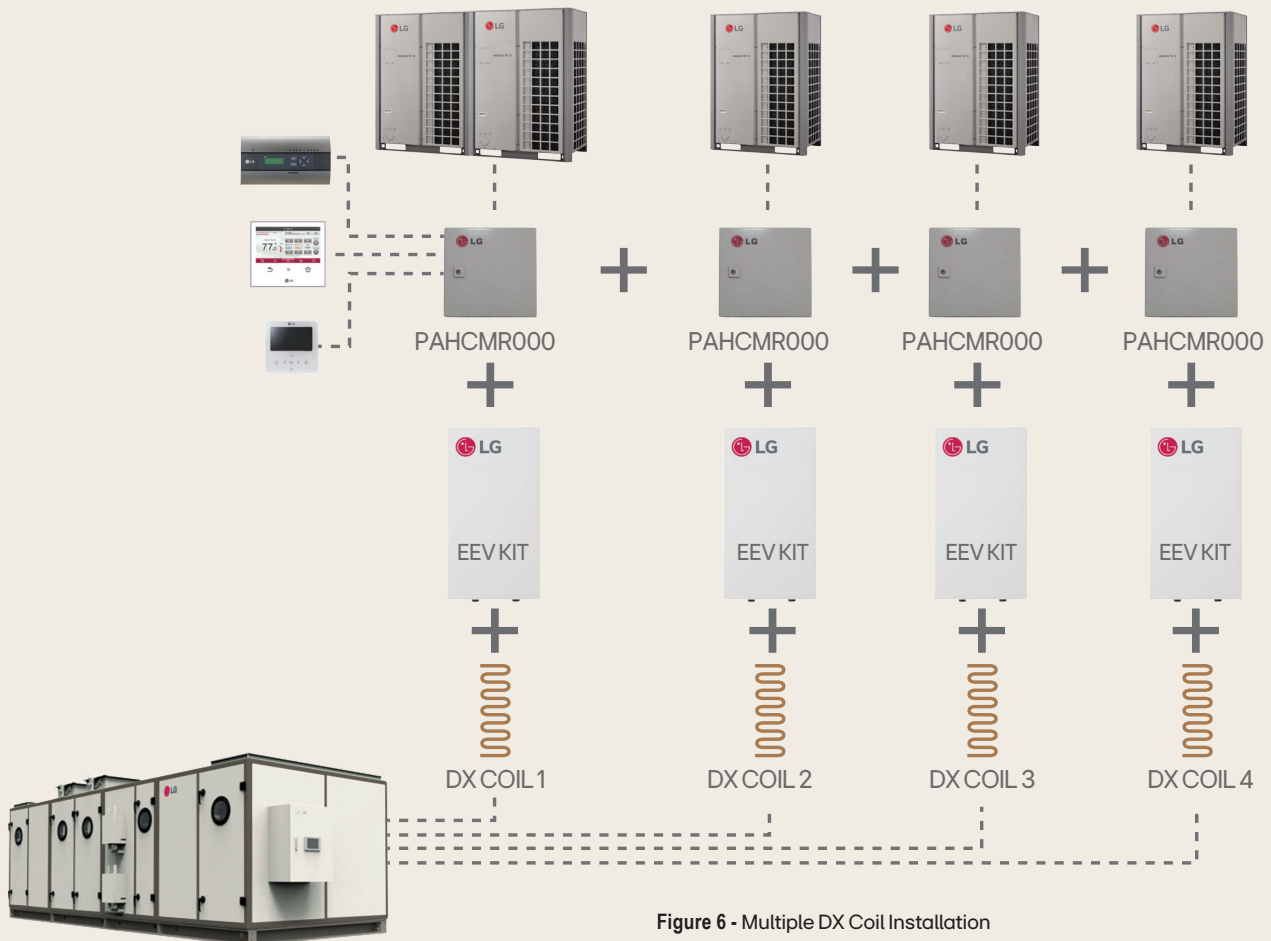


Figure 6 - Multiple DX Coil Installation

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Communication Kit Content qty 1 each of the following:

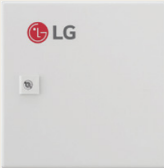





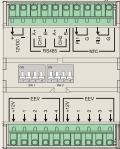
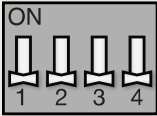
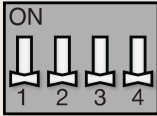
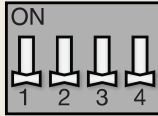
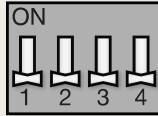
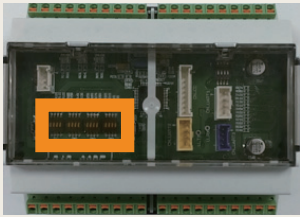
Part	PAHCMR000	PAHCMS000
Communication Kit	<div><p>Return Air</p></div>	<div><p>Supply Air</p></div>
Installation Manual	<div></div>	<div></div>
Return Air (Room) Thermistor	<div></div>	<div></div>
Additional EEV Module	None Required	<div><p>PAEEVA020¹</p></div>

Table 4 - Communication Kit Contents

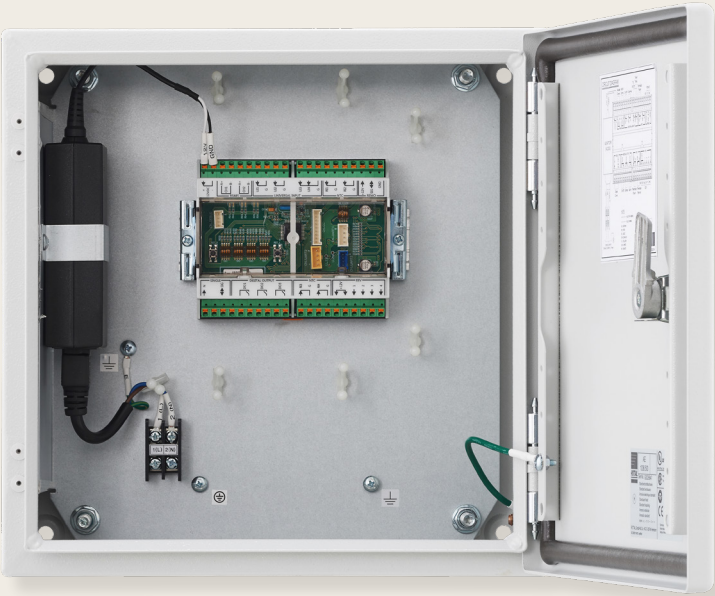
¹If PRLK594A0 EEV model is selected with PAHCMS000 Communication Kit, additional EEV Module (PAEEVA020) will be shipped which requires field installation inside the PAHCMS000 controller enclosure.

DIP Switch Settings – PAHCMR000

SW1	SW2	SW3	SW4	COMM MODULE
				

The default settings of all DIP switches is "OFF"

Table 5 - Default DIP Switch Settings for PAHCMR000 Comm Module



Switch#	No	Item	Setting		Note
SW1	1	ODU Type	Off	Multi V™ Comm.	Using Multi V™ outdoor unit
	2	Control Type	On	Communication	Controlled by DDC Modbus RTU or LG remote controllers & central controllers
			Off	Contact signal	Controlled by DDC through Contact signal LG Centralized controller can only monitor status
	3	DO Type	On	Fan Speed	DO1: High, DO2: Middle, DO3: Low DO changes according to fan speed setting value
			Off	Status	DO1: On/Off, DO2: Defrost, DO3: Alarm
	4	Fan Speed (TH. On/Off)	On	Fixed	The fan will always be running as set fan speed except defrost.
			Off	Change	The fan speed will be changed according to TH on/off For more detail please check 'Digital Output - Fan Speed'
SW2	1	Room thermistor sensor reference setting	On	Remote control / Indoor unit / 2TH	Control according to value of remote control installer setting no.4 (refer to the remote control manual)
			Off	Indoor unit	-
	2	Reserved	-	-	-
	3/4	UI Setting	Off/Off	UI Setting #1	UI1: Operation On/Off, UI2: Heating/Cooling UI3: Forced Thermo On/Off, UI4: Target air temperature
			Off/On	UI Setting #2	UI1: Operation On/Off, UI2: Cooling only/Off UI3: Heating only/Off, UI4: Forced Thermo On and Off
			On/Off	Reserved	-
			On/On	UI Setting #4 ¹	UI1: Operation On/Off UI2: Heating/Cooling UI3: Emergency stop
SW3	1	Group Main/ Sub (Return Air only)	On	Sub mode	Please see "9.3 Multiple module installation guide" for more detail
			Off	Main mode	Main mode is default for single AHU Controller installation. Please see "9.3 Multiple module installation guide" for more detail
	2/3	Operation Mode Setting	Off/Off	Heat Pump	Cooling or Heating operation mode is available
			Off/On	Heating Only	Operation mode is Heating only (Heating / Fan)
			On/Off	Cooling Only	Operation mode is Cooling only (Cooling / Fan)
			On/On	Reserved	-
	4	Reserved	-	-	-
SW4	1-4	Capacity Index Setting	-	-	According to ODU Type, you can setup the capacity index of Multi V™ or Single Split

Table 6 - DIP Switch Settings Details for Comm Module

¹'UI setting #4' is available when 'Dip SW1-2', 'Dip SW2-3', and 'Dip SW2-4' are ON.

Set DIP Switch SW4 as appropriate for the capacity of your air handling unit.


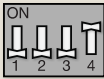
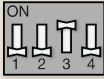













Switch Number 'On'	SW4 Dip Switch	Capacity (MBH) Multi V™
-		12
4		15
3		18
3,4		24
2		28
2,4		36
2,3		42
2,3,4		48
1		54
1,4		76
1,3		96
1,3,4		115
1,2		134
1,2,4		153
1,2,3		172
1,2,3,4		192

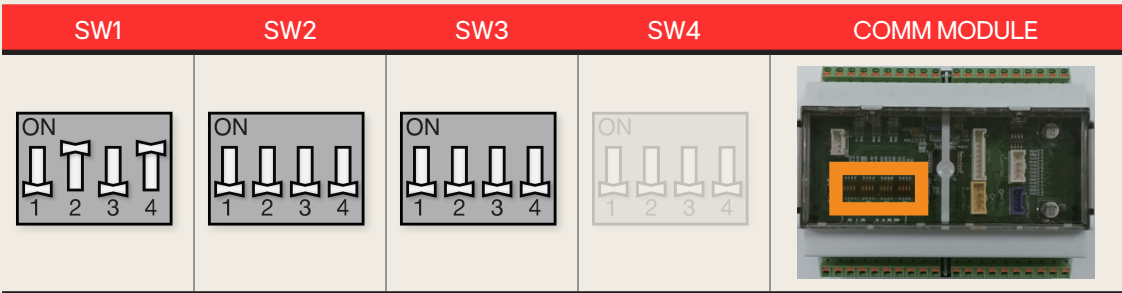
Table 7 - DIP Switch 4 Settings based on Capacity

NOTE:

1. If you want to connect the PRLK396A0/PRLK594A0 (EEV kit) with Multi V™ outdoor unit, you have to set Dip s/w 1, 2, 3 and 4 ON (Set the capacity as 192 kBTU/h).
2. PAHCMR000 model can only be connected to PRLK048A0/PRLK096A0/PRLK396A0 EEV kit.
3. PAHCMS000 model can be connected to PRLK048A0/PRLK096A0/PRLK396A0 EEV kit and if you can add EEV module (PAEEVA020) separately, it can be connected to the PRLK594A0 EEV kit.

DIP Switch Applications with Thermostats – PAHCMR000

The figure below shows the DIP switch settings of the return air comm. kit when the LG controls is used. When the LG controls method is used, an LG wired controller is required and LG central controller is optional.



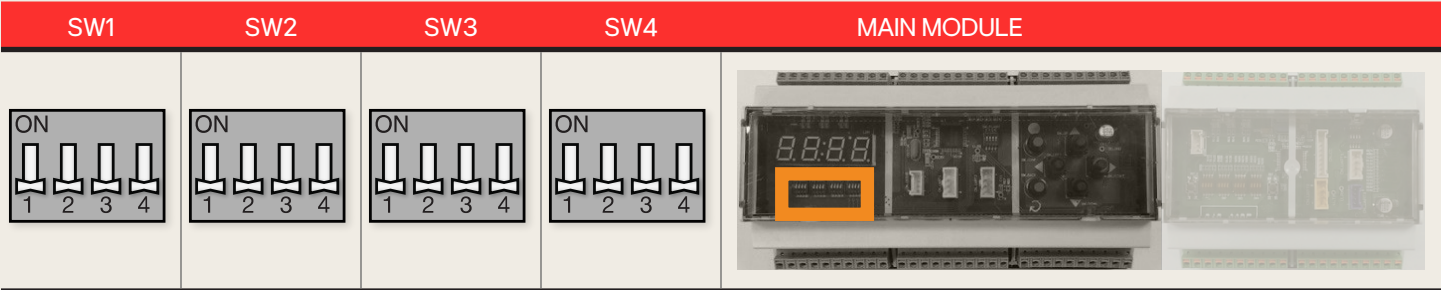
The default settings of all DIP switches is “OFF”

Table 8 - DIP Switch Settings for LG Thermostats

Return Air Kit Application Using LG Thermostat		
S/W name	No	Setting
SW1	1	Off
	2	On
	3	Off
	4	On
SW2	1	Off
	2	Off
	3	Off
	4	Off
SW3	1	Off
	2	Off
	3	Off
	4	Off

Table 9 - Return Air Kit DIP Switch Application using LG Thermostat

DIP Switch Settings – PAHCMS000



The default settings of all DIP switches is “OFF”

Table 10 - Default DIP Switch Settings for PAHCMS000 Main Module

Switch#	No	Item	Setting		Note
SW1	1	Control Type	On	Communication	Controlled by DDC through Modbus or LG wired controller
			Off	Contact Signal	Controlled by DDC through Contact signal LG Centralized controller can only monitor status
	2	Discharge Temp. Control Type	On	Stand alone	LG remote controllers or DDC(Modbus) can control discharge air temperature by using LG discharge temperature sensor
			Off	Manual by DDC	DDC(Contact Signal or Modbus) can control discharge air temperature by ODU capacity control referring to field supplied discharge temperature
	3	Defrost Operation Type ¹	On	Normal	In case of multiple outdoor units, Defrost operation can be operated simultaneously
			Off	Sequential Start up	In case of multiple outdoor units, the outdoor unit is sequentially started at intervals of 10 minutes
	4	Central Communication Type	On	Monitoring/ Control	Modbus communication between main module and LG central controller
			Off	Monitoring only	LGAP AHU communication between main module and LG central controller (monitoring only)
SW2	1	ODU Capacity Control ¹	On	ODU Capacity Setting #2	ODU capacity control #2
		Reserved	Off	ODU Capacity Setting #1	ODU capacity control #1
	2	ODU Capacity% Control ³ and Prevent Derosting	On	ODU Capacit-Setting #3	ODU Capacity Control #3 (Priority is higher than SW2-1) & Enable the function for prevent defrosting at the same time
			Off	-	According to SW2-1 setting
	3	Reserved	-	-	-
	4	Reserved	-	-	-
SW3	1	Reserved	-	-	-
	2	Reserved	-	-	-
	3	Reserved	-	-	-
	4	Reserved	-	-	-
SW4	1	Emergency Stop ²	On	Setting #2	System stops when the circuit(DI3-GND) is 'open'
			Off	Setting #1	System stops when the circuit(DI3-GND) is 'short'
	2	Reserved	-	-	-
	3	Reserved	-	-	-
	4	Reserved	-	-	-

Table 11 - DIP Switch Settings Details for PAHCMS000 Main Module

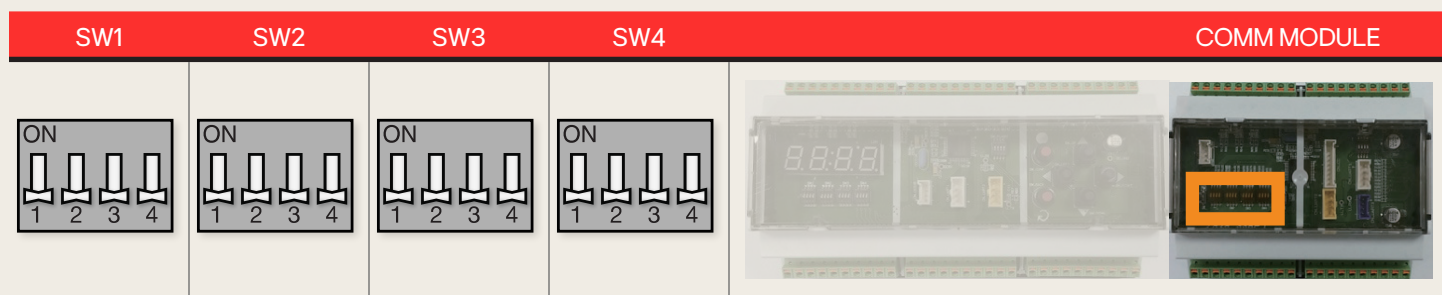
¹ Function of defrost operation type can be applied only to Multi V outdoor units (MULTI V™ 5 and after).

² Emergency Stop function is working regardless 'Control Type' setting (Dip Switch SW 1-1)

³ Function of ODU capacity control(capacity % control) can be applied only to Multi V outdoor units(after MULTI V 5 model) and please check the below.

- Check the software version : Main PCB version of MULTI V 5 model is after version 1.43.0 and main module's version of AHU communication kit is after version 1.3.
- Set the function : MULTI V 5 model should be set function FN39 option1 or option2.
- (Dip SW NO.5 : ON → Set to 'FUNC' → Set to 'FN39' : Option 1 or Option 2)
- Please see the Multi V manual for more detail how to set this function.
- In case of using the ODU capacity control(capacity % control), SW2-1(ODU Capacity control #1, #2) setting is ignored.

Communications Module DIP Switches



The default settings of all DIP switches is "OFF"

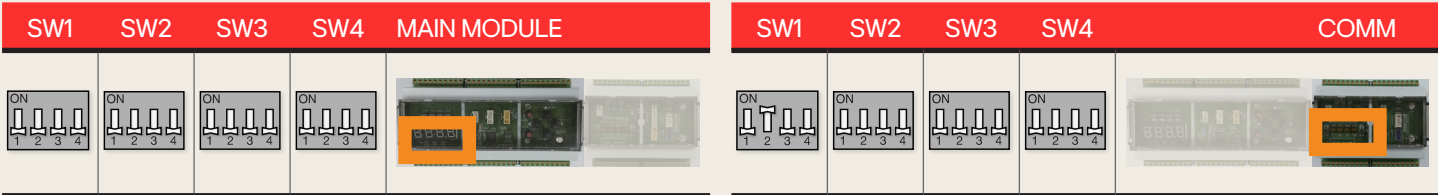
Table 12 - Default DIP Switch Settings for PAHCMS000 Comm Module

S/W name	No	Item	Setting		Note
SW1	1	ODU Type	Off	Multi V™ Comm	Using Multi V™ outdoor unit
	2	Control Type	On	Communication	Module Communication (it must be 'On', when Comm module is connected with Main Module, even if DDC controls Main Module by contract signal)
			Off	Contact signal	Not used
	3	DO Type	On	Fan Speed	Not used
			Off	Status	Not used
	4	Fan Speed (TH. On/Off)	On	Fixed	Not used
			Off	Change	Not used
SW2	1	Reserved	-	-	-
	2	Reserved	-	-	-
	3/4	UI Setting ¹	Off/Off	UI Setting #1	Not used
			Off/On	UI Setting #2	Not used
			On/Off	-	-
			On/On	-	-
SW3	1	Main/Sub	On	Sub mode	Not used
			Off	Main mode	Main is default
	2/3	Operation mode setting	Off/Off	Heat Pump	Cooling or Heating operation mode is available
			Off/On	Heating Only	Operation mode is Heating only (Heating/Ventilation)
			On/Off	Cooling Only	Operation mode is Cooling only (Cooling/Ventilation)
			On/On	Reserved	-
	4	Reserved	-	-	-
SW4	1-4	Capacity Index Setting	-	-	According to ODU Type, you can setup the capacity index of Multi V™. Please refer to 'Table of SW4' in Return Air Temperature Control (PAHCMR000)

Table 13 - DIP Switch Settings Details for PAHCMS000 Comm Module

Do not change the reserved switch (It may malfunction).

DIP Switch Application with Thermostats – PAHCMS000



The default settings of all DIP switches is "OFF"

The default settings of all DIP switches is "OFF"

Table 14 - Default DIP Switch Settings for PAHCMS000 Comm Module

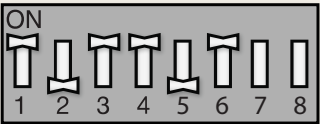
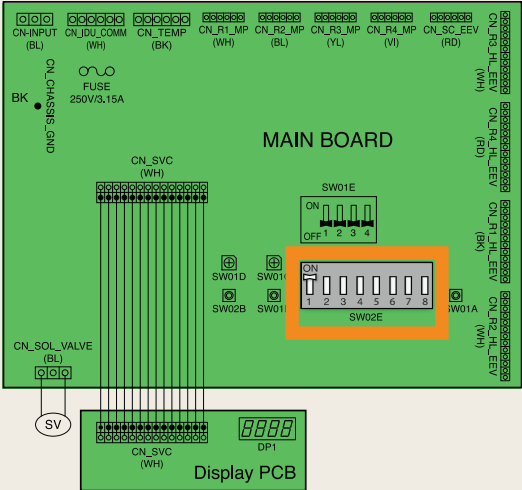
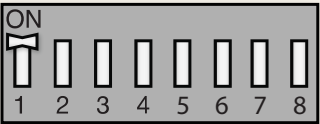
MAIN Module DIP Switch			Communication Module DIP Switch		
S/W name	No	Setting	S/W name	No	Setting
SW1	1	Off	SW1	1	Off
	2	Off		2	On
	3	Off		3	Off
	4	Off		4	Off
SW2	1	Off	SW2	1	Off
	2	Off		2	Off
	3	Off		3	Off
	4	Off		4	Off
SW3	1	Off	SW3	1	Off
	2	Off		2	Off
	3	Off		3	Off
	4	Off		4	Off
SW4	1	Off	SW4	1	Off
	2	Off		2	Off
	3	Off		3	Off
	4	Off		4	Off

Table 15 - Supply Air Kit (PAHCMS000) Application Using Third-Party Controller (DI and AI control)

NOTE: ODU Central control address must be set to "00"

- ODU address and Comm module (right module) address must set matched.
- The main module (left module) address is used for connecting BMS or LG central controller.
- The comm. module address is used for communicating with ODU for capacity control. If you set comm. module address "00", also set ODU address "00"
Ex.) ODU #1 (00) <-----> Comm. module #1 (00)
ODU #2 (01) <-----> Comm. module #2 (01)
- Comm. Module (right module) default address is "00"
- Comm. Module (right module) address range is "00"~"03"

DIP Switch Settings for Combining 3 HRU Ports

SW02E		SW02E Port on PRHR033A
Setting for 3-Ports Combined	 <p>Position 7 & 8 does not matter (ON/OFF)</p>	
Manual Pipe Search	 <p>Position 2 - 8 does not matter (ON/OFF)</p>	

Note: Only manual pipe search can be done with this setting

Table 16 - SW02E Dip Switch

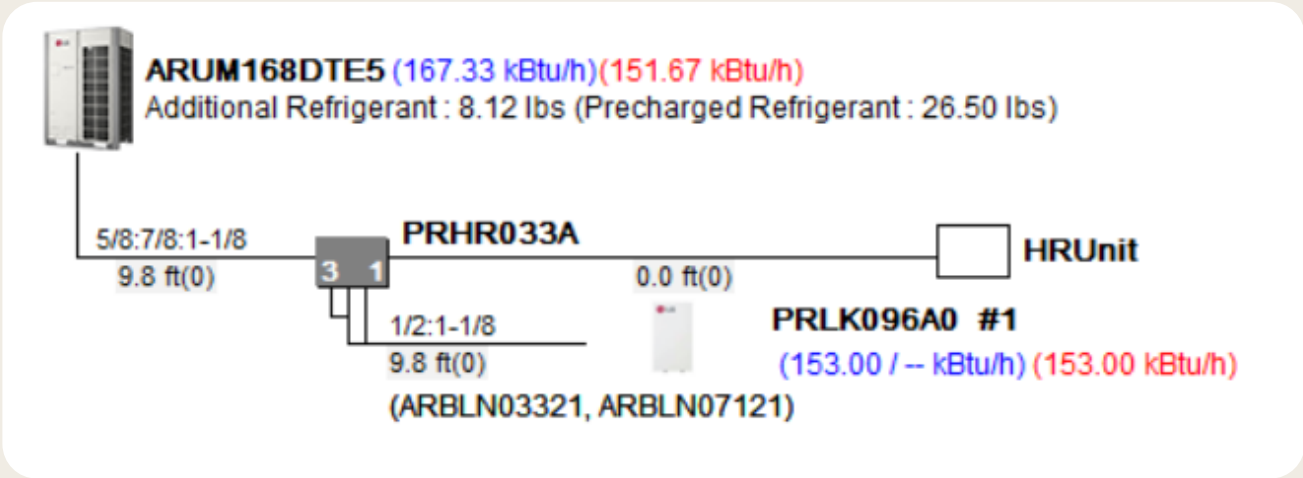


Figure 7 - LATS 3 HRU Port Diagram

Note: If AHU capacity requires to combined 3 ports (PRHR033A), the maximum capacity that HRU can deliver is 154 MBH.

Outdoor Unit Capacity Control Map

Target Pressure/Temperature Setting and ODU Capacity Control Map

Below tables are Function Code 8 ODU adjustments.

Multi V™ 5		Target Pressure(psi) & Target Temperature (°F)													
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)		
Cooling	1	100%	116.60	38.9	105.15	33.7	110.95	36.2	126.03	43.0	135.60	46.9	145.03	50.7	
	2	90%	120.38	40.7	109.06	35.3	114.72	38.1	129.80	44.6	139.37	48.4	143.15	50.0	
	3	80%	124.15	42.3	112.83	37.3	118.49	39.7	133.72	46.2	143.15	50.0	146.92	51.4	
	4	70%	127.92	43.8	116.60	38.9	122.26	41.4	137.49	47.7	146.92	51.4	150.69	52.8	
	5	60%	133.72	46.2	122.26	41.4	127.92	43.8	143.15	50.0	152.57	53.5	156.34	54.9	
	6	50%	141.26	49.2	129.80	44.6	135.60	46.9	150.69	52.8	160.26	56.3	164.03	57.7	
	7	45%	145.03	50.7	133.72	46.2	139.37	48.4	154.46	54.2	164.03	57.7	167.80	58.9	
	8	40%	150.69	52.8	139.37	48.4	145.03	50.7	160.26	56.3	169.69	59.7	173.46	60.9	

Table 17 - Multi V™ 5 Target Pressure/Temp Settings Cooling

Multi V™ 5		Target Pressure(psi) & Target Temperature (°F)													
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)		
Heating	1	100%	433.64	123.1	452.64	126.4	443.21	124.8	410.00	118.8	386.22	114.3	362.58	109.7	
	2	90%	410.00	118.8	429.00	122.3	386.22	114.3	367.36	110.7	348.36	106.7	329.36	102.7	
	3	80%	386.22	114.3	405.22	117.9	362.58	109.7	343.58	105.7	324.72	101.7	305.72	97.4	
	4	70%	362.58	109.7	381.58	113.4	338.94	104.8	319.94	100.7	300.94	96.4	281.94	91.9	
	5	60%	338.94	104.8	357.79	108.7	315.15	99.5	296.15	95.2	277.30	90.7	258.30	86.0	
	6	50%	315.15	99.5	334.15	103.7	291.51	94.2	272.51	89.5	253.51	84.7	234.66	79.7	
	7	45%	305.72	97.4	324.72	101.7	281.94	91.9	263.09	87.2	244.09	82.2	225.09	77.0	
	8	40%	291.51	94.2	310.51	98.5	267.73	88.3	248.87	83.6	229.87	78.4	210.87	72.9	

Table 18 - Multi V™ 5 Target Pressure/Temp Settings Heating

Multi V™ 5		Target Pressure(psi) & Target Temperature (°F)													
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)		
Hydrokit (Heating)			433.64	123.1	466.85	128.8	452.64	126.4	443.21	124.8	410.00	118.8	386.22	114.3	

Table 19 - Multi V™ 5 Target Pressure/Temp Settings Hydrokit Heating

Multi V™ S		Target Pressure(psi) & Target Temperature (°F)												
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)	
Cooling	1	100%	116.60	38.9	101.38	31.9	107.18	34.7	122.26	41.4	131.69	45.4	139.37	48.5
	2	90%	120.38	40.7	105.15	33.7	110.95	36.2	126.03	43.0	135.60	46.9	143.15	50.0
	3	80%	124.15	42.3	109.06	35.3	114.72	38.1	129.80	44.6	139.37	48.5	146.92	51.4
	4	70%	127.92	43.8	112.83	37.3	118.49	39.8	133.72	46.2	143.15	50.0	150.69	52.8
	5	60%	133.72	46.2	118.49	39.8	124.15	42.7	139.37	48.5	148.80	52.1	156.34	54.9
	6	50%	141.26	49.2	126.03	43.0	131.69	45.4	146.92	51.4	156.34	54.9	164.03	57.7
	7	45%	145.03	50.7	129.80	44.6	135.60	46.9	150.69	52.8	160.26	56.3	167.80	58.9
	8	40%	150.69	52.8	135.60	46.9	141.26	49.2	156.34	54.9	165.92	58.6	173.46	60.9

Table 20 - Multi V™ S Target Pressure/Temp Settings Cooling

Multi V™ S		Target Pressure(psi) & Target Temperature (°F)												
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)	
Heating	1	100%	433.64	123.1	452.64	126.4	410.00	118.8	391.00	115.3	372.00	111.6	353.15	107.7
	2	90%	410.00	118.8	429.00	122.3	386.22	114.3	367.36	110.7	348.36	106.7	329.36	102.7
	3	80%	386.22	114.3	405.22	117.9	362.58	109.7	343.58	105.7	324.72	101.7	305.72	97.4
	4	70%	362.58	109.7	381.58	113.4	338.94	104.8	319.94	101.0	300.94	96.4	281.94	91.9
	5	60%	338.94	104.8	357.79	108.7	315.15	99.5	296.15	95.2	277.30	90.7	258.30	86.0
	6	50%	315.15	99.5	334.15	103.7	291.51	94.2	272.51	89.5	253.51	86.2	234.66	79.7
	7	45%	305.72	97.4	324.72	101.7	281.94	91.9	263.09	87.2	244.09	82.2	225.09	77.0
	8	40%	291.51	94.2	310.51	98.5	267.73	88.3	248.87	83.5	229.87	78.4	210.87	72.9

Table 21 - Multi V™ S Target Pressure/Temp Settings Heating

Multi V™ S		Target Pressure(psi) & Target Temperature (°F)												
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)	
Hydrokit (Heating)	1	100%	433.64	123.1	466.85	128.8	452.64	126.4	410.00	118.8	391.00	115.3	372.00	111.6
	2	90%	410.00	118.8	443.21	124.8	429.00	122.3	386.22	114.3	367.36	110.7	348.36	106.7
	3	80%	386.22	114.3	419.43	120.6	405.22	117.9	362.58	109.7	343.58	105.7	324.72	101.7
	4	70%	362.58	110.3	395.79	116.2	381.58	113.4	338.94	104.8	319.94	100.7	300.94	96.4
	5	60%	338.94	104.8	372.00	111.6	357.79	108.7	315.15	99.5	296.15	95.2	277.30	90.7
	6	50%	315.15	99.5	348.36	106.7	334.15	103.7	291.51	94.2	272.51	89.5	253.51	84.7
	7	45%	305.72	97.4	338.94	104.8	324.72	101.7	281.94	91.9	263.09	87.2	244.09	82.2
	8	40%	291.51	94.1	324.72	101.7	310.51	98.5	267.73	88.3	248.87	83.5	229.87	78.4

Table 22 - Multi V™ S Target Pressure/Temp Settings Hydrokit Heating

Multi V WATER® 5

Target Pressure(psi) & Target Temperature (°F)														
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)	
Cooling	1	100%	112.83	37.3	101.38	31.9	107.18	34.7	122.26	41.4	131.69	45.4	139.37	48.4
	2	90%	116.60	38.9	105.15	33.7	110.95	36.2	126.03	43.0	135.60	46.9	143.15	50.0
	3	80%	120.38	40.7	109.06	35.5	114.72	38.1	129.80	44.6	139.37	48.4	146.92	51.4
	4	70%	124.15	42.3	112.83	37.3	118.49	39.7	133.72	46.2	143.15	50.0	150.69	52.8
	5	60%	129.80	44.6	118.49	39.7	124.15	42.3	139.37	48.4	148.80	52.1	156.34	54.9
	6	50%	137.49	47.7	126.03	43.0	131.69	45.4	146.92	51.4	156.34	54.9	164.03	57.7
	7	45%	141.26	49.2	129.80	44.6	135.60	46.9	150.69	52.8	160.26	56.3	167.80	58.9
	8	40%	146.92	51.4	135.60	46.9	141.26	49.2	156.49	55.0	165.92	58.4	173.46	60.9

Table 23 - Multi V WATER® 5 Target Pressure/Temp Settings Cooling

Multi V WATER® 5

Target Pressure(psi) & Target Temperature (°F)														
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)	
Heating	1	100%	433.64	123.1	452.64	126.4	410.00	118.8	391.00	115.3	372.00	111.6	353.15	107.7
	2	90%	410.00	118.8	429.00	122.3	386.22	114.3	367.36	110.7	348.36	106.7	329.36	102.7
	3	80%	386.22	114.3	405.22	117.9	362.58	109.7	343.58	105.7	324.72	101.4	305.72	97.4
	4	70%	362.58	109.7	381.58	113.4	338.94	104.8	319.94	100.7	300.94	96.4	281.94	91.9
	5	60%	338.94	104.8	357.79	108.7	315.15	99.5	296.15	95.2	277.30	90.7	258.30	86.0
	6	50%	315.15	99.5	334.15	103.7	291.51	94.2	272.51	89.5	253.51	84.7	234.66	79.7
	7	45%	305.72	97.4	324.72	101.7	281.94	91.9	263.09	87.2	244.09	82.2	225.09	77.0
	8	40%	291.51	94.2	310.51	98.5	267.73	88.3	248.87	83.5	229.87	78.4	210.87	72.9

Table 24 - Multi V WATER® 5 Target Pressure/Temp Settings Heating

Multi V WATER® 5

Target Pressure(psi) & Target Temperature (°F)														
Mode	Steps (Voltage)	Ref. Capacity	Off (psi & °F)		OP1 (psi & °F)		OP2 (psi & °F)		OP3 (psi & °F)		OP4 (psi & °F)		OP5 (psi & °F)	
Hydrokit (Heating)			433.64	123.1	466.85	128.8	452.64	126.4	410.00	118.8	391.00	115.3	372.00	111.6

Table 25 - Multi V WATER® 5 Target Pressure/Temp Settings Hydro kit Heating

Communication Kit Combination

Combination Options

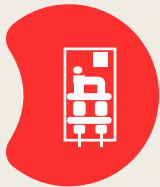
The table below shows the compatibilities of the communication kits with different outdoor units. The return air communication kit (PAHCMR000) and the supply air communication kit (PAHCMS000) are compatible with Multi V™ 5, Multi V™ S, and Multi V WATER® 5.

Model		Multi V™		Multi V WATER® 5
		5	S	5
Communication Kit	PAHCMR000	✓	✓	✓
	PAHCMS000	✓	✓	✓

Table 26 - Comm Kit Compatibility with Outdoor Units



Figure 8 - Communication Kit Combination



1:1 Combination

ODU	EEV Kit
-8 Ton HP	(1) PRLK048A0
10 - 16 Ton HP	(1) PRLK096A0
18 - 32 Ton HP	(1) PRLK396A0
34 - 48 Ton HP	(1) PRLK594A0

Table 27 - 1:1 ODU EEV Kit

1:2 Combination

ODU	EEV Kit
16 Ton HP	(2) PRLK048A0
32 Ton HP	(2) PRLK096A0
42 Ton HP	(2) PRLK396A0

Table 28 - 1:2 ODU EEV Kit

ODU 30 Ton

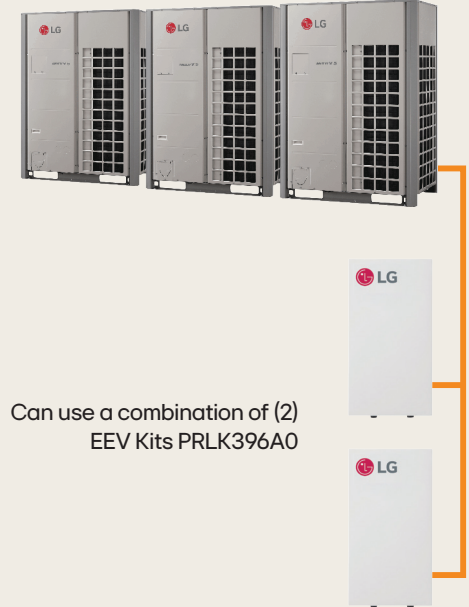


ODU 40 Ton



Figure 9 - 1:1 ODU Tonnage to EEV Kit Example

ODU 42 Ton



Can use a combination of (2)
EEV Kits PRLK396A0

Figure 10 - 1:2 ODU Tonnage to EEV Kit Example

ODU EEV Kit Combination – Not Possible

ODU	EEV Kit
40 Ton HP	PRLK048A0 + PRLK396A0
	PRLK048A0 + PRLK594A0
	PRLK096A0 + PRLK396A0
	PRLK096A0 + PRLK594A0
	PRLK396A0 + PRLK594A0

Table 29 - ODU/EEV Kit Not Possible Combinations

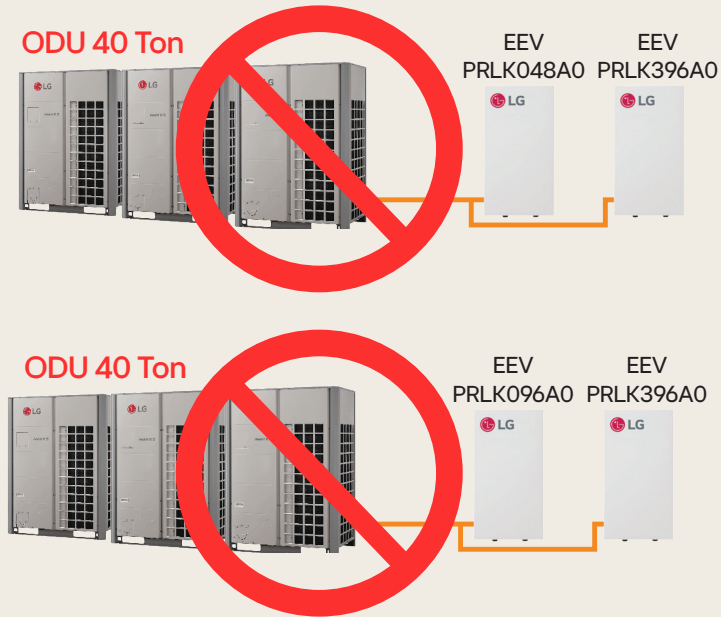


Figure 11 - ODU/EEV Kit Not Possible Combinations Diagram

EEV + IDU Combination Combination – Not Possible

ODU	EEV Kit
40 Ton HP	PRLK396/594A0 + Standard IDU

Table 30 - ODU/EEV + IDU Combination Not Possible



Figure 12 - ODU/EEV + IDU Combination Not Possible Diagram

EEV Kit Combination Ratio

Combination		Total	AHU	Expansion Kit Type
Pair (1ODU to 1AHU)		50 - 105%	-105%	EEV Kit
Multiple (1ODU to multiple AHUs)	in Heat Recovery AHU (Mixed Air)	50 - 130%	-130%	EEV Kit
	in Fresh Air AHU (100% Outside Air)	50 - 105%	-105%	EEV Kit
Multiple (1ODU to multiple AHUs + indoor units) <i>Only apply to Return Air Temperature Control</i>	in Heat Recovery AHU (Mixed Air)	50 - 130%	-50%	EEV Kit
	in Fresh Air AHU (100% Outside Air)	50 - 105%	-50%	EEV Kit

Table 31 - EEV Kit Combination Ratio

Note: Combination ratio (%) = Sum of total capacity index / Outdoor unit rated cooling capacity

Application Layout and Configuration for Communication Kits

Return Air Control: 1-ODU System + 1 AHU (1 coil) + Controls

- LG thermostats with AHU conversion kit can only do single setpoint
- LG thermostats with AHU conversion kit cannot do auto switchover mode

1. 1-ODU System + 1 AHU (1 coil) + LG Control

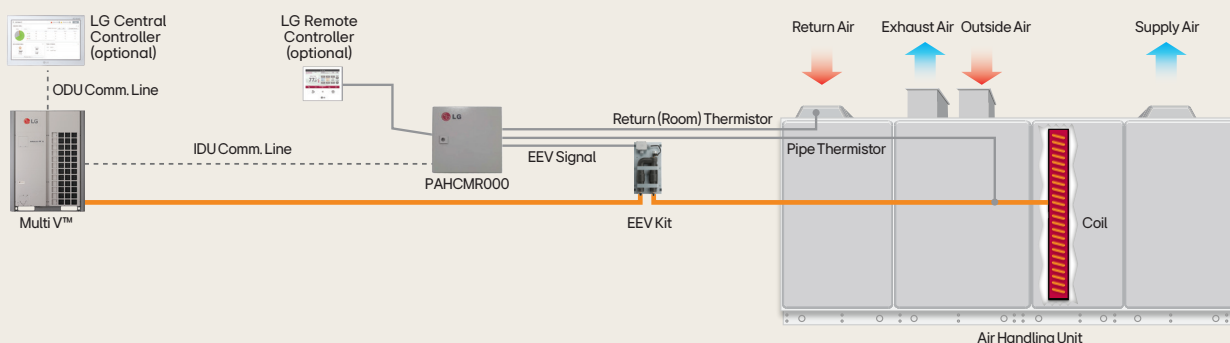


Figure 13 - ODU System + 1 AHU (1 coil) + LG Control

- 1 ODU can be connected with multiple EEV kits
- EEV kit should be connected with communication kit 1:1

2. 1-ODU System + 1 AHU (1 coil) + DDC (Modbus)

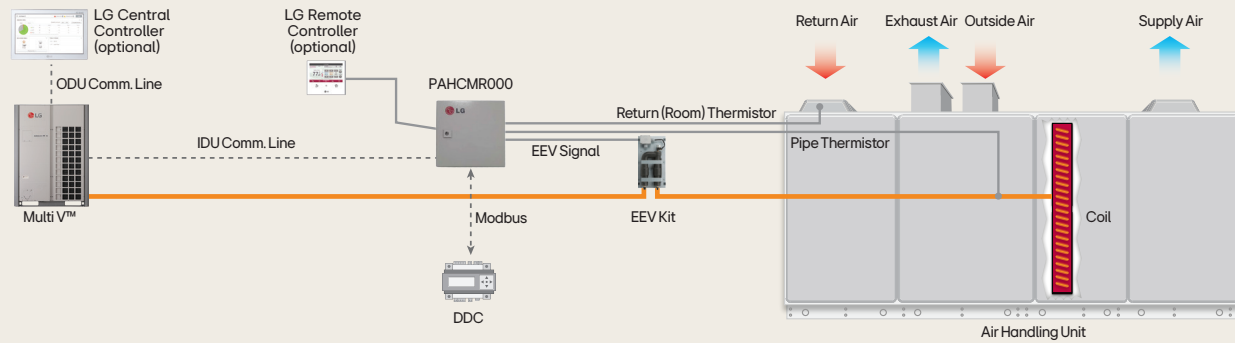


Figure 14 - 1-ODU System + 1 AHU (1 coil) + DDC (Modbus)

- 1 ODU can be connected with multiple EEV kits
- EEV kit should be connected with communication kit 1:1
- LG Remote Controller and LG Central Controller are optional for monitoring only

Return Air Control – 1-ODU (Multi-Frame) System + 1 AHU (2 coil) + Controls

- LG thermostats with AHU conversion kit can only do single setpoint
- LG thermostats with AHU conversion kit cannot do auto switchover mode

1. 1-ODU System + 1 AHU (2 coils) + LG Control

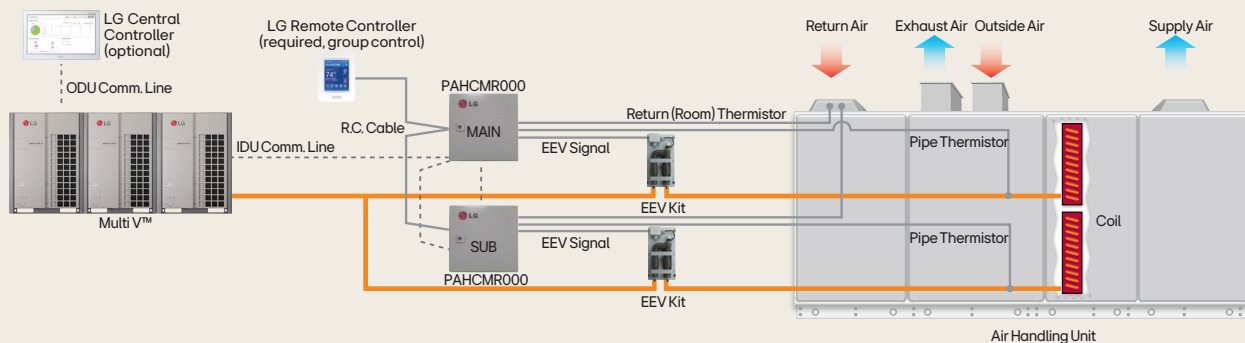


Figure 15 - 1-ODU (Multi-Frame) System + 1 AHU (2 coils) + LG Control

- 1 ODU can be connected with multiple EEV kits
- 1 Communication kit & 1 EEV kit are necessary for each coil
- Group control of coils is needed normally

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2. 1-ODU (Multi-Frame) System + 1 AHU (2 coils) + DDC (Modbus)

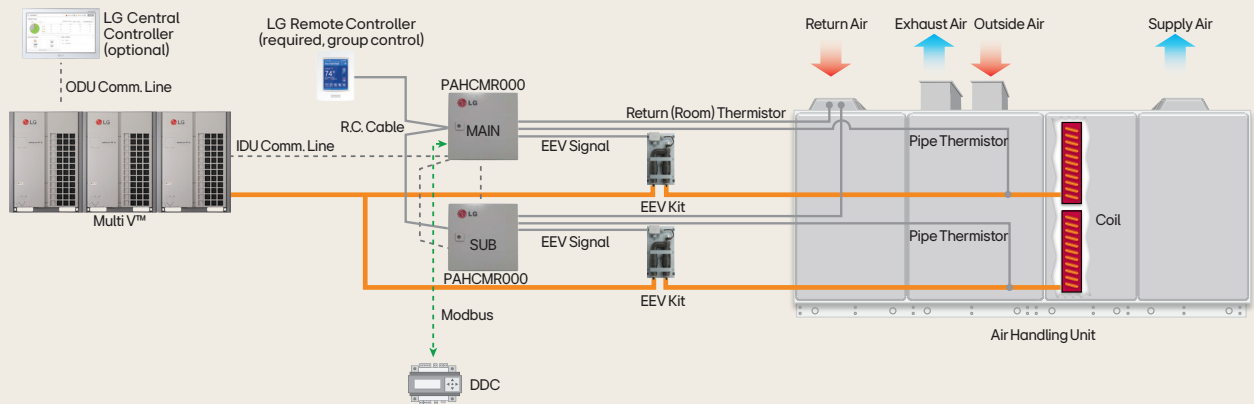


Figure 16 - 1-ODU (Multi-Frame) System + 1 AHU (2 coils) + DDC (Modbus)

- 1 ODU can be connected with multiple EEV kits
- 1 communication kit & 1 EEV kit are necessary for each coil
- Group control of coils is need normally

**NOT possible: Supply air control: 1 ODU + AHU kit/coil + IDU's
(Traditional VRF connected to IDU not allowed)**

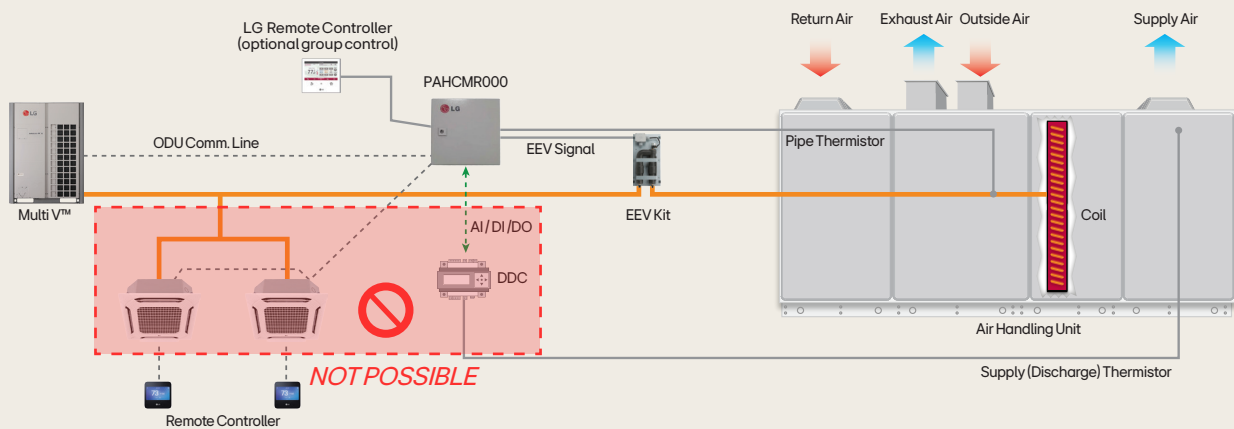


Figure 17 - Supply Air Control – 1-ODU System + 1 AHU (1 coil) + IDU's

- Supply air temperature control kit adjusts pressure (or AHU coil temperature)
- IDU capacity could be changed when supply air control kit controls AHU

Discharge Air Control: 1-ODU (Multi-Frame) System + 1 AHU (2 coils) + I/O Module + DDC Control

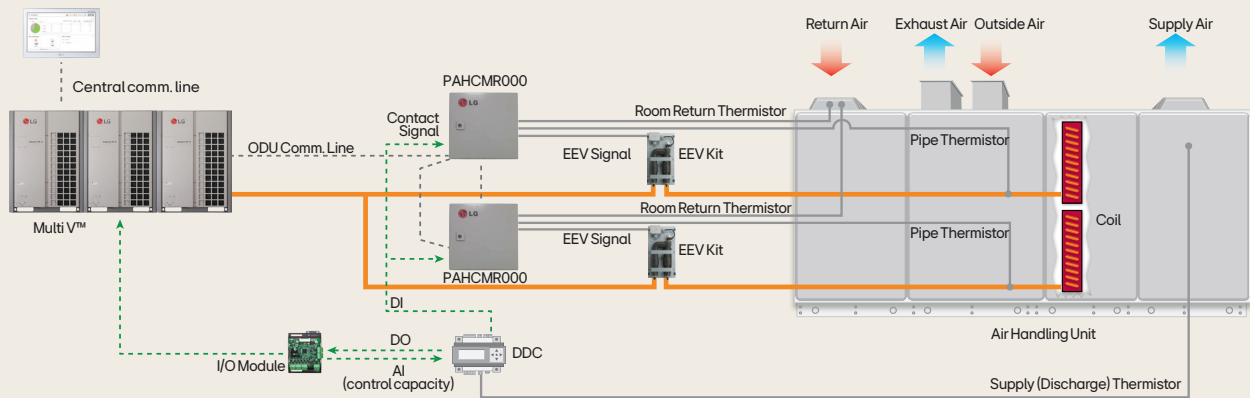


Figure 18 - Supply Air Control – 1-ODU (Multi-Frame) System + 1 AHU (2 coils) + I/O Module + DDC Control

- I/O Modules (PRVC2 and PWFCKN000) have capacity control feature built-in
- LG Central controller can be connected to ODU

Discharge Air Control: 2-ODU (Multi-Frame) System + 1 AHU (2 coils) + I/O Module + DDC Control

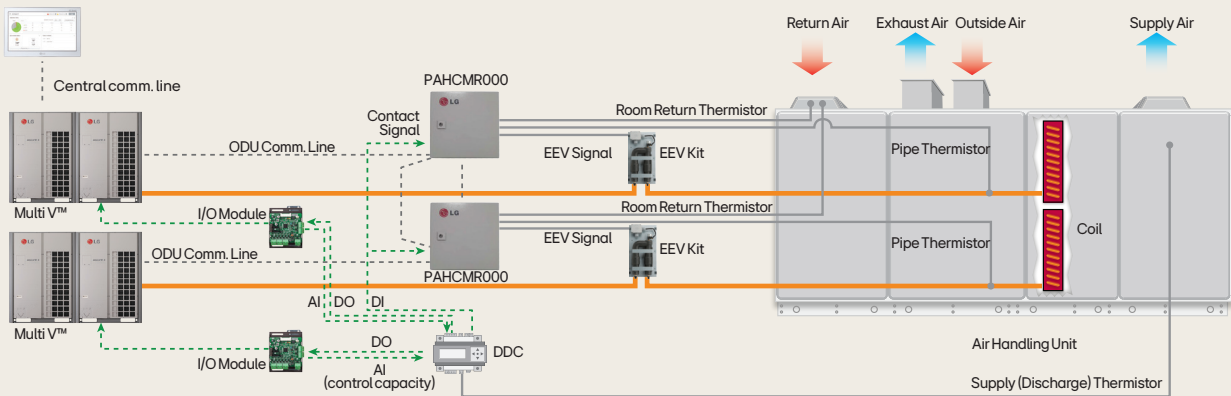


Figure 19 - Supply Air Control – 2-ODU (Multi-Frame) System + 1 AHU (2 coils) + I/O Module + DDC Control

- I/O Modules (PRVC2 and PWFCKN000) have capacity control feature built-in
- Each ODU needs separate I/O Modules
- Only (1) DDC controller is needed and can send out separate 0-10 volt signals to each I/O Module
- LG Central controller can be connected to ODU

Example AHU Kit for Large AHU

Components Required

- LG Wired Controller
- PAHCMR000 Communication Kit
- EEV Kit
- Multi V™ ODU
- Third-Party AHU

Selecting in LATS HVAC

Multi V System Setting

Systems: Multi V1

Region: N.America

ODU Series: Multi V 5

ODU Types: 50,60Hz/R410A/Heat Pump/MV5/N.America

Simulation mode: ☒ Both ☐ Cooling ☐ Heating

Design Conditions

	Indoor (Return Air)				Outdoor			
Cooling	DBT	80.6	°F		DBT	93.9	°F	
	WBT	67.0	°F		WBT	73.9	°F	
	RH	50.0	%		RH	39.8	%	
Heating	DBT	68.0	°F		DBT	17.1	°F	
	WBT	56.6	°F		WBT	16.1	°F	
	RH	50.0	%		RH	86.0	%	

OK Cancel

Figure 20 - Selecting ODU Series

When creating your LATS HVAC project, make sure to choose a Multi V™ Outdoor Unit. Note that PAHCMS000 Units are only compatible with heat pump systems.

Indoor Unit Properties

Indoor Unit

Generation 4

IDU Type EEV KIT

IDU Model PRLK396A0

Height difference from ODU

Above 5.0 ft

On Coil Temp.

DBT WBT RH[%]

Cooling 80.0 °F 67.0 °F 51.2

Heating 70.0 °F

Note: AHU Capacity is not simulated. "On Coil Temp." is only used to simulate outdoor unit capacity.

AHU Information

AHU Capacity index 264.0 kBtu/h (192.0~384.0)

Total HEX Volume 768.9 in³

AHU Type ☒ Return Air Mixing ☐ 100% Fresh Air

Model Capacity

	Total Cooling	Sensible Cooling	Heating	
IDU Capacity	264.0	0.0	264.0	kBtu/h
Design Load	0.0	0.0	0.0	kBtu/h
Room	0.0	--	0.0	%

EEV KIT

Tag# 10-DOAS-01A

Accessories

Future IDU

OK Cancel

1. After getting a coil selection from the coil manufacturer, select an EEV kit with the default return air temperatures (80°F DB/67°F WB for cooling, 70°F DB for heating).
2. Next, select AHU capacity index to match the total cooling capacity and volume from the coil manufacturer.
3. LATS HVAC is not able to simulate AHU coil entering air conditions and can only be used for sizing the ODU and pipe for AHU kits.

Figure 21 - Selecting EEV Kit

After selecting the EEV Kit, click on "Accessories" to add the Comm. Kit and thermostat

Accessory Table

All	Model Name	Description	Count
<input type="checkbox"/>	PAHCMR000	AHU Communications Kit [Return air]	1
<input checked="" type="checkbox"/>	PAHCMS000	AHU Communications Kit [Discharge (supply) air]	1
<input checked="" type="checkbox"/>	PREMTA201	Deluxe Wired Remote Controller (Black)	1
<input type="checkbox"/>	PREMTB100	Standard III Wired Remote Controller (White)	1
<input type="checkbox"/>	PREMTBB10	Standard III Wired Remote Controller (Black)	1
<input type="checkbox"/>	PREMTBVC2	MultiSITE CRC2 Remote Controller (Includes Hum...	1
<input type="checkbox"/>	PREMTBVC3	MultiSITE CRC2+ Remote Controller (Includes M...	1
<input type="checkbox"/>	PREMTBVC4	MultiSITE CRC2+Z Remote Controller (Includes H...	1
<input type="checkbox"/>	PREMTC00U	Simple Remote Controller	1

Add

Delete

OK

Cancel

Figure 22 - Selecting EEV Kit

Choose the PAHCMS000 as the communication kit and one of the LG wired controllers, then click "Add" and "Ok". Note that the thermostat is used for displaying error codes only when DDC by contact signal is used.

LATS Disclaimer: All material provided herein is for informational purposes only. It is not intended to be a substitute for professional advice. Please consult with your engineer or design professionals for application to your system. LATS is not able to simulate AHU coil entering air temperature and can only be used for sizing the ODU and pipe for AHU kits.



Figure 23 - LATS Example of Large AHU System

Here's an example of a Large AHU system in LATS HVAC. The combination ratios in Table 31 should be followed when designing with the AHU kits.

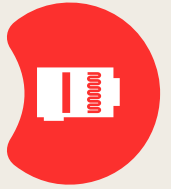


Figure 24 - VAV/Central Station Air Handler



Figure 25 - Rooftop Air Handler



Figure 26 - Custom Air Handler



Application Examples

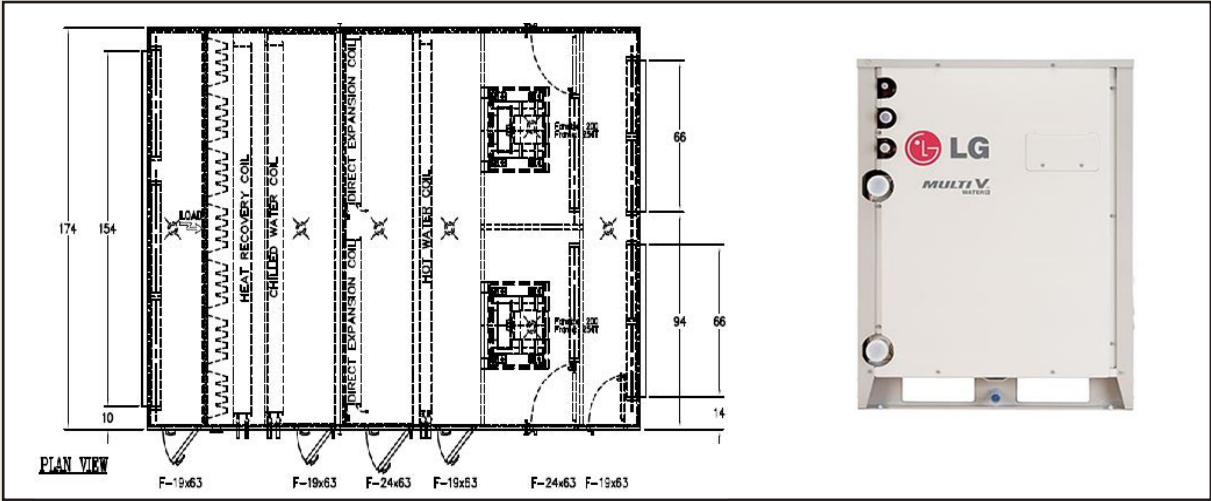


Figure 27 - Office Building

Outdoor Unit	Indoor Units	Controller
Multi V WATER® 5 HP (54 Tons)	33,000 CFM AHU x 1	Third-Party BMS

Table 32 - Office Building Example (Components Used)

- PAHCMR000 Communication Kit for outside air pre-conditioning to meet specific discharge air temperature.
- Multi V WATER® 5 units mounted, piped, and wired at AHU manufacturer.

AHU Conversion Kit for Small AHU

Components Required

- PAHCMR000 Communication Kit (Return Air)
- EEV Kit
- Multi V™ ODU
- LG wired controller
- Third-Party AHU

Selecting in LATS HVAC

Multi V System Setting

Systems: Multi V1

Region: N.America

ODU Series: Multi V 5

ODU Types: 50,60Hz/R410A/Heat Recovery/MV5/N.America

Simulation mode: ☒ Both ☐ Cooling ☐ Heating

Design Conditions

	Indoor (Return Air)			Outdoor		
Cooling	DBT	80.6	°F	DBT	84.0	°F
	WBT	67.1	°F	WBT	64.9	°F
	RH	50.0	%	RH	35.7	%
Heating	DBT	68.0	°F	DBT	21.0	°F
	WBT	56.7	°F	WBT	20.0	°F
	RH	50.0	%	RH	86.0	%

OK Cancel

Figure 28 - Selecting Multi V™ Outdoor Unit

When creating your LATS-HVAC project, make sure to choose a Multi V™ Outdoor Unit.

Note: PAHCMR000 communication kit only compatible with two EEV kit models in Heat Recovery application: PRLK048A0 AND PRLK096A0

Indoor Unit Properties

Indoor Unit

Generation: 4

IDU Type: EEV KIT

IDU Model: PRLK048A0

Height difference from ODU: Below 9.8 ft

Room Design Temp.(Return Air Temp.)

	DBT	WB T	RH[%]
Cooling	80.0 °F	67.0 °F	51.2
Heating	70.0 °F		<input type="checkbox"/> All

Note: Cooling capacity is simulated using WB T.

AHU Information

AHU Capacity index: 12 kBTu/h (10.5~96.0)

Heat exchanger volume: 67.1 in³

AHU Type: ☒ Return Air Mixing ☐ 100% Fresh Air

Model Capacity

	Total Cooling	Sensible Cooling	Heating	
IDU Capacity	12.0	0.0	12.0	kBTu/h
Design Load	0.0	0.0	0.0	kBTu/h
Room	0.0	--	0.0	%

EEV KIT

Tag# 1 ☐ Future IDU

Accessories

OK Cancel

When selecting an indoor Unit, choose "EEV Kit" under IDU Type.

For Heat Recovery system, only two EEV Kit options available (PRLK48A0 and PRL096A0)

80°F / 67°F WB in cooling and 70°F in heating must always be used for return air temperatures

Figure 29 - Selecting EEV Kit

After selecting the EEV Kit, click on "Accessories" to add the Comm. Kit and thermostat

Accessory Table

All	Model Name	Description	Count
<input checked="" type="checkbox"/>	PAHCMR000	AHU Communications Kit [Return air]	1
<input checked="" type="checkbox"/>	PREMTA201	Deluxe Wired Remote Controller (Black)	1
<input type="checkbox"/>	PREMTB100	Standard III Wired Remote Controller (White)	1
<input type="checkbox"/>	PREMTBB10	Standard III Wired Remote Controller (Black)	1
<input type="checkbox"/>	PREMTBVC2	MultiSITE CRC2 Remote Controller (Includes Hum...	1
<input type="checkbox"/>	PREMTBVC3	MultiSITE CRC2+ Remote Controller (Includes M...	1
<input type="checkbox"/>	PREMTBVC4	MultiSITE CRC2+Z Remote Controller (Includes H...	1
<input type="checkbox"/>	PREMTC00U	Simple Remote Controller	1

Add

Delete

OK

Cancel

Figure 30 - Selecting Comm Kit for Wired LG Controllers

Choose the PAHCMR000 as the communication kit and one of the LG wired controllers, then click "Add" and "OK".

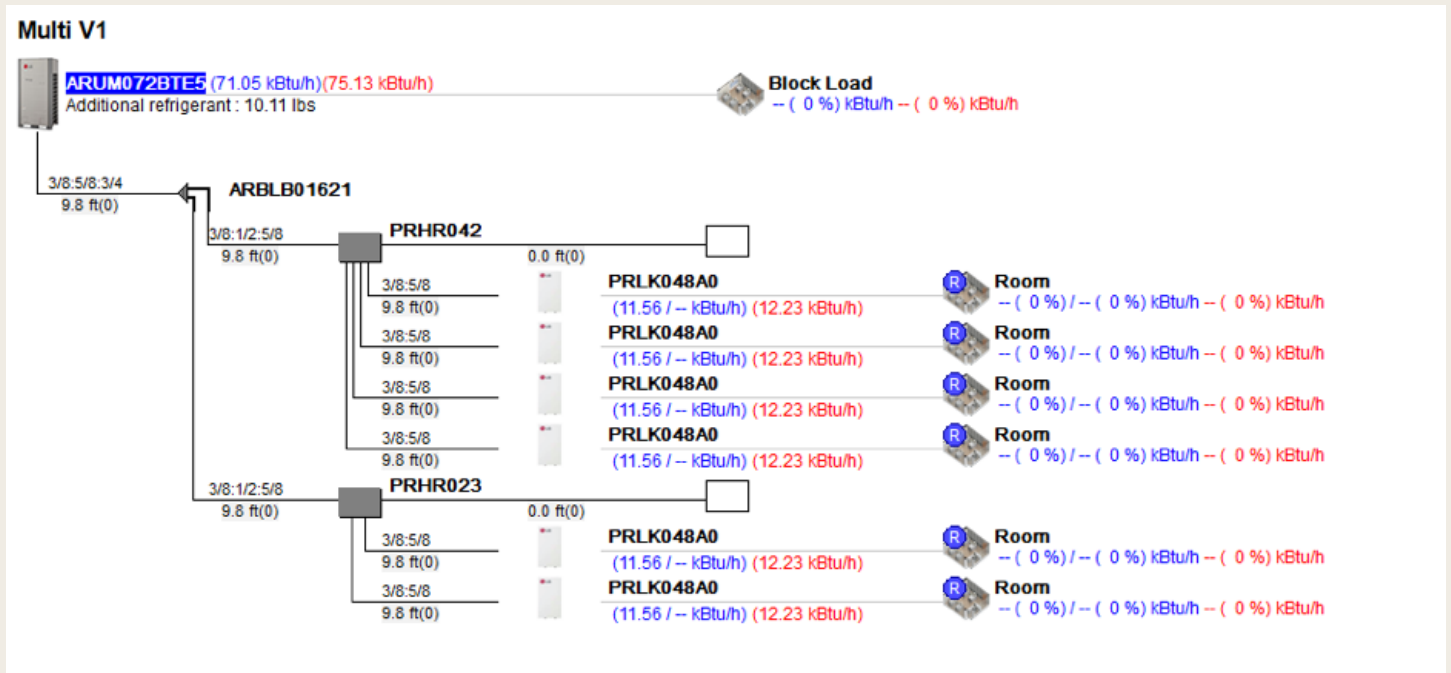


Figure 31 - LATS Example of Small AHU System

Here's an example of a Small AHU system in LATS-HVAC. The combination ratio should follow the rules in the combination ratio table ("Table 31 - EEV Kit Combination Ratio" on page 27).



Figure 32 - High Filtration



Figure 33 - Large Gym Area

Application Examples

Restaurant



Figure 34 - Restaurant Application

Outdoor Unit	Indoor Units	Controller
Multi-V 5 (28 Tons)	3,700 CFM AHU x 1 Ducted x 9 High Wall x 3	AC Smart IV

Table 33 - Restaurant Example (Components Used)

- PAHCMR000 Comm. Kit for outside air pre-conditioning
- Standard LG IDU used for space conditioning
- AC Smart Central Controller schedules LG systems. Third-Party BMS controls AHU fan speed

Elementary/High School

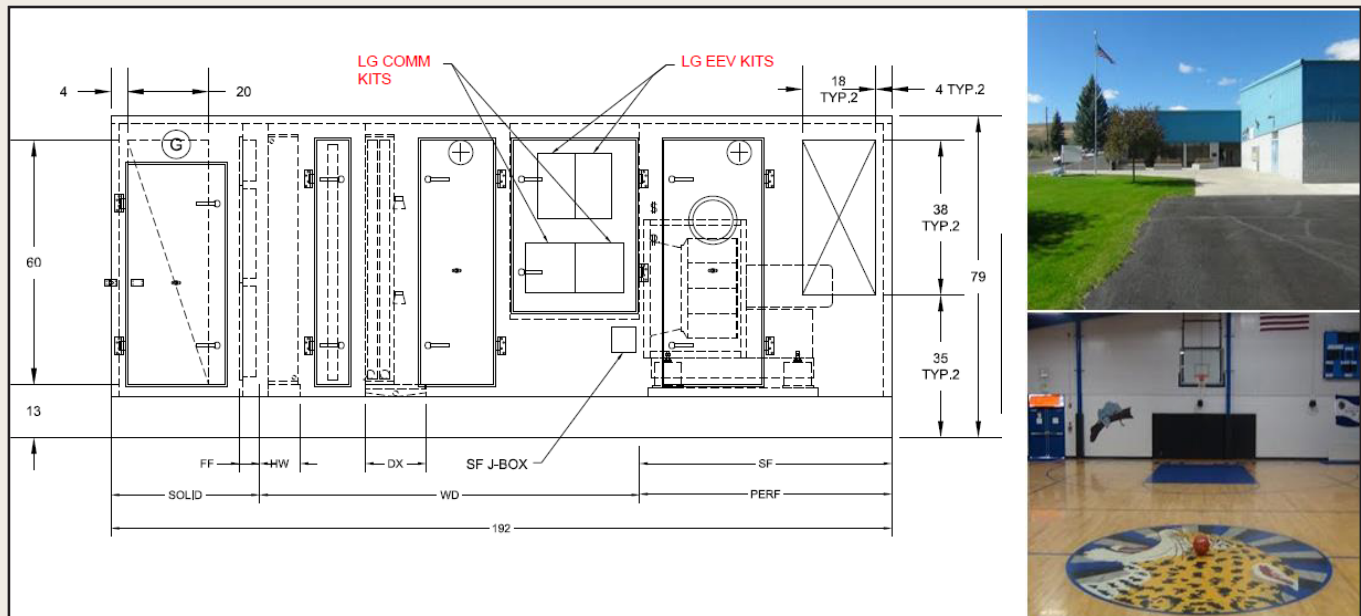


Figure 35 - Elementary/High School Application

Outdoor Unit	Indoor Units	Controller
Multi V WATER® 5 Heat Recovery Multi V WATER® 5 Heat Pump Multi V™ 5 Air Heat Recovery (128 Tons)	12,000 CFM AHU x 1 Ducted x 21 High Wall x 1	BMS and Third-Party Thermostat

Table 34 - Elementary/High School Example (Components Used)

- VRF equipment replacing WSHP to reduce site maintenance costs and reduce classroom noise
- PAHCMR000 Comm. Kit applied to Gym/Multipurpose Space AHU
- LG AHU Kits installed and piped at AHU factory

Coil Design Parameters

AHU Module – Design Tips (Do's)



Things to review before designing a coil for heat pump operation since it will impact the coil circuiting:

1. What are the cooling and heating LOADS? LOADS are DIFFERENT from specified cooling and heating coil CAPACITY COIL. Selections cannot be oversized, ESPECIALLY when operating in heating mode.
2. Is the AHU a VAV AHU or constant volume? Most important to know.
3. What is the minimum LOAD for cooling shoulder season and the MINIMUM load for heating in the shoulder season? (i.e. how much turn-down in coil capacity will be needed)
4. Is the entering and leaving air temperature to/from each coil constant or does it vary?
5. Is the Application 100% OA or mix of OA and return air?
6. Is it a constant volume or VAV fan?
7. What are the minimum airflow settings on VAV boxes connected to the duct system (as a % of design airflow)?

LG does not manufacture Third-Party DX coil.**

- Number of rows, fins per inch, coil area, coil velocity and distributor design are determined by coil manufacturer or specifying engineer based on performance requirements and LG's design parameters
- Minimum coil entering temperature is 41°F for heating mode. Apply the application design conditions to size the coil to deliver the required design capacity. Make sure that the coil is selected in accordance with the coil parameters and refrigerant conditions outlined in page 45 & 46
- Sizing can be done based on cooling or heating requirements

Note: Select the appropriate EEV kit by applying the designed coil volume (in³) and pick the EEV model matches the volume table 2 on page 9

- Refrigerant Pressure Drop (RPD) in Cooling or Heat Pump Application
 1. Cooling only: RPD across coil range is 7.25 to 14.5 psi (RPD does not include nozzle/distributor)
 2. Heat Pump coil - Dual temperature control: First design the DX coil (Evaporator) around 17.0 psi PD. (RPD does not include nozzle/distributor). Then design the same coil as a condenser coil (heating mode) with minimum PD of 5.0 psi
- Cooling (DX coil) Target RPD: Maximum 17.0 psi*
- Heating (Condenser) Target RPD: Minimum of 5.0 psi*

**Consult with coil manufacture to meet the values by changing the coil circuiting and other coil characteristic such as Tube diameter. Recommended tube diameter is 3/8" and if the coil selected for a too large capacity coil, engineer may need to break down the capacity to smaller capacity per circuit in order to maintain the tube diameter in 3/8".*

**** LG Air Conditioning Technology is NOT responsible for the selection of any third-party product (AHU) installed using this guide. Refer to the third party product selected for pertinent manufacturers' documentation for, but not limited to, proper sizing, coil selection, material selection, installation guidance, startup, warranty terms and conditions.**

Recommended Third-Party Coil Sizing Parameters:

Cooling Mode

- Evaporator Saturation Suction Temperature (SST) for coil is 43°F*
- Target Superheat Across Coil is 8°F
- Condensing (liquid) temperature for coil sizing is 100°F - 108°F

**If SST selection not possible at this value contact LG representative for option available in Function Code 8 Table to adjust target SST setting.*



Field Supply Sensors (Thermistor)

Heating Mode

- Saturated Condensing Temperature (SCT) for coil is 122°F
- Target Subcooling Across Coil is 20°F
- Standard minimum coil entering air temperature is 41°F for heating mode
- For 23°F to 41°F see LG product development bulletin #092920A
- Coil tube sizes should be 3/8" or 1/2" (First choice to design DX coil is 3/8" tube diameter)
- Coil volume should be within LG's minimum and maximum limits for a given capacity (see "Table 2 - Third-Party DX Coil Min/Max Volume per EEV Model" on page 9)
- Coil volume data is needed from coil manufacturer to calculate refrigerant trim charge amount
- Coil distributor and nozzle should be designed for equal distribution of refrigerant
- Pipe sizing rules are same rules as the connected ODU (see ODU Engineering Manual or updated LATS version)
- Maximum recommended combination ratio is 100% (Refer to table 31 on page 27)
- EEV Kits are not weather proof and must be protected from rain, snow, etc.
- See diagram for Pipe in sensor location

Installation Instructions: First temperature sensor should be installed behind the distributor on the coldest pass of the DX coil (liquid line). Second temperature sensor should be installed at the outlet of DX coil (Suction line). Both sensors must be properly secured and insulated.

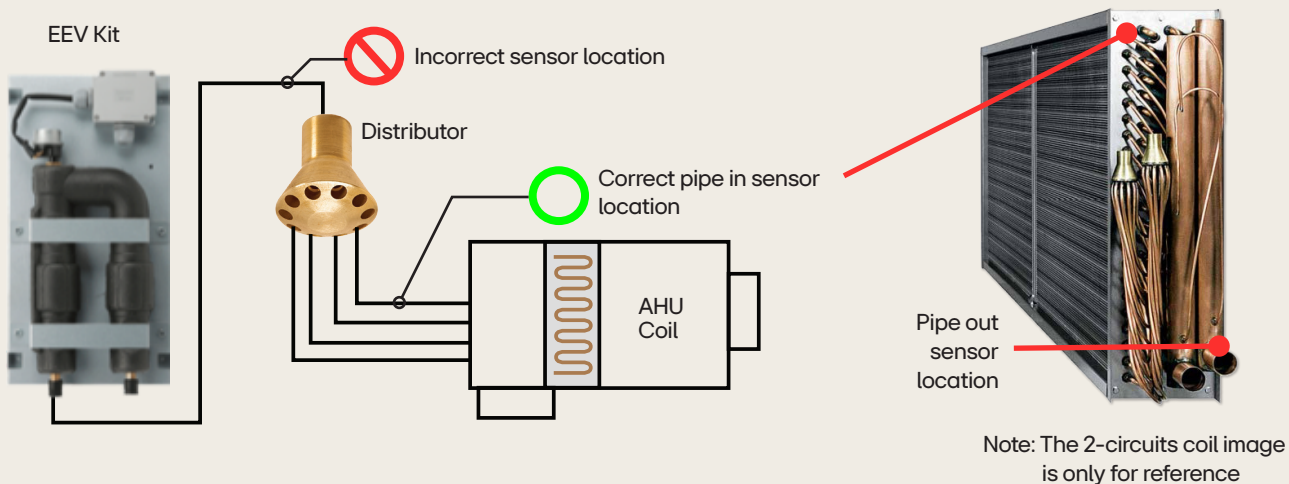


Figure 36 - Correct Pipe Sensor Location

AHU Module – Design Tips (Dont's)

- Do not design AHU coil**
- Rows, fins per inch, coil area, coil velocity are determined by coil manufacturer or specifying engineer
- Do not directly connect AHU fan motor (load) to AHU Comm Kit
- Fan motor control center (relays or starter) is required
- Do not exceed outdoor design temperature limits for outdoor units
- 14°F minimum outdoor temperature for simultaneous operation of Multi V™ 5
- 60°F maximum on heating mode
- Do not exceed air velocity of 550 FPM (feet per minute) to avoid blow off of condensate water into airstream

**** LG Air Conditioning Technology is NOT responsible for the selection of any third-party product (AHU) installed using this guide. Refer to the third party product selected for pertinent manufacturers' documentation for, but not limited to, proper sizing, coil selection, material selection, installation guidance, startup, warranty terms and conditions.**

AHU Module DX Coil Sizing Parameters – Cooling

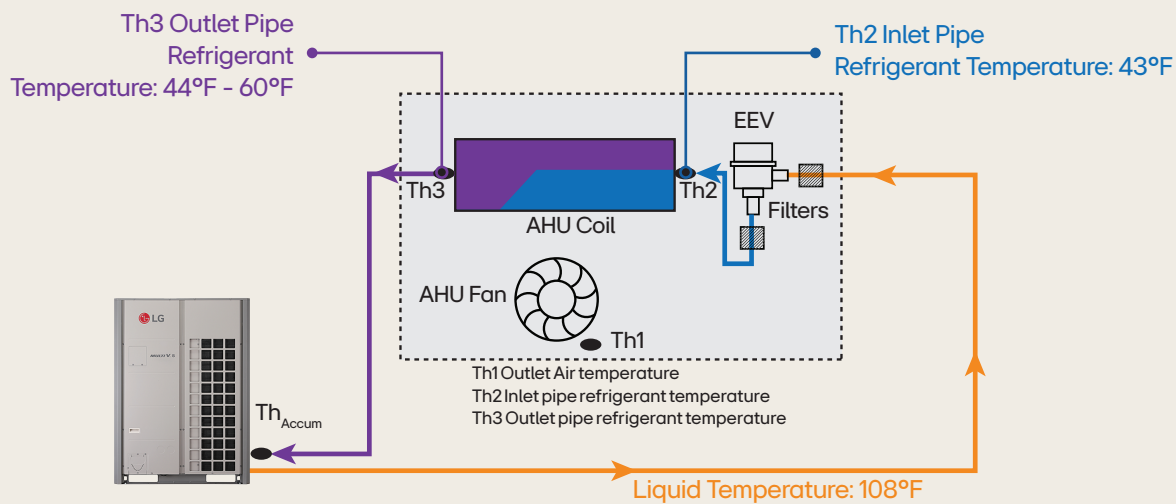


Figure 37 - System Performance in Cooling Mode

- The EEV pulses to maintain a constant superheat across the Indoor coil. Depending on Third-Party coil design and ambient conditions, the superheat may change.
- **Superheat(Cooling Mode) =**
 $\text{Outlet Pipe Refrigerant Temperature (Th3)} - \text{Inlet Pipe Refrigerant Temperature (Th2)} = \text{Target Value } 8^{\circ}\text{F}$
- Use 108°F as the coil selection entering liquid temperature for ALL coil selections.

AHU Module DX Coil Sizing Parameters – Heating

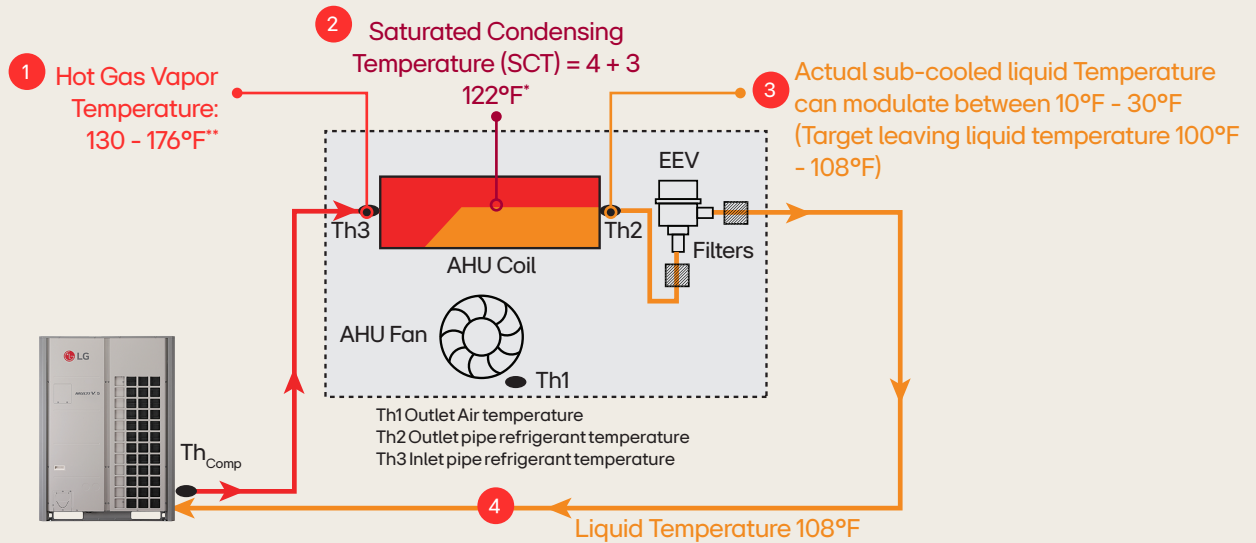


Figure 38 - System Performance in Heating Mode

*SCT is obtained by taking 100°F liquid temperature (set value) and adding sub-cooling value (varies). Use 20°F for selections.

**Suggestion to use 160°F at full load and 130°F at minimum unload coil design to be conservative (Range is 130°F - 176°F)

- The EEV pulses to maintain a constant subcooling across the Indoor coil. Depending on Third-Party coil design and ambient conditions, the superheat may change.
- Sub-cooling (Heating Mode) = Saturated Condensing Temp (SCT) – Leaving Liquid Temp(Th2) = Target Value 20°F
- Airflow (CFM) over the coil must match with coil selection. Air balance is critical to have the system cycle work properly.

Heating Coil Selections Notes:

- Use 108°F as the target leaving liquid temperature temperature and 122°F condenser temperature for ALL coil selections.
- If EAT is above 59°F the coil selection software will produce a coil selection that will have a leaving liquid temperature between 108°F - 100°F with 14°F - 22°F subcooling
- If EAT is below 59°F the coil selection software will produce a coil selection that will have a leaving liquid temperature between 105°F - 95°F with 17°F - 27°F subcooling
- When selecting a coil at the design heating condition and maximum design air flow, use a value of 160°F for superheated vapor temperature in selection software and value of 14-22 degrees of sub-cooling. A successful full load coil selection will produce the specified LAT, at specified airflow rate and the leaving liquid temperature will be between 100°F and 108°F and the sub-cooling will be between 14 and 22 and refrigerant pressure drop at least 5.0 PSI.
- After successfully selecting the coil at design heating conditions, check to make sure the refrigeration circuit operates at lowest part load condition. To do this, keep the exact same physical parameters of the coil selected set the superheated vapor temperature at 130°F and set sub-cooling value at the same for the full load condition selection. A successful min load coil selection will produce the specified LAT (and not higher than), at the unloaded coil airflow rate and the leaving liquid temperature will be between 100°F and 108°F and the sub-cooling will be between 12 and 20 and refrigerant pressure drop at least 5.0 PSI.
- **Note 1:** If the entire face of the coil is active, the maximum airflow rate turn-down is 60% of full airflow.
- **Note 2:** In the case of VAV AHU coils, obtain the minimum Airflow setting for the VAV boxes that are connected to AHU system

Guide for application which AHU coil Entering Air Temperature is Lower than 41°F

Strategies to consider when the entering air temperature is between 23°F to 41°F

- Preheat entering air with an ERV or heating coil
- Mixed outdoor air with return air to raise the coil entering temperature
- Add a gas furnace or electric heating section to the AHU to provide heat in lieu of the DX coil

Guide to design system if above strategies not possible and entering air temperature is between 23°F to 41°F

- AHU coil design airflow rate above 41°F max load ratio = 100%
- AHU coil design airflow rate below 41°F max load ratio not to exceed 50%
- To reduce the load ratio to 50% try doubling the ODU capacity or reduce IDU airflow rate to ≤ 200 CFM/Ton
- Where Load Ratio = Sum of IDU corrected capacity / ODU corrected capacity

Circuit Diagram

Supply Air Communication Kit - PAHCMS000

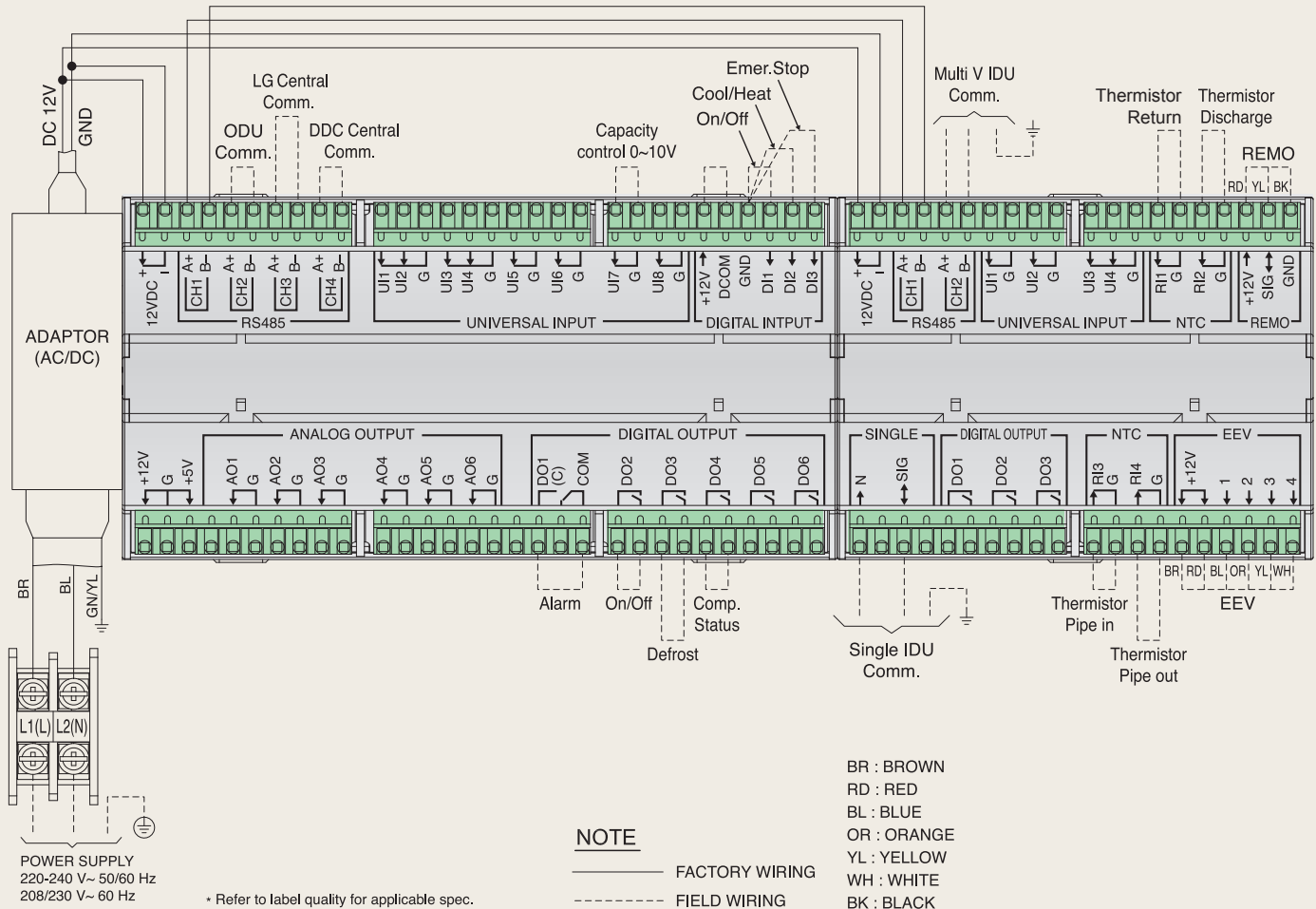
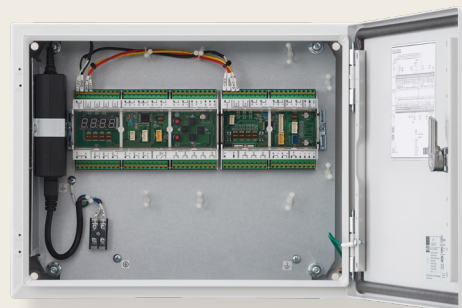


Figure 39 - PAHCMS000 Wiring



Return Air Communication Kit – Quick Setup Guide

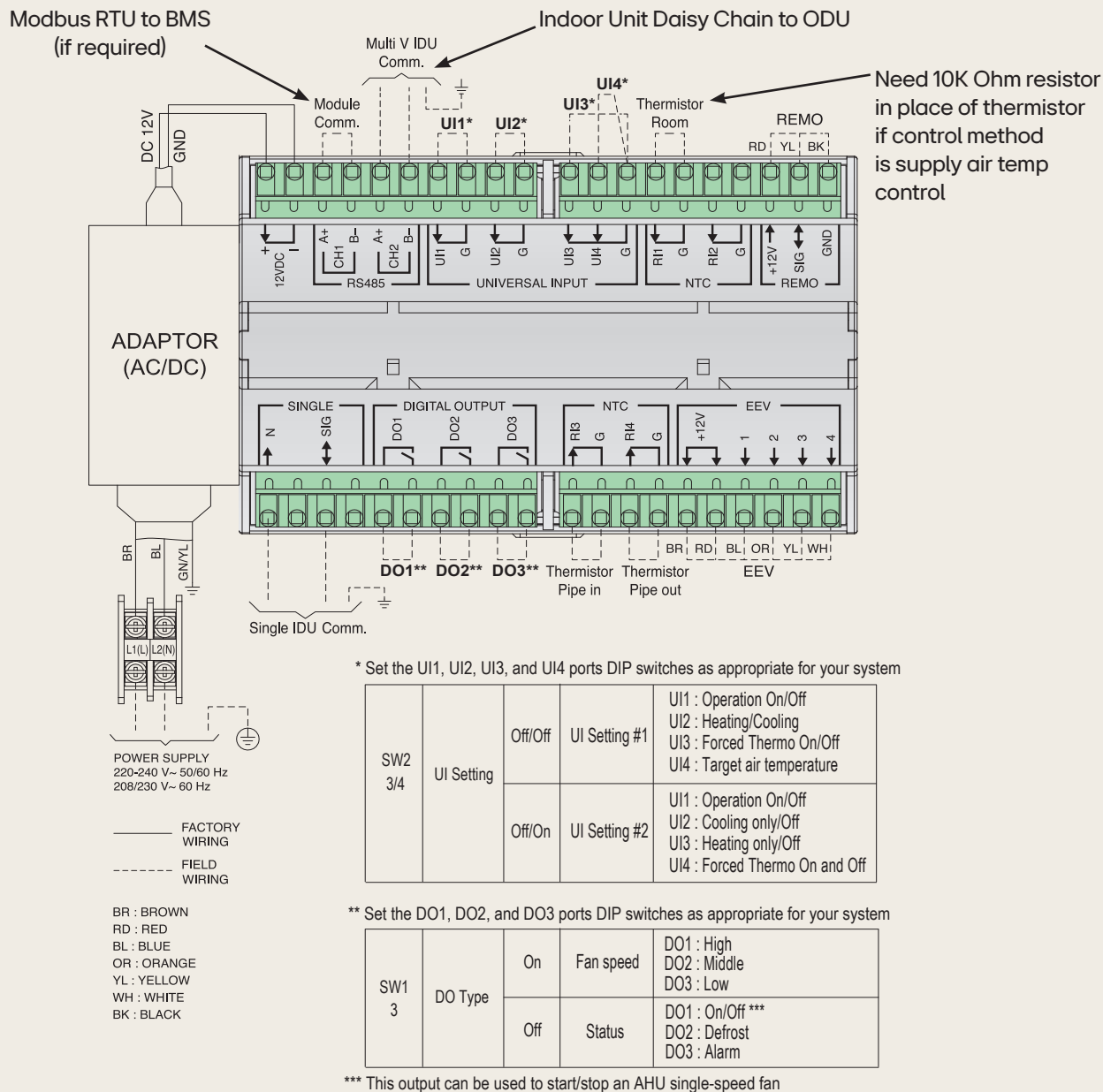


Figure 40 - PAHCMR000 Wiring

- Return Control – Use return sensor or room button sensor input – DS2 = ON
- Space Temperature Control – Use LG remote in space – DS2 = ON
- Contact Input Control – Use BMS with external contact closure inputs – DS2 = OFF
- Supply Air Control – DS2 = ON
 - Use 1 – PRVC2 per main chassis in air source ODU
 - Use 1 – PWFCCKN000 per main chassis in water source ODU
- Modbus Control – Direct connect Modbus RTU to each RA module – DS2 = ON
- BACnet Control – LG Gateway required for control & monitoring of IDU and ODU points – DS2 = ON



Correct Field Wiring (PRLK594A0)

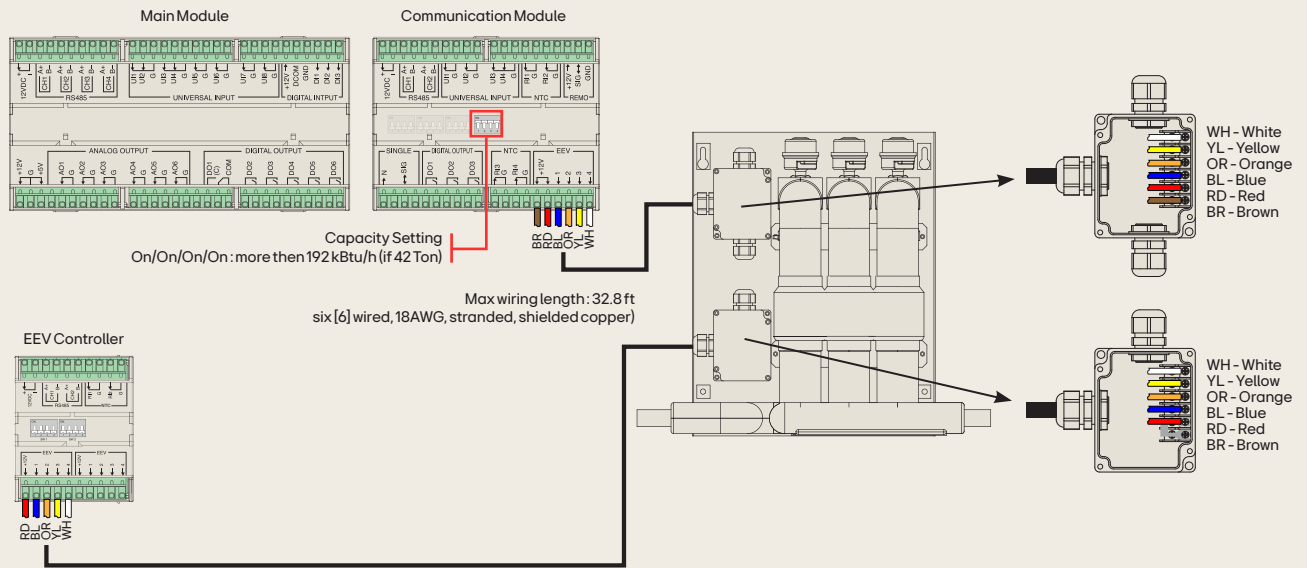


Figure 41 - Model PRLK594A0 Correct Electrical Connection



Pay attention to the connection between the terminal blocks in the EEV Kit and its designated controller module. - Failure to do so may result in component damage or fire.

Incorrect Field Wiring

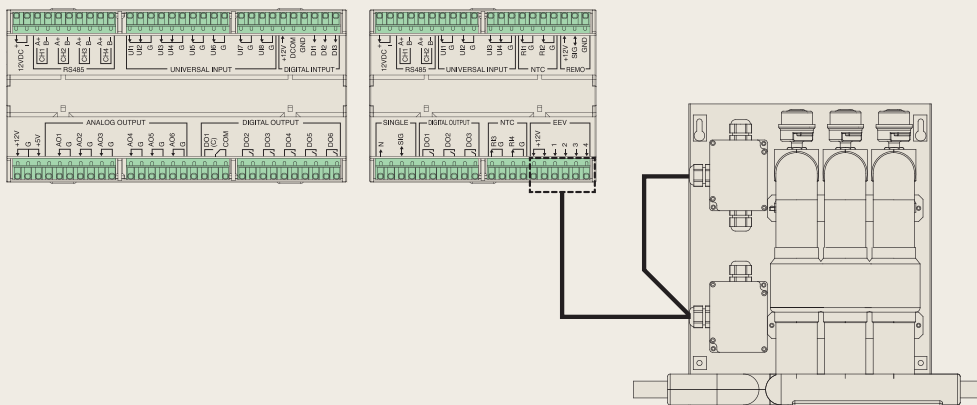


Figure 42 - Incorrect Electrical Connection



Do not connect to the AHU Controller directly after wiring two terminal blocks together inside of the EEV Kit.

Main Module Troubleshooting Guide

Error Code

Display			Title	Cause of Error
0	0	1	Air (Return/Discharge) Thermistor Error	Thermistor of Comm. Module Air Temperature is disconnected or has shorted circuit
0	0	2	Pipe In Thermistor Error	Pipe in thermistor of Comm. Module is disconnected or has shorted circuit
0	0	3	Communication error (Wired Remote Controller < Comm.Module)	No communication signal from the controller to the Comm. Module
0	0	5	Communication error (ODU Comm.Module)	No communication signal from Comm. Module Kit to the Outdoor Unit.
0	0	6	Pipe out Thermistor Error	Pipe has shorted out thermistor of Comm. Module is disconnected or circuit
2	4	2	Network error of Central controller	Wrong wiring or Main. Module Dip SW setting is not match with central controller setting
5	0	1	Communication error (Main.Module - Comm. Module)	Wiring is disconnected or No signal from Main Module to Comm. Module
5	1	1	Communication error (Main.Module - EEV Module)	Communication error Main ~ EEV.kit

Table 35 - Error Codes

Main Module Error Display

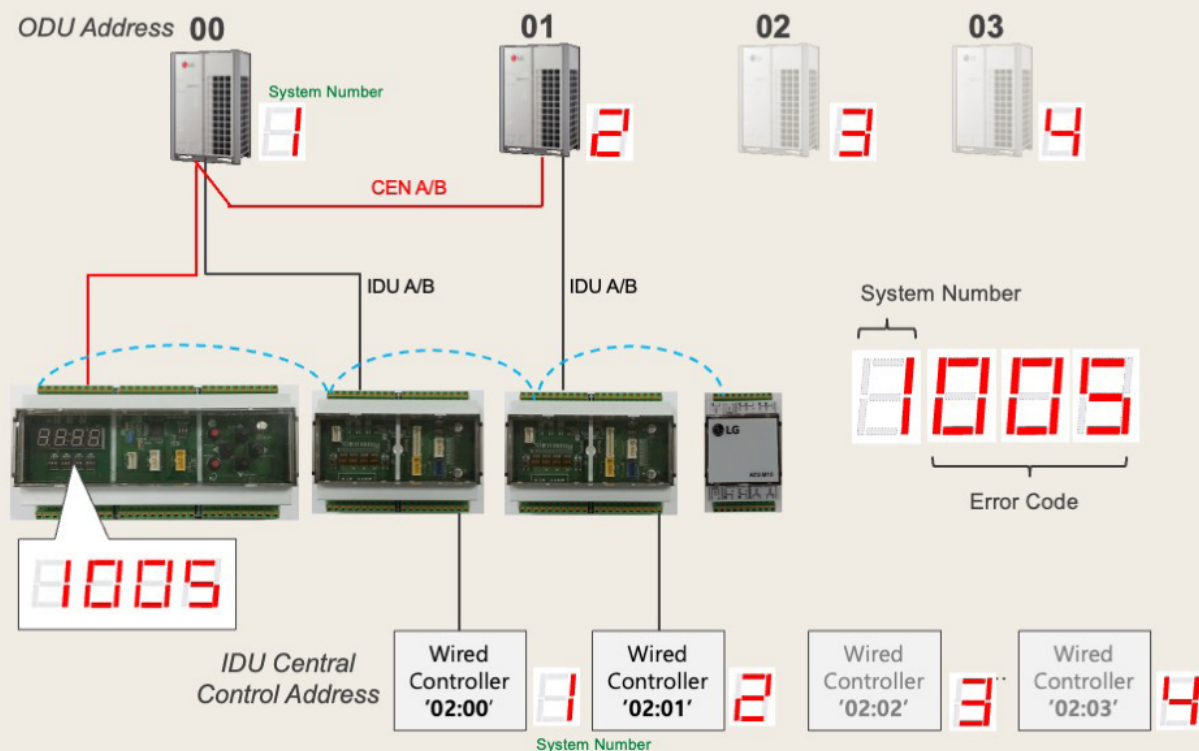


Figure 43 - Main Module Error Display

AHU Comm. Kit is not Cycling

Check list for PAHCMR000

1. Check Dip Switch 1-2

- 1-1 LG Control or DDC Modbus: it should be "On"
- 1-2 DDC Contact Control: it should be "Off"
- 1-3 Group Control Application: It should be "On" regardless control type

(For DDC control only)

2. Check UI1(Operation On/Off) Status: It should be "Short"

(In case of UI Setting #1 – Dip Switch 2-4 is "Off")

- 2-1. Check whether Analog input level (0~10V) of UI4 is above 2V
 - 2-1-1. If UI4 input is less than 2V, UI3 (Forced on/off) should be On

(In case of UI Setting #2 – Dip Switch 2-4 is "On")

- 2-2. Check UI4 (Forced on/off) input, it should be "On"

Check list for PAHCMS000

- 1. Check +12V-DCOM status whether "Short" (Non voltage input) or "Open" (12V Input)
- 2. Dip Switch 1-2 of All Comm. Module linked with Main Module Should be "On" regardless of control type
- 3. Check Dip Switch 1-1 of Main Module
 - 3-1. LG Control or DDC Modbus: It should be "On"
 - 3-2. DDC Contract Control: It should be "Off"
 - 3-2-1 Check DI 1 status, it should be "Short"

CH05 Communication Error Code (Comm. Module - ODU)

If wires are properly connected between ODU's IDU A-B and CH2 of Comm. Module, the problem comes from dip switch setting and wiring while Comm. Module power is on. Setting and wiring should be done while power is off.

Checklist

1. Check wiring between IDU A-B and CH2 of Comm. Module
2. If you did setting and wiring while product power is on, please reset product

CH03 Communication Error Code (Comm. Module – wired controller)

If you removed wired remote controller during operation, CH3 will occur, If not please check whether multiple Mains are set with one wired controller.

Checklist

1. If you removed wired controller during operation, please reset product

(In case of Group Control Application)

2. Main Unit should be one, Check Main and Sub setting (Dip switch 1-3 of Comm. Module)

One Main Unit → Dip Switch 3-1 Off

Sub Units → Dip Switch 3-1 On

CH242 Communication Error Code (Main Module - ODU)

CH242 happens with wrong wiring between ODU's CEN A-B and CH2 of Main module or wrong address setting. But rarely, if the input voltage from the adapter to Main module is not sufficient, it may occur CH242

Checklist

1. Check wiring between CEN A-B of ODU and CH2 of Main Module
2. Check ODU address using Dip Switch 5 of ODU (FN: ODU Address)
ODU address should be within 0 to 1 And started from 0 to 3
3. Check Voltage level coming from the adapter if voltage level is lower than 12V, please replace the adapter

ODU Capacity Control Is Not Properly Operating

ODU capacity is controlled by the signal (ODU Capacity level) from Main Module. Main Module should know about ODU's address to control its capacity.

Checklist for PAHCMS000

1. Check wiring between CEN A-B of Main ODU and CH2 of Main Module
2. Check ODU's address and Comm. Module's address
each system should start from 00 to 03 (00 → 01 → 02 → 03)

(ODU Capacity through LG's air thermistor (RI2 of Comm. Module))

3. Check Dip Switch 1-1 of Main Module: It should be "On"
Check Dip Switch 1-2 of Main Module: It should be "On"
Check Dip Switch 1-2 of Comm. Module: It should be "On"
- 3-1. Check target pressure whether changing its level every 2 minute according to the gap between set temp and current supply air temperature sensing by LG's air thermistor

(ODU Capacity through third-party's air thermistor)

4. Check Dip Switch 1-1 of Main Module: It should be "Off"
Check Dip Switch 1-2 of Main Module: It should be "Off"
Check Dip Switch 1-2 of Comm. Module: It should be "On"
- 4-1. Check the polarity of analog input
UI7 → + (anode), G → - (cathode)
- 4-2. Check the level of voltage input of UI7-G (Capacity Control) and compare LGMV's target pressure value.
(Reference: "ODU Capacity Control Map" on page 23)

Compressor On/Off Is Different from Expected

AHU comm. Kit is based on IDU PCB, thus it also has option for selecting which air sensor will be used between AHU Comm. Kit's air thermistor (RI1 or RI2) or wired controller's

Checklist for the wired controller

(In case you installed wired remote controller)

Select air thermistor setting according to the application

04:01: Wired Controller

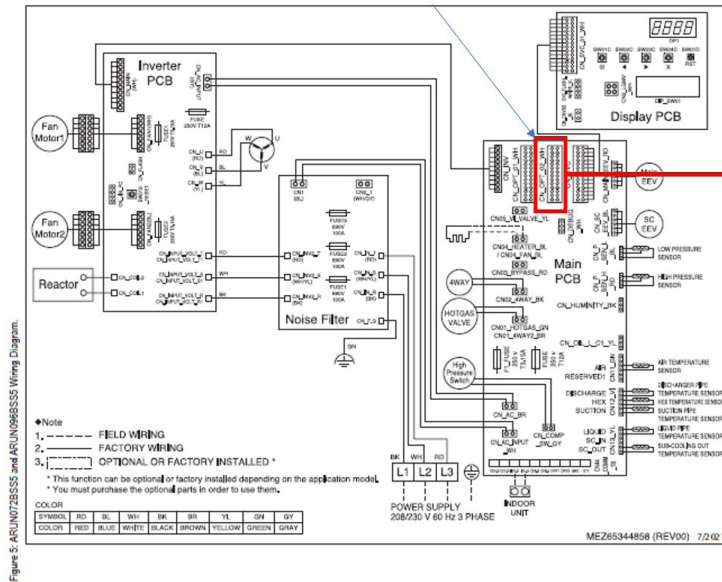
04:02: IDU (AHU Comm. Kit) air thermistor

04:03: Wired Controller and IDU

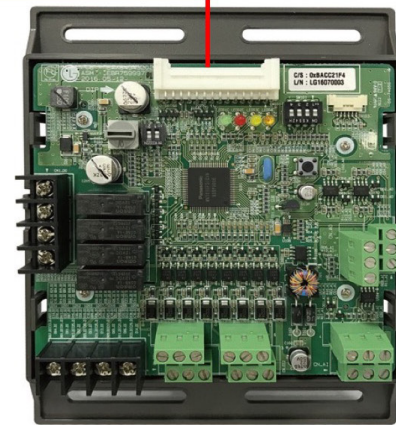
Multi V™ S with PRVC2

Multi V™ S 6 and 8 Ton (ARUN072BSS5 and ARUN096BSS5)

Socket to Connect PRVC2



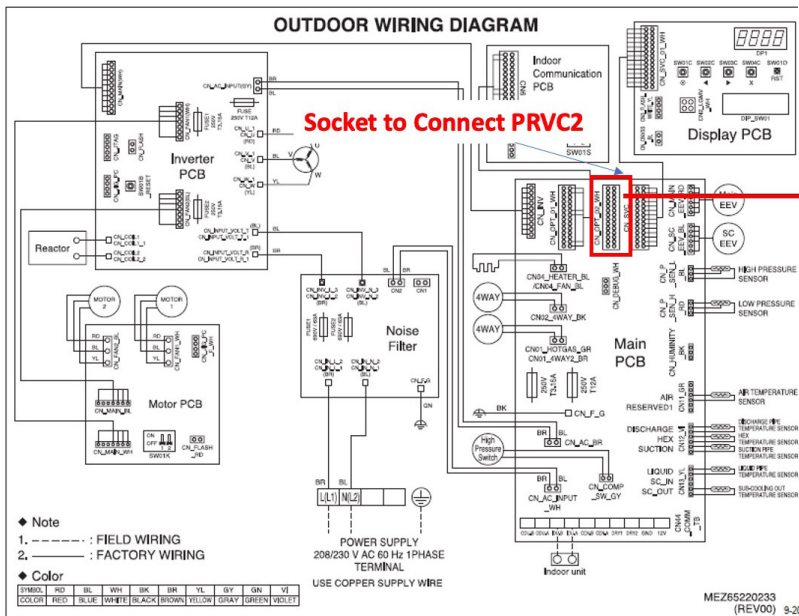
- Field fabricated bracket is required to mount PRVC2 inside Multi V™ S
- PRVC2 will only provide I/O function for 0-10 volt Signal in Multi V™ S



Multi V™ S 3, 4, and 5 Ton (ARUN036GSS5, ARUN048GSS5, and ARUN060GSS5)

OUTDOOR WIRING DIAGRAM

Socket to Connect PRVC2

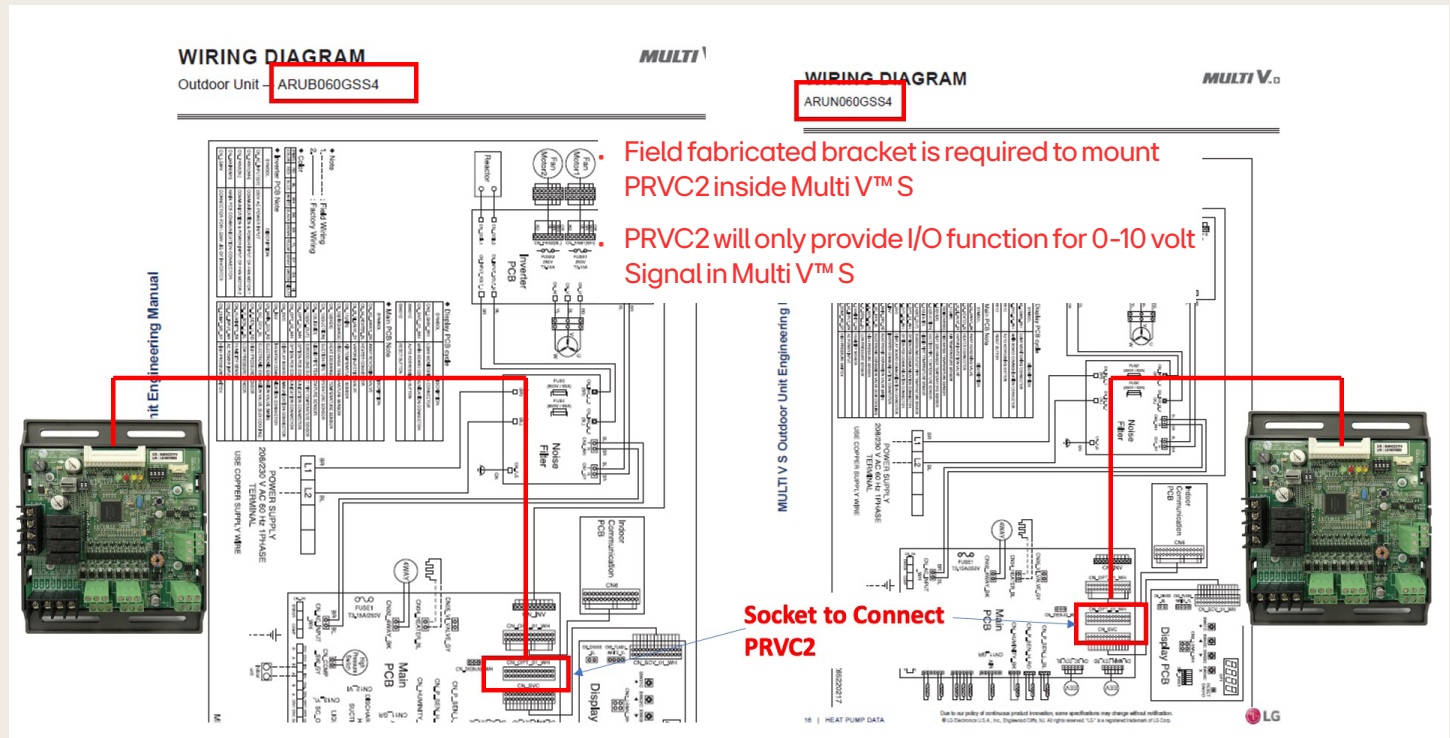


- Field fabricated bracket is required to mount PRVC2 inside Multi V™ S
- PRVC2 will only provide I/O function for 0-10 volt Signal in Multi V™ S



PRVC2 can be connected to Multi V™ S to provide 0 – 10 Volt signal for AHU Kit applications.

Multi V™ S 5 Ton (ARUB060GSS4 and ARUN060GSS4)



PRVC2 can be connected to Multi V™ S to provide 0 – 10 Volt signal for AHU Kit applications.

NOTES:



LG Electronics U.S.A., Inc.
Air Conditioning Technologies
4300 North Point Parkway, Alpharetta, GA 30022

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