DAIKIN
AIR INTELLIGENCE

VRV

BUILDING AUTOMATION APPLICATION GUIDE

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About Daikin:

Daikin Industries, Ltd. (DIL) is a global Fortune 1000 company, which celebrated its 95th anniversary in May 2019. The company is recognized as one of the largest HVAC (Heating, Ventilation, Air Conditioning) manufacturers in the world. DIL is primarily engaged in developing indoor comfort products, and refrigeration systems for residential, commercial, and industrial applications. Its consistent success is derived, in part, from a focus on innovative, energy-efficient, and premium quality indoor climate and comfort management solutions.

A WORLD LEADING MANUFACTURER OF HVAC PRODUCTS

FOUNDED IN 1924

OVER 60,000 DAIKIN VRV SYSTEMS
OPERATING
THROUGHOUT NORTH AMERICA

RESEARCH & DEVELOPMENT
OVER $300 MILLION

BUILDING AUTOMATION APPLICATION GUIDE

Contents

Introduction

The Daikin *VRV* (Variable Refrigerant Volume) control system consists of zone controllers, centralized controllers, and BMS (Building Management System) Interfaces. The customizable Daikin control system is built around the *VRV* system and does not require any advanced field engineering (such as programming of refrigerant or compressor control) for the control of the *VRV* system except for field settings configurations.

The Daikin BMS Interfaces can be used for monitoring, scheduling, control, and interlock operation of *VRV* indoor units. A BMS can be used in conjunction with the Daikin controllers to share some of the workloads to reduce project costs. The Daikin *VRV* system can be integrated with the BMS, regardless of the open protocol (BACnet™, LonWorks® or Modbus®) used by the BMS. The *VRV* control system uses DIII-NET communication, which is a proprietary communication protocol developed by Daikin. The Daikin BMS Interfaces act as interpreters between the BMS system and Daikin's DIII-Net system.

The integration of *VRV* into a BMS is typically the last step undertaken in a project. There is a possibility of issues (such as controlling auto-changeover, conflict between BMS and Daikin controllers) arising that require attention, and this can cause delays at the critical stage of the project. It is possible to avoid issues or delays that could occur during integration by following the steps, laid out in this guide, during the project. The purpose of this guide is to demonstrate how to successfully integrate the *VRV* system with a BMS system. It also introduces the capabilities of control available through the Daikin BMS Interfaces options. It is vital for any project team (sales, engineers, and contractors) to make themselves familiar with the information in this guide to achieve a smooth integration between the systems.

This application guide introduces different approaches to integrate *VRV* with a BMS and discussed various building automation interfaces available from Daikin such as:

(1) *intelligent Touch Manager (iTM)* with *BACnet* Server/Gateway option (utilizes *BACnet* /IP communication)

(2) *BACnet* Interface (utilizes *BACnet* /IP communication)

(3) *Modbus* Adaptor (utilizes *Modbus* RTU communication)

(4) *LonWorks* Interface (utilizes with *LonWorks* networks)

(5) Dry contact adaptors (used for small projects)

The guide helps to understand integrating various Daikin HVAC equipment such as:

(1) *VRV* Indoor unit

(2) Daikin Zoning Kit (DZK)

(3) Daikin Dedicated Outside Air System (DOAS)

(4) Daikin Mini and Multi-split

intelligent Touch Manager with BACnet™ Server Option (DCM014A51)

The *intelligent Touch Manager (iTM)* can serve as a *BACnet* interface for Building Management System (BMS) integration. The *iTM BACnet* Server Gateway option (DCM014A51) will provide BMS integrators with the ability to monitor and control the *VRV* indoor units via the BACnet/IP protocol. The *iTM BACnet* Server Gateway option eliminates the need for an additional hardware interface for the BMS to monitor and control a *VRV* system. The *iTM BACnet* Server Gateway option provides seamless control-logic integration between the *iTM* and BMS.
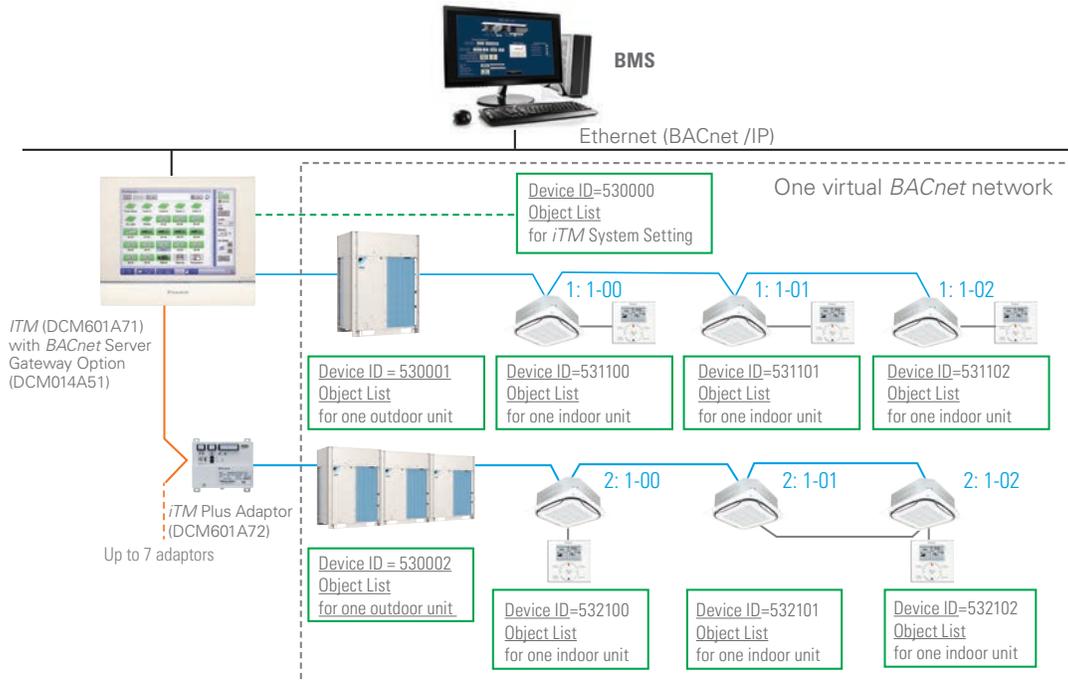
Up to 128 indoor unit and outdoor unit management points can be controlled and monitored through the *iTM BACnet* Server Gateway. The *iTM BACnet* Server software is compatible with the *iTM* Plus Adaptors. The *iTM* Plus Adaptor is intended for use with the *iTM* and shall not be used independently.

Features

» Direct connection on *iTM* using the BACnet/IP Protocol.

» *BACnet* virtual router function implemented: Individual *BACnet* device ID assigned to each indoor unit group address and compatible outdoor unit.

» Indoor unit group names created in the *iTM* are visible on the BMS.

» Easy commissioning using CSV file.

» Available objects can be configured for each indoor unit.

» Support Change of Value (COV) notifications to BMS.

» Configurable as a *BACnet* foreign device if BBMD exists on a different subnet within *BACnet* network.

» Independent heating and cooling Setpoints for occupied and unoccupied periods.

» Individual min/max Setpoint Range Limitation for heat and cool modes.

» The *iTM's* auto-changeover, Setpoint range limitation, setback, dual Setpoint logic, and schedule can be accessed by the BMS.

» Monitor the operation of *VRV* indoor units and outdoor units.

Points List

#	Point Name	Point Description
System Configuration Points for *iTM*		
1	Enable *iTM* Schedule Operation	Enable or Disable *iTM* Schedule operation
2	Enable *iTM* Auto Changeover Operation	Enable or disable *iTM* Auto changeover logic.
3	Timed Override Minutes	Set override time in minutes
4	System Forced Off	The System Forced Off command will force the indoor unit to stop running. Remote controllers will be locked out from restarting the indoor units during the forced system stop event.

#	Point Name	Point Description
Monitoring Points		
1	Unit On_Off Status	Monitors if the indoor unit fan is On or Off
2	Alarm Status	Monitors whether or not the indoor unit is operating normally and issues an alarm if the indoor unit has a malfunction. Error Code is shown in the description property of the *BACnet* point.
3	Room Temperature	Monitors and displays the room temperature.
4	Unit On Details	Indoor unit details operation Off - Normal (ON) - Override - Setback
5	Filter Sign Status	Monitors filter run time and provides service alert.
6	Indoor Fan Status	Monitors if the indoor unit fan is On or Off
7	Communication Status	Monitor if the communication is Normal or in Alarm
8	Thermo-on Status	Monitors whether or not the indoor unit is actively cooling or heating.
9	Compressor Status	Monitors if the compressor of the outdoor unit is On/Off/Defrost
10	Aux Heater Status	Monitors if the external heater controlled by the indoor unit is operating.
11	Changeover Option	Monitor if *iTM* changeover logic is Active.
12	Return Air Temperature	Monitors and displays the return air temperature.
13	Discharge Air Temperature	Monitors and displays the discharge air temperature of the FXMQ_P(B) indoor unit only.
14	Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature.
15	Gas Pipe Temperature	Monitors and displays the gas pipe temperature.
16	EV Position	Monitors and displays the expansion valve position.
17	Freeze Protection	Monitors if the freeze protection is active (For FXEQ_P, FXFQ_T, FXTQ_TA, FXUQ_P, FXZQ_TA, FXSQ_TA, CXTQ_TA indoor unit only).

Points List

Control Points		
#	**Point Name**	**Point Description**
1	Occupancy Mode	Set the occupancy of the indoor unit Occupied, Unoccupied or Standby
2	Operation Mode	Set Cool - Heat - Fan - Dry operation mode. for the indoor unit and monitors the latest mode
3	Occ Cooling Setpoint	Sets the occupied cooling Setpoint of the indoor unit and monitors the latest Setpoint value.
4	Occ Heating Setpoint	Sets the occupied heating Setpoint of the indoor unit and monitors the latest Setpoint value.
5	Unocc Cooling Setpoint	Sets the unoccupied cooling Setpoint of the indoor unit and monitors the latest Setpoint value.
6	Unocc Heating Setpoint	Sets the occupied heating Setpoint of the indoor unit and monitors the latest Setpoint value.
7	Max Cooling Setpoint	Sets the maximum cooling Setpoint of the indoor unit and monitors the latest Setpoint value.
8	Min Cooling Setpoint	Sets the minimum cooling Setpoint of the indoor unit and monitors the latest Setpoint value.
9	Max Heating Setpoint	Sets the maximum heating Setpoint of the indoor unit and monitors the latest Setpoint value.
10	Min Heating Setpoint	Sets the minimum heating Setpoint of the indoor unit and monitors the latest Setpoint value.
11	Min Setpoint Differential (Cooling & Heating)	Set the minimum differential value between cooling and heating Setpoint and monitor the latest differential value.
12	Cooling & Heating Setpoint Tracking Mode	Enable or disable *iTM* Setpoint tracking mode.
13	Fan speed	Sets the indoor unit fan speed and monitors the latest setting
14	Timed Override Operation	Enable or disable *iTM* override timer
15	Remote Controller Prohibit (On_Off)	Permits or prohibits the remote controller to control the indoor unit's On/Off.
16	Remote Controller Prohibit (Operation Mode)	Permits or prohibits the remote controller to control the indoor unit's Operation mode.
17	Remote Controller Prohibit (Setpoint)	Permits or prohibits the remote controller to control the indoor unit's Setpoint.
18	Filter Sign Reset	Clears the filter sign status.
19	Forced Thermo-off	Force the indoor unit to stop actively cooling or heating.

Points List

#	Point Name	Point Description
	General Outdoor Unit Points List	
1	Communication Status	Monitors and displays the communication status
2	Operation Mode	Monitors and displays the operation mode (Cool, Heat, Fan or Heat &Cool)
3	Outdoor Unit Alarm Status	Monitors whether or not the outdoor unit is operating normally.
4	Defrost Mode	Monitors if the defrost mode is active.
5	Oil Return Mode	Monitors whether or not the outdoor unit is in oil return operation.
6	Electric Power	Monitors and displays the electric power. Calculated
7	Electric Current	Monitors and displays the electric current.
8	System Capacity Code	Monitors and displays the system capacity code.
9	Outdoor Air Temperature	Monitors and displays the outdoor air temperature.

#	Point Name	Point Description
	Module Specific Outdoor Unit Points list; Available for Each Module	
1	Condensing Pressure	Monitors and displays the condensing pressure
2	Evaporating Pressure	Monitors and displays the evaporating pressure
3	Condensing Temperature	Monitors and displays the condensing temperature
4	Evaporating Temperature	Monitors and displays the evaporating temperature
5	Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor 1
6	Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor 2
7	Fan Step	Monitors and displays the fan step
8	EV Position 1	Monitors and displays the position of the expansion valve 1
9	EV position 2	Monitors and displays the position of the expansion valve 2
10	Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor 1
11	Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor 2
12	Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature
13	Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX
14	Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX
15	Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer
16	Gas Pipe Temperature (HX Upper)	Monitors and displays the gas pipe temperature for the upper HX
17	Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX
18	Suction Temperature	Monitors and displays the suction temperature
19	Compressor Suction Temperature	Monitors and displays the compressor's suction temperature
20	Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature
21	Subcool Outlet temperature	Monitors and displays the subcool outlet temperature
22	Subcool EV Position	Monitors and displays the subcool expansion valve position

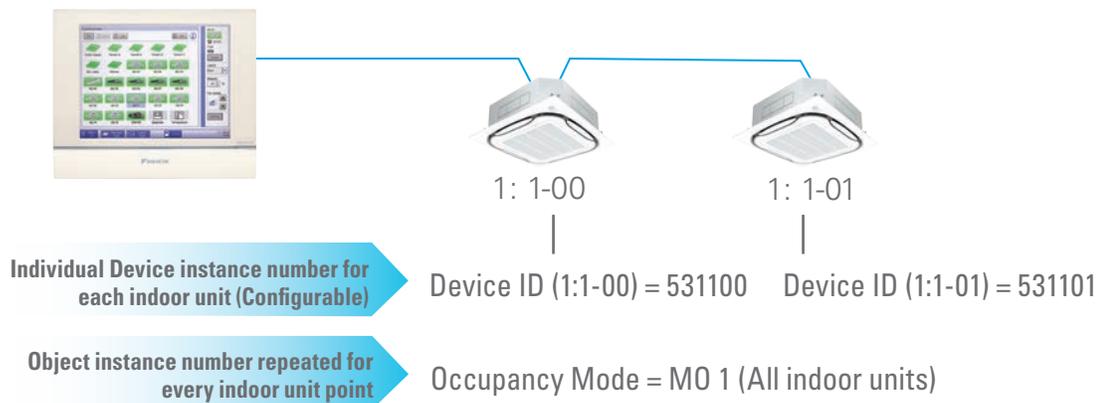# *intelligent Touch Manager* with BACnet™ Server Option (DCM014A51)

Virtual Router Function

The *iTM* with *BACnet* Server provides a virtual router function which enables the following:

» Individual Device Instance number for each indoor unit management point.

» Individual Device instance number for each outdoor unit management point.

Thanks to the virtual router function, it is possible to assign individual device instance numbers which allow the integrator to identify indoor units & outdoor units while also allowing the integrator to replicate their programming and graphics. Since the integrator can reproduce their work, it significantly reduces the programming load and reduces the cost to integrate.

Enhanced BMS Integration Solution for Indoor Unit Operation

1: 1-00   1: 1-01

Individual Device instance number for each indoor unit (Configurable)

Device ID (1:1-00) = 531100   Device ID (1:1-01) = 531101

Object instance number repeated for every indoor unit point

Occupancy Mode = MO 1 (All indoor units)

iTM Native Programming

One of the biggest advantages of using the *iTM* as a *BACnet* server is that it's native programming can be utilized to reduce the programming; the following programming has already been implemented in the *iTM*.

1. Auto-changeover (Refer Appendix-1 for auto changeover Logic)
2. Setback (Appendix-2 for auto setback logic)
3. Afterhours override timer
4. Email alerts
5. Setpoint range limitation
6. Dual Setpoints
7. Setpoint tracking and minimum differential
8. Remote controller prohibits

Operation Data

The *iTM* offers indoor unit and outdoor unit operation data which can be used to trend and program service alerts and create a backup for troubleshooting. Six additional points for each indoor unit (depending on indoor unit model type) and over 17 points per outdoor unit module are available such as Compressor Speed, Liquid Pipe Temp, Gas Pipe Temp, Condensing Pressure, Evaporating Pressure, Oil Return Mode, Electric power, Electric Current, Outside Air Temperature.

The following is an example of the implementation of outdoor unit operation data graphics created on the BMS.
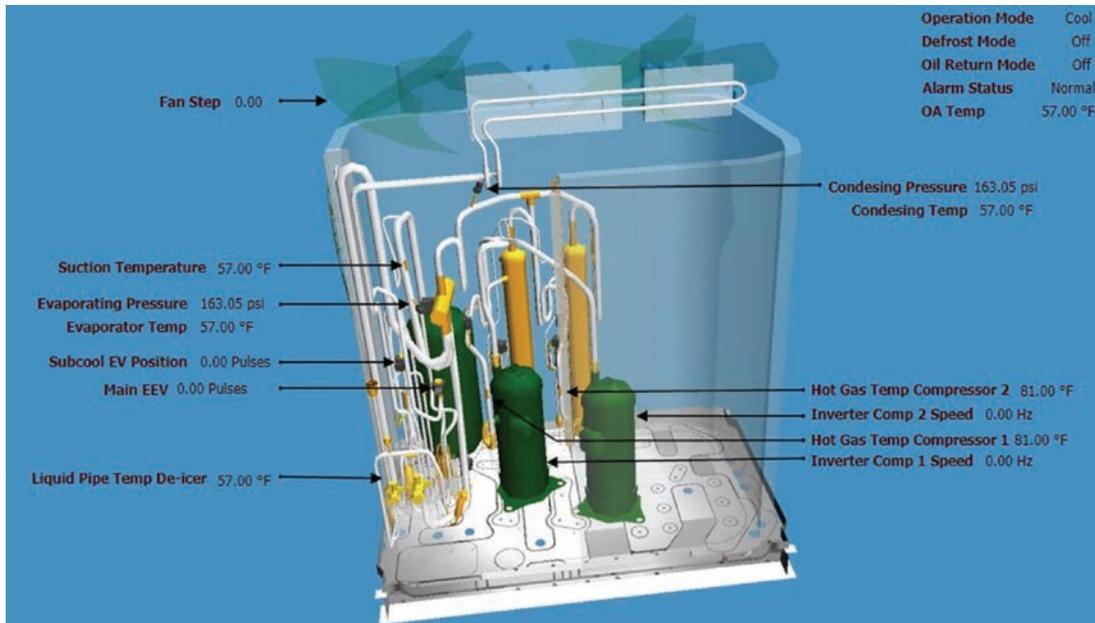
The operation data enables the facilities to have more in-depth information about the operation of the *VRV*.

In order to get the additional operation data, Airnet commissioning is required; inform the startup technician if the operational data points are necessary for a project. The operation data is available for all indoor units and compatible outdoor units. For a list of the compatible outdoor unit, please refer to Appendix-3.

Compatibility

When applying the *iTouch Manager* to a project it is very important to take note of the below-mentioned application rules and software compatibility requirements.

» *iTM BACnet* Client DCM009A51 cannot be activated on the same *iTM* with the *iTM BACnet* Server.

» Number of the indoor unit and outdoor unit exposed to the BMS shall not exceed 128 total

» Schedule function should not be used; BMS master schedule is normally used.

» The interlocking function should NOT be used.

» PPD should not be used with *iTM BACnet* Server.

» WAGO I/O points should not be used with *iTM BACnet* Server.

» D-Net monitoring should not be used with *iTM BACnet* Server.

» The outdoor unit operation data is not available for all outdoor unit models. (Please refer to appendix).

» The Daikin ERV (i.e. VAM) is not compatible with *iTM BACnet* Server.

intelligent Touch Manager with BACnet™ Server Option (DCM014A51)

iTM Options	iTM BACnet Client (DCM009A51)	iTM BACnet Server (DCM014A51)	PPD (DCM002A71)	WAGO I/O	Daikin iTM BACnet / IP Controller 750-831	D-Net
iTM BACnet Client (DCM009A51)	N/A	NG	OK	OK	OK	OK
iTM BACnet Server (DCM014A51)	NG	N/A	NG	NG	OK*	NG
PPD (DCM002A71)	OK	NG	N/A	OK	OK	OK
WAGO I/O	OK	NG	OK	N/A	OK	OK
iTM BACnet / IP Controller 750-831	OK	OK*	OK	OK	N/A	OK
D-Net	OK	NG	OK	OK	OK	OK

*iTM with BACnet server cannot monitor the 750-831 IP controller.

Trendlog Capability

The iTM records data every one minute for a rolling five-day period. The following information is available for the VRV indoor units and VRV outdoor units.

» Indoor unit functional data (Setpoint, mode, room temperature, etc.)

» Indoor unit operation data (liquid pipe temperature, gas pipe temperature, etc.)

» Outdoor unit operation data (inverter speed, fan step, etc.)

Users can specify the start and end date and time for the data download. The data can be downloaded either by using a USB drive at the iTM or by using a compatible web browser.

Computer with web access

USB
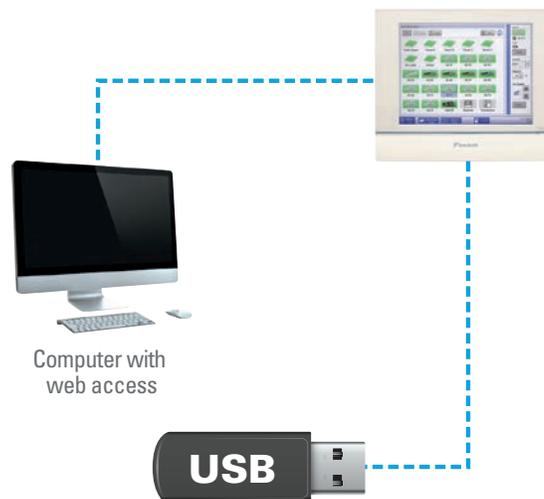
Daikin offers a Microsoft excel based macro tool to review and process the data available.

BACnet™ Interface (DMS502B71)

The Daikin Interface, for use with *BACnet*/IP networks, operates as a *BACnet* interpreter using the services defined by *BACnet* to return the status of the indoor units connected to the DIII-Net. It also allows the BMS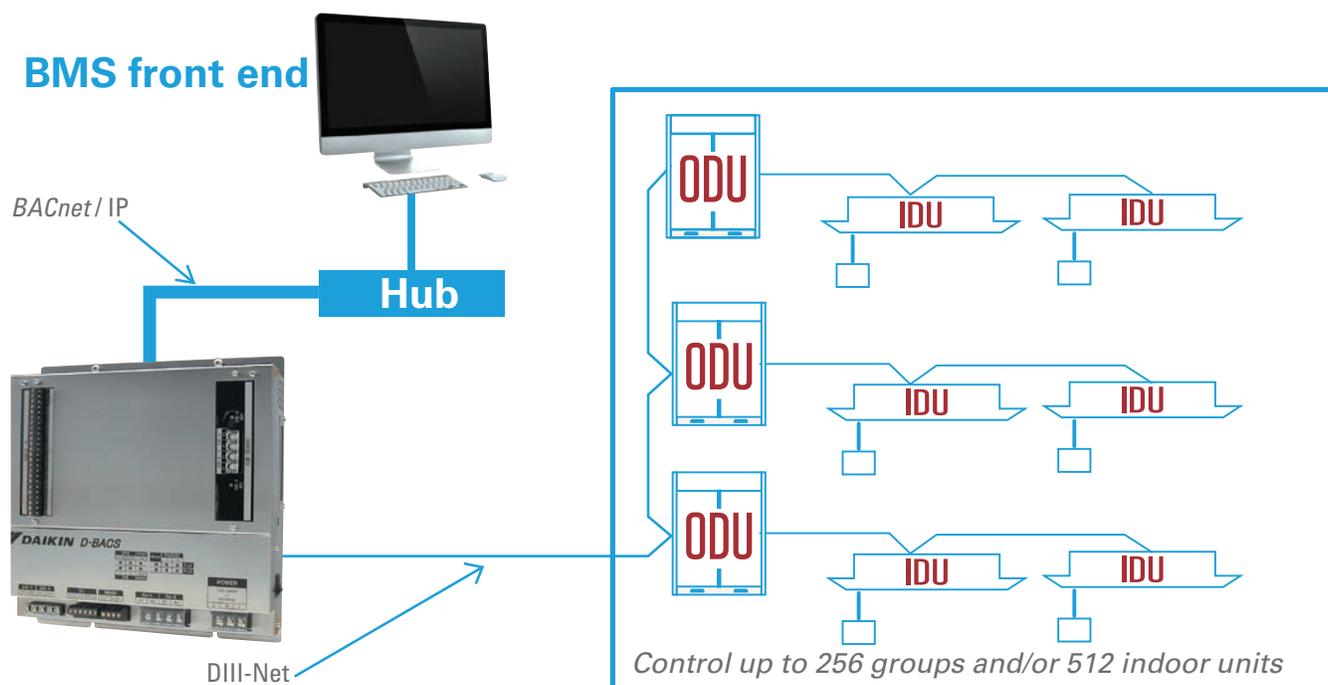 to send commands to the indoor units. The BMS, using the *BACnet* Interface, can control up to 128 indoor unit groups (up to 256 indoor units), and it can be expanded up to 256 indoor unit groups (up to 512 indoor units) at once by adding the optional DIII board (DAM411B51).

BMS front end

BACnet / IP

Hub

DIII-Net

ODU
IDU   IDU

ODU
IDU   IDU

ODU
IDU   IDU

Control up to 256 groups and/or 512 indoor units

Features

» BTL listed product with a direct connection to *BACnet*/IP network.

» Controls up to 256 groups or 512 indoor units (4 individual DIII-Net) with optional adaptor.

» Compatible with *VRV* Indoor units, VAM units, *SkyAir* units, multi-zone and single-zone systems.

» Supports Change Of Value (COV)

» Supports both °F and °C for temperature

» On-board diagnostic LED's

» 2 Alarms Output contacts

» 4 Digital Inputs for forced off function

» The BMS can use the *BACnet* interface to program the following using the points

  – Auto-changeover

  – Setpoint range limitation

  – Setback

  – Schedules

  – Dual Setpoint

  – Remote controller button prohibits
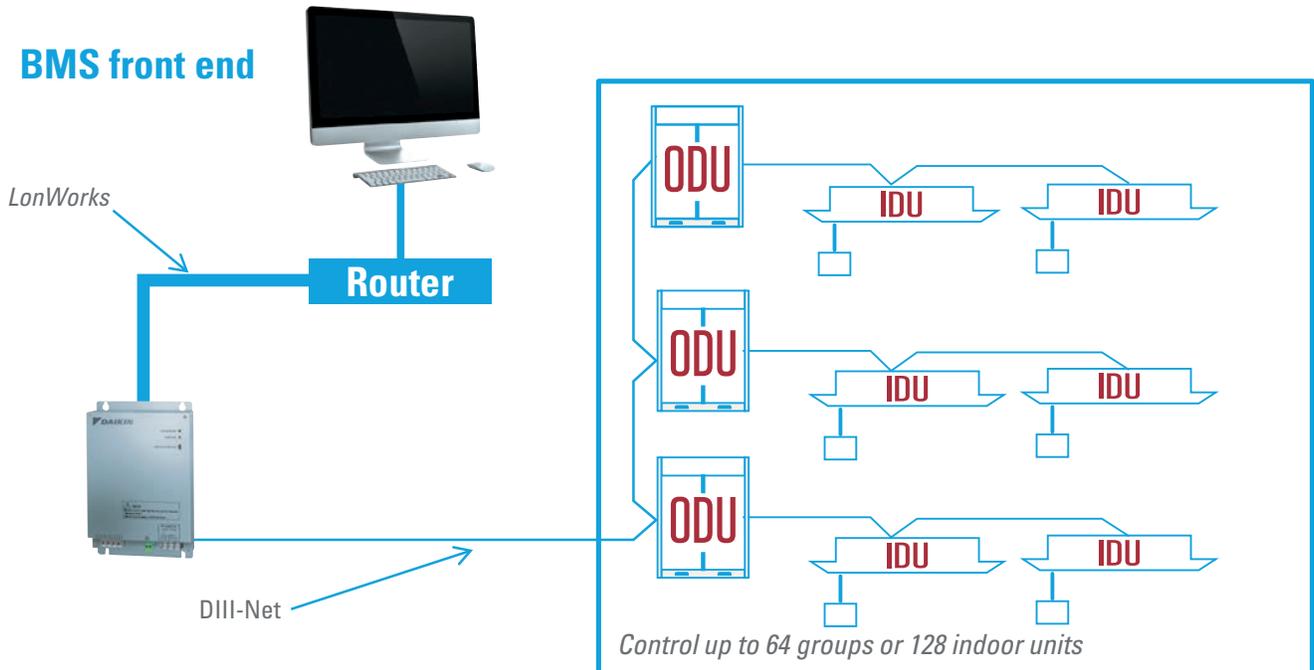
  – Alarm monitoring

BACnet™ Interface (DMS502B71), *Continued*

Points List

Monitoring Points		
#	**Point Name**	**Point Description**
1	On / Off status	Monitors the On / Off status of the indoor unit.
2	Alarm	Monitors whether or not the indoor unit is operating normally and issues an alarm if the indoor unit has a malfunction.
3	Malfunction code	Displays a malfunction code specified by Daikin if an indoor unit in the system has a malfunction.
4	Operation mode	Monitors if the indoor unit is in Cool, Heat, Fan, or Dry mode. [Auto mode is not displayed].
5	Room temperature	Room temperature monitors and displays the room temperature.
6	Filter sign	Monitors filter run time and provides service alert.
7	Thermo-on Status	Monitors whether or not the indoor unit is actively cooling or heating.
8	Compressor status	Monitors if the compressor of the outdoor unit connected to the indoor unit is operating.
9	Indoor fan status	Monitors if the indoor unit's fan is operating.
10	Heater operation status	Monitors if the auxiliary heater is enabled/disabled.
11	Communication status	Monitors the indoor unit's DIII-Net communications status.
12	Temperature Setpoint	Reports the current temperature Setpoint of the indoor unit.
13	Fan speed	Reports the current fan speed setting of the indoor unit.
14	Remote Controller prohibits	Indicates the restriction status of the remote controller

Control Points		
#	**Point Name**	**Point Description**
1	On / Off stop operation	It starts/ stops the indoor unit and monitors the current status.
2	Operation mode setting	Sets the Cool / Heat / Fan / Dry / Auto mode for the indoor unit and monitors the current mode.
3	Setpoint setting	Sets the Setpoint of the indoor unit and monitors the current Setpoint.
4	Filter sign and reset	Provides service filter alert and allows a manual reset of the filter alert.
5	Remote permit / prohibit	Permits or prohibits the remote controller so that it can or cannot be used to control the indoor unit's On/Off / Operation mode / Setpoint.
6	Lower Centralized Controller operation enable / disable	Enables or disables the operation of a Centralized Controller connected to the DIII network.
7	Fan speed setting	Sets the fan speed and monitors the current setting.
8	Vane direction setting	Sets the vane direction and monitors the current setting.
9	Forced system stop	The forced system stop command will force the indoor unit to stop running based upon a received emergency alarm input. Remote controllers will be locked out from restarting indoor units during the forced system stop event. Remote controllers will be locked out from restarting indoor units during the forced system stop event.
10	Forced thermo-off	In response to the forced thermo-off command, the indoor unit stops actively cooling or heating.
11	Energy saving offsets	The internal Setpoint change +3.6°F (2°C) in cooling, and -3.6°F (-2°C) in heating in an indoor unit. The actual Setpoint is not changed.

LonWorks® Interface (DMS504C71)

The *LonWorks* interface enables monitoring and control of Daikin's *VRV* system by the BMS using the Lon talk protocol. Using the interface allows the BMS to control up to 64 indoor units groups (up to 128 indoor units). The XIF file is available for download from www.daikinac.com or www.daikincity.com

BMS front end

LonWorks

Router

DIII-Net

ODU

ODU

ODU

IDU   IDU

IDU   IDU

IDU   IDU

Control up to 64 groups or 128 indoor units

Features

» XIF configuration file is available (required for *LonWorks* installation).

» Control up to 64 groups or 128 indoor units.

» Compatible with *VRV* Indoor units, *Skyair* units, multi-zone and single-zone systems.

» Digital Input for forced off function.

» The BMS can use the *LonWorks* interface to program the following using the available points

 – Auto-changeover

 – Setpoint range limitation

 – Setback

 – Schedules

 – Dual Setpoint

 – Remote controller button prohibits

 – Alarm monitoring

LonWorks® Interface (DMS504C71), *Continued*

Points List

Monitoring Points		
#	Point Name	Point Description
1	On / Off status	Monitors the On / Off status of the indoor unit.
2	Alarm	Monitors whether or not the indoor unit is operating normally and issues an alarm if the indoor unit has a malfunction.
3	Malfunction code	Displays a malfunction code specified by Daikin if an indoor unit in the system has a malfunction.
4	Operation mode	Monitors if the indoor unit is in Cool, Heat, Fan, or Dry mode. [Auto mode is not displayed]
5	Room temperature	Room temperature monitors and displays the room temperature.
6	Filter sign	Monitors filter run time and provides service alert.
7	Thermo-on Status	Monitors whether or not the indoor unit is actively cooling or heating.
8	Communication status	Monitors the indoor unit's DIII-Net communications status.
9	Temperature Setpoint	Reports the current temperature Setpoint of the indoor unit.
10	Fan speed	Reports the current fan speed setting of the indoor unit.
11	Remote Controller prohibits	Indicates the restriction status of the remote controller

Control Points		
#	Point Name	Point Description
1	On / Off stop operation	It starts/ stops the indoor unit and monitors the current status.
2	Operation mode setting	Sets the Cool / Heat / Fan / Dry / Auto mode for the indoor unit and monitors the current mode.
3	Setpoint setting	Sets the Setpoint of the indoor unit and monitors the current Setpoint.
4	Filter sign and reset	Provides service filter alert and allows a manual reset of the filter alert.
5	Remote permit / prohibit	Permits or prohibits the remote controller so that it can or cannot be used to control the indoor unit's On/Off / Operation mode / Setpoint.
6	Lower Centralized Controller operation enable / disable	Enables or disables the operation of a Centralized Controller connected to the DIII network.
7	Fan speed setting	Sets the fan speed and monitors the current setting.
8	Forced system stop	The forced system stop command will force the indoor unit to stop running based upon a received emergency alarm input. Remote controllers will be locked out from restarting indoor units during the forced system stop event.
9	Forced thermo-off	In response to the forced thermo-off command, the indoor unit stops actively cooling or heating.

Modbus® Adaptor (DTA116A51)

The DIII-Net *Modbus* Adaptor enables the connection of the *VRV* system to the BMS through *Modbus* communication. With this adaptor, third-party controllers can monitor and control *VRV* indoor units through RS485 *Modbus* Protocol. The *Modbus* Adaptor is designed to be used on small projects, such as residential applications where a home automation system is required, or small *VRV* projects with an existing BMS system. This adaptor can be mounted to the *VRV* outdoor unit. This Adaptor can also be installed on the indoor unit. A maximum of 2 outdoor units and 16 indoor units can be connected to the adaptor.
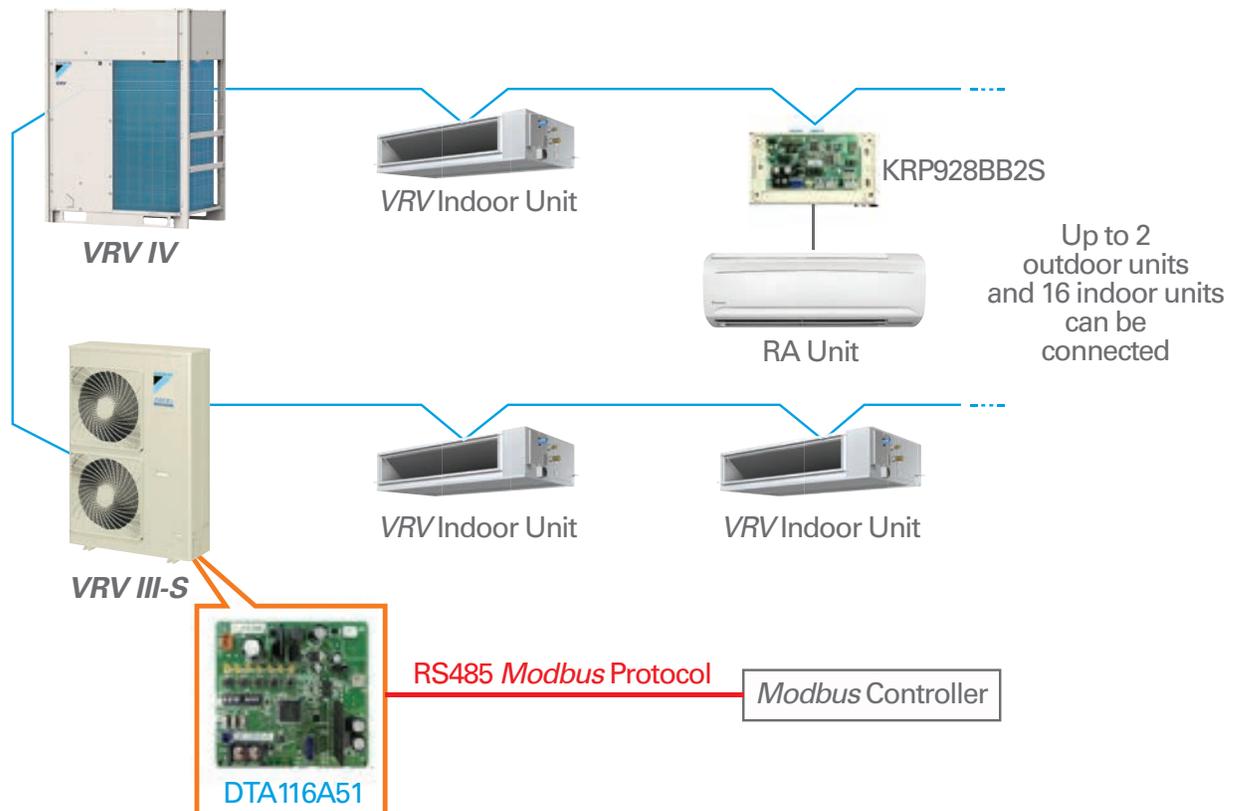
Features

» Control up to 16 indoor unit groups and 2 outdoor units.

» Compatible with *VRV* indoor units, *SkyAir* units, multi-zone and single-zone systems.

» It can be powered by an indoor unit or outdoor unit if an optional adaptor power terminal is available.
An external power supply is required when the adaptor power terminal is not available.

» The BMS can program the following functions using the points provided by the *Modbus* Adaptor

– Auto-changeover

– Setpoint range limitation

– Setback

– Schedules

– Dual Setpoint

– Alarm monitoring

Points List

Monitoring Points		
#	**Point Name**	**Point Description**
1	On/Off	On/Off status of the indoor units
2	Operation mode	Cool, Heat, Fan, Dry, Auto [indoor unit logic for supported models]
3	Setpoint	60 – 90°F or 16 – 32°C (single Setpoint)
4	Room temperature	Return air temperature at indoor unit or remote controller
5	Louver direction	Swing, louver direction (depending on indoor unit model)
6	Fan speed	L, M, H (depending on indoor unit model)
7	Forced off status	Forced stop status of the indoor unit
8	Error	Malfunction, warning with error code
9	Filter sign	Filter sign indicator for indoor unit
10	Communication status	Communication normal/error for indoor units

Control Points		
#	**Point Name**	**Point Description**
1	On/Off	On/Off status of the indoor units
2	Operation mode	Cool, Heat, Fan, Dry, Auto [indoor unit logic for supported models]
3	Occupied Setpoint	60 – 90°F or 16 – 32°F (single Setpoint)
4	Louver direction	Swing, louver direction (depending on indoor unit model)
5	Fan speed	L, M, H (depending on indoor unit model)
6	Filter sign reset	Reset filter sign indicator for indoor unit

Applications

1. Retrofit or Tennant Improvements

a. The Modbus® Adaptor can be applied as a low-cost BMS Interface to any project with less than16 indoor units are less.

b. Perfect for tenant buildout or tenant improvement projects.

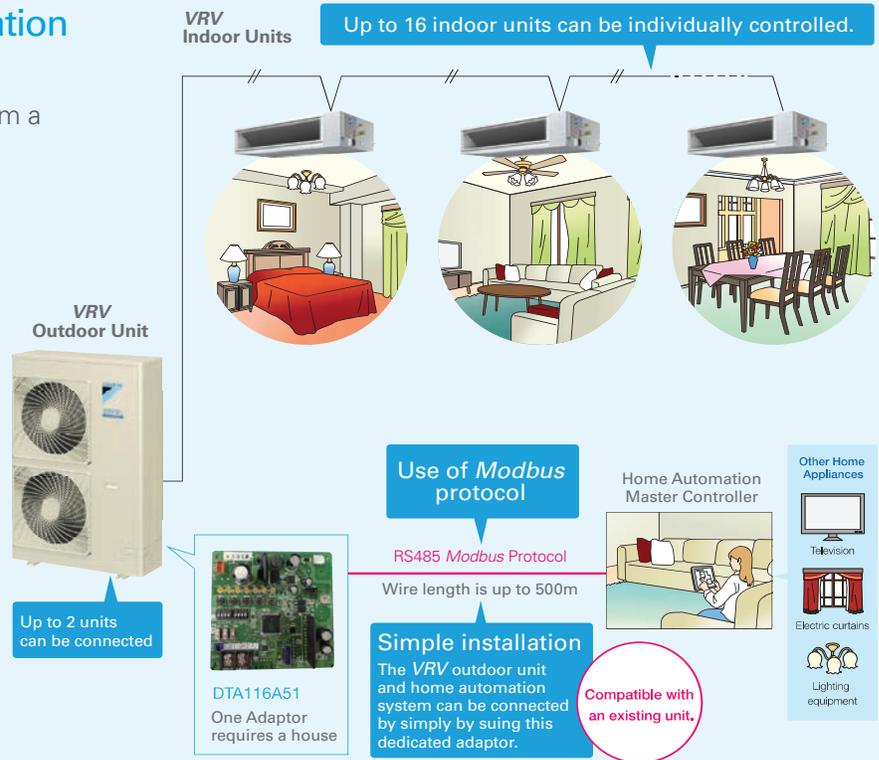c. It can be used as a cost-efficient adaptor for server room additions.

d. The *Modbus* Adaptor is also compatible with mini-split and multi-split units with the use of KRP928 Adaptor, when a *VRV* unit or another *VRV* centralized controller is connected to the same DIII-net circuit.

Relatively small *VRV* addition compared to the entire project
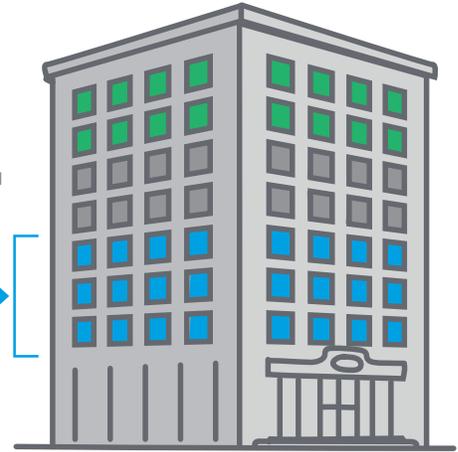
2. Home Automation Application

a. The *Modbus* Adaptor allows the operation of the *VRV* system from a home automation system.

b. Simple two-wire communication wiring between the adaptor and automation system.

c. The automation software can control *VRV* systems, lights, curtains, and security from a single access point.

VRV Indoor Units

Up to 16 indoor units can be individually controlled.

VRV Outdoor Unit

Up to 2 units can be connected

DTA116A51
One Adaptor requires a house

Use of *Modbus* protocol

RS485 *Modbus* Protocol
Wire length is up to 500m

Simple installation
The *VRV* outdoor unit and home automation system can be connected by simply by suing this dedicated adaptor.

Compatible with an existing unit.

Home Automation Master Controller

Other Home Appliances

Television

Electric curtains

Lighting equipment

3. Connecting to older BMS

a. *Modbus* communication is one of the oldest open protocols in existence. (Originally published in 1979)

b. Older building with existing BMS may not have the capability to use *LonWorks* or BACnet™, still may have the ability to integrate with *Modbus*

c. It could also be used as an alternative for job sites that do not prefer *BACnet*/IP.

d. Cost-effective option compared to the conventional BMS Interface (DMS502B71).
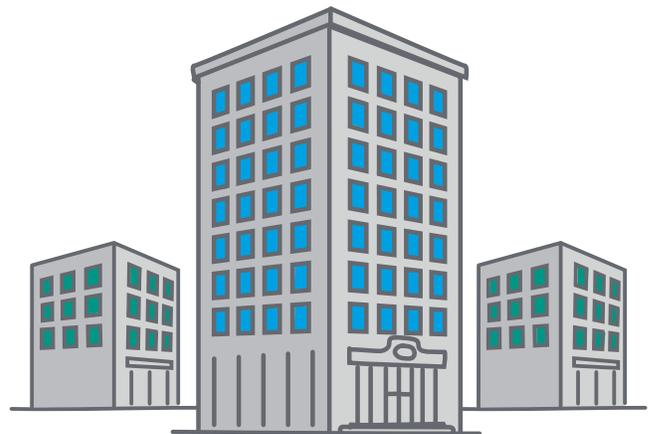
Applications for BMS Integrations

Offices

Maximizing employee work efficiency and customer satisfaction starts with a comfortable office environment where employees and customers can interact. The Daikin Interface provides the BMS the ability to centrally control and monitor the *VRV* indoor units, including Energy Recovery Ventilators (VAM units) and Outside Air Processing Units. The BMS can also monitor other Daikin systems (e.g. mini-splits) through the Interface. Using the Interface, the BMS (dependent on the capabilities on the third party BMS system) can individually control and monitor each indoor unit and meet controls requirements of an office building such as:

» Zone-based scheduling

» After hours and unoccupied operation

» Demand control ventilation

» Setback

» Alarms monitoring and email alerts

Schools

Fixed budgets and rising utility costs make energy efficiencies a top priority for educational institutions. The Daikin *VRV* product line provides schools with high-performance systems that help keep their electricity costs low. The integration of the *VRV* system with a BMS allows individual zone control, monitoring, and scheduling of each classroom. Also, a school district HQ can remotely monitor the performance and operation of the *VRV* equipment. Daikin *intelligent Touch Manager* can be used in conjunction with the BMS to provide all the necessary operation of the *VRV* system; while the BMS installed at district HQ could be used for remote monitoring.

A BMS (dependent on the capabilities on the third party BMS system) integrated with a Daikin Interface, can meet requirements of a school building such as:

» Scheduling

» Holiday scheduling

» DOAS integration

» Remote control prohibit

» Setback

» Remote monitoring

» Indoor unit louver control

Applications for BMS Integrations

Shops or Retail

With their competition often located nearby, retail outlets strive toward providing their customers with the ultimate shopping experience — an experience that begins with a comfortable environment. With Daikin *VRV*, store owners can reduce costs without sacrificing customer or employee comfort. The BMS can monitor store operation from a remote location such as corporate HQ or local area maintenance contractor. A BMS (dependent on the capabilities on the third party BMS system) integrated with a Daikin Interface can meet requirements of a retail building.

» Indoor units can be installed with no remote controller

» Remote or off-site monitoring

» Scheduling

» Alarms monitoring and email alerts

» The BMS can change the Setpoint and mode to
    meet the space requirements in response to climate changes

Hotels

Guest comfort is the hallmark of excellent hotels. Hotels worldwide turn to Daikin to provide comfort. Daikin delivers this comfort with a 'total solution' that integrates heating, cooling, and ventilation for quiet, draft-free operation and comfortable rest. The BMS using Daikin Interface can integrate the *VRV* system with the hotel management system.

In some cases, the BMS is the hotel management system. The BMS can control each room separately as well as the units serving the conference rooms. A BMS (dependent on the capabilities on the third party BMS system) integrated with a Daikin Interface can meet requirements of a hotel building.
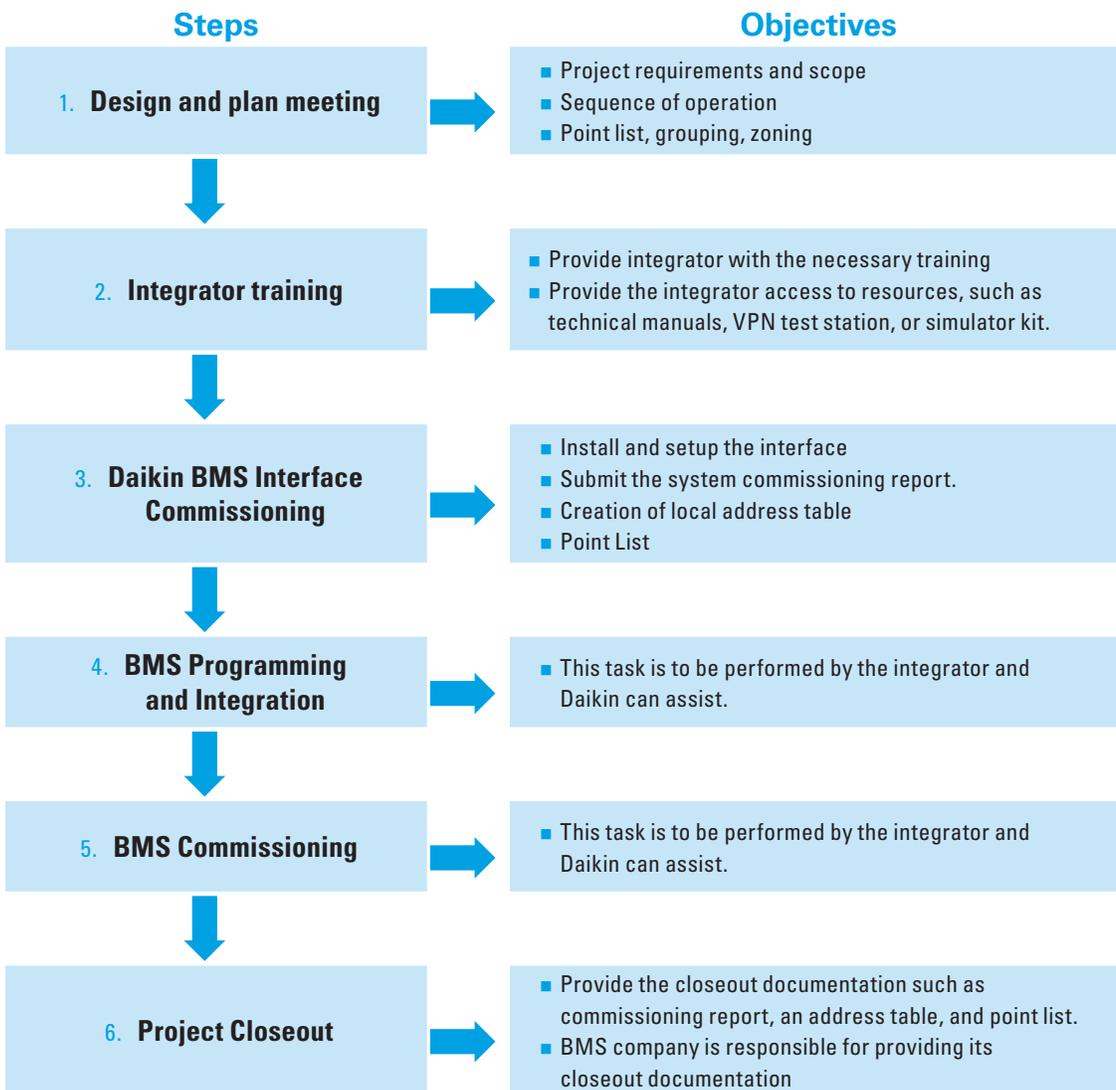
» Setback for rooms that have not been sold/rented

» Guest room occupancy sensor

» Light switches

» Energy-saving function for unoccupied rooms

» Setpoint range limitation

Project Preparation

Integration is often is the last step undertaken in a project. However, it is highly recommended that project requirements should be established in the early stages of the project. To prepare for a project involving the integration of *VRV* into a BMS, the following steps are recommended:
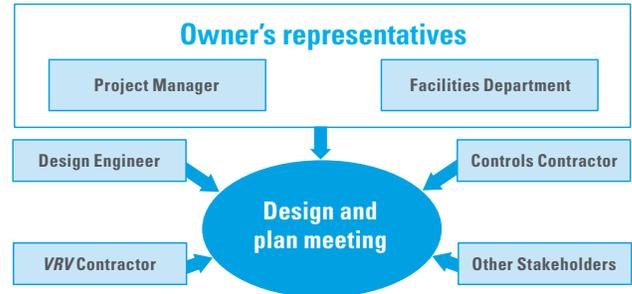
1. Design and plan meeting
2. Integrator training
3. Daikin BMS Interface commissioning

4. BMS programming and integration
5. Commissioning
6. Project closeout

Steps	Objectives
1. **Design and plan meeting**	■ Project requirements and scope ■ Sequence of operation ■ Point list, grouping, zoning
2. **Integrator training**	■ Provide integrator with the necessary training ■ Provide the integrator access to resources, such as technical manuals, VPN test station, or simulator kit.
3. **Daikin BMS Interface Commissioning**	■ Install and setup the interface ■ Submit the system commissioning report. ■ Creation of local address table ■ Point List
4. **BMS Programming and Integration**	■ This task is to be performed by the integrator and Daikin can assist.
5. **BMS Commissioning**	■ This task is to be performed by the integrator and Daikin can assist.
6. **Project Closeout**	■ Provide the closeout documentation such as commissioning report, an address table, and point list. ■ BMS company is responsible for providing its closeout documentation

Integration design and planning meeting

When a project's requirements are to provide BMS integration with the Daikin *VRV* system, the design and planning meeting is an opportunity to promote discussion between the owner, the design engineers, *VRV* contractor and controls contractor about the scope and requirements of the project.

An important aspect to consider when laying out the project is the building automation protocol, *intelligent Touch Manager* and *Navigation* controller, as these can be used in conjunction with the BMS front end. Sharing responsibility between Daikin controls and BMS can help save costs and reduce BMS programming effort. It is also important to note there is some difference points list available using the different BMS interface products. Here is a control logic chart that can be used to compare capability between different gateway/interface available from Daikin.

Owner's representatives

| Project Manager | Facilities Department |

| Design Engineer | | Controls Contractor |

Design and plan meeting

| *VRV* Contractor | | Other Stakeholders |

Control Logic Table

#	Control Points and Features that can be Used by BMS	DMS502B71 (note 3)	DMS502C71 (note 3)	DTA116A51 (note 3)	DCM014A51
1	On/Off	■	■	■	■
2	Mode changeover	■	■	■	■
3	Room temperature	■	■	■	■
4	Setpoint adjustment	■	■	■	■
5	Schedules	■	■	■	■
6	Setback	■	■	■	■ (Note 1)
7	After hours override timer	■	■	■	■ (Note 1)
8	Power proportional distribution	N/A	N/A	N/A	N/A
9	Alarms and alert notification by email	■	■	■	■ (Note 1)
10	Trending	■	■	■	■ (Note 1)
11	Monitor Indoor operation data	N/A	N/A	N/A	■
12	Monitor outdoor unit operation data	N/A	N/A	N/A	■
13	Setpoint range limitation	■	■	■	■ (Note 1)
14	Fan speed adjustment	■	■	■	■
15	Filter sign reset	■	■	■	■
16	Prohibit RC On/OFF	■	■	N/A	■
17	Prohibit RC Mode Change	■	■	N/A	■
18	Prohibit RC Setpoint	■	■	N/A	■
19	Ventilation Mode	■	N/A	N/A	N/A (Note 2)
20	Ventilation amount	■	N/A	N/A	N/A (Note 2)

1. *iTM's* native logic is available for the BMS to use.
2. The VAM unit data points are not exposed to BMS using the *iTM* BACnet™ server software.
   However local control is available.
3. These devices do not have any inherent control logic; however, they provide data points that can be used by the BMS to program the functionality.

It is also good to discuss the following topic with the Owner and Design Engineer.

1. Does the owner need PPD?
2. Should the occupant have access to thermostat buttons?
3. Should a Setpoint range limitation logic be implemented?
4. Is a Daikin ERV included in the design?
5. Is there a need to monitor third-party sensors and equipment using a Daikin controller?

It is essential the project stakeholders understand the automated features of the *VRV* system.

The *VRV* system contains sophisticated controls for its refrigerant and compressor control; hence the following items cannot be controlled by the third party; however, it can be monitored using the *iTM* with BACnet™ Server.

» Outdoor unit compressor operation such as compressor ON/OFF, compressor speed control, oil return, defrost, etc.

» Outdoor unit fan operation such as ON/OFF and speed control.

» The modulation of EEV to maintain the target superheat or subcool.

» The *VRV* system self-monitors and reports if there is an error in the system

Integrator Training

Once the scope of the project has been established, arrange for the integrator to be trained by an instructor-led training offered through the Daikin training department. This training will be a very beneficial for integrators that are new to integration with *VRV*. Daikin also provides a very detailed design guide that is specific to the BMS Interface that can help with the integration.

Daikin BMS Interface commissioning

All of the Daikin BMS Interfaces are to be commissioned by a trained person. The commissioning procedure varies between one product to the other and some even may require specialized tools. It is essential that a startup technician has taken the training and has the necessary software tool to commission the interface and verify the data.

It is useful to gather some of the necessary information ahead of the startup.

» Temperature units

» Static IP address

» Instance number or address for the interface and units

BMS Programming and Integration

It is recommended that the integrator refers to the programming guide or design guide before programming the BMS.

Documents that the integrator may need to review for programming and integration:

» Interface commissioning report provided by startup technician.

» Indoor unit group address information. This is used to identify the *VRV* indoor units.

» The sequence of operation and points list.

» If the BMS cannot AUTO discover points, then obtain object ID information from Daikin points list creator file or refer to the design guide or the programming guide.

» LonWorks® and Modbus® do not support the Auto-Discover function for the points, so it is essential the integrator has access to the design guide.

BMS Programming
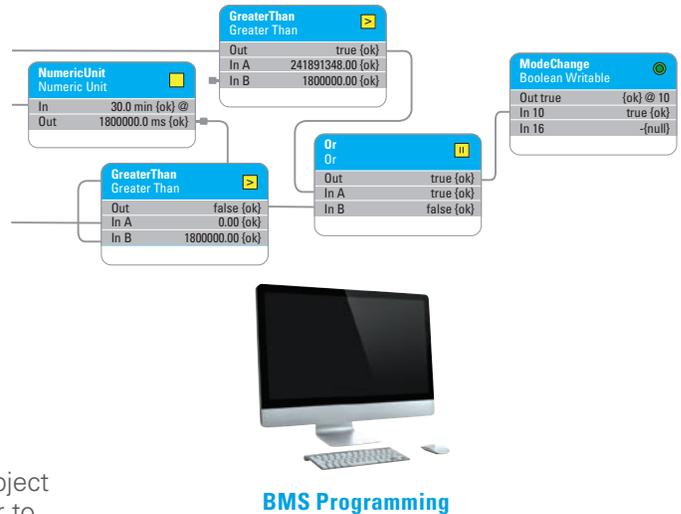
BMS Plugins for Niagara® AX and Niagara® 4 — Facilitate Easy Integration with the *VRV* System

Plugins are pre-programmed BMS toolkits are available to help reduce integrator efforts on the project. The *Niagara* Toolkit consists of two sample stations, PX files, and *VRV* Palette.

From traditional HVAC systems, The *VRV* control logic is different and may seem challenging for integrators that are not familiar with the *VRV* systems. Daikin endeavors to resolve this issue by providing BMS Plugins to the integrator for easy integration. BMS Plugins are pre-programmed objects and graphics built for *Niagara* AX and *Niagara* 4 specifically for Daikin *VRV*. With BMS Plugins, the integrators' workload is reduced to point linking for control of the *VRV* indoor unit.
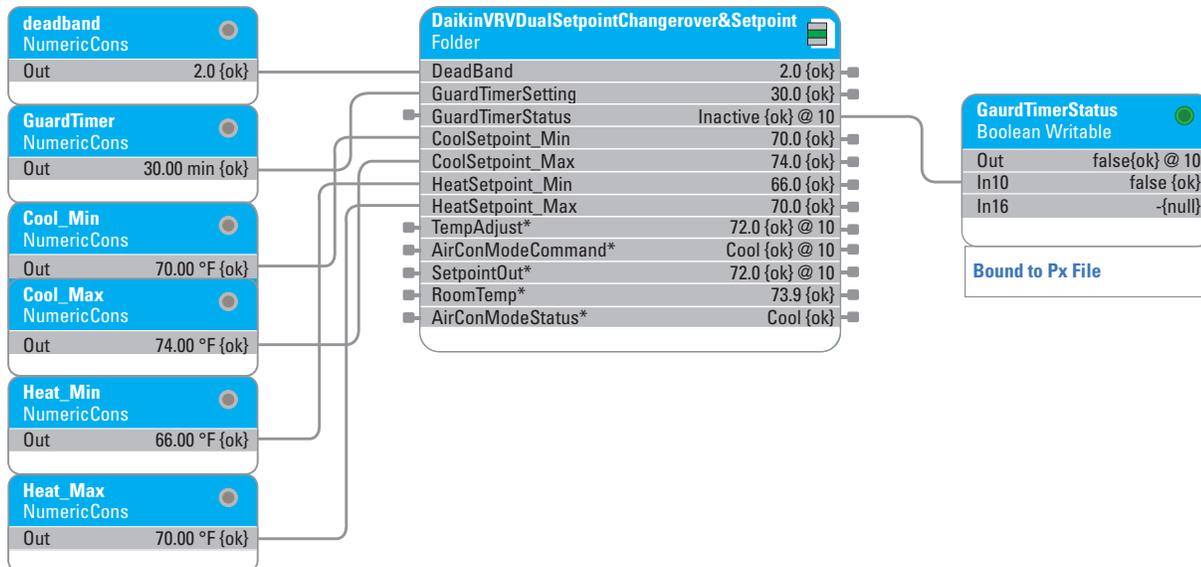
Features / Benefits

» Built with the most commonly used BMS Platform: *Niagara* AX and *Niagara* 4

» Easy integration for integrators

   – Graphics with provided PX files

   – Simple point linking with programmed functions

» Reduced possibility of integration issues with *VRV* systems
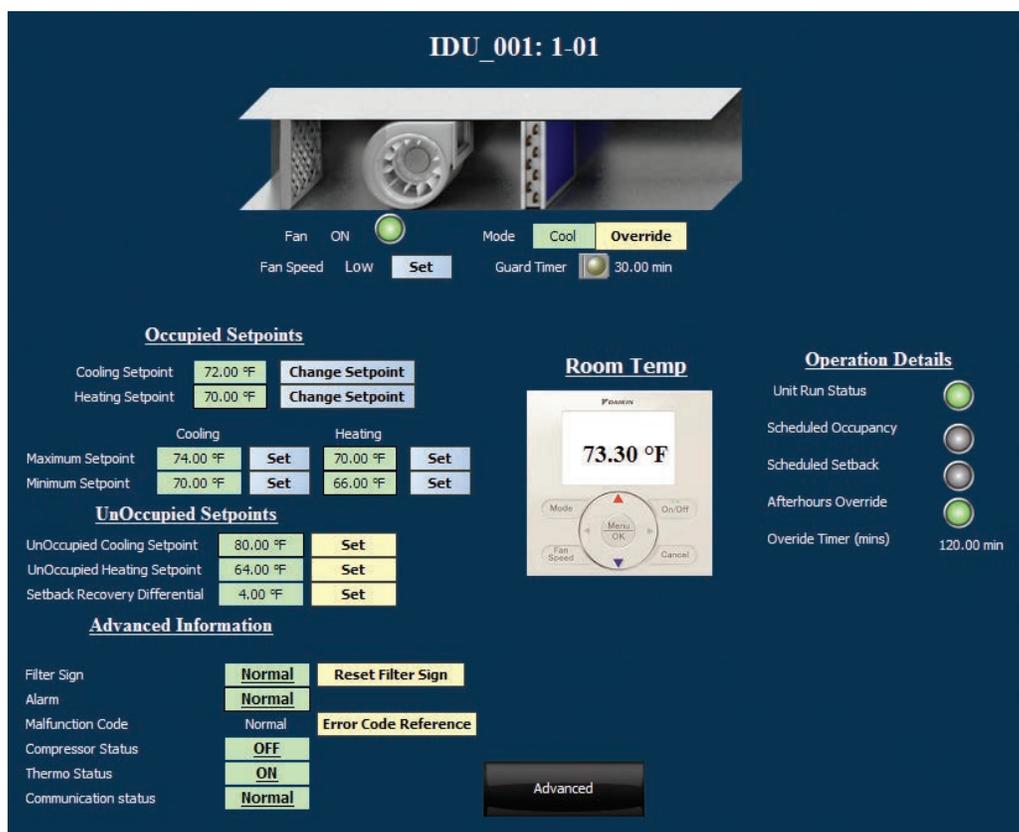
Specifications

» Pre-programmed objects

   – Auto-changeover — dual and single Setpoint

   – Setback

   – Setpoint range limitation — dual and single Setpoint

» Reduced possibility of integration issues with *VRV* systems

» Replicable graphics

» Applicable to both Heat Pump and Heat Recovery system

» The locally developed software package that can be updated to meet the market needs

The BMS Plugins are free of charge and can be downloaded from the Daikin City website. The plugins are designed to be compatible with a properly licensed *Niagara* AX based BMS systems version 3.8 and *Niagara* 4.

deadband	
NumericCons	◉
Out	2.0 {ok}

GuardTimer	
NumericCons	◉
Out	30.00 min {ok}

Cool_Min	
NumericCons	◉
Out	70.00 °F {ok}

Cool_Max	
NumericCons	◉
Out	74.00 °F {ok}

Heat_Min	
NumericCons	◉
Out	66.00 °F {ok}

Heat_Max	
NumericCons	◉
Out	70.00 °F {ok}

DaikinVRVDualSetpointChangerover&Setpoint	
Folder	
DeadBand	2.0 {ok}
GuardTimerSetting	30.0 {ok}
GuardTimerStatus	Inactive {ok} @ 10
CoolSetpoint_Min	70.0 {ok}
CoolSetpoint_Max	74.0 {ok}
HeatSetpoint_Min	66.0 {ok}
HeatSetpoint_Max	70.0 {ok}
TempAdjust*	72.0 {ok} @ 10
AirConModeCommand*	Cool {ok} @ 10
SetpointOut*	72.0 {ok} @ 10
RoomTemp*	73.9 {ok}
AirConModeStatus*	Cool {ok}

GaurdTimerStatus	
Boolean Writable	◉
Out	false{ok} @ 10
In10	false {ok}
In16	-{null}

Bound to Px File

FC-1 – Graphical User Interface (GUI)

The BMS Plugins

Project Preparation, *Continued*

BMS Commissioning

BMS commissioning is a necessary step to verify all systems in the building operate as per the specified sequence of operation. Typically, this step is performed by the controls contractor to demonstrate to a third-party building commissioning agent that the BMS programming has achieved the specified sequence of operation. The *VRV* contractor can assist in this step, but this function is the responsibility of the control's contractor.

Project Closeout

The controls contractor is responsible for closeout related to BMS programming and the integration itself. The *VRV* contractor may be required to submit reports regarding the Gateway/Interface setup.

Working with Integrators

For the duration of a project, it is a good practice to establish and maintain the responsibilities between the *VRV* contractor and controls contractor:

VRV Sales Rep or Contractor	Controls Contractor
» Setup design and plan meeting	» Responsible for all BMS programming
» Review the specified sequence of operations and modify to meet the capabilities of the system	» Discovering the Interface and mapping/binding the points
» Arrange for the integrator to be trained	» Creating all required graphics, and setting up points in the front end
» Provide the integrator with the necessary documentation and technical manuals	
» Set up the Interface and confirm the operation of the indoor units.	
» Provide the Interface commissioning report, points list and address table	
» Set up of Daikin controllers	

During the integration process, it is very important to reach out to the correct technical support for assistance to get a quicker resolution. If the issues are Daikin's Interface related, then Daikin's technical support should be contacted. Similarly, if an issue is related to BMS programming, then the controls contractors shall work with BMS vendor's technical support.

Dry contact Adaptors for Low-Cost Integrations

Small projects, or projects that have proprietary BMS, cannot always provide the budget/means to integrate using open protocols such as LonWorks® or BACnet™. In this situation, there is a low-cost adaptor available to integrate with a BMS.

Group Control Adaptor (KRP4A7x)

This adaptor is applied to individual *VRV* indoor unit remote control groups to facilitate start/stop control and temperature Setpoint for remote control groups from a BMS. The BMS can also monitor contact closure outputs for operation and malfunction status.

»   This is a low-cost alternative to traditional energy management integration for small projects with simple control requirements.

»   This is an option for retrofit application, where an existing BMS does not have open protocol capability

»   One adaptor simultaneously controls up to 16 indoor units.

»   The part number for the adaptor varies with the indoor unit model.

This adaptor offers four functions for each control group.

1. Start/Stop
2. Temperature Setpoint (0-135Ω)
3. Status (Monitoring)
4. Malfunction (Monitoring)

Part numbers are listed below:

| Indoor Unit Model	Group Adaptor
FXMQ, FXAQ, FXNQ, FXLQ	KRP4A71
FXHQ	KRP4A72
FXZQ	KRP4A73
FXDQ, FXFQ, FXEQ, FXUQ, FXTQ, FXSQ	KRP4A74

The adaptor offers a few more control features outside of the BMS control. It is important to review the installation manual to select the correct setting.

Solutions for Daikin Mini-splits / Multi-splits / *SkyAir*

The Single-zone, Multi-zone, and *SkyAir* systems can be integrated in to the Building Management System (BMS) by using a Daikin BACnet™ BMS Interface or using a dry contact adaptor. Single-zone or *SkyAir* systems are commonly used for cooling IT and equipment rooms on projects that use *VRV* for comfort cooling and heating.

Method 1: Using the Daikin BMS Interface

To integrate a Mini or Multi-Split to a BMS using of the *VRV* Daikin BMS Interface, a KRP928BB2S adaptor is required. This adaptor is compatible with units that have S21 connector. technical support.
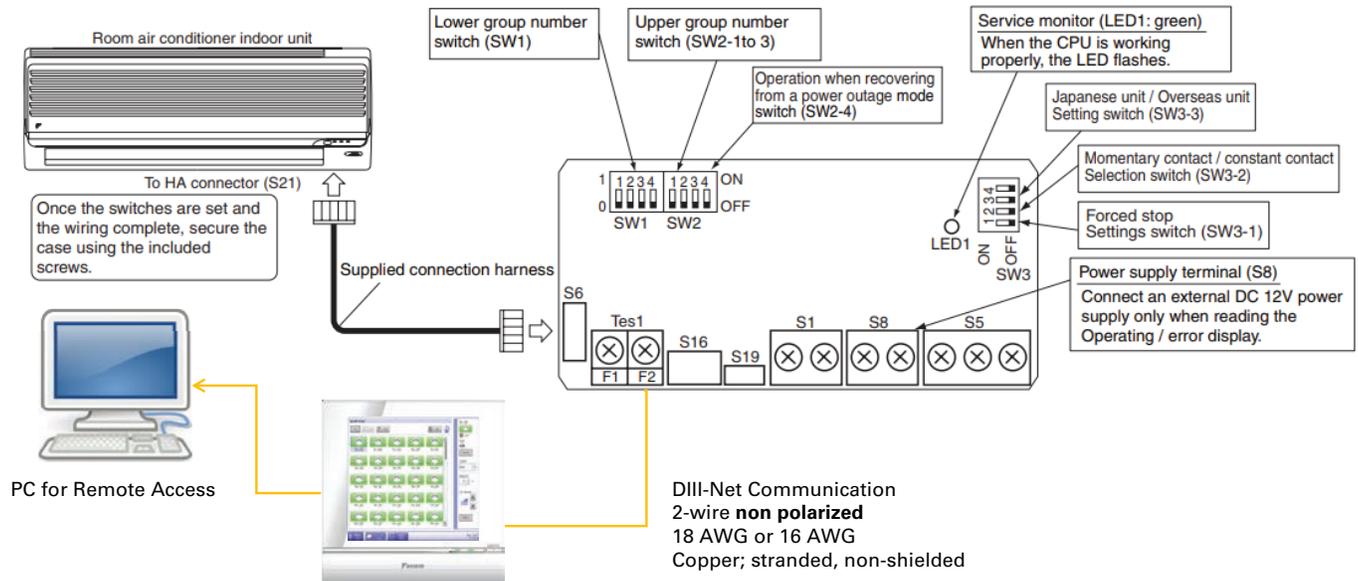
Once the KRP928BB2S is installed, the F1-F2 is wired to the *iTM* or an Interface to allow BMS control. The below table provides the details of the functionality available from each interface using the KRP928BB2S.

Function	iTM w/BACnet Server	BACnet Interface	LonWorks Interface	ModBus Interface
On/Off operation and monitoring	■	■	■	■
Malfunction notification	■	■	■	■
Room temperature monitoring	■	■	■	■
Setpoint setting and monitoring	■	■	■	■
Operation mode setting and monitoring	■	■	■	■
Filter sign monitoring and reset	N/A	N/A	N/A	N/A
Thermo-on status	N/A	N/A	N/A	N/A
Compressor Status	N/A	N/A	N/A	N/A
Indoor unit fan status	N/A	N/A	N/A	N/A
Vane setting monitoring Adjustment	N/A	N/A	N/A	N/A
Fan speed setting and monitoring	N/A	N/A	N/A	N/A
Force thermo-Off setting	N/A	N/A	N/A	N/A
Energy Savings Settings	N/A	N/A	N/A	N/A

Note: The *Modbus* interface requires a *VRV* unit or a *VRV* centralized controller connected to the DIII-Net to integrate with a mini-split unit that does not have F1-F2.

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Solutions for Daikin Mini-splits / Multi-splits / *SkyAir*, *Continued*

Some *SkyAir* units and a few Mini-Splits already have the F1-F2 connections to communicate with the interface directly without the need for an adaptor.

Function	*iTM* w/BACnet™ Server	BACnet™ Interface	LonWorks® Interface	ModBus® Interface
On/Off operation and monitoring	■	■	■	■
Malfunction notification	■	■	■	■
Room temperature monitoring	■	■	■	■
Setpoint setting and monitoring	■	■	■	■
Operation mode setting and monitoring	■	■	■	■
Filter sign monitoring and reset	■	■	■	■
Thermo-on status	■	■	■	N/A
Compressor Status	■	■	N/A	N/A
Indoor unit fan status	■	■	N/A	■
Vane setting monitoring Adjustment	■	■	N/A	■
Fan speed setting and monitoring	■	■	■	■
Force thermo-Off setting	■	■	■	Monitor only
Energy Savings Settings	■	■	N/A	N/A

The table below provides a connection method for different types of units.

Model Number	Building Automation Network Control (A BMS Interface is required in all cases below)
FTXS, FVXS, FDXS, FDMQ, FTXG, CTXG	KRP928BB2S
FTX 09/12	KRP928BB2S (Note 1)
FTX 18/24	KRP928BB2S (Note 2)
FTK 09/12	KRP928BB2S (Note 1)
FTK 18/24	KRP928BB2S (Note 2)
FFQ	Connect F1F2 terminal to Interface
FDMQ	Connect F1F2 terminal to Interface

Note 1: KRP067A41E Adaptor is required. Note 2: KRP980B2 Adaptor is required.

Method 2: Using the Dry contact Adaptor

On certain projects, the BMS may want to control the unit by means of dry contact or prefer a simple control method to avoid the cost of the BMS Interface. In these scenarios, the KRP413AB1S Adaptor or KRP4A71 Adaptor can be used. The KRP413A1BS adaptor allows the unit to be monitored and controlled by the BMS. The adaptor provides different functions based on DIP switch configuration, such as:

» On/Off

» Mode changes

» Fan speed adjustment

» Operation Status

» Error Status

The KRP4A71 adaptor has been discussed in an earlier chapter. The table below provides compatibility of adaptors based on indoor unit model numbers.

Model Number	Building Automation Network Control (A BMS Interface is required in all cases below)
FTXS, FVXS, FDXS, FDMQ, FTXG, CTXG	KRP413AB1S
FTX 09/12	KRP413AB1S (Note 1)
FTX 18/24	KRP413AB1S (Note 2)
FTK 09/12	KRP413AB1S (Note 1)
FTK 18/24	KRP413AB1S (Note 2)
FFQ	KRP4A71
FDMQ	KRP4A71

Note 1: KRP067A41E Adaptor is required.
Note 2: KRP980B2 Adaptor is required.

Integrating DZK

The DZK brings zoning flexibility to an individual fan coil and features optional front-end integration to any BACnet™ IP compatible Building Management System.

The DZK system is not directly compatible with the Daikin BMS Interfaces such as *iTM BACnet* Server Gateway or *BACnet* Interface. However, it is now possible to address this requirement with the DZK *BACnet* Interface module. The DZK *BACnet* Interface module will work with any *BACnet* IP compatible Building Management System, including the *iTM BACnet* Client option, and allow for monitoring and controlling the various DZK zone dampers from a centralized control system.
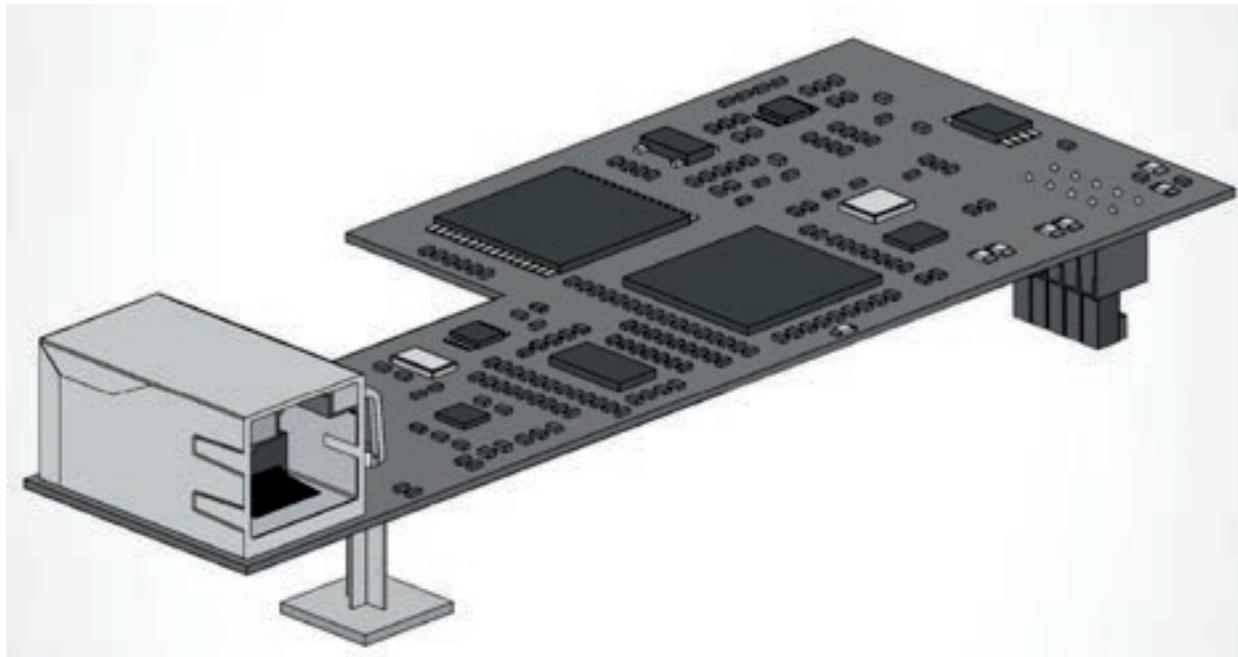
The DZK *BACnet* Interface is a Plug & Play device for DZK, and it allows controlling and monitoring the following variables:

» Indoor Unit status.

» Fan status and Fan Speed.

» Auxiliary Heat stages status.

» Global Ventilation status.

» Operation Mode Control status.

» On/Off control for each zone.

» Setpoint setting for Cooling and Heating for each zone.

» Room Temperature in each zone.

» Local Ventilation activated/deactivated for each zone.

» Unoccupied Override activate/deactivate.

» Vacation Override activate/deactivate.

» Opening Damper Status for each zone.

» Indoor Unit and DZK errors.

The full object for the DZK system is available from the installation manual.

Integrating DZK, *Continued*

It is important to note that the fan coil connected to a DZK system, cannot be controlled by the BMS directly. The DZK zoning kit can only be controlled via the DZK BACnet™ Interface. In projects that use DZK there will different points of access for the BMS; the regular *VRV* fan coil is accessed using the *VRV* BMS Interface such as *iTM BACnet* server and the DZK system is accessed using the DZK *BACnet* Interface.

Typical system layout with DZK card:

iTM with *BACnet* Server

F1F2   F1F2

BACnet/IP

DZK *BACnet* Gateway

BMS
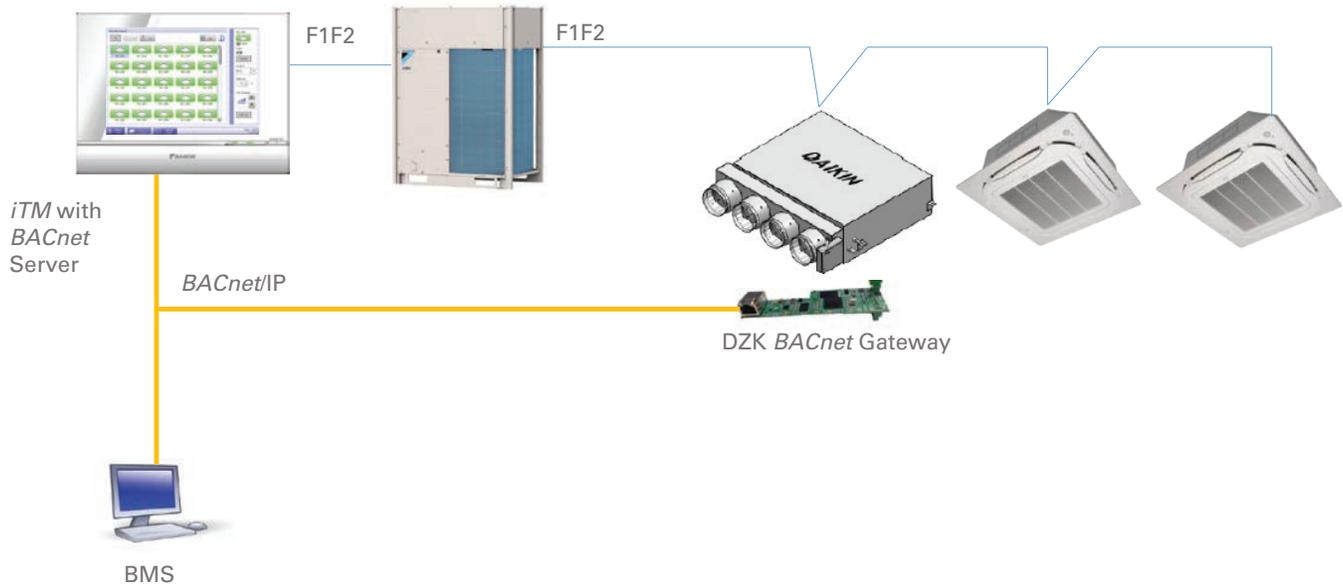
Integrating DVS

Daikin Dedicated Outside Air System (DVS – DOAS AHU) is designed for seamless integration with *VRV* air-cooled heat recovery outdoor units and controls to provide conditioning of 100% outside ventilation air.

The DVS AHU is equipped with a Microtech III controller that can connect to either a BACnet™ / IP or *BACnet* MS/TP or LonWorks® system. The Building automation cards are an add-on accessory to the Microtech III controller.

The table below shows the part numbers for the Building Automation card for the DVS.

Module	Part Number
BACnet IP kit	090016709
BACnet MSTP Kit	090016710
LonWorks Kit Discharge air control	090016712

Example of a *BACnet* / IP communication module connected to the Microtech III controller.

BACnet Module

Since there are multiple options, when integrating with the DVS it is very important to know the BMS's preferred communication protocol.

Typical schematic of DVS connected to BMS along with *VRV* system:

iTM with *BACnet* Server

BACnet/IP

DZK *BACnet* Gateway

Microtech III controller with *BACnet*/IP card

BMS

DVS
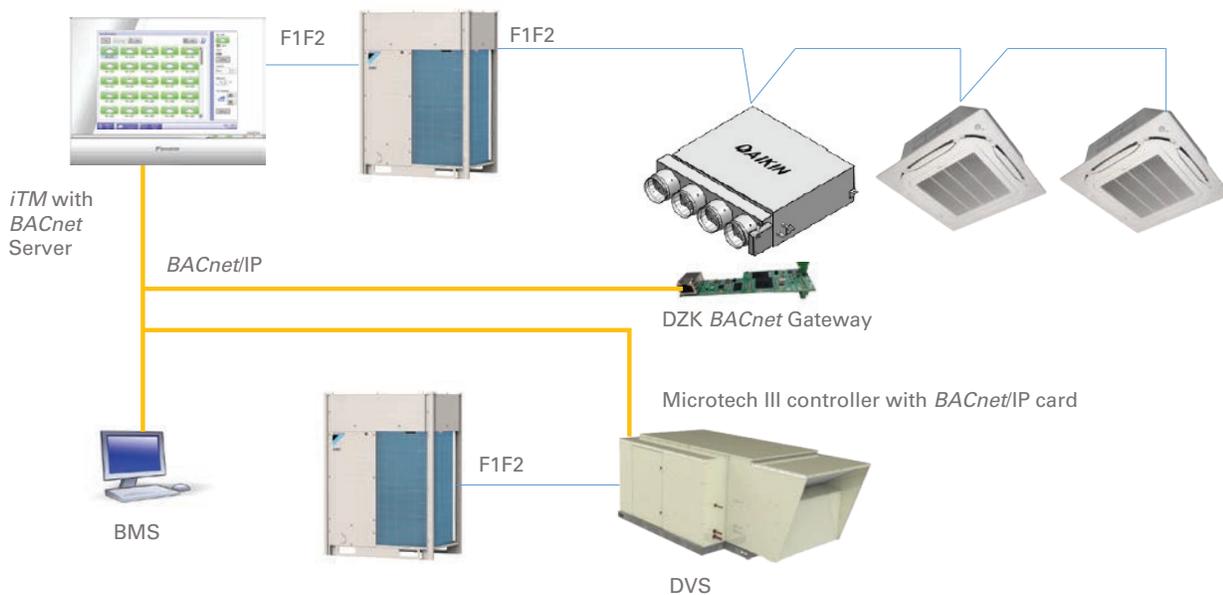
Integration of Daikin Energy Recovery Ventilator

An Energy Recovery Ventilator (ERV) is an air-to-air heat exchanger that transfers not only sensible heat but also latent heat. The ERV recovers energy by exchanging the energy contained in a normally exhausted building and using it to treat (precondition) the incoming outdoor air. In the summer months, the ERV pre-cools and dehumidifies the outdoor air and in winter months the ERV pre-heats and humidifies the outdoor air. The Daikin VAM is available 4 different sizes based on the supply cfm (300, 470, 600, and 1200 cfm). The Daikin VAM operates in the following modes:

ERV Mode: The return air is exhausted through the VAM core; therefore, energy is exchanged between the outside air and return air.

Bypass Mode: The return air is exhausted without passing through the VAM core; therefore, energy is not exchanged between the outside and return air.

Auto Mode: Based on the indoor unit operation (cool, heat, fan, Setpoint) and the VAM indoor and outdoor temperatures the ventilation mode is automatically selected between ERV mode and Bypass mode.

The VAM unit can be connected to the BMS using a compatible *VRV* Interface. The below table provides the points list for each of the Interface.

Function	*iTM* w/BACnet™ Server	BACnet™ Interface	LonWorks° Interface	ModBus° Interface	Dry Contact
Start/Stop command	N/A	■	■	■	■
Start/Stop Status	N/A	■	■	■	■
Fan volume Command	N/A	■	N/A	N/A	N/A
Fan volume status	N/A	■	N/A	N/A	N/A
ERV Mode Command	N/A	■	N/A	N/A	N/A
ERV Mode Status	N/A	■	N/A	N/A	N/A
Fresh Up	N/A	■	N/A	N/A	■
Fan Status monitoring	N/A	■	N/A	N/A	N/A
Alarm Monitoring	N/A	■	■	N/A	■

Integration of Daikin Outdoor-Air Processing Unit

The Daikin Outdoor Air Processing Unit is a fresh air treatment indoor unit that can connect to a *VRV* system. The Daikin Outdoor Air Processing Unit controls a fixed discharge air temperature Setpoint based on the field setting performed by local control. The outdoor unit processing does not provide much control from a BMS; however, its operation can be monitored.

The OA processing unit can be connected to the BMS using a compatible *VRV* BMS Interface. Below table provides the points list for each of the interfaces.

Function	*iTM* w/BACnet™ Server	BACnet™ Interface	LonWorks® Interface	ModBus® Interface	Dry Contact
Start/Stop command	■	■	■	■	■
Start/Stop Status	■	■	■	■	■ (with a relay and optional PCB)
Fan Status	■	■	■	■	■ (with a relay and optional PCB)
Entering Air Temperature	■	■	■	■	N/A
Thermo-On Status	■	■	■	N/A	■ (with a relay and optional PCB)
Compressor Status	■	■	■	N/A	N/A
Operation Mode Command	■	■	■	■	N/A
Operation Mode Status	■	■	■	■	N/A
Discharge Air Temperature		N/A	N/A	N/A	N/A
Malfunction Code	■	■	■	■	N/A
Alarm	■	■	■	■	■ (with a relay and optional PCB)
Filter Status and Reset	■	■	■	■	N/A
Setpoint Adjustment	N/A	N/A	N/A	N/A	N/A

Understanding Operation Data

The operation data of the *VRV* outdoor unit and indoor units are available to BMS using *iTM* BACnet™ Server Gateway option. This chapter explains most of the data points available as operation data.

Outdoor Unit

Compressor Speed: Inverter compressor is modulated based on system demand. When an outdoor unit has more than two compressors, the two compressors are staged per their programmed operation.

Outdoor Unit Fan Speed: The outdoor unit fan speed is controlled in steps; the number of steps can be monitored from this point. When the outdoor unit has more than one fan, both the fans operate at the same step.

High-Pressure Sensor: The high-pressure sensor measures the refrigerant pressure on the outlet side of the compressor and is used to monitor Tc (saturated temperature) of the refrigerant; which is used in compressor speed control. Additionally, this sensor is used in the high-pressure protection mechanism of the outdoor unit.

Low-Pressure Sensor: The low-pressure sensor measures the refrigerant pressure before the inlet of compressor and is used to monitor Te (saturated temperature) of the refrigerant, which is used in compressor speed control. Additionally, this sensor is used in the low-pressure protection mechanism of the outdoor unit.

Condensing Temperature: The condensing temperature is calculated Tc (saturated temperature) from the high-pressure sensor value. These sensors are used in various programming such as compressor speed control.

Evaporator Temperature: The evaporator temperature is calculated Te (saturated temperature) from the low-pressure sensor value. These sensors are used in various programming such as compressor control.

Hot Gas Temperature: This sensor measures the gas temperature at the outlet of the compressor. This value is used in discharge pipe protection control which is used to protect the compressor's internal temperature against an error or transient increase of discharge pipe temperature. This sensor is also used in the crankcase heater logic.

Liquid Pipe Temperature (De-icer): When in Heating mode, this temperature value is used to make judgments regarding the defrost operation of the outdoor unit.

Outdoor Air Temperature: The outdoor air temperature values are used to make system operation settings such as VRT (Variable Refrigerant Temperature). It is also used in the heat pump lockout logic, which is settable using the outdoor field settings.

Compressor Suction Temp: This point is monitoring the refrigerant temperature entering the compressor.

Suction Temp: This point is monitoring the temperature of the refrigerant return from the indoor units.

Defrost Mode: Defrost operation is performed to melt the frost on the outdoor unit heat exchanger when heating, and thus recover heating capacity.

Oil Return Mode: In order to prevent the compressor from running out of oil, oil return operation is conducted to recover oil that has been distributed throughout the system. This data point provides the status of the outdoor unit in oil return mode.

EV Position: EV (Electronic Valve) in the outdoor unit controls the refrigerant flow through the outdoor unit heat exchanger. Depending on the unit, there will be one or two such EV.

HX Liquid Pipe Temp and Gas Pipe Temperature: These sensors monitor the refrigerant entering and exiting the heat exchanger and used in controlling the refrigerant flow to heat exchanger.

Subcool Inlet Temperature, Subcool Outlet Temperature and Subcool EV position: These temperature sensors are part subcool circuit and control the subcool EV position.

Indoor Unit

Liquid Pipe Temperature: This value is used with the gas pipe temperature, to adjust the expansion valve to maintain superheat in cooling. This value is used with the Tc saturated temperature, to adjust the expansion valve to maintain the subcool in heating.

Gas Pipe Temperature: This value is used with the liquid pipe temperature, to adjust the expansion valve to maintain superheat in cooling.

Indoor EEV Position: These values indicated the degree of Electronic Expansion Valve (EEV) opening in the indoor unit. The values opening is measured in pulse, higher pulses mean a higher degree of opening consequently more refrigerant flow.

Freeze Protection Status: This point indicates the indoor unit is in a special operation mode, wherein the indoor unit expansion valves is closed and fan speed is set to L. Freeze protection is activated when the liquid pipe temperature is too low to prevent operation issues.

Discharge Air Temperature: This point monitors the discharge air temperature from the unit.

Return Air Temperature: This point monitors the return air temperature to the unit. Depending upon the field setting, this value could be used for control of the unit. When Outside air is ducted into the unit, this value may read abnormal values because the return at this point would read mixed air.

BUILDING AUTOMATION APPLICATION GUIDE

APPENDIX 1:
iTM AUTOCHANGEOVER FUNCTION
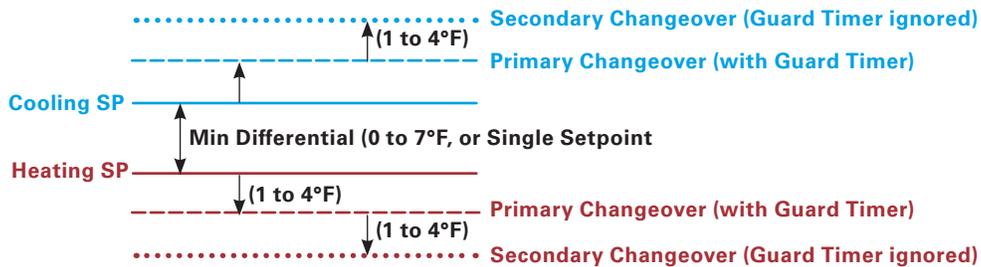
Appendix 1: *iTM* Autochangeover Function

Using the advanced auto changeover functions in the *iTM*, the BMS programming time can be greatly reduced. Shown here are the options available in the *iTM* for an auto changeover. Automatic changeover is available for both Heat Pump and Heat Recovery systems. The changeover is automatically controlled to occur in either of the following two cases:

Case 1: Changeover at the primary changeover temperature after the guard timer expires

1. In default, the primary changeover setpoint is 1°F above setpoint or 1°F below the heating setpoint, which is configurable between 1°F – 4°F.

2. In default, the guard timer is 60 minutes, which is selectable among 15, 30, or 60 (default) minutes.

3. The initiation of guard timer is built in to help prevent frequent changeover which may cause energy loss.

Case 2: Changeover at the secondary changeover temperature.

1. In default, the secondary changeover temperature is °F above the primary changeover temperature for cooling or 1°F below the primary changeover temperature for heating, which is configurable between 1°F – 4°F.

2. Case 2 will happen while the guard time is active in case 1.

There are 4 ways the above changeover logic can be implemented:

1. Fixed   2. Individual   3. Average   4. Vote function

Fixed Method: This method evaluates the room temperature and the setpoint for the first indoor unit registered in a changeover group. This method is typically used for Heat Pump systems and Heat Recovery systems with multiple indoor units connected to the same port of the Branch Selector Box.
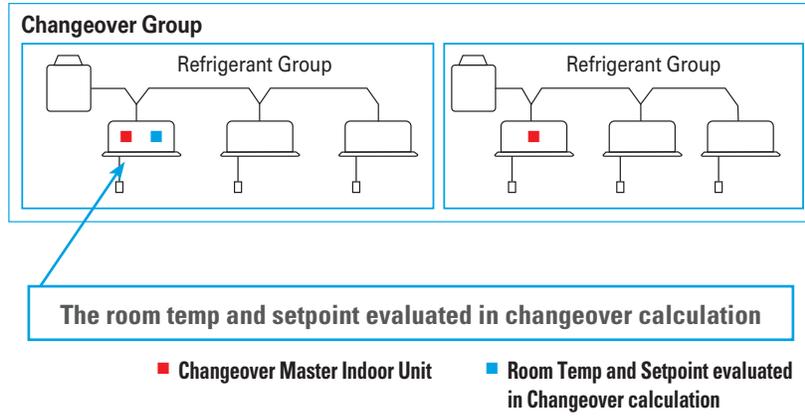
Individual Method: This method enables switching between the cooling and heating modes individually for each indoor unit in the changeover group. This method should be used for Heat Recovery systems where each refrigerant group has control of the operation mode without depending on another refrigerant group. For example, in a hotel or nursing home where there are many refrigerant groups, which can be configured with the same changeover configuration.
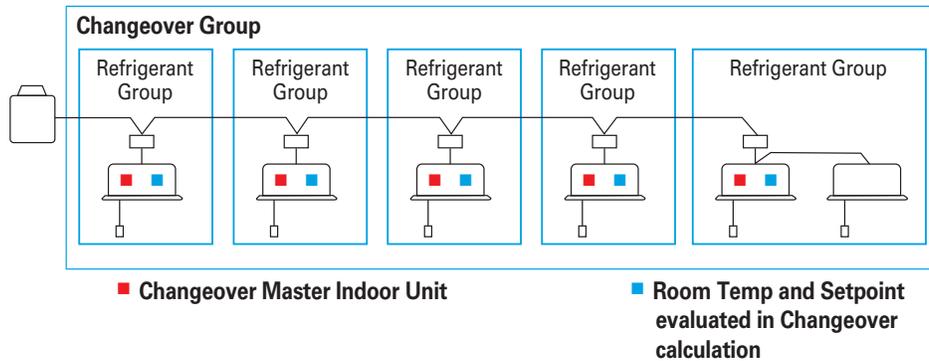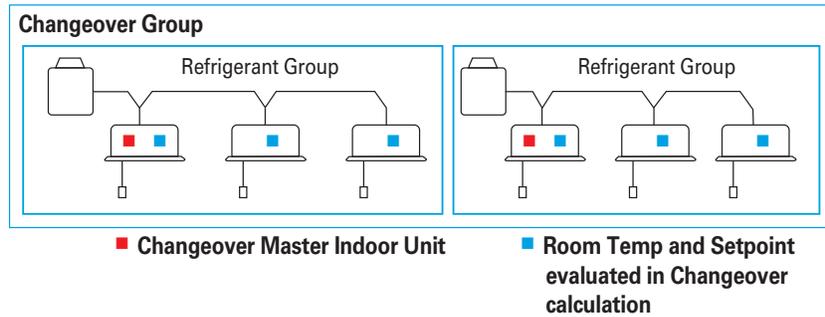

Vote Method: This method enables the *iTM* to determine the operation mode by calculating the average room temperatures and the average setpoints of all indoor units in the changeover group. A weight (0-3) can be added to each indoor unit in the changeover group. It is used in cases where there is a desire to evaluate temperature throughout a large physical space, for example when multiple indoor units are installed in hallways.
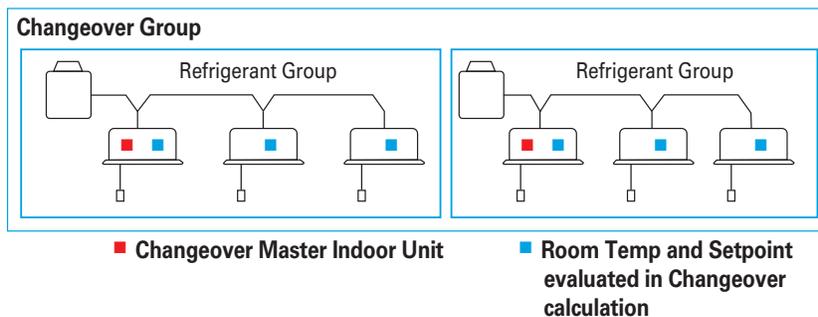
Average Method: This method enables the *iTM* to determine the operation mode by calculating the weighted demand between room temperatures and setpoints for each indoor unit in the changeover group. A weight (0-3) can be added to each indoor unit in the changeover group, a weight of zero means the unit is not evaluated and a weight of three means the unit has the highest weight in the demand calculation. The vote method provides a pseudo Heat Recovery operation on a Heat Pump system or where multiple indoor units are connected to the same Branch Selector Box.

Changeover Group

Refrigerant Group   Refrigerant Group

■ **Changeover Master Indoor Unit**   ■ **Room Temp and Setpoint evaluated in Changeover calculation**

BUILDING AUTOMATION
APPLICATION GUIDE

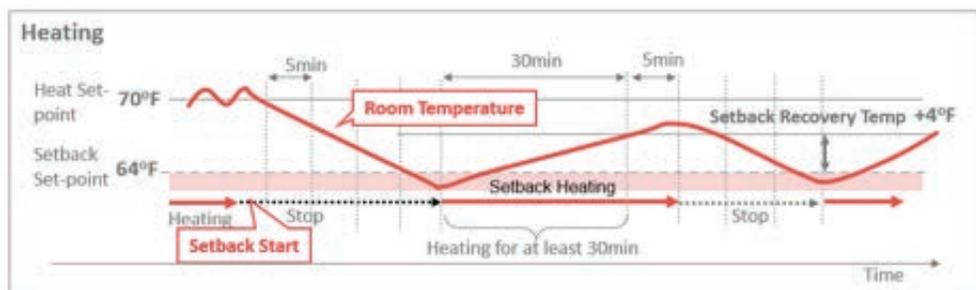# APPENDIX 2:
iTM SETBACK FEATURE
FUNCTION

Appendix 2: *iTM* Setback Function

Using the *iTouch Manager's* setback feature can reduce the programming on BMS. It is recommended when using the *iTM's* BACnet™ server option.

Setback Cooling: During the unoccupied period, the unit will operate in setback cooling mode if the room temperature goes above the unoccupied cooling setpoint. The decision to start a setback is made every 5 minutes. Once the room temperature has been recovered by the set recovery temperature (setting available on the *iTM*), the unit shall turn Off. There is a minimum 30-minute run timer that must be satisfied before the indoor unit turns Off.
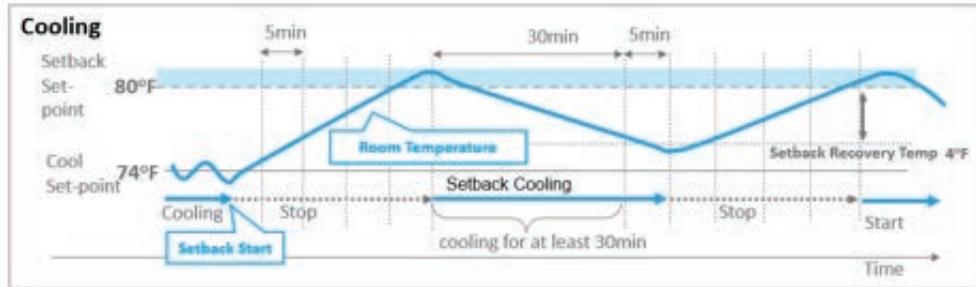
Setback Heating: During the unoccupied times, the unit will operate in setback heating mode if the room temperature goes below the unoccupied heating setpoint. The decision to start a setback is made every 5 minutes. Once the room temperature has been recovered by the set recovery temperature (setting available on the *iTM*), the unit shall turn Off. There is a minimum 30-minute run timer that must be satisfied before the indoor unit turns Off.

# BUILDING AUTOMATION APPLICATION GUIDE

APPENDIX 3:

ODU COMPATIBLE MODEL FOR *iTM* BACNET™ SERVER OPTION

Appendix 3: ODU compatible model for *iTM* BACnet™ Server option

# of Modules	Heat Pump	Heat Recovery
Single	RXYQ72-120TAYDU RXYQ72-120TATJU	REYQ72TAYDU REYQ72TATJU
	RXYQ144-168TAYDU RXYQ144-168TATDU	REYQ96-168TAYDU REYQ96-168TATDU
Double	RXYQ192-240TAYDU RXYQ192-240TATDU	REYQ192TAYDU REYQ192TATJU
	RXYQ264TAYDU RXYQ264TATJU	REYQ216-336TAYDU REYQ216-336TATDU
	RXYQ288-336TAYDU RXYQ288-336TATDU	–
Triple	RXYQ360TAYDU RXYQ360TATJU	REYQ360-456TAYDU REYQ360-456TATDU
	RXYQ384TAYDU RXYQ384TATJU	–
	RXYQ408TAYDU RXYQ408TATJU	–
Single (*AURORA*)	RXLQ72TATJU RXLQ72TAYCU RXLQ72TAYDU	RELQ72TATJU RELQ72TAYCU RELQ72TAYDU
	RXLQ96TATJU RXLQ96TAYCU RXLQ96TAYDU	RELQ96TATJU RELQ96TAYCU RELQ96TAYDU
Double (*AURORA*)	RXLQ120TATJU RXLQ120TAYCU RXLQ120TAYDU	RELQ120TATJU RELQ120TAYCU RELQ120TAYDU
	RXLQ144TATJU RXLQ144TAYCU RXLQ144TAYDU	RELQ120TATJU RELQ120TAYCU RELQ120TAYDU
	RXLQ192TATJU RXLQ192TAYCU RXLQ192TAYDU	RELQ192TATJU RELQ192TAYCU RELQ192TAYDU
	RXLQ240TATJU RXLQ240TAYCU RXLQ240TAYDU	RELQ240TATJU RELQ240TAYCU RELQ240TAYDU

The following outdoor units are not compatible:

1. *VRV-III Air-Cooled*   2. *VRV-III Water-Cooled*   3. *VRV-IV Water-Cooled*   4. *VRV-S*   5. *SkyAir*

Notes

Notes
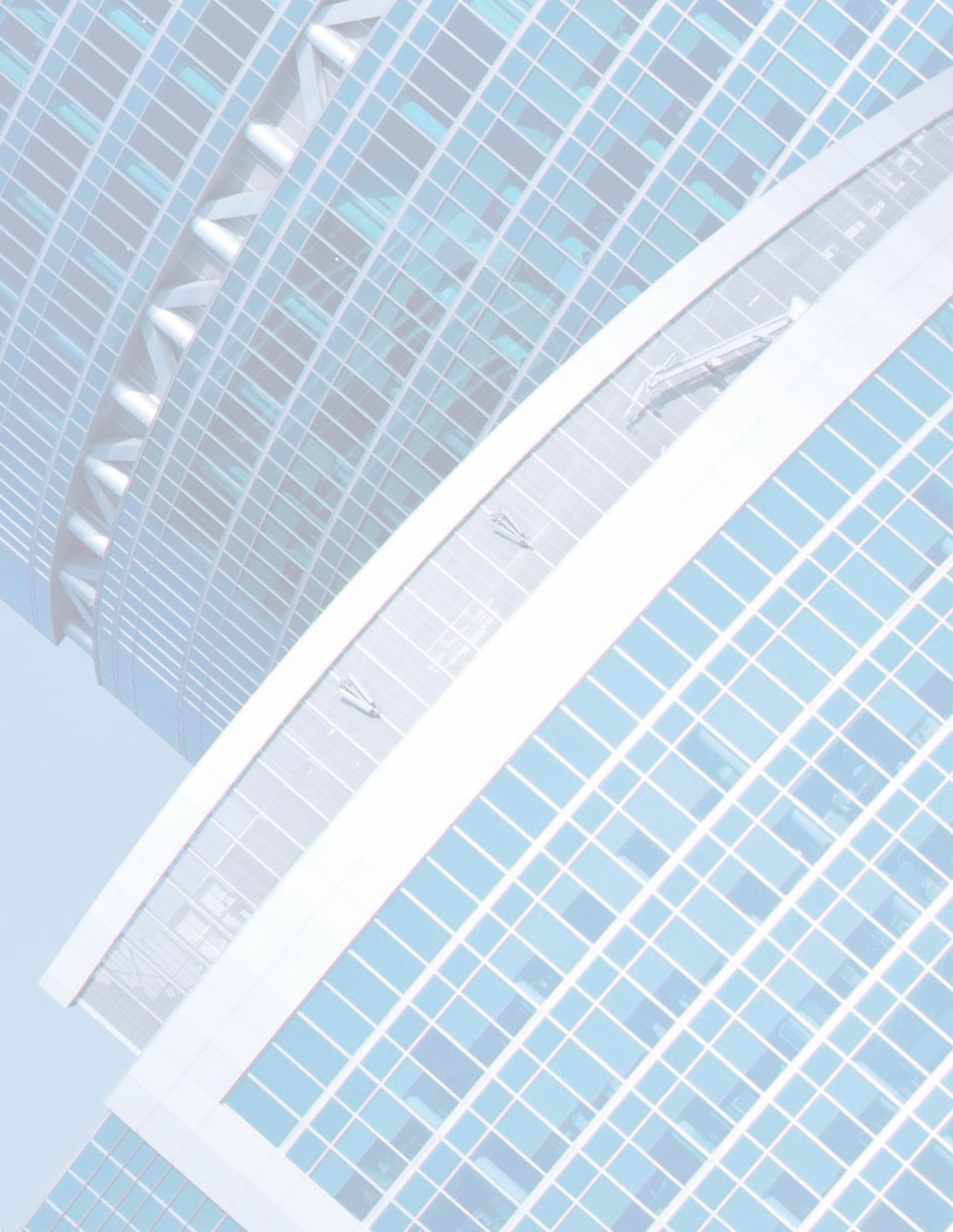
Daikin is one of the largest manufacturers of HVAC products in North America delivering environmentally-friendly conscious, *"air intelligent"* technology solutions for residential, commercial, and industrial applications.

ADDITIONAL INFORMATION

Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer. **Visit www.daikinac.com to learn more.**