Installation

Variable Refrigerant Flow (VRF) System
Mode Control Unit (MCU)

Models:

4MCUTV6A548B1A
4MCUTV4A548B1A
4MCUTV2A548B1A
4MCUTV1A548B1A

May 2017   **VRF-SVN42D-EN**

Ingersoll Rand®

Introduction

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants—including industry replacements for CFCs and HCFCs such as saturated and unsaturated HFCs and HCFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

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⚠ **WARNING**
Personal Protective Equipment (PPE) Required!
Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:
• **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
• **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
• **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

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Revision History

The second generation mode control unit series (4MCUTV1/2/4/6*) is introduced in this revision. In addition, errors have been corrected.
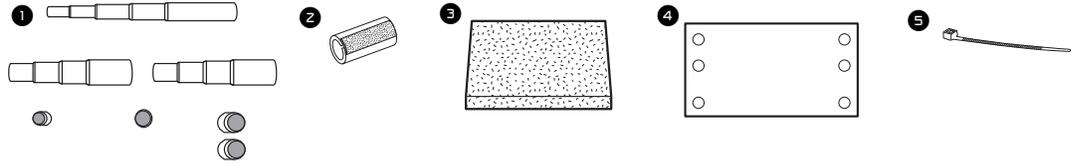
Table of Contents

Preparing for Installation

Components

Use the illustrations below to identify the components included with the mode control unit (MCU) kit.

❶	Pipe socket	❷	Pipe insulation	❸	Base insulation
❹	Template	❺	Cable ties		

Note: Y-joints must be purchased separately.

Indoor Unit Compatibility and Maximum Quantities

Figure 1. MCU compatibility with outdoor and indoor units

Outdoor Unit	MCU	Indoor Unit
4TVP*** 4TVR***	4MCUTV6A548B1A 4MCUTV4A548B1A 4MCUTV2A548B1A 4MCUTV1A548B1A	4TVB*** 4TVC*** 4TVD*** 4TVE*** 4TVL*** 4TVW*** 4TVX*** 4TVA*** 4TVM***

Table 1.   Maximum indoor unit quantities and capacity

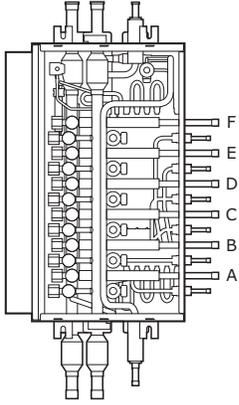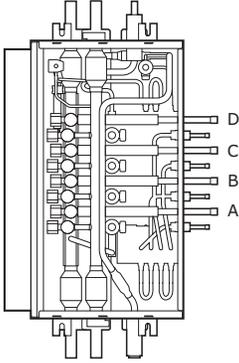|	4MCUTV6A548B1A	4MCUTV4A548B1A	4MCUTV2A548B1A	4MCUTV1A548B1A
Exterior of MCU models[a]				
Maximum number of indoor units at one port	8	8	8	8
Maximum number of indoor units (total)	32	32	16	8
The maximum capacity of the connectable indoor units at one port	54 MBH	54 MBH	54 MBH	54 MBH
The maximum capacity of the connectable indoor units at one port (with Y-joint)	108 MBH	108 MBH	108 MBH	—
The maximum capacity of the connectable indoor units (total)	216 MBH	216 MBH	108 MBH	54 MBH
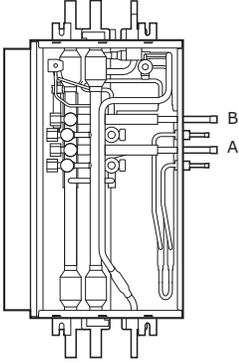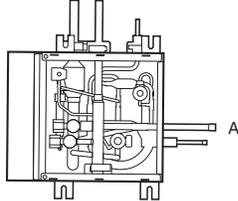
(a) Internal EEV is not included with MCU kits.

Location and Clearance Requirements

> ⚠ **CAUTION**
>
> **Avoid equipment damage and personal injury!**
>
> **Ensure that the ceiling is strong enough to support the weight of the unit. Before hanging the unit, test the strength of each of the attached suspension bolts.**

Select a location that can support the weight of the MCU and the indoor unit and that has strong vibration resistance and no slope.

Follow the space requirements given in the following illustration:
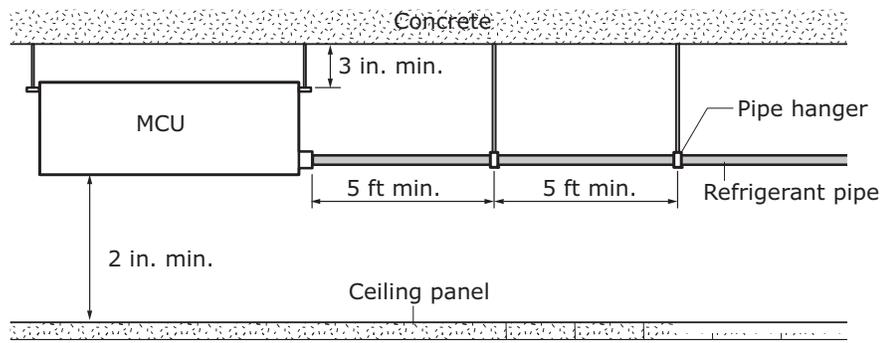
Ensure that the minimum service clearances exist.

Note: *Clearances listed in this manual are minimum for system operation. All installations shall comply with codes and standards adopted by the Authority Having Jurisdiction (AHJ).*
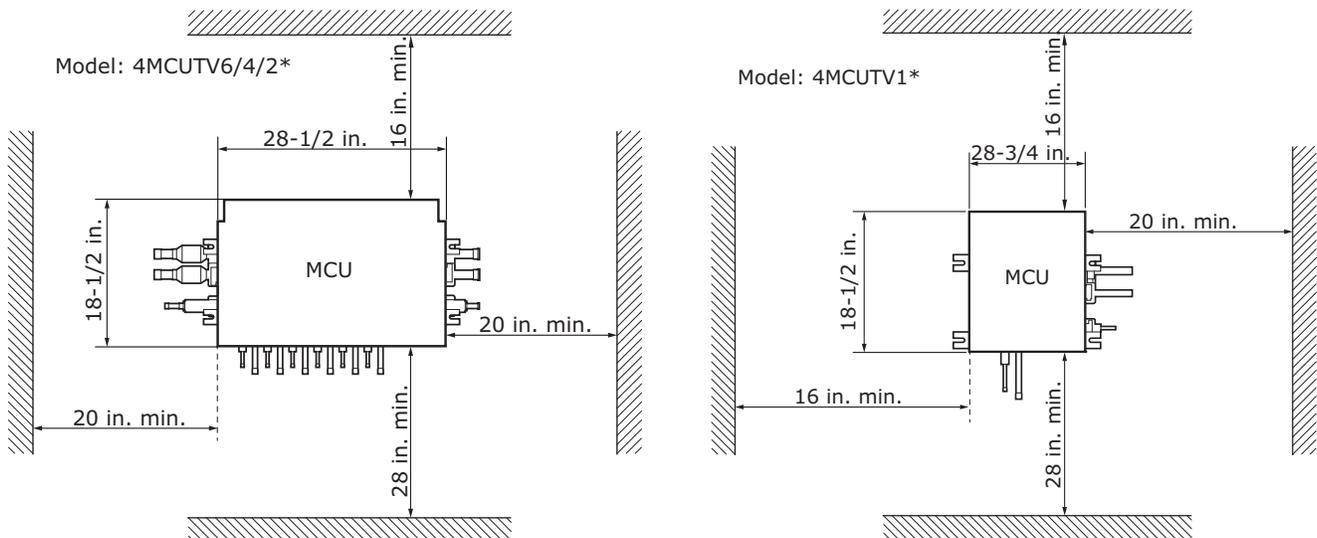
Installation

Follow the requirements and guidelines given in this section.

Installation Requirements

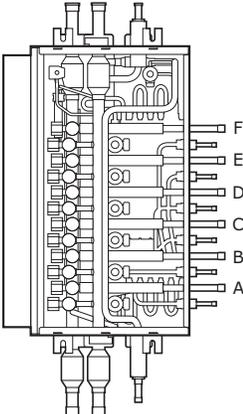|	4MCUTV6A548B1A	4MCUTV4A548B1A	4MCUTV2A548B1A	4MCUTV1A548B1A
MCU models with ports identified	F E D C B A	D C B A	B A	A
Indoor unit installation requirements	• For indoor unit capacity < 54 MBH: Connect the indoor unit liquid and gas pipes to a single MCU port. • For indoor unit capacity of 54–108 MBH, join two MCU ports (liquid and gas) with Y-joint and connect to indoor unit. • For continuous cooling at ambient conditions of < 23°F (–5°C), enable the outdoor unit installation option "Expand operational temperature range for cooling operation (HR only)" and use a Y-joint on an 18–54 MBH indoor unit. • A Y-joint can connect only the following port combinations: ports A and B, ports C and D port, ports E and F. • Non-connectable port combinations are ports B+ C, ports D + E, and any non-continuous ports. • MCU series connection maximum indoor unit capacity is 216 MBH. 			
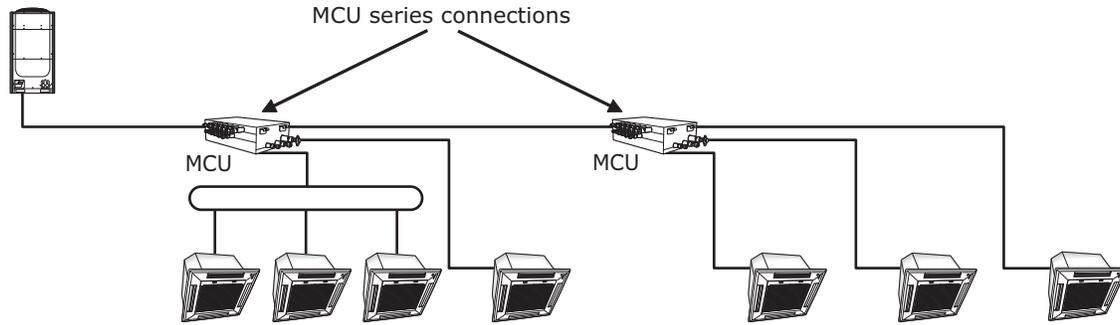
Mounting the Unit

To mount the unit:

1. Place the provided template on the spot where the unit is to be installed and mark the holes.

Note: *Since the template is made of paper, it may shrink or stretch slightly due to temperature or humidity. Before drilling holes, verify proper dimensions between the marks.*
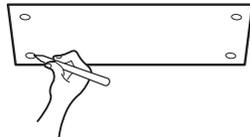
2. Determine the appropriate type of suspension bolts and anchors according to the ceiling type. Insert bolt anchors into existing ceiling supports (A) or construct a suitable support (B).
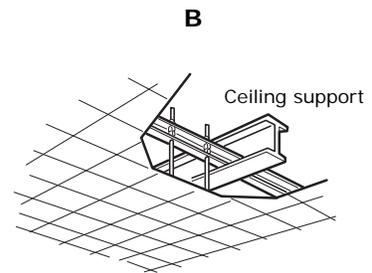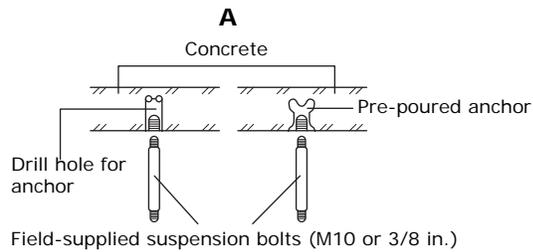
3. Install the suspension bolts at all four locations.

   • If the length of suspension bolt is more than 4.92 ft, use vibration-preventive measures.

   • If necessary, create an opening in the false ceiling that allows access to the unit to perform required operations.

   • If attaching the unit from a ceiling, use suspension bolts.

   • Make sure that all four corners are attached and that nuts and washers are used.

   • Use care to make sure the unit is not installed upside down.

4. Refer to the following illustrations.
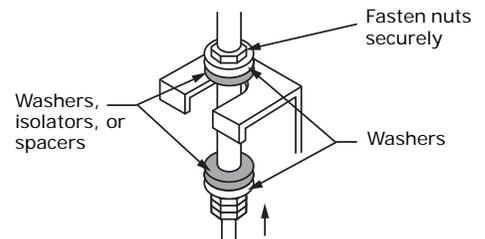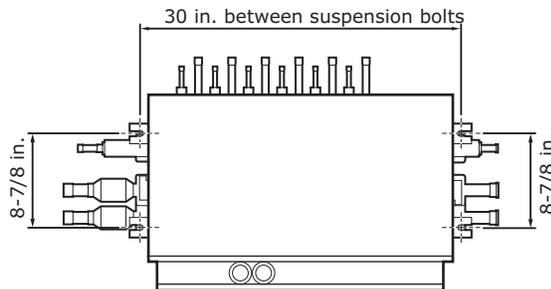
Installing Refrigerant Piping

Follow the requirements and guidelines presented in this section for MCU piping installation. For additional information on refrigerant pipe selection and installation, refer to the manual that is appropriate for the system type:

- For air-source systems, refer to VRF-SVN34*-EN.
- For water-source systems, refer to VRF-SVN070*-EN.

⚠ WARNING

Hazard of Explosion and Deadly Gases!

Failure to follow all proper safe refrigerant handling practices could result in death or serious injury. Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids.

NOTICE:

System Damage!

Failure to follow this procedure could result in system damage. If brazing is used for connecting pipes, a nitrogen purge is required to prevent the formation of copper oxides inside the piping.

NOTICE:

Avoid Unit Damage!

Failure to follow instructions coujld result in damage to the unit, capacity loss, and reduced long-term reliability. Do not braze pipe connections without performing nitrogen flushing.

For piping installation:

1. Cut or extend field-supplied piping as needed. To extend pipes, braze or using flared pipe connections (not supplied).
2. Make sure that pipes are free of dirt, debris, and moisture, and do not leak.
3. Connect piping.
    - Use brazed or use flared pipe connections, referring to the details given in in Figure 2.
    - When using a Y-joint to connect the indoor unit to an MCU, connect the Y-joint to the MCU in series, as shown in Figure 3.

Figure 2. Connecting refrigerant piping to the MCU

Side view

Pipe connections to outdoor unit

Ø1-1/8
Ø7/8 (4MCUTV1* only)

Protect with wet towel when welding

Ø1-1/8
Ø3/4 (4MCUTV1* only)

Pipe connection from outdoor unit
← (Default installation direction*)

Ø5/8
Ø1/2 (4MCUTV1* only)

Pipe connections to indoor unit

Gas pipe

Liquid pipe

Low pressure gas pipe connection (welding)

High pressure gas pipe connection (welding)

Liquid pipe connection (welding)

*When connecting the MCU to outdoor units, the default direction is set on the MCU. If installing in the opposite direction from default, weld the enclosed copper cap in each high pressure, low pressure, and liquid pipes.

Φ3/8
Φ5/8

Liquid pipe (welding)   Gas pipe (welding)
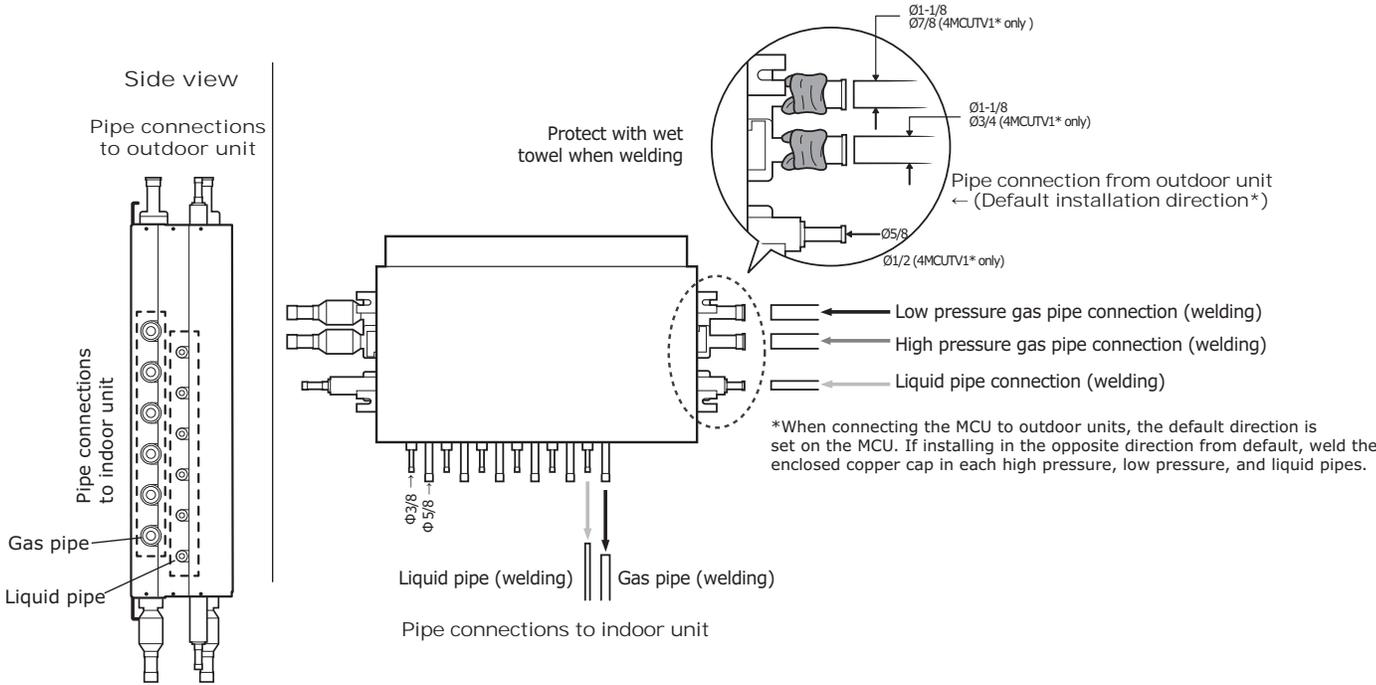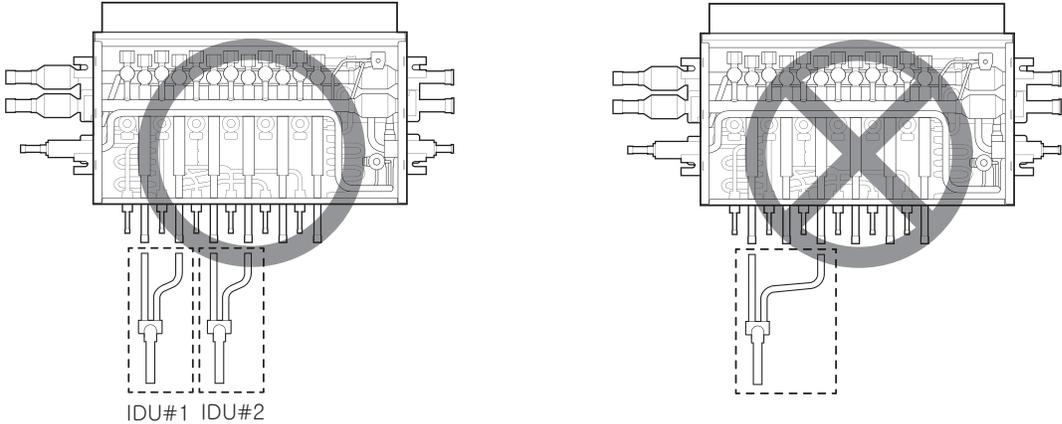
Pipe connections to indoor unit

Figure 3. Connect Y-joint in series to MCU

IDU#1 IDU#2

Electrical Wiring

Observe the following precautions when making electrical connections.

⚠ WARNING
Hazardous Voltage!
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

NOTICE
Use Copper Conductors Only!
Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

- Make all electrical connections in accordance with electrical codes and ordinances.
- Select the power cable in accordance with relevant local and national regulations.
- Wire size must comply with local and national code.
- Use grade H07RN-F or H05RN-F power cable.
- Connect the power cable into the power cable terminal and fasten it with a clamp.
- Unbalanced power must be maintained within 10% of supply rating among whole indoor units.
- Significantly unbalanced power may shorten the life of the system. If the unbalanced power is greater than 10% of supply rating, the unit will stop and an error code will be generated.
- Connect the power cable to the auxiliary circuit breaker. An all-pole disconnection from the power supply must be incorporated in the fixed wiring (1/8 in.).
- All wiring must be protected from weather and damage.
- Maintain a distance of 2 in. or more between power and communication cables to prevent interference.
- Maintain a voltage drop of less than 10% between the power source and the unit(s).
- Use an appropriate screwdriver for tightening the terminal screws. A screwdriver with a small head will strip the head and make proper tightening impossible.
- Over-tightening the terminal screws may break them.
  Tightening torque for M4 screws: 0.86–1.06 lbf·ft.
- After making a knockout hole, apply rust-preventive paint to the bare metal around the hole.
- Secure the cable conduit to the outdoor knockout using the proper connector and bushing.

Power

Supply 208–230 V power separately to MCU through terminals L and N. Refer to Figure 4.

Communication

Connection the communication cable indoor units and outdoor unit to terminals F1 and F2. Refer to Figure 4.

Figure 4. MCU wiring terminal connections: three examples
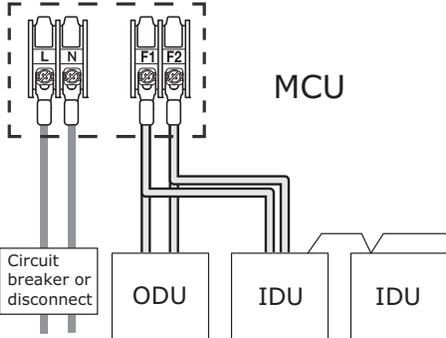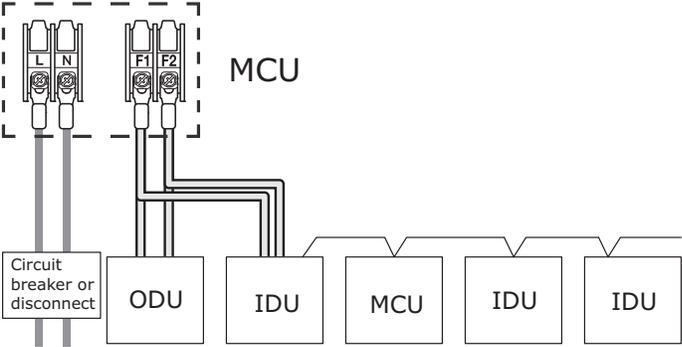
MCU

Circuit breaker or disconnect

ODU   IDU   IDU

220–240 V/208–230 V/Single phase
(supply separately)

MCU

Circuit breaker or disconnect

ODU   IDU   MCU   IDU   IDU

220–240 V/208–230 V/Single phase
(supply separately)

MCU

Circuit breaker or disconnect

ODU   MCU   IDU   IDU   IDU
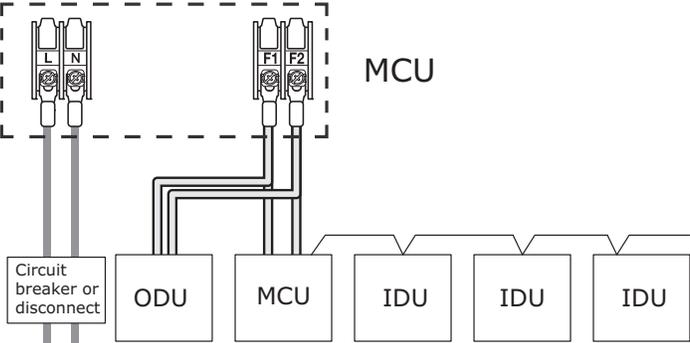
220–240 V/208–230 V/Single phase
(supply separately)

Control System

Figure 5 identifies DIP switches and the rotary address switches on the MCU control board.

⚠ **WARNING**

Hazardous Voltage!

Before making contact with the inverter circuit board, wait for at least 15 minutes after powering down the outdoor unit to allow the unit to fully discharge high DC voltage. Failure to allow the high DC voltage to discharge completely could result in death or serious injury.

Figure 5. MCU control board

DIP switches for IDU use ———   ——— DIP switches for Y-joint use

Rotary switches for —— setting MCU address
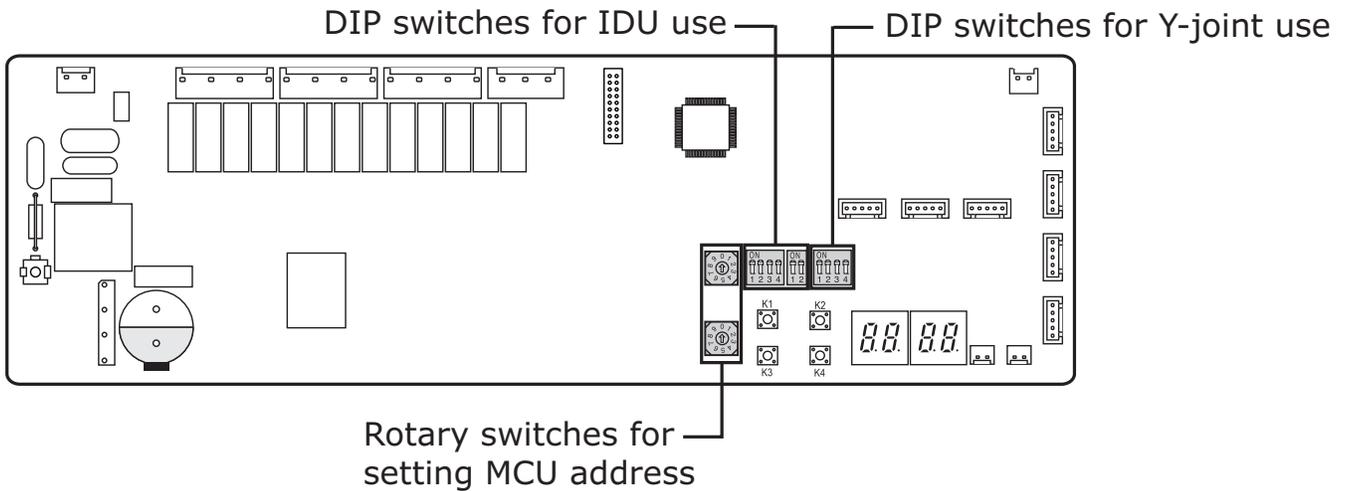
Setting the MCU Address

Use the two rotary switches on the MCU control board to set the MCU address. Example: To set the MCU address to "21," set the top rotary switch to "2" and the bottom rotary switch to "1."

MCU Address   MCU Address

Default   Setting MCU address to "21"
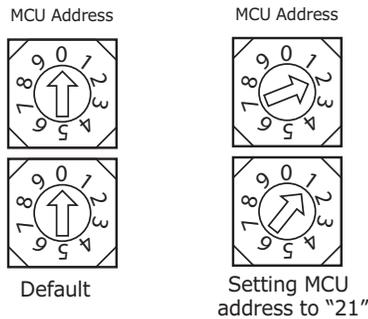
Setting MCU Port Addresses

Set the DIP switches on the MCU control board to **ON/OFF** to correspond to the MCU ports A–F that are **connected/not connected** to indoor units. (Refer to Figure 5, p. 14 for DIP switch location.)

Ports Connected to Indoor Unit Gas and Liquid Pipes

For example, if indoor units are **connected** at ports A, B, C, and F, set DIP switches 1, 2, 3, and 2 to **ON**, as shown in the example:

Example:
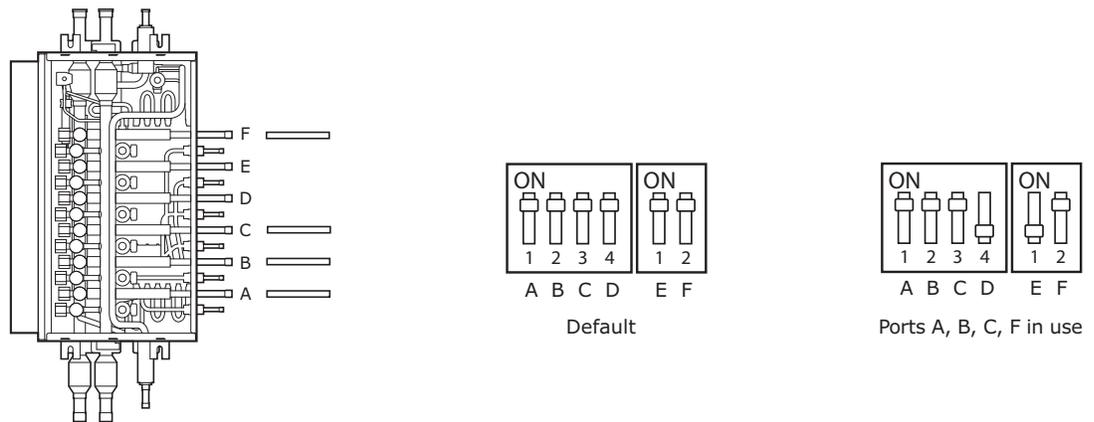
Ports Connected to Indoor Units by Y-Joints

Set the DIP switches on the MCU control board that are dedicated to Y-joint use (see Figure 5, p. 14) to **OFF** as shown in the following table and example:

- Connectable port combinations are A+B, C+D, and E+F.
- Non-connectable port combinations are B+ C, D + E, and any non-continuous ports.

DIP switch	Y-joint connected to . . .
S/W 1: **OFF**	A+B port
S/W 2: **OFF**	C+D port
S/W 3: **OFF**	E+F port
S/W 4: **ON** (default)	Unused
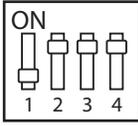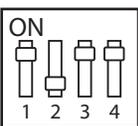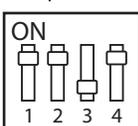
Setting MCU and Port Addresses on Indoor Units

Any of the following control devices can be used to manually set MCU and port addresses on indoor units:

- Technician Utilities Tool (TUT) (strongly recommended)
- VRF Wireless Remote Control
- VRF Wired Remote Control (TVCTRLTWRWD02* or (TVCTRLTWR0002*)

Note: *To automatically set MCU and port addresses (applies to 2nd generation MCUs only [model 4MCUTV*]), refer to "Automatic Port Addressing Operation" in the Outdoor Unit IOM (VRF-SVN34D or a more recent edition).*

Using the Technician Utilities Tool (TUT) to Set Addresses

To set MCU and port addresses on indoor units with the TUT, go to **Add-on** > **Change address**. For more detailed *instructions, see the TUT Help.*

Using the Wireless Remote Controller to Set Addresses

To set MCU and port addresses on indoor units with the wireless remote controller:

1. Turn on the indoor unit and the wireless remote control.
2. Enter the option setting mode on the remote control.
3. Set the address of each MCU port that is connected to an indoor unit by referring to Table 2. (You can also set the address of each indoor unit using this procedure.)

Note: *To automatically set MCU and port addresses, see "Automatic Port Addressing Operation" in the Outdoor Unit IOM: VRF-SVN34D-EN or a more recent edition.*

Table 2.   Wireless remote controller: procedure for setting MCU, port, and indoor unit addresses

Option	Digit 1	Digit 2	Digit 3	Digit 4	Digit 5	Digit 6
Value	0	A: Address setting mode	0: The address of the indoor unit will not be set. 1: The address of the indoor unit will be set.	0 to 9: Hundreds digit of the indoor unit address	0 to 9: Tens digit of the indoor unit address	0 to 9: Units digit of the indoor unit address
Option	**Digit 7**	**Digit 8**	**Digit 9**	**Digit 10**	**Digit 11**	**Digit 12**
Value	1	0	0: No RMC address. 1: RMC address setting mode.	0	0 to F: RMC group channel	0 to F: RMC group address
Option	**Digit 13**	**Digit 14**	**Digit 15**	**Digit 16**	**Digit 17**	**Digit 18**
Value	2	0	0: No MCU address. 1: MCU address setting mode.	0 to 1: Tens digit of MCU address	0 to 9: Units digit of MCU address	A to F: MCU port address
Option	**Digit 19**	**Digit 20**	**Digit 21**	**Digit 22**	**Digit 23**	**Digit 24**
Value	3	0	0	0	0	0

Note: For example, if the indoor unit whose address is not yet set is connected to port A on the MCU 1, set 0A0000-100000-20101A-300000. If the indoor unit whose address is set to "9" is connected to port B on the MCU 2, set 0A1009-100000-20102B-300000.

Using the Wired Remote Controller to Set Addresses

To set MCU and port addresses on indoor units with the wired remote controller (TVCTRLTWRWD02*):

1. Press the **Delete** and **Set** buttons simultaneously for > 3 seconds to enter configuration mode. The main menu will flash "1".

2. Assign an indoor unit MCU port address using main menu 4, sub-menu 7. (The MCU address is assigned to Digit 12; the port address is assigned to Digit 4.)

Note: *For more detailed instructions, refer to the installation manual: VRF-SVN59C-EN (or a more recent revision).*

Figure 6. Wired remote controller display
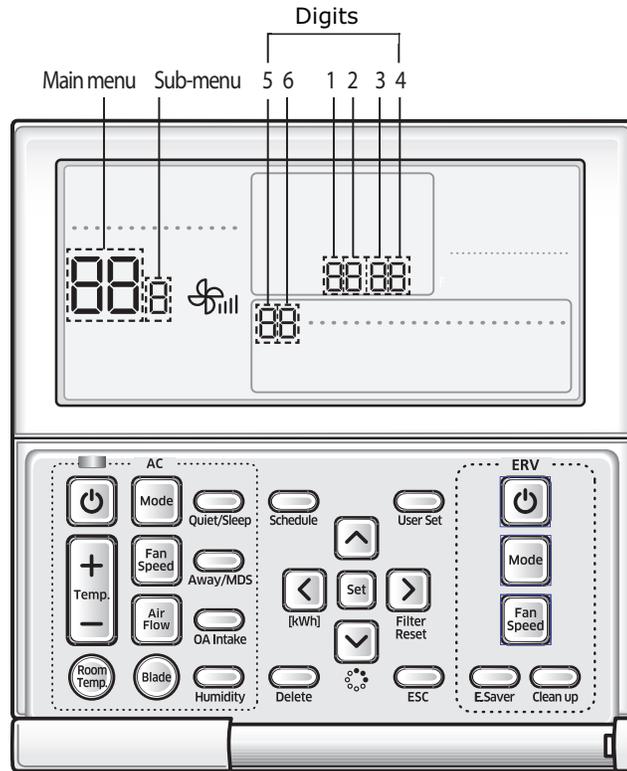
Using the Simple Touch Wired Remote Controller to Set Addresses

To set MCU and port addresses on indoor units with the simple touch wired remote controller (TVCTRLTWR0002*):

1. Access the configuration screen by pressing the top right (hidden) button for >3 seconds.

2. Press the **+**/**–** buttons to select "3". Then press **OK**.
   The display will change to the configuration screen and the main menu will flash "0".

3. Assign an indoor unit MCU port address using main menu 4, sub-menu 7. (The MCU address is assigned to Digit 12; the port address is assigned to Digit 4.)

Note: *For more detailed instructions, refer to the installation manual: VRF-SVN077*-EN.*

Figure 7.   Wireless remote controller display
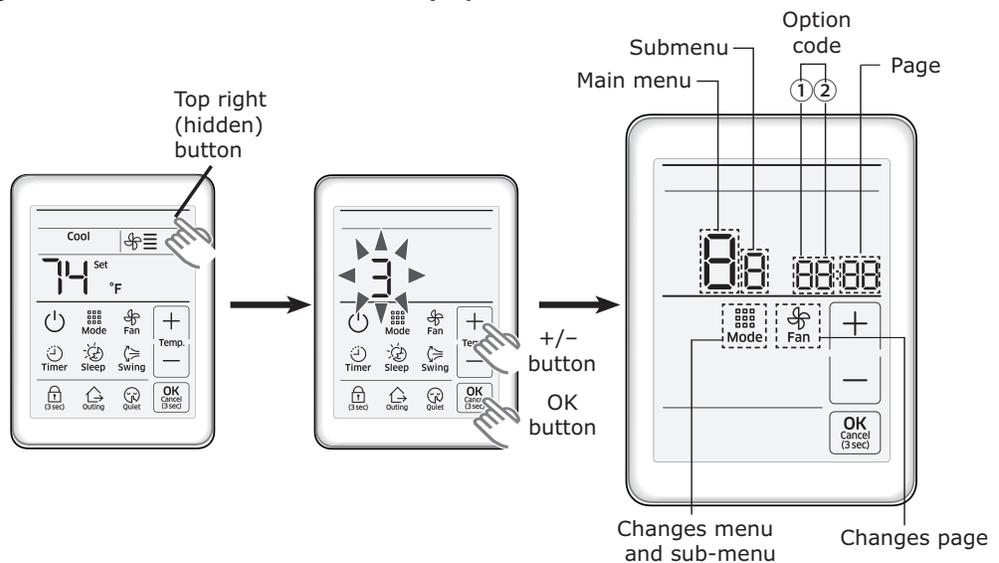
Settings on Direct-Connected Indoor Units (Without MCUs)

The installation option setting that enables Cooling Only is required for direct-connected indoor units without MCUs, as shown in the illustration below.
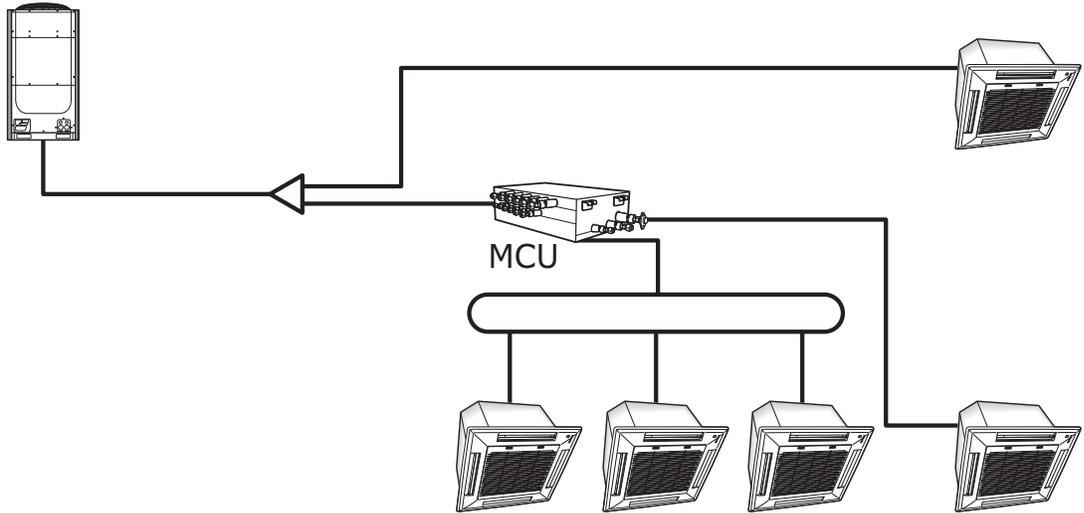
1. Set Installation Option #2 Digit 3 to a value of "2" as shown below in the Cooling Only required setting:

Default:	050000 - 100000 - 20000 - 30000
Cooling Only required setting:	052000 - 100000 - 20000 - 30000

Monitoring System Settings

Figure 8.   MCU control board: Buttons K1, K2, K4

K1 ⧈ ⧈ K2

⧈ ⧈ **K4**

Button K1 is used to monitor MCU status. Table 3 shows the settings that correspond to each K1 button press, and provides an example for each setting.

Table 3.   Button K1: MCU status

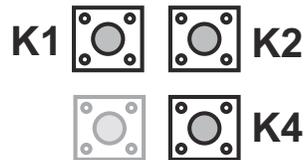| Number of times button K1 is pressed	Setting	7-segment display examples				Explanation
		1	**2**	**3**	**4**	
1	MCU address	0	Blank	0	0	MCU address 0
			Blank	0	1	MCU address 1
			Blank	0	2	MCU address 2
			Blank	1	1	MCU address 11
			Blank	1	5	MCU address 15
2	Mode switching EEV1 step	1	4	8	0	Example) 480 steps
3	Mode switching EEV2 step	2	4	8	0	Example) 480 steps
4	Mode switching EEV3 step	3	4	8	0	Example) 480 steps
5	Mode switching EEV4 step	4	4	8	0	Example) 480 steps
6	Mode switching EEV5 step	5	4	8	0	Example) 480 steps
7	Mode switching EEV6 step	6	4	8	0	Example) 480 steps
8	Subcooler EEV step	7	4	8	0	Example) 480 steps
9	Subcooler-in sensor temperature	8	—	0	1	Example) 30.2°F (-1°C)
			Blank	1	0	Example) 50.0°F (10°C)
10	Subcooler-out sensor temperature	9	—	0	1	Example) 30.2°F (-1°C)
			Blank	1	0	Example) 50.0°F (10°C)
11	On/Off for solenoid valve A_C[a], A_H[b]	A				
12	On/Off for solenoid valve B_C, B_H	B				
13	On/Off for solenoid valve C_C, C_H	C	—	Cool: On:1 Off:0	Heat: On:1 Off:0	—
14	On/Off for solenoid valve D_C, D_H	D				
15	On/Off for solenoid valve E_C, E_H	E				
16	On/Off for solenoid valve F_C, F_H	F				
17	On/Off for liquid by pass solenoid valve	G	Blank	0	N	Example) On
			0	F	F	Example) Off
18	Version	8	A	2	0	Example) October 20, 2008
19	End of K1 display					

(a)   *_C: Cooling solenoid valve at port*. Applies to button K1 pressed 11–17 times.

(b)   *_H: Heating solenoid valve at port*. Applies to button K1 pressed 11–17 times.

Button K2 is used to display indoor unit addresses. Table 4 provides details and examples.

Table 4.   Button K2: Indoor unit address

Number of times button K2 is pressed	Displayed setting	7-segment display examples				Explanation
		1	2	3	4	
1	Address of indoor unit connected to port A	A	-	0	0	Indoor unit address at port is "0"
2	Address of indoor unit connected to port B	B	-	0	3	Indoor unit address at port B is "3"
3	Address of indoor unit connected to port C	C	-	0	6	Indoor unit address at port C is "6"
4	Address of indoor unit connected to port D	D	-	0	9	Indoor unit address at port D is "9"
5	Address of indoor unit connected to port E	E	-	1	1	Indoor unit address at port E is "11"
6	Address of indoor unit connected to port F	F	-	1	5	Indoor unit address at port F is "15"
7	End of K2 display					

Button K4 is used to manually test electronic solenoid valves. Refer to Table 5.

Note: *During the test, the valve operates according to the number of times K4 is pressed, irrespective of the indoor unit operating mode.*

Table 5.   Button K4: Manual electronic solenoid valve test

Number of times button K4 is pressed	Setting	7-segment display			
		1	2	3	4
1	A_C valve ON, other valves Off	P	A	1	0
2	A_H valve ON, other valves Off	P	A	0	1
3	B_C valve ON, other valves Off	P	B	1	0
4	B_H valve ON, other valves Off	P	B	0	1
5	C_C valve ON, other valves Off	p	C	1	0
6	C_H valve ON, other valves Off	P	C	0	1
7	D_C valve ON, other valves Off	P	D	1	0
8	D_H valve ON, other valves Off	P	D	0	1
9	E_C valve ON, other valves Off	P	E	1	0
10	E_H valve ON, other valves Off	P	E	0	1
11	F_C valve ON, other valves Off	P	F	1	0
12	F_H valve ON, other valves Off	P	F	0	1
13	Liquid b/p valve ON, other valves Off	P	S	0	1
14	Liquid b/p valve ON, other valves Off	P	Communication data display		
Note: To return to normal operation, push button K1 once.					

Commissioning

After installing the MCU, check each item listed below to make sure it has been completed. Details about each item can be found in this manual or in the outdoor unit manual (VRF-SVN34D or a more recent version).

Item	Check
Leak test has been completed successfully.	
The MCU has been securely installed so that there is no danger of falling or of vibration.	
Pipes and pipe connections have been insulated properly.	
Refrigerant R-410A has been charged.	
Electrical wiring: Ensure that prescribed wiring has been used and supplied power per local codes.	
Power and communication wiring function properly.	
MCU has been installed correctly (right side up).	
Electrical grounding has been properly installed per local code.	
Clearances between walls, ceiling concrete, and ceiling panels have been complied with.	
Hangers support piping at intervals of 4.92 ft.	
Additional refrigerant has been correctly calculated and charged.	

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