# VARIABLE REFRIGERANT VOLUME (VRV) HVAC SYSTEM

# Building Management System Integration (Open Protocol Interface)

# Part 1 – General

## Physical characteristics

* 1. The VRV Controls Network shall be capable of supporting remote controllers, schedule timers, system controllers, centralized controllers, an integrated web-based interface, graphical user workstation, and system integration to Building Management Systems via BACnet®, Lonworks® and Modbus.
  2. The BACnet and Lonworks Interfaces shall be made from stainless steel. Each interface shall have a battery backup and LED lights to display status/error.
  3. The Modbus Interface and DIII-Net/BACnet MS/TP Communication Adaptor shall be a PCB mounted in the outdoor unit or indoor unit that provides LED lights to communicate status.

## Electrical characteristics

* 1. **General:** 
     1. The BACnet and Lonworks Interfaces will require 24 VAC to power the unit. The Open Protocol Interface shall supply 16 volts DC to the communication bus on the F1F2 (out-out) terminal of the outdoor unit.
     2. The Modbus Interface and DIII-Net/BACnet MS/TP Communication Adaptor will require 16 VDC to power the unit from the outdoor unit or indoor unit.
  2. **VRV Communication Wiring:** 
     1. The Open Protocol Interface communication wiring shall be terminated in a daisy chain design at the outdoor unit, which is then daisy chained to branch selector (Heat Recovery system), then daisy chained to each indoor unit in the system and terminating at the farthest indoor unit. The termination of the wiring shall be non-polar.
     2. The remote-control wiring shall run from the indoor unit control terminal block to the remote controller connected with that indoor unit.
  3. **VRV Wiring size:** 
     1. Wiring shall be non-shielded, 2-conductor sheathed vinyl cord or cable and 18 AWG stranded copper wire.
  4. **VRV Controls Network:** 
     1. The VRV Controls Network is made up of local remote controllers, multi-zone controllers, advanced multi-zone controllers, and open protocol network devices that transmit information via the communication bus.
     2. The VRV Controls Network shall also be accessed via a networked PC.
     3. The VRV Controls Network supports operation monitoring, scheduling, error e-mail distribution, general user software, tenant billing, maintenancesupport, and integration with Building Management Systems (BMS) using open protocol via BACnet®, Lonworks® or Modbus interfaces; all of which blend to provide the optimal control strategy for the best HVAC comfort solution.

# Part 2 – Products

## Open Protocol Interfaces

* 1. **General**
     1. The Open Protocol Interfaces are designed as a translator between the DIII-Net communications and the protocols used in BACnet®, Lonworks® and Modbus integration.
     2. The Daikin VRV Open Protocol Interfaces are compatible with VRV indoor, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter.
     3. The Open Protocol Interface wiring consists of a stranded non-polar two-wire connection to the outdoor unit.
     4. The BACnet and Lonworks Interfaces may be wall-mounted.
     5. The Modbus interface and DIII-Net/BACnet MS/TP Communication Adaptor shall be mounted in the outdoor or indoor unit.
     6. The BACnet and Lonworks interface can be used in conjunction with a Building Management System (BMS) to maintain the optimal operation of up to 64 connected indoor unit groups and 128 indoor units (dependent upon interface option configuration).
     7. The Modbus interface can be used in conjunction with a Building Management System (BMS) to maintain the optimal operation of a maximum of 16 connected indoor unit groups and 2 outdoor units.
     8. The DIII-Net/BACnet MS/TP Communication Adaptor can be used in conjunction with a Building Management System (BMS) to maintain the optimal operation of a maximum of 32 connected indoor unit groups and 4 outdoor units.
     9. In cases where a system or unit error may occur, the VRV controllers and the BMS central monitoring system will display an error code as specified by Daikin.
     10. Interface for use in BACnet: DMS502B71
     11. Interface for use in Lonworks: DMS504C71
     12. DIII-Net/Modbus Interface Adapter: DTA116A51
     13. DIII-Net/BACnet MS/TP Communication Adaptor: DTA118A72

# Part 3 – Specifications

# DMS502B71: Interface for use in BACnet

## **General**

* + 1. The Interface for use in BACnet shall provide the ability for a Building Management System (BMS) to control all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter.
    2. It shall be capable of controlling a maximum of 2 DIII-Net systems or 64 indoor unit groups (128 indoor units) connected to a maximum of 10 outdoor units on each DIII-Net system. Each DIII-Net system is independent of each other, and each DIII-Net system will terminate on its own DIII-Net port (2 DIII-Net ports standard).
    3. The Optional DIII Board (DAM411B51) can be added to the interface. This option provides 2 additional DIII-Net ports to the interface; a total of 4 DIII-Net ports (maximum of 64 indoor unit groups per DIII-Net port) which can handle a maximum of 256 indoor unit groups (512 indoor units) and 40 outdoor units.
    4. The Interface for use in BACnet shall support operations superseding that of the Daikin centralized controller, local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.
    5. The Interface for use in BACnet uses a standard open protocol based on ANSI/ASHREA Standard 135. The BACnet Interface has been certified by the BACnet Testing Laboratories (BTL). The BACnet Interface is compatible with BACnet IP (ISO16484-5).
    6. The interface wiring shall consist of a non-polar two-wire connection to the terminals F1F2 (out-out) of the outdoor unit. The Interface for use in BACnet is wall mounted and is used as a translator between the BACnet Building Management System (BMS) and the VRV DIII-Net communication bus to maintain the optimal operation of the connected indoor unit(s).
    7. The Interface for use in BACnet can be used in conjunction with following remote controllers to control the same indoor unit groups,
       1. BRC1E71/ 72/ 73 (Navigation Remote Controller)
       2. BRC2A71 (Simplified Remote Controller),
       3. BRC4C82/ 7E83/ 7C812/ 7E818 (Wireless Remote Controller),
       4. BRC1H71W (Madoka Remote Controller)
       5. No more than 2 remote controllers can be placed in the same group. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together.
    8. The Interface for use in BACnet can be used in conjunction with following centralized controllers to control the same indoor unit groups,
       1. DCS601C71 (Intelligent Touch Controller (ITC)) with or without the DCS601A72 (ITC DIII Plus Adapter)
       2. DCM601A71 (intelligent Touch Manager (iTM)) with or without the DCM601A72 (iTM Plus Adapter)
    9. Manual addressing is required of each indoor unit group associated with the Intelligent Touch Controller, intelligent Touch Manager and the Interfaces for use in BACnet.
    10. The Interface for use in BACnet shall be equipped with one RJ-45 Ethernet port to support interconnection with a network PC via the Internet or Local Area Network (LAN). The Ethernet connection shall be capable of transmission on 10Base-T and/or 100Base-TX connection at 100 Mbps.
    11. The Interface for use in BACnet shall be capable of being configured as a foreign device. It shall be capable of communicating across BACnet Broadcast Management Devices (BBMD) in different subnet networks.
    12. The Interface for use in BACnet shall be capable of supporting Change of Value (COV) notification for all available objects.
    13. The Daikin BACnet Setup Tool shall be available so that certified commissioning personnel/facility staff can securely log into each Interface for use in BACnet via a PC to support the configuration and testing of the Interface for use in BACnet.
    14. Mounting: The Interface for use in BACnet shall be mounted on the wall or in an enclosure.

## **Features:**

* + 1. The Interface for use in BACnet shall be approximately 10.81” x 10.34” in size.
    2. LED display provides the interface’s operational status and alarm.
    3. The Interface for use in BACnet shall be capable of displaying indoor unit objects on the BACnet building management system.
    4. The Interface for use in BACnet shall provide the BACnet building management system the capability to command the setpoint temperature in 10F (0.100C) increments with a range acceptable to indoor unit. Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius
    5. The Interface for use in BACnet shall provide the BACnet building management system the capability to display the room temperature in 0.100F (0.100C) increments Display of room temperature information shall be configurable for Fahrenheit or Celsius
    6. Error codes generated by the indoor units, outdoor units, branch selector boxes, and remote controllers shall be displayed on the BACnet building management system in the event of system abnormality/error with a two-digit error code as specified by Daikin. Communication errors between the Interface for use in BACnet and the BACnet building management system shall be displayed with a red flashing LED on the Interface for use in BACnet

## **Basic Operation:**

* + 1. The Interface for use in BACnet will provide up to 31 objects that can be monitored/controlled via the BACnet building management system (see the Interface for use in BACnet Design Guide – EDUS72-749C) Capable of controlling up to 64 indoor unit groups (128 indoor units) per DIII-Net port (2 DIII-Net ports standard). Optional DIII Board (DAM411B51) can be added to increase DIII-Net ports to a total of 4 DIII-Net ports. This provides a total of 256 indoor unit groups (512 indoor units) that can be monitored and controlled via the BACnet building management system
    2. The Building Management System shall control the following group operations:
* On/Off
* Operation Mode (Cool, Heat, Fan, Auto, and Dry)
* Single setpoint setting for Cooling and Heating in the occupied mode.
* Fan status
* Fan Speed
* Up to 3 speeds (dependent upon indoor unit type)
* Vane direction (dependent upon indoor unit type), 5 fixed positions or swing positions
* Remote controller permit/prohibit of On/Off, Mode, and Setpoint
* Filter sign reset for indoor units
* Disable the Intelligent Touch Controller or Manager.
* Forced off for indoor units
* Forced Thermo-off for indoor units
* Energy saving offset of indoor unit setpoint
* Compressor status
* Thermo-on status
* Heater status
  + 1. Capable of providing battery backup power for up to 3 years in total time for the clock for settings stored in non-volatile memory

## **Programmability:**

* + 1. The BACnet building management system shall support weekly schedule settings through its programming.
       1. The schedule shall support the indoor unit On/Off
       2. Each scheduled event shall specify time and target group
       3. Each scheduled event shall include On/Off, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, Setup (Cooling) setback setpoint, Setback (Heating) setback setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable
       4. Setback (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied) by Group
       5. An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BACnet building management system programming.
    2. The BACnet building management system shall support auto-changeover through its programming.
       1. Auto-change shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit’s mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
       2. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or the same branch selector box in the Heat Recovery system.
       3. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint, Differential to be determined by BACnet building management system programming
       4. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint. Differential to be determined by BACnet building management system programming
       5. Guard timer: Upon changeover, guard timer will prevent another changeover during this period. Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule. Guard timer to be configured by BACnet building management system programming (30 minute minimum recommended)
    3. The Interface for use in BACnet shall support force shutdown of associated indoor unit groups.

# DTA118A72: DIII-Net/BACnet MS/TP Communication Adaptor.

* 1. **General** 
     1. The DIII-Net/BACnet MS/TP Communication Adaptor shall provide the ability for a Building Management System (BMS) to control all VRV, VAM, SkyAir, and Daikin RA/QA units (Some units may require additional adaptor). It shall be capable of controlling a maximum 32 indoor unit groups connected to a maximum of 4 outdoor units. A maximum of two adaptors shall be installed on each DIII-Net system. Each DIII-Net system shall be of independent of each other.
     2. The DIII-Net/BACnet MS/TP Communication Adaptor uses a standard open protocol based on ANSI/ASHREA Standard 135. The BACnet Interface has been certified by the BACnet Testing Laboratories (BTL). The BACnet Interface is compatible with BACnet MS/TP (EIA-485).
     3. The adaptor wiring shall consist of a non-polar two-wire connection to the terminals F1F2 (out-out) of the outdoor unit.
     4. The adaptor is mounted on the outdoor unit or the indoor unit or in an appropriate enclosure with a field provided power supply.
     5. DIII-Net/BACnet MS/TP Communication Adaptor is used as a translator between the BACnet Building Management System (BMS) and the VRV DIII-Net communication bus to maintain the optimal operation of the connected indoor unit(s).
     6. The DIII-Net/BACnet MS/TP Communication Adaptor can be used in conjunction with following remote controllers to control the same indoor unit groups,
        1. BRC1E71/72/73 (Navigation Remote Controller)
        2. BRC2A71 (Simplified Remote Controller),
        3. BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller),
        4. BRC1H71W (Madoka Remote Controller)
        5. No more than 2 remote controllers can be placed in the same group. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together.
     7. The DIII-Net/BACnet MS/TP Communication Adaptor can be used in conjunction with following centralized controllers to control the same indoor unit groups,
        1. DCS601C71 (Intelligent Touch Controller (ITC)) with or without the DCS601A72 (ITC DIII Plus Adapter)
        2. DCM601A71 (intelligent Touch Manager (iTM)) with or without the DCM601A72 (iTM Plus Adapter)
     8. Manual addressing is required of each indoor unit group and outdoor unit associated with the DIII-Net/BACnet MS/TP Communication Adaptor
     9. Restrictions:
        1. DIII-NET Expansion Adaptor cannot be connected between the adaptor and indoor / outdoor units DTA109 on the same DIII line
        2. The following controllers and options are not allowed in the same DIII-net network:
           1. Modbus ADP [DTA116A51]
           2. Indoor unit control from a control system [KRP4A]
           3. Wiring Adaptor for Electrical Appendices [KRP2A516]
           4. Outdoor Unit Mode Changeover / Demand Control [DTA104]
           5. System On/Off from a control system [DCS302A]
           6. BACnet Interface [DMS502B71]
           7. Lonworks® Interface [DMS504C71]
           8. iTM BACnet Server Gateway Option [DCM014A51]
     10. The DIII-Net/BACnet MS/TP Communication Adaptor shall be equipped with one RS-485/EIA-485 connection port to support interconnection with a BACnet MS/TP network.
     11. The adaptor shall support the following communication speed (Baud Rate) for MS/TP network: 9600 Bps, 19200 Bps, 38400 Bps
  2. **Features:**
     1. The adaptor shall be approximately 3.94 x 3.94 inch (100 x 100 mm).
     2. The LEDs on the adaptor shall display communication status.
     3. The DIII-Net/BACnet MS/TP Communication Adaptor shall function as BACnet router to provide unique virtual BACnet device identification number (ID) for every indoor unit group address and every outdoor unit device.
     4. The DIII-Net/BACnet MS/TP Communication Adaptor shall provide configurable BACnet Network number.
     5. The DIII-Net/BACnet MS/TP Communication Adaptor shall provide configurable MAC address and BACnet instance number for the adaptor
     6. The DIII-Net/BACnet MS/TP Communication Adaptor shall be capable of displaying indoor unit objects on the BACnet building management system.
     7. The DIII-Net/BACnet MS/TP Communication Adaptor shall provide the BACnet building management system the capability to command the setpoint temperature in 10F (0.10C) increments with a range acceptable to the indoor unit. Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius
     8. The DIII-Net/BACnet MS/TP Communication Adaptor shall provide the BACnet building management system the capability to display the room temperature in 0.10F (0.10C) increments. Display of room temperature information shall be configurable for Fahrenheit or Celsius
     9. Error codes generated by the indoor units, outdoor units, branch selector boxes, and remote controllers shall be displayed on the BACnet building management system in the event of system abnormality/error with an error code as specified by Daikin.
     10. The Adaptor shall support force shutdown of associated indoor unit groups. Even if Forced stop status turns ON from another controller, it is possible to give a driving instruction to the adaptor. Even if adaptor instructs to drive, it will not drive.
  3. **Basic Operation:**
     1. The Building Management System shall monitor and control the following BACnet objects for indoor units
* Unit On\_Off Status
* Unit On/Off Command
* Alarm Status
* Operation Mode
* Ventilation Mode
* Ventilation Rate
* Fresh Up
* Room Temperature
* Cooling Setpoint
* Heating Setpoint
* Fan Speed
* Airflow Direction
* Remote Controller Prohibit (On\_Off)
* Remote Controller Prohibit (Operation Mode)
* Remote Controller Prohibit (On\_Off)
* Filter Sign Status
* Filter sign Reset
* Indoor Unit Fan Status
* Communication Status
* Thermo On status
* Compressor Status
* Aux Heater Status
* Forced Thermo Off
* Indoor unit changeover option
* Return air temperature
* Discharge air temperature
* Liquid pipe temperature
* Gas pipe temperature
* EV position
* Outdoor unit Airnet address
* Forced Stop status
* Energy saving command (Setpoint shift)
  + 1. The Building Management System shall monitor the following BACnet objects (if available) for outdoor unit devices:
       1. Generic Outdoor Unit Points (Available one per refrigerant circuit)
* Communication Status
* Operation Mode
* Outdoor unit Alarm Status
* Special Modes
* Electric Power (calculated)
* Electric Current (calculated)
* Outdoor Air Temperature
* Backup Operation
* Stepdown control
  + - 1. Module Specific Outdoor Unit Points (Available for each module in a multi-module system)
* Condensing Pressure
* Evaporating Pressure
* Condensing Temperature
* Evaporating Temperature
* Inverter Compressor 1 Speed
* Inverter Compressor 2 Speed
* Fan Step
* EV Position 1
* EV Position 2
* Hot Gas Temperature (Compressor 1)
* Hot Gas Temperature (Compressor 2)
* Liquid Pipe Temperature
* Sub Compressor Body Temperature Monitors and displays the compressor body temperature.
* Liquid Pipe Temperature (HX Upper)
* Liquid Pipe Temperature (HX Lower)
* Liquid Pipe Temperature (Deicer)
* Gas Pipe Temperature (HX Upper)
* Gas Pipe Temperature (HX Lower)
* Suction Temperature
* Compressor Suction Temperature
* Subcool Inlet Temperature
* Subcool Outlet Temperature
* Compressor Body Temperature
* Receiver Inlet Temperature
* Subcool EV Position
* 4WayValve Monitors and displays the 4 Way valve position
* Compressor1 current
* Compressor2 current
  + - 1. The valid data points shall vary based on the type of outdoor unit connected.

4. **Programmability:**

* + 1. The BACnet building management system shall support weekly schedule settings through its programming.
       1. The schedule shall support the indoor unit, On/Off
       2. Each scheduled event shall specify time and target indoor unit.
       3. Each scheduled event shall include On/Off, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit.
       4. Setback (Cooling) and Setback (Heating) setback setpoints when unit is Off (unoccupied) by Group
       5. An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BACnet building management system programming.
    2. The BACnet building management system shall support auto-changeover through its programming.
       1. Auto-changeover programming shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit’s mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
       2. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or the same branch selector box in the Heat Recovery system.
       3. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint Differential to be determined by BACnet building management system programming
       4. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint. Differential to be determined by BACnet building management system programming
       5. Guard timer: Upon changeover, guard timer will prevent another changeover during this period. Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule. Guard timer to be configured by BACnet building management system programming (30 minute minimum recommended)

# DMS504C71: Interface for use in Lonworks

* 1. **General** 
     1. The Interface for use in Lonworks shall provide control for all VRV, SkyAir indoor units, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of handling a maximum of 64 indoor unit groups (128 indoor units) connected to a maximum of 10 outdoor units.
     2. The Interface for use in Lonworks shall support operations superseding that of the Daikin centralized controller, local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.
     3. The Interface for use in Lonworks wiring shall consist of a stranded non-polar two-wire connection to the terminals F1F2 (out-out) of the outdoor unit. The Interface for use in Lonworks is wall mounted and can be used in conjunction with the Intelligent Touch Manager to maintain the optimal operation of the connected indoor unit(s).
     4. The Interface for use in Lonworks is connected to the Lonworks building management system by twisted two wire pair specified by Echelon.
     5. The Interface for use in Lonworks can be used in conjunction with following remote controllers to control the same indoor unit groups,
        1. BRC1E71/ 72/7 3 (Navigation Remote Controller)
        2. BRC2A71 (Simplified Remote Controller),
        3. BRC4C82/ 7E83/7C812/ 7E818 (Wireless Remote Controller),
        4. BRC1H71W (Madoka Remote Controller)
        5. No more than 2 remote controllers can be placed in the same group. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together.
     6. The Interface for use in Lonworks can be used in conjunction with following centralized controllers to control the same indoor unit groups,
        1. DCS601C71 (Intelligent Touch Controller (ITC)) with or without the DCS601A72 (ITC DIII Plus Adapter)
        2. DCM601A71 (intelligent Touch Manager (iTM)) with or without the DCM601A72 (iTM Plus Adapter)
     7. Manual addressing is required of each indoor unit group associated with the Interface for use in Lonworks.
     8. Mounting: The Interface for use in Lonworks can be mounted on the wall or in an enclosure (field supplied).
  2. **Features:**
     1. The Interface for use in Lonworks shall be approximately 10.23” x 6.61” in size.
     2. LED display provides the interface’s operational status and alarm.
     3. The Interface for use in Lonworks shall be capable of displaying the indoor unit network variable points on the Lonworks building management system.
     4. The Interface for use in Lonworks shall provide the Lonworks building management system the capability to command the setpoint temperature in 0.10C increments with a range acceptable to the indoor unit.
     5. Display of temperature setpoint information shall be displayed in Celsius
     6. Fahrenheit display will require the Lonworks building management system to convert the temperature setpoint from Celsius to Fahrenheit
     7. The Interface for use in Lonworks shall provide the Lonworks building management system the capability to display the room temperature in 0.10C increments.
     8. Display of room temperature information shall be shown in Celsius
     9. Fahrenheit display will require the Lonworks building management system to convert the room temperature from Celsius to Fahrenheit
     10. Error codes generated by the indoor units, outdoor units, branch selector boxes, and remote controllers shall be displayed on the Lonworks building management system in the event of system abnormality/error with a decimal value error code that can be cross referenced as specified by Daikin.
     11. Communication errors between the Interface for use in Lonworks and the Lonworks building management system shall be displayed with a red flashing LED on the Interface for use in Lonworks
  3. **Basic Operation:**
     1. The Interface for use in Lonworks will provide 2 Node Network Variables, 4 Common Network Variables for the DIII-Net communication bus, and 23 indoor unit Network Variables for each indoor unit that can be monitored/controlled via the Lonworks building management system (see the Interface for use in Lonworks Design Guide –ED72-333) Capable of controlling up to 64 indoor unit groups (128 indoor units)
     2. The building management system shall control the following group operations for a typical VRV indoor unit:
        + On/Off
        + Operation Mode (Auto, Heat, Cool, Fan)
        + Single setpoint setting for Cooling and Heating in the occupied mode
        + Fan Speed
        + 2 fan speeds selectable (High/Low)
        + Indoor units with 3 or more fan speeds will display as either high or low based upon fan speed value.
        + Fan speeds with a value less than 4 will display as “Low”. Values 5 or greater will display as “High”.
        + Remote controller permit/prohibit of On/Off, Mode, and Setpoint
        + Filter sign reset for indoor units
        + Disable the Intelligent Touch Controller
        + Forced off of the indoor units
        + Forced Thermo-off of indoor units
     3. Capable of providing battery backup power for up to 3 years in total time, Capable of providing battery backup power for up to 1 month in total time with a minimum charging time of 24 hours. Settings stored in non-volatile memory, Binding between the Interface for use in Lonworks and the Lonworks building management system will be saved if power is lost.
  4. **Programmability:**
     1. The Lonworks building management system shall support weekly schedule settings through its programming.
        1. The schedule shall support the indoor unit: On/Off
        2. Each scheduled event shall specify time and target group
        3. Each scheduled event shall include On/Off, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, Setup (Cooling) setback setpoint, Setback (Heating) setback setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Operation Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable
        4. Setback (Cooling) and Setback (Heating) setback setpoints when unit is Off (unoccupied) by Group
        5. An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BACnet building management system programming.
     2. The Lonworks building management system shall support auto-changeover through its programming.
        1. Auto-changeover shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit’s mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
        2. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or to the same branch selector box in the Heat Recovery system.
        3. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint Differential to be determined by BACnet building management system programming.
        4. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint. Differential to be determined by BACnet building management system programming
        5. Guard timer: Upon changeover, guard timer will prevent frequent changeover during a short period. Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule Guard timer to be configured by the Lonworks building management system programming (30 minute minimum recommended) The Interface for use in Lonworks shall support force shutdown of associated indoor unit groups.

# DTA116A51: DIII-Net/Modbus Interface Adapter

* 1. **General** 
     1. The DIII-Net/Modbus Interface Adapter shall provide control for all VRV, SkyAir indoor units, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of handling a maximum of 16 indoor unit groups (16 indoor units) connected to a maximum of 2 outdoor units.
     2. The DIII-Net/Modbus Interface Adapter shall support operations superseding that of the Daikin centralized controller, local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.
     3. The DIII-Net/Modbus Interface Adapter wiring shall consist of a stranded non-polar two-wire connection to the connectors F1F2 (out-out) of the outdoor unit for communication and X37A of the Heat Pump outdoor unit for power (16 VDC). The DIII-Net/Modbus Interface Adapter is mounted in the outdoor unit or indoor unit. If mounted in the indoor unit, the power shall be provided by the indoor unit power out connection (may vary depending upon indoor model type).
     4. The DIII-Net/Modbus Interface Adapter is connected to the home automation or building management system by twisted two wire pair (polarity sensitive) specified for RS-485 communication.
     5. The DIII-Net/Modbus Interface Adapter can be used in conjunction with following remote controllers to control the same indoor unit groups,
        1. BRC1E71/72/73 (Navigation Remote Controller)
        2. BRC2A71 (Simplified Remote Controller),
        3. BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller),
        4. BRC1H71W (Madoka Remote Controller)
        5. No more than 2 remote controllers can be placed in the same group. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together.
     6. The DIII-Net/Modbus Interface Adapter can be used in conjunction with following centralized controllers to control the same indoor unit groups,
        1. DCS601C71 (Intelligent Touch Controller (ITC)) with or without the DCS601A72 (ITC DIII Plus Adapter)
        2. DCM601A71 (intelligent Touch Manager (iTM)) with or without the DCM601A72 (iTM Plus Adapter)
     7. Manual addressing is required of each indoor unit group associated with the DIII-Net/Modbus Interface Adapter.
     8. Mounting: The DIII-Net/Modbus Interface Adapter can be mounted in the outdoor unit or the indoor unit.
  2. **Features:**
     1. The DIII-Net/Modbus Interface Adapter shall be approximately 0.32” x 0.32” in size.
     2. LED display provides the interface’s communication status.
     3. The DIII-Net/Modbus Interface Adapter shall be capable of displaying the indoor unit monitor and control points on home automation or building management system.
     4. The DIII-Net/Modbus Interface Adapter shall provide the building management system the capability to command the setpoint temperature in 0.10C increments. The indoor units will only accept setpoints in the range acceptable to the indoor unit.
     5. The setpoint command is limited to a single setpoint. Dual setpoints will require programming by the BMS system
     6. Display of temperature setpoint information shall be displayed in Celsius
     7. Fahrenheit display will require the building management system to convert the temperature setpoint from Celsius to Fahrenheit
     8. The DIII-Net/Modbus Interface Adapter shall provide the building management system the capability to display the room temperature in 0.10C increments.
     9. Display of room temperature information shall be shown in Celsius
     10. Fahrenheit display will require the building management system to convert the room temperature and setpoint from Celsius to Fahrenheit
     11. Error codes generated by the indoor units, outdoor units, branch selector boxes, and remote controllers shall be displayed on the building management system in the event of system abnormality/error with a numerical value error code that can be cross referenced as specified by Daikin.
     12. Communication errors between the DIII-Net/Modbus Interface Adapter and the building management system shall be displayed with flashing LED on the DIII-Net/Modbus Interface Adapter
  3. **Basic Operation:**
     1. The DIII-Net/Modbus Interface Adapter will provide 16 indoor unit points for each indoor unit that can be monitored/controlled via the building management system (see the DIII-Net/Modbus Interface Adapter Engineering Manual –EDMT721419) Capable of controlling up to 16 indoor unit groups (16 indoor units)
     2. The building management system shall control the following group operations for a typical VRV indoor unit:
        + On/Off
        + Operation Mode (Cool, Heat, Fan, Dry, Auto)
        + Single or Dual setpoint setting for Cooling and Heating in the occupied mode
        + Fan Speed
        + 3 fan speeds selectable (Low/Med/High) Not available with RA and FTXS indoor units
        + Filter sign reset for indoor units
  4. **Programmability:** 
     1. The building management system shall support weekly schedule settings through its programming.
        1. The schedule shall support the indoor unit: On/Off
        2. Each scheduled event shall specify time and target group
        3. Each scheduled event shall include On/Off, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, Setup (Cooling) setback setpoint, Setback (Heating) setback setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Operation Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable
        4. Setup (Cooling) and Setback (Heating) setback setpoints when unit is Off (unoccupied) by Group
        5. An override shall be provided for use enabling indoor unit operation during the unoccupied period by the building management system programming.
     2. The building management system shall support auto-changeover through its programming.
        1. Auto-changeover shall provide changeover for both Heat Pump and Heat Recovery systems based upon the group configurations. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit’s mode between Cool and Heat in accordance with the room temperature and setpoint temperature.
        2. Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained on the same DIII-Net communication bus to the same outdoor unit in the Heat Pump system or to the same branch selector box in the Heat Recovery system.
        3. Changeover to cooling mode shall occur when the room temperature is great than or equal to the cooling setpoint. Differential to be determined by the building management system programming
        4. Changeover to heating mode shall occur when room temperature is less than or equal to the heating setpoint. Differential to be determined by the building management system programming
        5. Guard timer: Upon changeover, guard timer will prevent frequent changeover during a short period. Guard timer should be ignored by a change of setpoint manually from the BMS, Remote Controller, or by schedule. Guard timer to be configured by the building management system programming (30 minute minimum recommended), The DIII-Net/Modbus Interface Adapter shall support force shutdown of associated indoor unit groups.