

SECTION 23 09 00
CONTROLS FOR HVAC (EMS)

PART 1 - GENERAL

1.01 PHYSICAL CHARACTERISTICS

A. General:

1. The advanced multi-zone controller shall be made from plastic materials with a neutral color. Each control shall have a LCD (Liquid Crystal Display) that shows On/Off, setpoint, room temperature, mode of operation (Cool/Heat/Dry/Fan/Auto), louver position, and fan speed.

1.02 ELECTRICAL CHARACTERISTICS

A. General

1. The advanced multi-zone controller will require 24 VAC to power the controller. The advanced multi-zone controller shall supply 16 VDC to the communication bus on the F1F2 (out-out) terminal of the outdoor unit. The voltage may rise or fall in relation to the transmission packets that are sent and received.

B. Wiring:

1. The advanced multi-zone controller 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. The remote control wiring shall run from the indoor unit control terminal block to the remote controller connected with that indoor unit.

C. Wiring size:

1. Wiring shall be non-shielded, 2-conductor sheathed vinyl cord or cable, and 18 AWG stranded copper wire.

1.03 VRV CONTROLS NETWORK

- A. 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. The VRV Controls Network shall also have the ability to be accessed via a networked PC. The VRV Controls Network supports operation monitoring, scheduling, error e-mail distribution, general user software, tenant billing, maintenance support, and integration with Building Management Systems (BMS) using open protocol via BACnet[®] interface, Lonworks[®] interface or Modbus[®] adapter; all of which blend to provide the optimal control strategy for the best HVAC comfort solution.

PART 2 - PRODUCTS

2.01 ADVANCED MULTI-ZONE CONTROLLERS

- A. The Daikin AC VRV advanced multi-zone controllers are compatible with all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. The advanced multi-zone controller wiring consist of a non-polar two-wire connection to the outdoor unit. The advanced multi-zone controllers may be wall-mounted and can be adjusted to maintain the

optimal operation of up to 64 connected indoor unit groups and 128 indoor units. Set temperatures can be adjusted in increments of 1°F. In the cases where a system or unit error may occur, the VRV controllers will display a two-digit error code and the unit address.

2.02 DCM601A71: INTELLIGENT TOUCH MANAGER (ITM)

- A. The intelligent Touch Manager (version 2.06) shall provide control for all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of controlling a maximum of 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The intelligent Touch Manager shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.
- B. The controller wiring shall consist of a non-polar two-wire connection to the indoor unit at terminals F1F2 (out-out) of the outdoor unit. The intelligent Touch Manager is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s).
- C. The intelligent Touch Manager can be used in conjunction with the BRC1E73 (Navigation Remote Controller), the BRC2A71 (Simplified Remote Controller), or the BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller), BACnet interface, Lonworks interface, and Modbus adapter to control the same indoor unit groups. The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together. Manual addressing is required of each remote controller group associated with the intelligent Touch Manager. DIII-NET address can be set for one (1) indoor unit or each indoor unit in the remote controller group. No more than 2 remote controllers can be placed in the same group.
- D. The intelligent Touch Manager shall be equipped with two RJ-45 Ethernet ports for 100 Mbps network communication to support interconnection with a network PC via the Internet, Local Area Network (LAN), or connection with a non-networked PC after completed installation.
- E. Web access functions shall be available so that facility staff can securely log into each Intelligent Touch Manager via the PC's web browser to support monitoring, scheduling, error recognition, downloading of system operation data (trend log (refer to pints list under bacnet server)) and general user functions. Error emails are also sent to designated email addresses. An additional optional software function Power Proportional Distribution (PPD) tenant billing shall also be available. The optional software shall require advanced purchase and can only be activated upon receipt of a license activation key from Daikin AC.
 1. Mounting:
 - a. The intelligent Touch Manager shall be mounted on the wall or into the mounting fixtures included with the intelligent Touch Manager.
 2. Display Features:
 - a. The intelligent Touch Manager shall be approximately 11.42" x 9.57" x 1.97" in size with a backlit 10.4" LCD display.
 - b. Display information shall be selectable from English, French, Italian, Korean, Dutch, Portuguese, Chinese, Japanese, German, or Spanish.
 - c. Featured backlit LCD with auto off after 30 minutes (default) is adjustable between 1 to 60 minutes, or the choice of 3 different screen savers.
 - d. Area and Group configuration
 - (1) Area contains one (1) or more Area(s) or Group(s)
 - (2) A Group may be an indoor unit, Di, Dio point that has a DIII-NET address
 - (3) A Group may be an external management point such as a Di, Do, Bi, Bo, Bv, Ai, Ao, Av, Mi, Mo, Mv that does not have a DIII-NET address
 - e. An Area is a tiered group where management points (indoor unit, digital input/output, and analog input/output groups) can be monitored and controlled

by global settings. Up to 650 Areas can be created. Area hierarchy can have up to 10 tiered levels (ex. top level: 1st floor West, 2nd level: offices, hallways, 3rd level: Office 101, 102, and 103, etc.). Area configuration shall classify levels of monitoring and control for each management point

- (1) Areas and Groups may be assigned names (ex. Office 101, Lobby, North Hallway, etc.)
- f. The Controller shall display On/Off, Operation Mode, Setpoint, Space Temperature, Louver Position, Fan Speed for each Area or Group.
- g. The Controller shall display Date (mm/dd/yyyy, yyyy/mm/dd, or dd/mm/yyyy format selectable) and day of the week along with the time of day (12hr or 24hr display selectable).
- h. The Controller shall adjust for daylight savings time (DST) automatically.
- i. Display information shall be updated every 3 seconds to show the latest status of the indoor unit groups.
- j. System status icons shall display On/Off (color coded), Malfunction/Error (color coded), Forced Stop, Setback, Filter, Maintenance, and Screen Lock.
- k. The controller shall display the temperature setpoint in one degree increments with a range of 60°F - 90°F, 1°F basis (16°C - 32°C, 0.1°C basis).
 - (1) Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius
- l. Display shall reflect room temperature in one tenth degree increments with a range of -58°F - 248°F, 0.1°F basis (-50°C - 120°C, 0.1°C basis) with 0.1°C accuracy.
 - (1) Display of room temperature information shall be configurable for Fahrenheit or Celsius
- m. The Menu List shall be used to configure options and display information for each Area or Group.
- n. Error status shall be displayed in the event of system abnormality/error with one of three color coded icons placed over the indoor unit icon or lower task bar.
 - (1) System errors are generated when the intelligent Touch Manager system with other VRV controls systems are combined incorrectly or power proportional distribution calculation errors occur. The intelligent Touch Manager shall display the error with a red triangle placed on the lower task bar.
 - (2) Unit errors occurring within the VRV system shall be displayed with a yellow triangle placed over the indoor unit icon
 - (3) Limit errors are based upon preconfigured analog input upper and lower limit settings and are generated when the limits have been met. When limit error is generated a yellow triangle will be placed over the unit icon.
 - (4) Communication errors between the intelligent Touch Manager and the indoor units shall be displayed with a blue triangle placed over the indoor unit icon
 - (5) Error history shall be available for viewing for up to 500,000 errors/abnormality events with operation events.
- o. Layout View
 - (1) Capable of displaying site floor plan or graphical user interface (GUI) as the background for visual navigation. Indoor unit, DIII-Net Di and Dio, and External Di, Do, Ai, Ao, Av, Mi, Mo, Mv icons with operational status can be placed on the floor layout or GUI
 - a) Up to 4 status points can be assigned to the indoor unit icon (room name, room temperature, setpoint, and mode)
 - b) Digital input and output icons will display On/Off status
 - c) Analog icons will display Ai, Ao and Av.

- d) Multistate icons will display Mi, Mo and Mv.
- (2) Up to 60 floor layout sections can be created
3. Basic Operation:
 - a. Capable of controlling by Area(s) or Group(s)
 - b. Controller shall control the following group operations:
 - (1) On/Off
 - (2) Operation Mode (Cool, Heat, Fan, Dry, and Auto)
 - (3) Independent Cool and Heat dual Setpoints or single Setpoint for current mode in the occupied period
 - (4) Controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating based upon the Area or Group configurations
 - (5) Independent Setup (Cooling) and Setback (Heating) setpoints in the unoccupied mode adjustable to 50 - 95°F
 - a) Setup and Setback setpoints can only be set outside of the occupied setpoint range
 - b) The Setup and Setback setpoints will automatically maintain a 2°F fixed differential from the highest possible occupied setpoints
 - c) The recovery differential shall be 4°F (default) and adjustable between 2 - 10°F
 - d) Settings shall be applied based upon the Area or Group configurations
 - (6) Fan Speed
 - a) Up to 3 speeds (dependent upon indoor unit type)
 - (7) Airflow direction (dependent upon indoor unit type)
 - a) 5 fixed positions or oscillating
 - (8) Remote controller permit/prohibit of On/Off, Mode, and Setpoint
 - (9) Lock out setting for Intelligent Touch Manager display
 - (10) Indoor unit Group/Area assignment
 - c. Capable of providing battery backup power for the clock at least 1 year when no AC power is applied.
 - (1) The battery can last at least 13 years when AC power is applied
 - (2) Settings stored in non-volatile memory
4. Programmability:
 - a. Controller shall support weekly schedule settings.
 - (1) 7 -day weekly pattern (7)
 - (2) Weekday + Weekend (5 + 2)
 - (3) Weekday + Saturday + Sunday (5 + 1 + 1)
 - (4) Everyday (1)
 - (5) The schedule shall have the capabilities of being enabled or disabled
 - (6) 100 independent schedules configurable with up to 20 events settable for each day's schedule
 - a) Each scheduled event shall specify time and target Area or Group
 - b) Each scheduled event shall include On/Off, Optimum Start, Operation Mode, Occupied Setpoints, Setback Setpoints, Remote Controller On/Off Prohibit, Remote Controller Mode Prohibit, Remote Controller Setpoint Prohibit, Timer Extension Setting, Fan Speed, and Setpoint Range Limit
 - Setpoint when unit is On (occupied)
 - Configurable Setup (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied)
 - c) Time setting in 1-minute increments

- d) Timer Extension shall be used for a timed override (settable from 30 – 180 minutes) to allow indoor unit operation during the unoccupied period
- (7) A maximum of 40 exception days can be schedule on the yearly schedule (repeats yearly)
 - a) Exception days shall be used to override specified days on the weekly schedule based upon irregular occupied/unoccupied conditions
 - b) Exception days can be configured on a set date (Jan 1) or floating date (1st Monday in September)
- b. Controller shall support auto-changeover.
 - (1) Auto-change shall provide Fixed (default), Individual, Averaging, and Vote changeover methods for both Heat Pump and Heat Recovery systems based upon the changeover group configuration. 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. The following changeover scheme shall be applicable to the Fixed, Individual, and Averaging methods.
 - a) Changeover to cooling mode shall occur at cooling setpoint + 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
 - Configurable from 1 – 4°F
 - b) Changeover to cooling mode shall occur at the primary changeover deadband to cooling + 1°F as the secondary changeover deadband.
 - Configurable from 1 – 4°F
 - c) Changeover to heating mode shall occur at heating setpoint - 1°F (0.5°C) as the primary changeover deadband and takes the guard timer into consideration
 - Configurable from 1 – 4°F
 - d) Changeover to heating mode shall occur at the primary changeover deadband to heating - 1°F as the secondary changeover deadband.
 - Configurable from 1 – 4°F
 - e) A weighted demand shall be configurable for the Averaging and Vote methods.
 - (2) Fixed Method
 - a) Changeover evaluated by room temperature and setpoint of the representative indoor unit (first registered indoor unit in changeover group) in the changeover group even when it is not operating (must be in Cool, Heat, or Auto mode)
 - b) Changeover affects all indoor unit groups in the changeover group.
 - (3) Individual method (recommended for Heat Recovery Systems)
 - a) Changeover evaluated by room temperature and setpoints of the individual indoor unit group in the changeover group
 - b) Changeover affects individual indoor unit group in the changeover group
 - (4) Average method
 - a) Changeover evaluated by the average of all indoor unit group's room temperatures and setpoints operating in Cool, Heat, or Auto mode in the changeover group list
 - b) If none of the indoor units in the group meet the above requirements the Fixed method of changeover will be applied
 - c) A weighted demand (0 – 3) can be configured for each indoor unit in the changeover group.

- d) Changeover affects all indoor unit groups in the changeover group.
- (5) Vote Method
 - a) In each indoor unit, the cooling demand is calculated based upon the difference between the room temperature and cooling setpoint. If the room temperature falls below the primary cool changeover point (cool setpoint plus the primary changeover deadband) the cooling demand is considered as 0 (zero). Then the total cooling demand is calculated as the sum of each indoor unit's cooling demand
 - b) The opposite is true for the total heating demand
 - c) A weight (0-3) can be added to each indoor unit's demand in the changeover group. The default setting is 1
 - d) The weight 0 (zero) means the indoor unit's demand is not added in the total demand, so the indoor unit's demand is considered to be 0 (zero)
 - e) The weight 2 or 3 means the indoor unit's demand is added 2 or 3 times in the total demand, respectively
 - f) Changeover to cooling mode shall occur when the total cooling demand is greater than the total heating demand.
 - g) The opposite is true for changeover to heating
 - h) Vote supports a Heating Override option, which prioritizes switching to the heating mode if at least one room temperature falls below the secondary heat changeover point (heat setpoint minus the secondary changeover deadband) even if the total cooling demand is greater than the total heating demand.
 - i) Changeover affects all indoor unit groups in the changeover group.
- (6) 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 to the same outdoor unit in the Heat Pump system or branch selector box in the Heat Recovery system.
- (7) Guard timer
 - a) Upon changeover, guard timer will prevent another changeover during the guard timer activation period (15, 30, 60 (default) min).
 - b) Guard timer is ignored by a change of setpoint manually from either intelligent Touch Manger or Remote Controller, by schedule, or the room temperature meets or exceeds the secondary changeover deadband of the mode opposite of the current mode setting
- c. Controller shall support Interlock
 - (1) Interlock feature for use with 3rd party equipment (DOAS, dampers, occupancy sensing, etc...) to automatically control Groups or Areas corresponding to the change of the operation states or the On/Off states of any Group.
 - (2) WAGO I/O unit - Di, Do, Ai, Ao
 - a) On/Off based monitoring and control of equipment
 - b) Manual or scheduled operation of equipment
 - c) Operation based upon interlock with management points (group(s))
 - d) Monitor equipment error/ alarm status
 - e) WAGO I/O operation data for every minute in the last 5 days are stored and can be downloaded from Web access or USB
 - (3) Digital Input/Output (DEC102A51-US2) unit or Digital Input (DEC101A51-US2) unit
 - a) On/Off based monitoring and control of equipment

- b) Manual or scheduled operation of equipment
 - c) Operation based upon interlock with management points (group(s))
 - d) Monitor equipment error/alarm status
 - d. Controller shall support force shutdown of associated indoor unit groups.
5. Web/Email Function
- a. Each intelligent Touch Manager shall be capable of monitoring, operating, and scheduling a maximum of 64 indoor unit groups (up to 512 indoor unit groups with the addition of the iTM Plus Adapter) from a networked PC's web browser. It shall also be capable of creating general user access and sending detailed error emails to a customized distribution list (up to 10 email addresses).
 - b. All PCs shall be field supplied
 - c. The following operation data stored in iTM every minute for the last 5 days can be accessed and downloaded through ITM web function:
 - (1) Indoor and outdoor unit (applied model only) operation data.
 - (2) BACnet Client management data points (AI, AO, AV, BI, BO, BV, MI, MO and MV).
 - (3) WAGO IO system data points (External DI, DIO, PI, AI and AO).
6. Operational Data History
- a. Operation data are stored in the iTM every minute for the last 5 days:
 - (1) VRV indoor and outdoor unit (if supported) operation data.
 - (2) BACnet Client management data points (AI, AO, AV, BI, BO, BV, MI, MO and MV).
 - (3) WAGO IO system data points (External DI, DIO, PI, AI and AO).
 - b. The operation data can be exported through the iTM web function or USB output with a user specified time period.
 - c. Airnet addressing required for both indoor units and outdoor units to enable the operation data on the iTM.
7. Optional Software - Licensed per option, per intelligent Touch Manager shall be required.
- a. DCM002A71: Power Proportional Distribution (PPD)
 - (1) The tenant billing option shall be capable of calculating VRV Controls Network equipment energy usage in kWh based on the energy consumption of the outdoor unit(s) divided among the associated indoor units. This software is used in conjunction with the intelligent Touch Manager and a Watt Hour Meter (WHM). A maximum of 3 Watt Hour Meters can be connected to the intelligent Touch Manager. Up to 4 additional Watt Hour Meters can be connected to each iTM Plus Adapter, and up to 7 iTM Plus Adapters can be connected to the intelligent Touch Manager.
 - (2) The Power Proportional Distribution results data can be saved to a USB flash drive, or on a PC with the use of the web access. Data is saved in the CSV format. Results can be stored up to 13 months in the intelligent Touch Manager.
 - b. DCM009A51: BACnet Client Option
 - (1) The iTM BACnet Client Option shall be capable of making the intelligent Touch Manager work as a BACnet client using the BACnet/IP protocol. A BACnet client machine is able to send service requests to a BACnet server machine that then performs the services and reports the results to the client. By registering equipment and sensors connected to a BACnet server as

- management points, equipment and sensors can be monitored and controlled by the intelligent Touch Manager. The BACnet Client option must be enabled/ activated in each intelligent Touch Manager to be used.
- (2) System Capacity
 - a) A maximum of 50 BACnet servers can be monitored and/or controlled by one intelligent Touch Manager.
 - b) A maximum of 1536 objects can be monitored and/or controlled by one intelligent Touch Manager.
 - c) A maximum of 512 management points, including BACnet management points, external management points, internal Ai management points, AHU management points, and Chiller management points, can be registered in one intelligent Touch Manager.
 - (3) Objects that can be used in BACnet management points are:
 - a) Analog Input (Object Type Number 0)
 - b) Analog Output (Object Type Number 1)
 - c) Analog Value (Object Type Number 2)
 - d) Binary Input (Object Type Number 3)
 - e) Binary Output (Object Type Number 4)
 - f) Binary Value (Object Type Number 5)
 - g) Multi-Sate Input (Object Type Number 13)
 - h) Multi-Sate Output (Object Type Number 14)
 - i) Multi-Sate Value (Object Type Number 19)
 - c. DCM014A51: BACnet Server Gateway Option
 - (1) The iTM BACnet Server Gateway Option shall be capable of making the intelligent Touch Manager work as a BACnet gateway using the BACnet/IP protocol. The iTM BACnet Server Gateway Option shall be capable of exposing indoor unit management points and indoor/outdoor unit operation data as BACnet objects to the BMS. The iTM BACnet Server/Gateway Option shall be capable of allowing the BMS to monitor and/or control indoor units and outdoor units via BACnet objects.
 - (2) The iTM BACnet Server Gateway Option shall support VRV, SkyAir, Outdoor Air Processing Unit, Mini-Split system with use of KRP928, and FFQ indoor unit for Multi-split system.
 - (3) The iTM BACnet Server Gateway Option shall support operation data for VRV IDUs only (requires Airnet addressing)
 - (4) The iTM BACnet Server Gateway Option shall support operation data for the following VRV IV outdoor units: REYQ_TATJU, REYQ_TAYDU (requires Airnet addressing).
 - (5) Functions:
 - a) The iTM BACnet Server Gateway Option shall be capable of supporting Change of Value (COV) notification.
 - b) The iTM BACnet Server Gateway Option shall communicate to BMS using port number 47808 (configurable).
 - c) The iTM BACnet Server Gateway Option 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.
 - d) The iTM BACnet Server Gateway Option shall provide configurable BACnet Network number.
 - e) The iTM BACnet Server Gateway Option 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.
- f) The iTM BACnet Server Gateway Option shall be run in environments with BACnet communication traffic up to 100 packets/second.
 - g) The iTM BACnet Server Gateway Option functions shall be configurable through CSV file which shall be downloaded from iTM and configured by trained personnel.
- (6) System Capacity
- a) A maximum of 128 device IDs (including indoor units groups outdoor units) and a maximum of 4000 BACnet objects can be monitored and/or controlled from a BMS
 - b) Max of 8 DIII-Net ports shall be connected to iTM.
- (7) The Building Management System shall monitor and control the following BACnet objects for indoor units
- a) Indoor unit ON/OFF status.
 - b) Alarm status with error description
 - c) Room temperature.
 - d) Indoor Unit ON details
 - Off
 - Normal [ON]
 - Override
 - Setback
 - e) Filter sign status.
 - f) Fan status.
 - g) Communication status.
 - h) Thermo-on status.
 - i) Compressor status
 - On
 - Off
 - Defrost
 - j) Aux heater status.
 - k) Occupancy Mode
 - Unoccupied,
 - Occupied
 - Standby
 - l) Operation Mode (Cool, Heat, Fan, and Dry)
 - m) Cooling and Heating setpoints during occupied mode.
 - n) Cooling and Heating setpoints during unoccupied mode.
 - o) Maximum and minimum cooling setpoint.
 - p) Maximum and Minimum heating setpoint
 - q) Minimum cooling and heating setpoint differential.
 - r) Fan Speed
 - Up to 3 speeds (dependent upon indoor unit type)
 - s) Vane direction (dependent upon indoor unit type)
 - 5 fixed positions or swing position
 - t) Remote controller permit/prohibit
 - On/Off
 - Mode,
 - u) Setpoint
 - v) Filter sign reset for indoor units
 - w) Forced indoor units off.

- x) Return air temperature
 - y) Discharge air temperature
 - z) Liquid pipe temperature
 - aa) Gas pipe temperature
 - bb) EV position
- (8) The Building Management System shall monitor the following BACnet objects (if available) for outdoor unit devices:

Point Name	Point Description
Communication Status	Monitors and displays the communication status <i>(General)</i>
Operation Mode	Monitors and displays the operation mode (Cool, Heat, Fan or Heat &Cool) <i>(General)</i>
Outdoor Unit Alarm Status	Monitors whether or not the outdoor unit is operating normally. <i>(General)</i>
Defrost Mode	Monitors if the defrost mode is active. <i>(General)</i>
Oil Return Mode	Monitors whether or not the outdoor unit is in oil return operation. <i>(General)</i>
Electric Power	Monitors and displays the electric power (calculated). <i>(General)</i>
Electric Current	Monitors and displays the electric current (calculated). <i>(General)</i>
System Capacity Code	Monitors and displays the system capacity code. <i>(General)</i>
Outdoor Air Temperature	Monitors and displays the outdoor air temperature. <i>(General)</i>
M_Condensing Pressure	Monitors and displays the condensing pressure <i>(Master Module)</i>
M_Evaporating Pressure	Monitors and displays the evaporating pressure <i>(Master Module)</i>
M_Condensing Temperature	Monitors and displays the condensing temperature <i>(Master Module)</i>
M_Evaporating Temperature	Monitors and displays the evaporating temperature <i>(Master Module)</i>
M_Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor1 <i>(Master Module)</i>
M_Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor2 <i>(Master Module)</i>
M_Fan Step	Monitors and displays the fan step <i>(Master Module)</i>
M_EV Position 1	Monitors and displays the position of the expansion valve1 <i>(Master Module)</i>
M_EV position 2	Monitors and displays the position of the expansion valve2 <i>(Master Module)</i>
M_Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor1 <i>(Master Module)</i>
M_Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor2 <i>(Master Module)</i>

M_Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature (<i>Master Module</i>)
M_Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX (<i>Master Module</i>)
M_Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX (<i>Master Module</i>)
M_Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer (<i>Master Module</i>)
M_Gas Pipe Temperature (HX Upper)	Monitors and displays the gas pipe temperature for the upper HX (<i>Master Module</i>)
M_Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX (<i>Master Module</i>)
M_Suction Temperature	Monitors and displays the suction temperature (<i>Master Module</i>)
M_Compressor Suction Temperature	Monitors and displays the compressor's suction temperature (<i>Master Module</i>)
M_Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature (<i>Master Module</i>)
M_Subcool Outlet temperature	Monitors and displays the subcool outlet temperature (<i>Master Module</i>)
M_Subcool EV Position	Monitors and displays the subcool expansion valve position (<i>Master Module</i>)
S1_Condensing Pressure	Monitors and displays the condensing pressure (<i>Sub Module1</i>)
S1_Evaporating Pressure	Monitors and displays the evaporating pressure (<i>Sub Module1</i>)
S1_Condensing Temperature	Monitors and displays the condensing temperature (<i>Sub Module1</i>)
S1_Evaporating Temperature	Monitors and displays the evaporating temperature (<i>Sub Module1</i>)
S1_Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor1 (<i>Sub Module1</i>)
S1_Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor2 (<i>Sub Module1</i>)
S1_Fan Step	Monitors and displays the fan step (<i>Sub Module1</i>)
S1_EV Position 1	Monitors and displays the position of the expansion valve1 (<i>Sub Module1</i>)
S1_EV position 2	Monitors and displays the position of the expansion valve2 (<i>Sub Module1</i>)
S1_Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor1 (<i>Sub Module1</i>)
S1_Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor2 (<i>Sub Module1</i>)

S1_Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature (<i>Sub Module1</i>)
S1_Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX (<i>Sub Module1</i>)
S1_Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX (<i>Sub Module1</i>)
S1_Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer (<i>Sub Module1</i>)
S1_Gas Pipe Temperature (HX Upper)	Monitors and displays the gas pipe temperature for the upper HX (<i>Sub Module1</i>)
S1_Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX(<i>Sub Module1</i>)
S1_Suction Temperature	Monitors and displays the suction temperature (<i>Sub Module1</i>)
S1_Compressor Suction Temperature	Monitors and displays the compressor's suction temperature (<i>Sub Module1</i>)
S1_Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature (<i>Sub Module1</i>)
S1_Subcool Outlet temperature	Monitors and displays the subcool outlet temperature (<i>Sub Module1</i>)
S1_Subcool EV Position	Monitors and displays the subcool expansion valve position (<i>Sub Module1</i>)
S2_Condensing Pressure	Monitors and displays the condensing pressure (<i>Sub Module2</i>)
S2_Evaporating Pressure	Monitors and displays the evaporating pressure (<i>Sub Module2</i>)
S2_Condensing Temperature	Monitors and displays the condensing temperature (<i>Sub Module2</i>)
S2_Evaporating Temperature	Monitors and displays the evaporating temperature (<i>Sub Module2</i>)
S2_Inverter Compressor 1 Speed	Monitors and displays the speed of the inverter compressor1 (<i>Sub Module2</i>)
S2_Inverter Compressor 2 Speed	Monitors and displays the speed of the inverter compressor2 (<i>Sub Module2</i>)
S2_Fan Step	Monitors and displays the fan step (<i>Sub Module2</i>)
S2_EV Position 1	Monitors and displays the position of the expansion valve1 (<i>Sub Module2</i>)
S2_EV position 2	Monitors and displays the position of the expansion valve2 (<i>Sub Module2</i>)
S2_Hot Gas Temperature (Compressor 1)	Monitors and displays the hot gas temperature of the compressor1 (<i>Sub Module2</i>)
S2_Hot Gas Temperature (Compressor 2)	Monitors and displays the hot gas temperature of the compressor2 (<i>Sub Module2</i>)

S2_Liquid Pipe Temperature	Monitors and displays the liquid pipe temperature (<i>Sub Module2</i>)
S2_Liquid Pipe Temperature (HX Upper)	Monitors and displays the liquid pipe temperature for the upper HX (<i>Sub Module2</i>)
S2_Liquid Pipe Temperature (HX Lower)	Monitors and displays the liquid pipe temperature for the lower HX (<i>Sub Module2</i>)
S2_Liquid Pipe Temperature (De-Icer)	Monitors and displays the liquid pipe temperature for the de-icer (<i>Sub Module2</i>)
S2_Gas Pipe Temperature (HX Upper)	Monitors and displays the gas pipe temperature for the upper HX (<i>Sub Module2</i>)
S2_Gas Pipe Temperature (HX Lower)	Monitors and displays the gas pipe temperature for the lower HX(<i>Sub Module2</i>)
S2_Suction Temperature	Monitors and displays the suction temperature (<i>Sub Module2</i>)
S2_Compressor Suction Temperature	Monitors and displays the compressor's suction temperature (<i>Sub Module2</i>)
S2_Subcool Inlet Temperature	Monitors and displays the subcool inlet temperature (<i>Sub Module2</i>)
S2_Subcool Outlet temperature	Monitors and displays the subcool outlet temperature (<i>Sub Module2</i>)
S2_Subcool EV Position	Monitors and displays the subcool expansion valve position (<i>Sub Module2</i>)

- (9) The Building Management System may choose to monitor and control the following BACnet objects linked to iTM control logic:
 - a) Enable/Disable iTM Schedule operation.
 - b) Enable/Disable iTM Auto Changeover Operation.
 - c) Set Timed Override Minutes.
- (10) Monitor and configure timer extension on iTM (30, 60, 90, 120, 150, 180 minutes)
- (11) System forced off
 - a) Enable/Disable all emergency stop programs that are registered on the iTM.

8. Schedule

- a. The BMS shall utilize iTM schedule function or support weekly schedule settings through its programming.
 - (1) BMS schedule shall support the indoor unit:
 - a) Each scheduled event shall specify time and target group address.
 - b) Each scheduled event shall include Occupancy Mode, Operation Mode, Occupied Cooling Setpoint, Occupied Heating Setpoint, and Unoccupied cooling setpoint, Unoccupied heating setpoint, Remote Controller On/Off Permit/Prohibit, Remote Controller Mode Permit/Prohibit, Remote Controller Setpoint Permit/Prohibit, and Timed Override Enable.
 - c) An override shall be provided for use enabling indoor unit operation during the unoccupied period by the BMS programming.

9. Auto Changeover
 - a. The BMS shall utilize iTM Auto changeover function or 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 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
 - a) 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.
 - a) Differential to be determined by BACnet building management system programming
 - (5) Guard timer
 - a) Upon changeover, guard timer will prevent another changeover during this period.
 - b) Guard timer should be ignored by a change of setpoint manually from the BMS, Intelligent Touch Controller, Remote Controller, or by schedule.
 - c) Guard timer to be configured by BMS programming (30 minute minimum recommended)
 - (6) Setpoint limitation
 - a) The BMS shall utilize maximum and minimum cooling and heating setpoint to configure upper and lower setpoints range.
 - (7) System shutdown:
 - a) BMS should utilize System forced off point to execute emergency stop program registered on the iTM.
 - (8) Restricted functions:
 - a) The following iTM functions shall be prohibited when the BACnet Server Gateway option enabled:
 - Interlocking Control.
 - Emergency Stop (Emergency stop manual release).
 - Power Proportional Distribution (PPD) option.
 - BACnet Client option.
 - D-Net Service.
 - External Management Point Registration
 - b. DCM601A72: iTM Plus Adapter
 - (1) The iTM Plus 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 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The iTM Plus Adapter is to be used in conjunction with intelligent Touch Manager. Up to 7 iTM Plus Adapters can be connected to a single intelligent

- Touch Manager. This combination will provide intelligent Touch Manager monitoring and control of up to 512 indoor unit groups, 1024 indoor units, and 80 outdoor units. The iTM Plus Adapter shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.
- (2) The controller wiring shall consist of a non-polar two-wire connection to the outdoor unit at terminals F1F2 (out-out). The iTM Plus Adapter is wall mounted and is used in conjunction with the intelligent Touch Manager to maintain the optimal operation of the connected indoor unit(s). The iTM Plus Adapter is connected to the intelligent Touch Manager via a polarity sensitive 18-2 AWG stranded non-shielded wire (field supplied).
 - (3) The iTM Plus Adapter can be used in conjunction with the BRC1E73 (Navigation Remote Controller), the BRC2A71 (Simplified Remote Controller), or the BRC4C82/7E83/7C812/7E818 (Wireless Remote Controller), BACnet interface, Lonworks interface and Modbus Adapter to control the same indoor unit groups. 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. Manual addressing is required of each indoor unit group associated with the iTM Plus Adapter.
 - a) Mounting:
 - The iTM Plus Adapter can be mounted on the wall or in a standard enclosure (field supplied).
 - b) Features:
 - The iTM Plus Adapter shall be approximately 6.30" x 5.87" x 2.41" in size.
 - c) Basic Operation:
 - Control of all associated indoor unit groups shall be done via the connected intelligent Touch Manager.
 - d) Programmability:
 - Programming of all associated indoor unit groups shall be done via the connected intelligent Touch Manager.