REV	09
Date	05-2026
Supersedes	D-EOMOC00610-21_08EN

Operating Manual
D-EOMOC00610-21_09EN

Intelligent Chiller Manager (Opt.184)

Table of contents

List of Figures 5
List of Tables 6
1 WHAT IS iCM© 7
1.1 Before starting 7
1.2 Available Control functions 7
1.3 Possible configurations 8
1.4 Limitations 9
1.4.1 Four Pipe Plant Limitations 10
1.4.2 iCM Expandable Limitations 11
1.5 Integration in a Building Management System 12
1.6 Daikin on Site 13
2 LICENSING 14
2.1 When license is needed 14
2.2 Temporary License 14
2.3 Permanent License 15
3 FIELD WIRINGS 16
3.1 Daikin Communication Network connection 16
3.2 Common water temperature sensors 16
3.3 Four-pipe Plantroom: equipment installation 17
3.3.1 Four-pipe Plantroom consisting in Multipurpose, A/C Heat pump and A/C Chiller 18
3.3.2 Four-pipe Plantroom consisting in A/C Heat pump and A/C Chiller 18
3.4 System Variable primary flow with dedicated pump: equipment installation (Only with iCM) 19
3.5 System Pump Management in manifolded piping: Shut-off valve installation 20
3.6 System Variable primary flow with manifolded pump: equipment installation (Only with iCM) 21
3.7 System composed by Up to 16 units: iCM Expandable layout 22
4 HMI DESCRIPTION 23
4.1 Introduction 23
4.2 Preliminary configuration 23
4.3 Main Menu 24
4.4 System Data 25
4.4.1 Units: States 27
4.4.2 Units: ActMode 27
4.4.3 Unit: Defrost 28
4.4.4 Units: Load 28
4.4.5 Evap Water Temps 28
4.4.6 Cond Water Temps 29
4.4.7 Units: Heat Recovery 29
4.4.8 Units: Free Cooling 29
4.4.9 Units: DHW (Domestic Hot Water) 30
4.4.10 iCM Expandable Data 31
4.5 Evap / Cond PM (Evaporator or Condenser Pump Manager Menu) 32
4.6 Cooling Tower Manager 34
4.7 Secondary Pump Managers 35
4.8 Maintenance 36
4.8.1 Units Starts 37
4.8.2 Units Run Hours 37
4.9 System Settings 37
4.9.1 Priority 39
4.9.2 Staging thresholds 39
4.10 Standby Chiller 40
4.11 Configuration 41
4.11.1 System Control Configuration in Unit Commissioning 41
4.11.2 System Configuration 41
4.11.3 Evaporator/Condenser Pump Manager Configuration (PM Config) 43
4.11.4 Cooling Tower Manager Configuration (iCT Config) 43
4.11.5 Secondary Pump Managers Configuration (iSM Config) 44

5 SYSTEM COMMISSIONING 45
5.1 Introduction 45
5.2 Before starting the Commissioning 45
5.3 How to configure the iCM 46
5.3.1 Unit Configuration→OptionSW Menu 46
5.3.2 Unit Configuration→System Control Menu 46
5.3.3 System→Configuration menu 46
5.3.4 Configuration Check 47
5.3.5 Available Configurations and Configuration Alarm 48
5.3.6 Configuring the Controlled Temperatures 49
5.3.7 Configuring Unit Load Control function (only in Two pipe plant-room) 50
5.3.8 Configuring System Mode Management 51
5.3.9 Configuring System Defrost Management (only in Two pipe plant-room) 52
5.3.10 Heat Recovery Configured (only in Two pipe plant-room) 52
5.3.11 Free-cooling Configured (only in Two pipe plant-room) 53
5.3.12 Configuring iCM Expandable (only in Two pipe plant-room) 53
5.4 How to setup the System Settings 55
5.4.1 Priority 55
5.4.2 Min and Max Run Units 56
5.4.3 Staging Settings 57
5.4.4 Staging Capacity Thresholds (only in Two-Pipe Plant-room) 58
5.4.5 Staging Temperature Differentials 60
5.4.6 Staging Delays 61
5.4.7 Unit Capacity Control (only for Two-pipe Plant-room) 62
5.4.8 Heat Recovery (only for Two-pipe Plant-room) 62
5.4.9 Free-cooling (only for Two-pipe Plant-room) 63
5.4.10 Standby Unit 64
5.4.11 iCM Expandable 65
6 SYSTEM OPERATING 66
6.1 System Enable setpoint 66
6.1.1 Master Disable 66
6.1.2 Slave Disable 66
6.2 System water temperature setpoints 66
6.2.1 System Cool Setpoint 66
6.2.2 System Heat Setpoint 66
6.2.3 System Heat Recovery EWT Setpoint in Two-pipe plantroom 67
6.2.4 System Heat Recovery EWT Setpoint in Four-pipe plantroom 67
6.2.5 System Setpoints by Network communication 67
6.2.6 System Active Setpoint 67
6.3 System mode and System mode setpoint 68
6.3.1 System Mode in Two Pipe Plant-room 68
6.3.2 Changeover management on Slave units 68
6.3.3 System Mode in Four pipe Plant 68
6.4 System controlled temperature 69
6.5 System Heat Recovery (iCM option only) 69
6.5.1 System Heat Recovery Enable in Two Pipe Plant-room 69
6.5.2 Heat Recovery Disable on Master 69
6.5.3 System Heat Recovery Enable in four-pipe plant 70
6.5.4 Heat Recovery Disable on Slave 70
6.6 System Free Cooling Enable (iCM option only in two pipe plant-room) 70
6.6.1 Free-cooling Disable on Master 70
6.6.2 Free-cooling Disable on Slave 70
6.7 Standalone Mode 71
6.7.1 Setting Slave in Standalone 71
6.7.2 Setting Master in Standalone 71
6.8 iCM Expandable Operating (only in Two-pipe Plant-room) 71
6.8.1 iCM Expandable Enable setpoint 71
6.8.2 iCM Expandable Mode Setpoint and System Changeover 72

6.8.3 iCM Expandable Temperature setpoint 72
6.8.4 iCM Expandable Heat Recovery Function 72
6.8.5 iCM Expandable Freecooling Function 72
6.9 System Overview 73
7 TROUBLESHOOTING 74
7.1 iCM Master Alarms 74
7.1.1 iCM Configuration Alarm 74
7.1.2 System Lwt Sensor Fault 75
7.1.3 System Heat Lwt Sensor Fault 75
7.1.4 Slave Communication Error 76
7.1.5 Slave Missing 76
7.2 Slave Alarms 77
7.2.1 Master Communication Error 77
7.2.2 Master Missing 77
7.2.3 Master Disconnect 77
7.3 Evaporator/Condenser Pump Manager Alarms 78
7.3.1 Pump Manager Communication Error 78
7.3.2 Pump Manager Missing 78
7.3.3 Pump Manager Configuration Error 78
7.3.4 Pump Manager Sensor Fault 79
7.3.5 Pump Manager Available Pump Alarm 79
7.4 Cooling Tower Manager Alarms 80
7.4.1 Cooling Tower Manager Communication Error 80
7.4.2 Cooling Tower Manager Missing 80
7.4.3 Cooling Tower Configuration Error 80
7.4.4 Cooling Tower Manager Sensor Fault 81
7.5 iCM Expanded Alarm 81
7.5.1 iCM Expanded BACnet Communication Error 81
7.5.2 iCM Expanded Leaving water temperature alarm on 1st iCM Master 82
7.5.3 iCM Expanded: Leaving water temperature alarm on 2nd iCM Master 82
7.6 Events 83
7.6.1 Heat Recovery Configuration Error 83
7.6.2 Free-cooling Configuration Error 83
7.6.3 Energy Monitoring Configuration Error 83

List of Figures

Figure 1 iCM plant visualization on Daikin on Site 13
Figure 2 iCM System configuration page on Daikin on Site 13
Figure 3: Temporary Activation 14
Figure 4: Temporary password activation 14
Figure 5:Software Options page 15
Figure 6: Enter the license code 15
Figure 7: Activate the iCM Standard 15
Figure 8: Connecting the network 16
Figure 9 - Common Leaving water temperature installation position 17
Figure 10 - Four-pipe: Multipurpose, A/C Chiller and A/C Hea pump 18
Figure 11 - Four-pipe: A/C Heat Pump and A/C Chiller with Heat Recovery 18
Figure 12 - Variable Flow based on DP in primary system with dedicated pumps 19
Figure 13 - Shut-off valve electrical installation 20
Figure 14 - Variable Primary Flow with iCM and iPM 21
Figure 15 - iCM Expandable Cable Connections 22
Figure 16: Basic system configuration 23
Figure 17: Extended configuration menu 24
Figure 54 - Configuration -> System Control menu 46
Figure 55: iCM license type and system configuration type indications 46
Figure 56: System Configuration from Daikin on Site 47
Figure 57 Configuration Status menu 47
Figure 58 Unit types menu 48
Figure 59: Selection of the controlled temperature 49
Figure 60: Load control Enable/Disable 50
Figure 61: Load control mode selection 50
Figure 62: Unload Type selection 51
Figure 63 - Mode Changeover selection 51
Figure 64 – Defrost Management selection 52
Figure 65: Activation status of Heat Recovery 52
Figure 66: Activation status of Free-cooling 53
Figure 67 - Configuration of iCM Expandable 53
Figure 68 - Unit Menu: Commission --> BACnet IP 54
Figure 69: System settings page 55
Figure 70: Max number of Units running equal 5 56
Figure 71 - Staging Setting effects in two pipe plant room 57
Figure 72 Staging Setting effects in four pipe Plant room 58
Figure 73: Staging thresholds 58
Figure 74 Load Sharing VS Minimum running Units 59
Figure 75: Staging thresholds for heat 59
Figure 76: Staging temperature thresholds configuration 60
Figure 77: Stage delays configuration 61
Figure 78: Staging delays calculations 61
Figure 79: Unit Capacity Control Settings 62
Figure 80: Heat Recovery settings 62
Figure 81 - Freecooling settings 63
Figure 82: Standby chiller configuration 64
Figure 83: Selection of the Standby chiller mode 64
Figure 84: Rotation strategy configuration 64
Figure 85: Temperature compensation with Standby Unit 65
Figure 86: System Overview on Main menu of Master unit HMI 73

List of Tables

Table 1: Comparison between iCM and Master/Slave 9
Table 2 - Four Pipe system: iCM Functions limitation 10
Table 3 - Limitations on System Configuration in case of iCM Expandable 11
Table 4 Common Leaving water temperature in plant room 16
Table 5: Example of parameter and setting representation 23
Table 6:Access levels 23
Table 7:Basic configuration 23
Table 8: Main Menu 24
Table 9: Additional settings in the Main Menu 24
Table 10: System Data parameters 26
Table 11: Unit States overview 27
Table 12:Units and circuits actual operating modes 27
Table 13: Units and circuits actual capacities 28
Table 14: Individual evaporator water temperatures (leaving and entering) 28
Table 15: Individual condenser water temperatures (leaving and entering) 29
Table 16: Individual heat recovery statuses 29
Table 17 - iCM Expandable Data on iCM Master First 31
Table 18 - iCM Expandable Data on iCM Master Second 32
Table 19 Evaporator or Condenser Pump Manager Menu 33
Table 20 Cooling Tower Manager Menu 35
Table 21 – Secondary Pump Managers Menu 35
Table 22: Maintenance page 36
Table 23: Individual number of starts for Units and circuits 37
Table 24: Individual running hours for Units and circuits 37
Table 25:System settings 38
Table 26: Priority settings for cooling and heating modes 39
Table 27: Stage up and stage down capacity thresholds for cooling and heating modes 40
Table 28: Standby chiller configuration 40
Table 29: System configuration 43
Table 30 Evaporator or Condenser Pump Manager Configuration menu 43
Table 31 Cooling Tower Manager Configuration menu 43
Table 32 Cooling Tower Manager Configuration menu 44
Table 39 Unit Types 47
Table 40: Available configurations between Master/Slave and iCM 49
Table 41: Setting the priorities 55
Table 42: System controlled temperature based on system layout 69

1 WHAT IS iCM©

1.1 Before starting

Each unit controller provides a set of embedded control functions that can be used to manage more than one Daikin unit in a plant-room.
Daikin unit will be connected to each other through the Daikin Communication Network. In this network, one unit will be elected as “Master” and the others will be elected as “Slave”.
Master unit is the single point of management of Daikin units, whereas the Slave units will follow the Master management.
Daikin unit manager can be distinguished in two categories:

- Master/Slave
- iCM© (intelligent Chiller Manager)

Each category provides a set of system control functionalities (resumed in the following paragraph).

Master/Slave control is available as a standard option and it can be activated at any time on Daikin units with Microtech III and Microtech IV controller.
iCM© control is available only on Daikin unit with Microtech IV controller and it must be bought as “Option 184” in the material request of each Daikin unit composing the plant-room. Purchase of “Option 184” provides a “License key” to activate iCM control on unit controller. The activation can be performed by Factory or during the commissioning of the units on site by a Daikin technician.

The main difference between iCM© and Master/Slave is that iCM© offers advanced optimization features and a comprehensive plant control management, whereas Master/Slave is limited by offering a very basic unit sequencing and staging without any energy efficiency optimization logics.

1.2 Available Control functions

In this section are resumed all the control function provided by iCM or Master/Slave. As aforementioned, not all the control functions are applicable with Master/Slave.

- **Unit Sequencing**: allows to equalize the operation hours of the units through rotation of units.
- **Unit Staging:** allows to provide a stable system controlled water, minimizing the number of running units and consequently reducing the power consumption.
- **Controlled temperature configuration:** allows to select the controlled temperature which Unit Staging is based on. Possible configurations are:
    - Control on Leaving water temperature: the installation of a temperature sensor on supply header is mandatory
    - Control on Entering water temperature: system control function manages the units to achieve a stable Return water temperature. In this case a sensor-less configuration is possible and the installation of the temperature sensor is not necessary.
- **Circuit Staging Control:** (applicable only to system with Multipurpose unit) allows to provide a stable chilled water and hot water in a four-pies distribution system, minimizing the number of running units and controlling the mode of unit circuits.

ⓘ	Control on Entering water temperature and consequently sensor-less installation is not always possible. Please refer to table Table 4 Common Leaving water temperature in plant room

Further system functions are available on with iCM. Those functions are related to advanced unit management or management of unit options at system level:

- **Unit Capacity control:** (not available for Multipurpose unit; available with M/S and EWT control) allows to manage the capacity generation of each unit, in order to increase or decrease the overall system capacity according to building load demand. Thus, this function provides energy efficiency optimization.
- **System Changeover:** (not available for Multipurpose unit) allows to set the operating mode of the system and consequently on all the units able to perform the changeover.
- **System Defrost:** (available only in system with Air-cooled Heat Pumps) allows to manage the defrost process of the units assuring that available heating capacity will be higher than cooling capacity generated during defrost
- **System collective housing:** (available only in system with Heat Pumps) allows to change automatically operating mode of the system and consequently on the units able to perform the changeover.
- **System Heat Recovery:** (available only for units with Heat Recovery option installed) allows to manage the activation of heat recovery function on the units in order to provide a stable system entering water temperature on Heat recovery circuit. Moreover, iCM will prioritize the start of units with heat recovery option among all the managed units to maximize the heat recovery production.
- **System Free Cooling** (available only for units with Free Cooling option installed) allows to manage the activation of free-cooling function on units in order to maximize the system cooling capacity generated through free-cooling

despite of mechanical cooling. For this reason, iCM will prioritize the start of units with free-cooling option among all the managed units.

- **System Variable primary flow management with dedicated pumps:** (available only for units with VPF option installed) allows to manage the speed of primary pumps dedicated to each unit in order to afford the building flow demand and assuring minimum flow to running units exchanger.
- **Evaporator Pump Manager:** (available only with additional “accessory” “iPMxx": external panel) allows to monitor the evaporator water distribution management based on manifolded piping.
- **Condenser Pump Manager:** (available only with additional “accessory” “iPMxx": external panel) allows to monitor the condenser water distribution management based on manifolded piping.
- **Cooling tower Manager** (available only with additional “accessory” “iPMxx": external panel, configured as Condenser Pump Manager) allows to monitor water distribution management based on manifolded piping and the cooling tower management.
- **Secondary Pump Manager:** (available only with additional “accessory” “iSM": external panel) allows to monitor the pump groups on secondary water distribution.
- **iCM Expandable:** allows to increase the number of managed units up to 16. The solution consists in two iCM Masters (each of them communicating with their own slaves), communicating to each other, and coordinating the management of the two sub-systems of Daikin units.
- **Four-pipe Management:** allows the possibility to manage Four pipe system and controlling the simultaneous and separated Hot and Chilled water production for the following layout:
    - **Multipurpose, AC Heat pump, AC Chiller** (with NO heat recovery)
    - **AC Heat pump and AC chiller with Heat Recovery**

  The iCM management, according to type of unit and request on both Heat and Chilled primary system, selects the best sequence of units to minimize energy consumption and it sets the operating mode to satisfy both demands.

1.3 Possible configurations

According to type (Air-cooled or water-cooled; chiller, heat pump or multipurpose) and combination of the Daikin units in the plant-room, only one category of Daikin unit manager (Master/Slave or iCM) is available:

Master/Slave can manage only plants with up to 4 Units and composed by:

- all chillers (mix of air-cooled and water cooled is not allowed; mix of unit with different compressor is not allowed)
- all heat pumps (mix of air-cooled and water cooled is not allowed; mix of unit with different compressor is not allowed; only in two-pipes water distribution)
- all multipurpose all the Units must have the same capacity control (all scroll or all screw compressors).

iCM can manage only plants with up to 8 Units and composed by:

- all chillers (mix of air-cooled and water cooled is not allowed)
- all heat pumps (mix of air-cooled and water cooled is not allowed)
- all multipurpose
- all single modular units R290
- arrays of modular units R290 managed by MUSE
- mix of single modular units R290 and arrays of modular units R290 managed by MUSE
- mix of Heat pumps and Chillers (operating in two-pipes water distribution: chiller units are stopped during Heating mode)
- mix of Screw and Scroll compressor Air-cooled unit
- mix of Screw and Scroll compressor air-cooled units with single modular units R290
- mix of Screw and Scroll compressor air-cooled units with arrays of modular units R290 managed by MUSE
- mix of Screw and Scroll compressor air-cooled units with both single modular units R290 and arrays of modular units R290 managed by MUSE
- mix of Screw and Centrifugal compressor Water-cooled unit
- mix of VFD and Slide compressor unit
- air cooled chillers with optional Heat Recovery (not all chillers must have heat recovery)
- air cooled chillers with optional Free-cooling (not all chillers must have free-cooling)
- mix of Multipurpose and Air cooled Chillers and Air-cooled Hea pumps (Four-Pipe Layout)
- mix of Air-cooled Heat pumps and Air-cooled Chiller with Heat Recovery (Four Pipe Layout)

Master controller is able to detect the type of units and the type of Daikin system management activated on each controller connected in the network. If the combination between Daikin unit type and Daikin System manager type were wrong, Master controller disables the Daikin System Manager and provide a notification.

ⓘ	In case of doubts about what Master/Slave can and cannot do, please refer to the following sections or contact your Sales Support reference.

ⓘ	In the case of one or more arrays of R290 modular units, each managed via MUSE, the iCM logic will treat the entire array as a single modular unit. This unit corresponds to the one designated as MUSE within the array. For further details, please refer to the MUSE AC manual.

1.4 Limitations

As mentioned in the previous Section 1.3, there are limitations in using Master/Slave and iCM in some plant layout. Nevertheless, limitations of Master/Slave can be overcome by using iCM© control. If any of those limitations are found during system commissioning, it is given the possibility to activate a trial of the iCM© for a limited period of time. When the trial expires and the permanent license has not been activated, iCM© will be automatically disabled by the controller. To clarify this specific aspect, please refer to Section 2.

The following Table 1 resumes the possible configurations and limitations of the two management:

Primary System Type	Master/Slave	iCM©
Up to 8 Units	×	✓
All Chillers	✓	✓
All Heat Pumps	✓	✓
All Multipurpose	✓	✓
All single modular units R290	×	✓
Arrays of modular units R290 managed by MUSE	×	✓
Mix of single modular units R290 and arrays of modular units R290 managed by MUSE	×	✓
Mix of Water-cooled Units + Air-cooled Units	×	×
Mix of Water-cooled Units + Multipurpose Units	×	×
All Screw Units	✓	✓
All Scroll Units	✓	✓
All Centrifugal Units	✓	✓
Mix of Screw + Scroll Units	×	✓
Mix of Centrifugal + Screw/Scroll Units	×	✓
Mix of Screw and Scroll compressor air-cooled units with single modular units R290	×	✓
Mix of Screw and Scroll compressor air-cooled units with arrays of modular units R290 managed by MUSE	×	✓
Mix of Screw and Scroll compressor air-cooled units with both single modular units R290 and arrays of modular units R290 managed by MUSE	×	✓
Mix of Screw Units with slide compressor + Units with VFD compressor	✓	✓
Two Pipe System: Mix of Chillers + Heat Pumps	×	✓
Heat Pumps + System Changeover	×	✓
Air-cooled Heat Pumps with Collective housing	×	✓
Air-cooled Heat Pumps + System Defrost	×	✓
Air-cooled Chillers with Heat Recovery (HR)	×	✓
Mix Air-cooled Chiller with HR + Air-cooled Chiller with no HR	×	✓
Mix of Chillers with HR + Multipurpose	×	×
Air-cooled Chillers with Free-cooling (FC)	×	✓
Mix Air-cooled Chiller with FC + Air-cooled Chiller with no FC	×	✓
Mix of Chillers with FC + Multipurpose	×	×
Four Pipe System: Multipurpose + Air-cooled Chillers + Air-Cooled Heat pumps	×	✓
Four Pipe System: Air-cooled Heat pumps + Air-cooled Chiller with HR	×	✓
Four Pipe System: Air-cooled Heat pumps + Air-cooled Chiller with no HR	×	×

Table 1: Comparison between iCM and Master/Slave

iCM is able to manage different plant layout and Daikin units:

a) **Two-pipe plant layout**: Only one primary distribution system is present for both Heated and Chilled water. iCM is able to manage Chiller and Heatpumps units and the changeover of them to satisfy the primary system demand.
b) **Four pipe plant layout**: it consists in two separated distribution systems respectively for Heated water and Chilled water. iCM is able to manage two different groups of units:
    a. Multipurpose connected to both sides, Air cooled Chiller connected to Chilled side, Air cooled Heat pump connected through changeover valve to both sides.

b. Air-cooled Heat pump connected through changeover valve to both sides, Air-cooled Chiller with heat Recovery connecting evaporator to Chilled side and Heat Recovery coil to Heated side

ⓘ	In case of doubts about what Master/Slave or iCM© can and cannot do, please refer to the following sections or contact your Sales Support referent in Daikin Applied Europe S.p.A.

1.4.1 Four Pipe Plant Limitations

iCM is able to manage only two groups of Daikin units:

1) Configuration A: Multipurpose, Air-cooled chiller and Air-cooled heatpump.
2) Configuration B: Air-cooled heat pump and Air-cooled Chiller with Heat recovery.

Both configuration working in Constant primary flow system.

Plant-room must consist in:

A) Configuration:
   a. At least one Multipurpose unit configured as iCM Master
   b. NO Air-cooled Chiller unit with “Heat Recovery with control” option
   c. ONLY Air-cooled Heat pump unit with “Changeover Valve Management” option
B) Configuration:
   a. At least one Air-cooled Heat pump unit with “Changeover Valve Management” configured as iCM Master
   b. ONLY Air-cooled Heat pump unit with “Changeover Valve Management” option
   c. At least one Air cooled Chiller unit with “Heat Recovery with control” option configured as iCM Slave 1;
   d. All Heat recovery circuits of Air cooled chiller units must be connected to hot primary headers
   e. Separated Heat Recovery circuit beside Hot primary system is NOT allowed
   f. NO Multipurpose unit

Both configurations have some limitations on provided function of iCM management:

Functions	Multi + AC-CO + AC-HP	AC-HP + AC-COwHR
Unit Sequencing	✓	✓
Unit Staging	✓	✓
System Leaving water temperature control	✓	✓
System Entering water temperature control	×	×
Circuit Staging & Mode Control (for Multipurpose)	✓	×
Unit capacity control	×	×
System Mode Changeover	✓	✓
System Defrost	×	×
System Collective housing	×	×
System Heat Recovery	×	✓
System Free-cooling	×	×
System Variable Primary Flow	×	×
Evaporator Pump Manager (iPM)	×	×
Condenser Pump Manager (iPM)	×	×
Cooling Tower Manager (iCT)	×	×
Secondary Pump Manager (iSM)	×	×
iCM Expandable	×	×

Table 2 - Four Pipe system: iCM Functions limitation

1.4.2 iCM Expandable Limitations

iCM Expandable cannot be configured on Multipurpose units and it is not able to manage four-pipe system.
When iCM Expandable is configured, the two iCM Masters are able to provide some functions of iCM option, listed in the table below:

Functions	iCM Expandable
Unit Sequencing	✓
Unit Staging	✓
System Leaving water temperature control	✓
System Entering water temperature control	×
Circuit Staging & Mode Control (for Multipurpose)	×
Unit capacity control	×
System Mode Changeover	✓
System Defrost	✓
System Collective housing	✓
System Heat Recovery	✓
System Free-cooling	✓
System Variable Primary Flow	×
Evaporator Pump Manager (iPM)	×
Condenser Pump Manager (iPM)	×
Cooling Tower Manager (iCT)	×
Secondary Pump Manager (iSM)	×

Consequently, if iCM Expandable is configured, the two Masters are able to manage only the following primary systems:

Primary System type	iCM Expandable
Up to 16 Units	✓
All Chillers	✓
All Heat Pumps	✓
All Multipurpose	×
All single modular units R290	✓
Arrays of modular units R290 managed by MUSE	×
Mix of single modular units R290 and arrays of modular units R290 managed by MUSE	×
Mix of Water-cooled Units + Air-cooled Units	×
Mix of Water-cooled Units + Multipurpose Units	×
All Screw Units	✓
All Scroll Units	✓
All Centrifugal Units	✓
Mix of Screw + Scroll Units	✓
Mix of Screw and Scroll compressor air-cooled units with single modular units R290	✓
Mix of Screw and Scroll compressor air-cooled units with arrays of modular units R290 managed by MUSE	×
Mix of Screw and Scroll compressor air-cooled units with both single modular units R290 and arrays of modular units R290 managed by MUSE	×
Mix of Centrifugal + Screw/Scroll Water-cooled Units	✓
Mix of Screw Units with slide compressor + Units with VFD compressor	✓
Mix of Chillers + Heat Pumps (only in two pipes system)	✓
Heat Pumps + System Changeover	✓
Heat Pumps with Collective housing	✓
Air-cooled Heat Pumps + System Defrost	✓
Air-cooled Chillers with Heat Recovery (HR)	✓
Mix Air-cooled Chiller with HR + Air-cooled Chiller with no HR	✓
Mix of Chillers with HR + Multipurpose	×
Air-cooled Chillers with Free-cooling (FC)	✓
Mix Air-cooled Chiller with FC + Air-cooled Chiller with no FC	✓
Mix of Chillers with FC + Multipurpose	×
Four Pipe System: Multipurpose + Air-cooled Chillers + Air-Cooled Heat pumps	×
Four Pipe System: Air-cooled Heat pumps + Air-cooled Chiller with HR	×

Table 3 - Limitations on System Configuration in case of iCM Expandable

1.5 Integration in a Building Management System

Daikin unit is elected as the “Master” of the plant, it is able to retrieve the most important information of all the other “Slave” units and of the equipment managed by additional Panels (Evaporator or Condenser Pump Manage) connected to Daikin Communication Network.
Thus, Master controller works as single point of integration with the BMS that will be able to gather all that information through protocol communication:

- BACnet over IP
- BACnet MSTP
- Modbus over RS485

Moreover, BMS will be able even to set the most important setpoints related to Daikin Unit Manager.

Please refer to document “BAS Integration – iCM Modbus protocol” or “iCM BACnet protocol” where all the datapoints are listed.

ⓘ	Not all the variables regarding the single unit are accessible through Master controller. In case all the information about single unit are request, even Slave controller must be integrated by BMS

1.6 Daikin on Site

iCM© is integrated within Daikin on Site (DoS). When a Unit is connected to DoS and it is elected as the Master of the plant, all the status info, settings and web graphics of the plant are displayed. Specific sections will support an easy commissioning of the system and trending to monitor capacities and temperatures, starts and stops can help the remote Operator to fine tune and optimize the plant control.

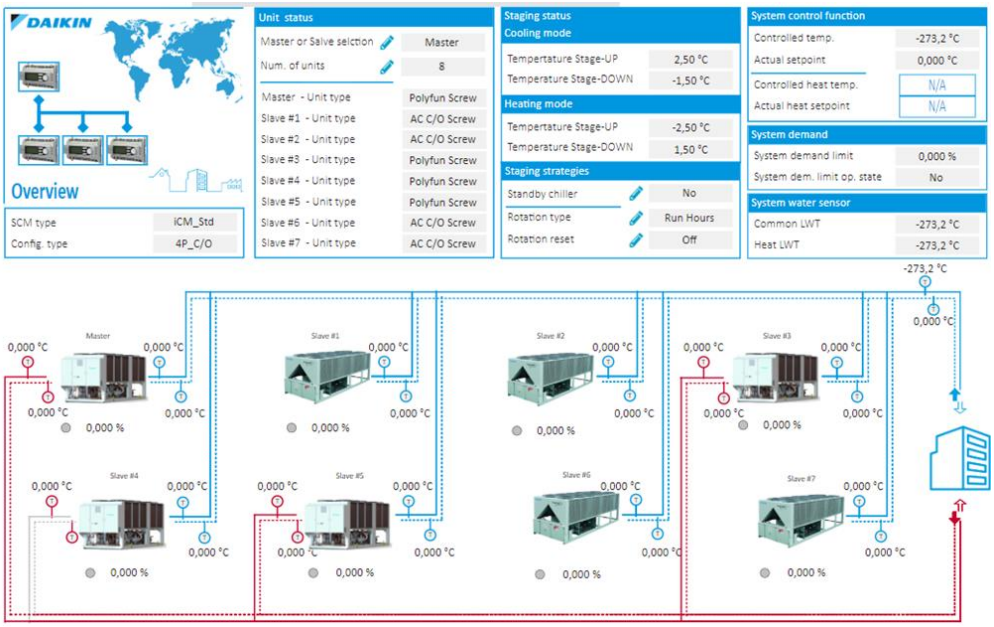


Figure 1 iCM plant visualization on Daikin on Site

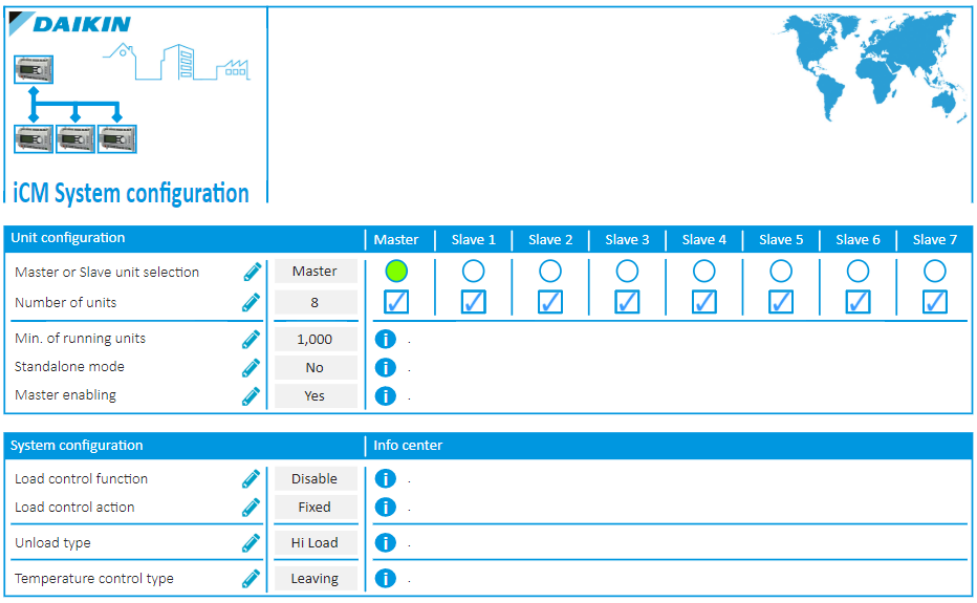


Figure 2 iCM System configuration page on Daikin on Site

2 LICENSING

2.1 When license is needed

When the plant configuration requires iCM©(please refer to Table 1 for more details), then a License key is needed.
In case iCM© is added to the Units' order, the control function is automatically activated from the Factory by allowing a Plug&Play control solution during the commissioning phase.
If iCM© is requested in a later stage, the License can be ordered from the Factory. Simple information like the order number of Units and the corresponding serial numbers of the Unit controllers are needed to for the License activation.
The License key is a unique code specifying the special options associated to that Unit and applicable to that Unit only.
In case of multiple Units in the same plant an individual License key must be set on every Unit to let iCM© being unlocked.

ⓘ	iCM© is a Unit option and must be purchased as any other option. Don't forget to add it to your order for Factory activation.

2.2 Temporary License

A temporary License can be used if iCM© has not been ordered and the system layout requires its functionalities. To activate the time-limited License for iCM© please, let's proceed through menu *Commissioning – Software Options* page and the *Temporary Passwords* menu:

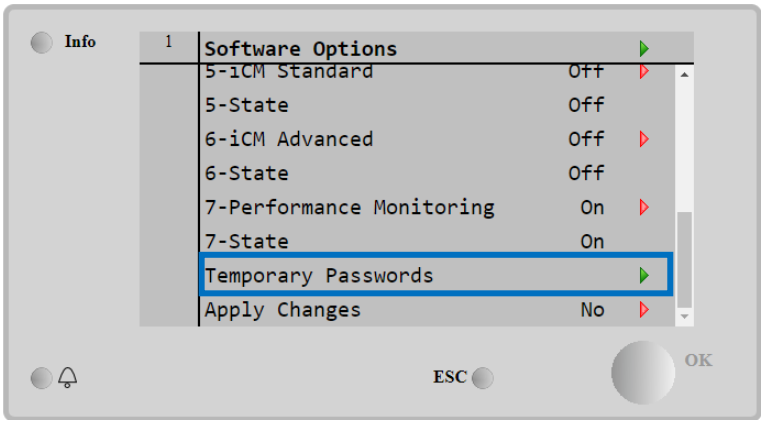


Figure 3: Temporary Activation

Then, by entering the page, three temporary passwords are displayed:

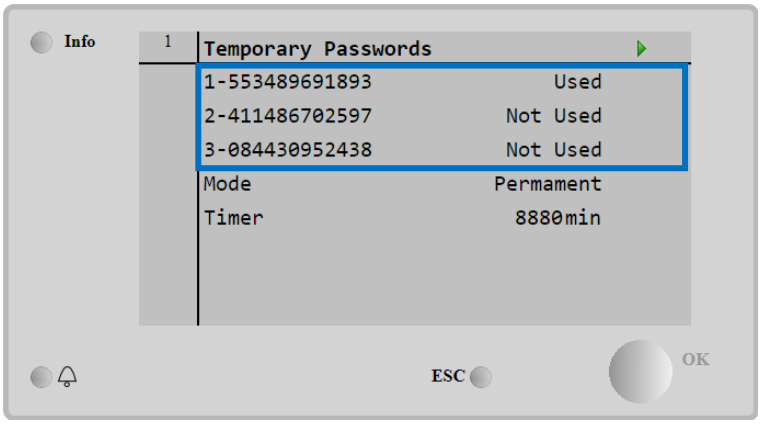


Figure 4: Temporary password activation

In the same page the usage of the activation code is also visible and a Timer indicating the remaining time before expiration can be checked.
When timer expires, iCM© will be disabled. All the settings will be retained, and a re-activation will restart the normal sequencing as per previous configuration.

ⓘ	If the iCM© get disabled because the temporary licenses expire, Daikin Applied Europe cannot be considered responsible for any consequence or claims from the customer.

2.3 Permanent License

To enter a permanent License and activation key of the iCM©, go into the *Commissioning – Software Options* page:

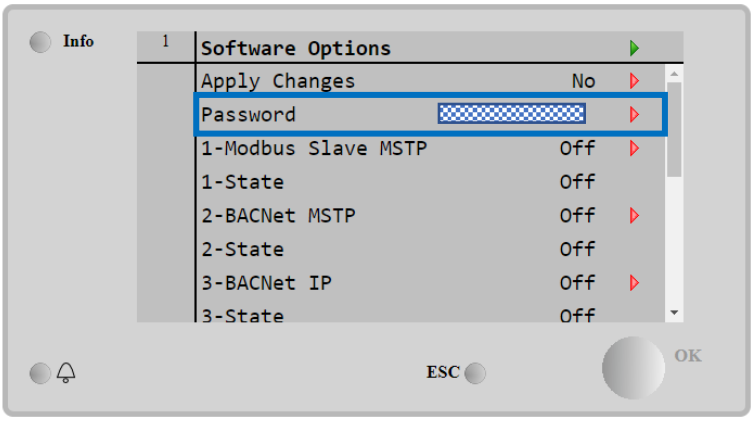


Figure 5:Software Options page

Click on the red arrow next to the item Password and enter the numeric License key.

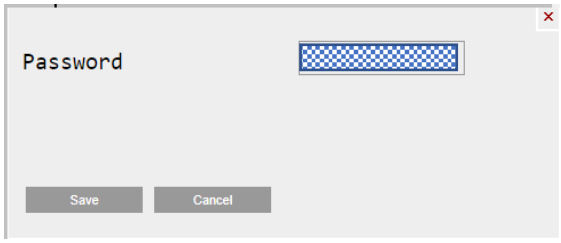


Figure 6: Enter the license code

With the License key correctly installed, let's proceed and activate all the options including the iCM© by changing the corresponding value to *On*, then apply all the changes.

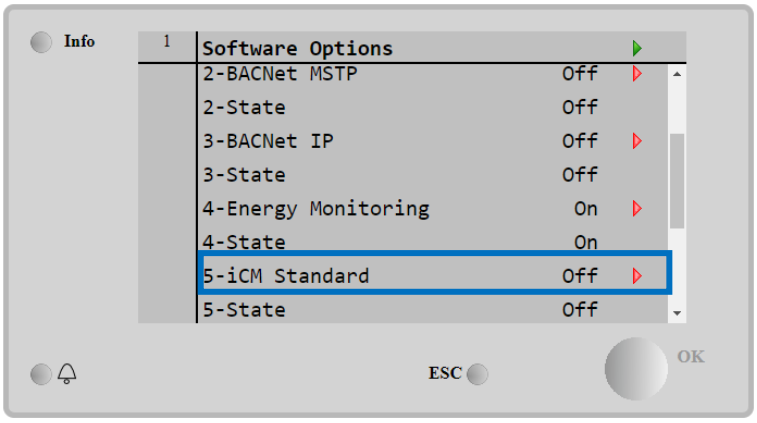


Figure 7: Activate the iCM Standard

After the controller reboot, go back again to the *Software Options* page and check if the activation states (5-State) are *On* to confirm the correct activation of the iCM© function.

3 FIELD WIRINGS

3.1 Daikin Communication Network connection

The following diagram shows how to connect the Daikin Units to each other and establish the Daikin communication Network. Starting from first Daikin Unit, connect in parallel the PB terminals [CE+ / CE-] of every controller. Refer to the Unit wiring diagram for the enumeration of the terminals.
A shielded twisted pair cable must be used to make the connection.

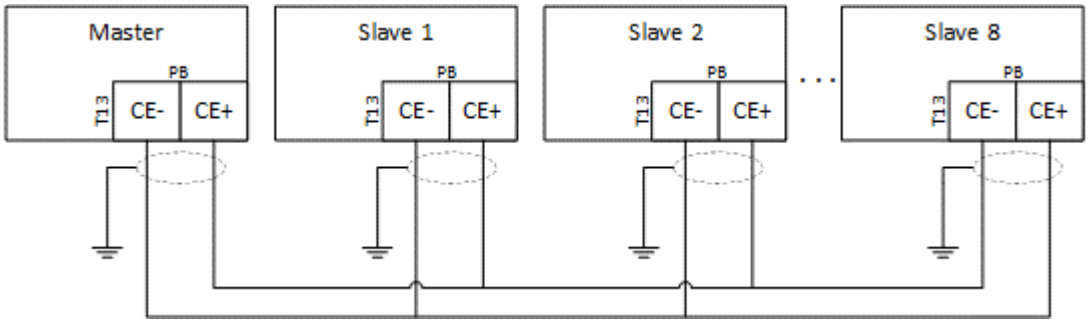


Figure 8: Connecting the network

It is important to respect the below limitation to avoid instability in the communication network:

- Twisted and Shielded 2-wire cable
- Bus cable length between 2 Units Max. 700 m
- Total bus cable length Max. 1,000 m

3.2 Common water temperature sensors

As explained in paragraph 1.2, Daikin unit managers can work in a sensor-less configuration, providing a stable Entering water temperature (calculated as average of entering water temperature of running units) and simplifying the installation but not assuring a stable system leaving water temperature.

It must be highlighted that “entering water temperature control” and sensor-less configuration is not always possible. For this reason, Master controller can be equipped with common water temperature sensors depending on the specific Control temperature configuration, set of Daikin units to be managed and set of Special option of the Daikin units. The following table resume when one or two common leaving water temperature sensors are needed or mandatory:

Option	1 sensor	2 sensors
All Chillers	✓	×
All Heat Pumps	✓	×
All Multipurpose	×	M
Two Pipe: Chillers + Heat Pumps	✓	×
Water cooled cooling only	✓	×
Water cooled cooling/heating	✓	✓
Water cooled heating only	✓	✓
Air cooled Heat Pump + Defrost	M	×
Air cooled Chiller + Heat recovery	M	×
Air cooled Chiller + Free-cooling	M	×
Modular units R290	M	✓
Four Pipe: Mix of Multipurpose + Chiller + Heat pump	×	M
Four Pipe: Heat Pumps + Chiller with HR	×	M

Table 4 Common Leaving water temperature in plant room

Configurations with the “M” highlights that installation of one or two sensors are mandatory. For example, any time a multipurpose is managed in the system, 2 temperature sensors are always needed.
Type of sensors that can be used are:

- Daikin NTC10K (with a beta of 3977), that can be bought as an “accessory” of the Daikin unit in the material request
- Generic PT1000 sensors.
- ATEX in case of modular units R290

Please refer to the specific Unit wiring diagrams for a correct hardwired connection of the sensors to the “Master” controller terminals.

These sensors must be installed in a proper position to measure the Supply water temperatures of the system.

The temperature sensor must be installed upstream an eventual bypass pipe or tank or common header that decouple primary circuit from secondary circuit.
Below picture shows the recommended position on supply header:

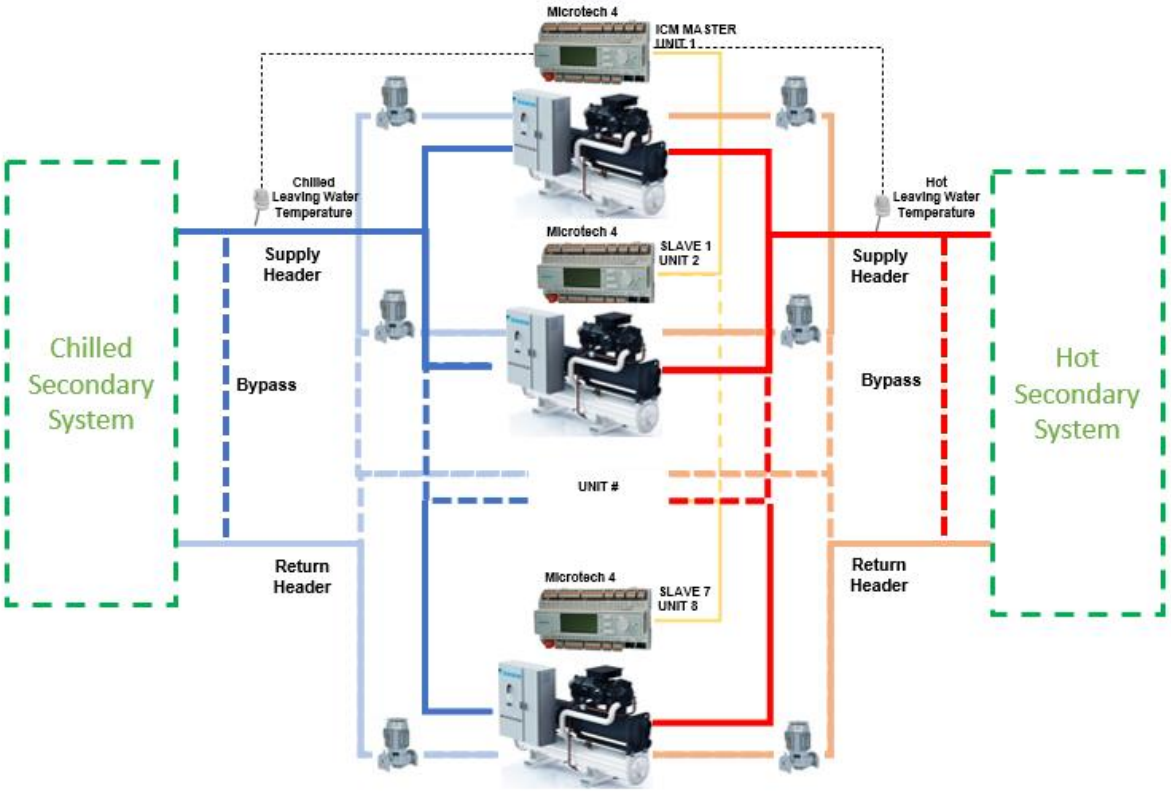


Figure 9 - Common Leaving water temperature installation position

3.3 Four-pipe Plantroom: equipment installation

iCM is able to manage only two groups of Daikin units

1) Configuration A: Multipurpose, Air-cooled chiller and Air-cooled Heat pump.
2) Configuration B: Air-cooled Heat pump and Air-cooled Chiller with Heat recovery.

Moreover Daikin Units must be equipped with specific options and must be installed in a specific way.

3.3.1 Four-pipe Plantroom consisting in Multipurpose, A/C Heat pump and A/C Chiller

This plant layout must comply with the following guidelines to be managed by iCM:

1) At least one multipurpose unit must be configured as iCM Master.
2) Two Common Leaving water temperature sensors must be installed on supply headers of Heated water and Chilled water primary systems and connected to Master Multipurpose
3) For all Multipurpose evaporator pipes must be connected to Chilled water primary headers and condenser pipes to Heated water primary headers
4) All the Air-cooled Heatpump must be equipped with “Changeover Valve Management” option. The valve must be installed on the outlet pipe and it is used to divert the water from evaporator pipes towards Heated primary headers or Chilled primary headers according to Unit Mode. It is recommended to install the evaporator pump/s on inlet evaporator pipe or upstream Changeover valve
5) For all the Air-cooled Chiller, evaporator pipes must be connected to Chilled Primary headers.

The following picture shows an example of this plant layout:

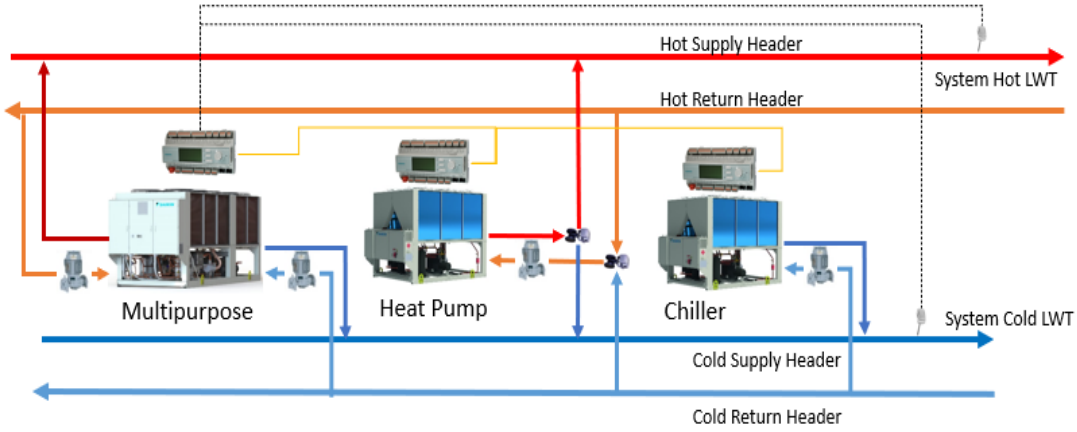


Figure 10 - Four-pipe: Multipurpose, A/C Chiller and A/C Hea pump

3.3.2 Four-pipe Plantroom consisting in A/C Heat pump and A/C Chiller

This plant layout must comply with the following guidelines to be managed by iCM:

1) At least one A/C Heat pump must be configured as iCM Master.
2) Common Heat Leaving water temperature sensor must be installed on supply header of Heated primary headers and connected to Master unit.
3) All the Air-cooled Heat pump must be equipped with “Changeover Valve Management” option. The valve must be installed on the outlet pipe and it is used to divert the water from evaporator pipes towards Heated primary headers or Chilled primary headers according to Unit Mode. It is recommended to install the evaporator pump/s on inlet evaporator pipe or upstream Changeover valve.
4) At least one A/C Chiller must be equipped with “Heat Recovery with control” option and configured as iCM Slave 1 unit.
5) Common Chilled Leaving water temperature sensor must be installed on supply header of Chilled primary headers and connected to Slave 1 unit.
6) For all the Air-cooled Chiller units with Heat Recovery, evaporator pipes must be connected to Chilled primary headers and Heat Recovery pipes to Heated primary headers.
7) For all the Air-cooled Chiller, evaporator pipes must be connected to Chilled Primary headers.

The following picture shows an example of this plant layout:

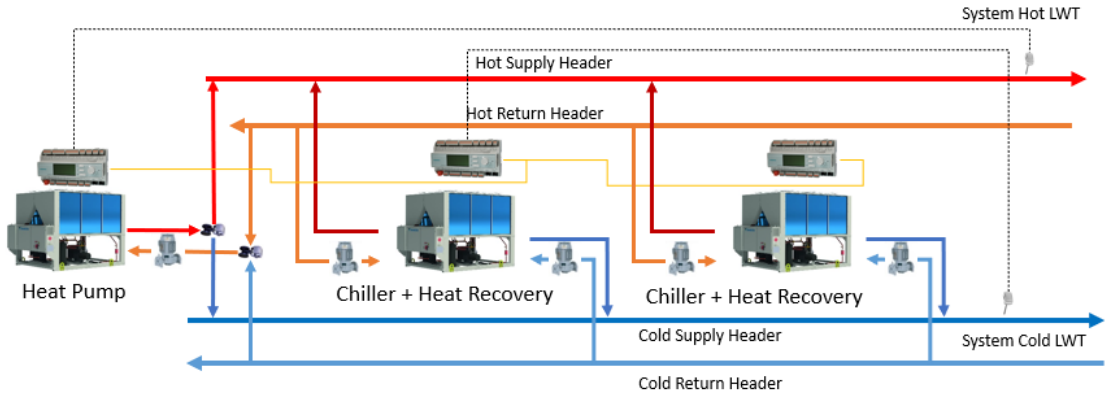


Figure 11 - Four-pipe: A/C Heat Pump and A/C Chiller with Heat Recovery

3.4 System Variable primary flow with dedicated pump: equipment installation (Only with iCM)

When Daikin unit controller is equipped with “VPF Option”, unit is provided with a Differential pressure sensor installed between Leaving and Entering water pipe on the exchanger, that notifies the possible minimum flow.
If multiple Daikin units with VPF option are connected to Daikin Network, unit (elected as Master controller) will be able to manage the speed of the primary pumps according to a Differential Pressure sensor, to assure the correct flow to the building, and to manage the opening of the by-pass valve to assure minimum flow to running units.
The equipment installation and connection to Daikin units is shown in the following picture:

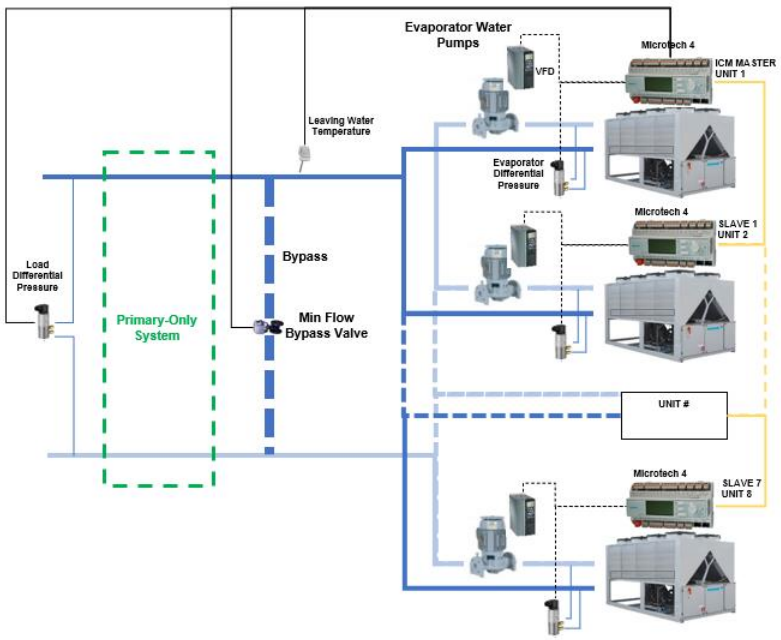


Figure 12 - Variable Flow based on DP in primary system with dedicated pumps

Daikin Units with VPF option are equipped with an Evaporator differential pressure and they are able to manage the dedicated primary pump with the following signals:

- “Pump #1 Request”: Digital Output (Normally Open contact) to command the start of variable speed driver (VFD) of the pump.

ⓘ	Pump Request Contact need an External Power Supply at 24 or 230 Vac (not provided by unit controller)

- Pump Speed Signal”: 0…10Vdc Output Signal to command the speed of VFD of the pump.

Only on Master controller, by-pass valve actuator and Differential pressure sensor on the building must be connected to the following controller terminals:

- “Load Differential pressure”: 0…10Vdc Input Signal to gather the measurement of the sensor (unit controller provides 24Vdc for power supply)
- “By-pass Valve Request”: Digital Output (Normally Close and Normally Open) of internal relay to command the closing/opening of the valve actuator.

ⓘ	By-pass Valve Request needs an External Power Supply at 24 or 230 Vac (not provided by unit controller)

ⓘ	Load Differential Pressure sensor and By-pass Valve actuator and body are not part of Factory provision

Please refer to the specific Unit wiring diagrams for a correct hardwired connection of the equipment to the controller terminals.

3.5 System Pump Management in manifolded piping: Shut-off valve installation

In plant-room where primary water distribution is projected as manifolded piping, primary pumps are installed in parallel and provide water flow to all the units. In order to avoid water flow when the unit is shut-down, shut-off valve must be installed on the inlet pipe of each unit.
Each unit can manage the closure or opening of the shut-off valve through the following output:

- "Pump #1 Request": Digital Output (Normally Open contact) to be connected to an External Relay that can provide separated Normally Close and Normally Open contact to send open/close command to valve.

The following scheme shows the electrical device that must be installed in unit panel and connections with valve actuator:

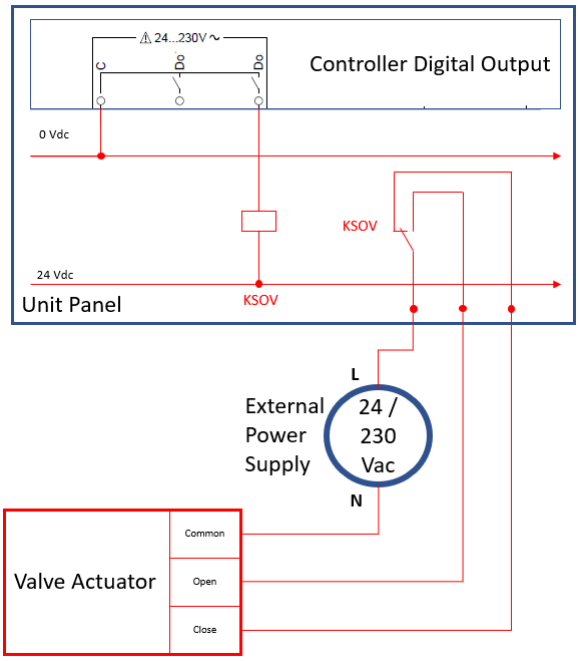


Figure 13 - Shut-off valve electrical installation

ⓘ	Installation of KSOV Relay, External Power supply, Valve actuator and body are not part of Factory provision

3.6 System Variable primary flow with manifolded pump: equipment installation (Only with iCM)

In plant-rooms with manifolded piping, intelligent Pump Manager can manage the primary pumps and variable primary flow, in conjunction with iCM that will manage the Daikin units.
In those plant-rooms:

- iPM will manage all the equipment related to water distribution:
  - VFD pump
  - Bypass Valve
  - Load Differential pressure
- Each unit must be equipped with “VPF option” to measure the Evaporator Differential Pressure
- Each unit can manage the dedicated inlet shut-off valve (connections are explained in the previous paragraph).

The following picture shows the hardwired connections to iPM and Daikin units:

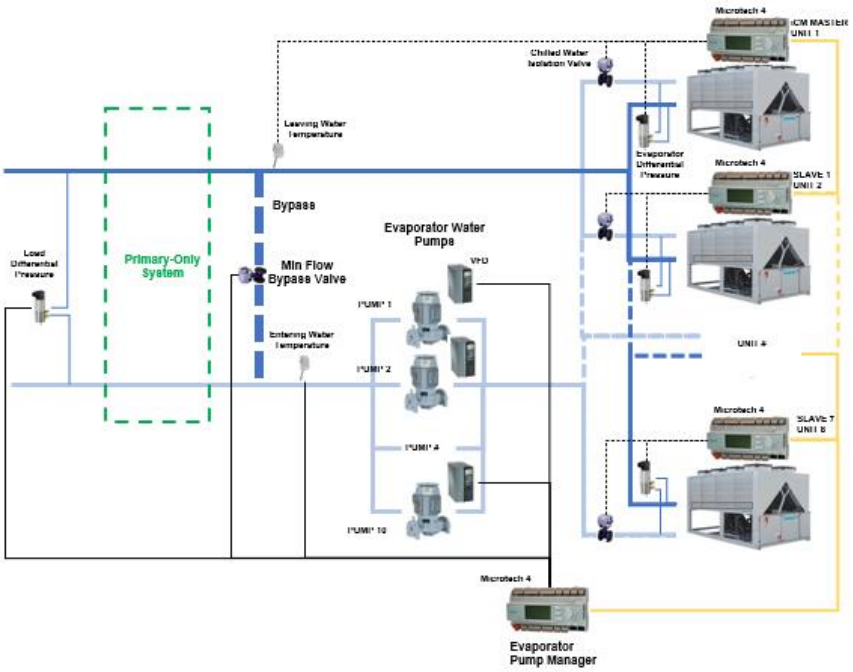


Figure 14 - Variable Primary Flow with iCM and iPM

3.7 System composed by Up to 16 units: iCM Expandable layout

iCM Expandable function allows to manage up to 16 units. The function is based on the BACnet over IP communication between two iCM Masters controller managing two subsystems of slave units.
For this reason, the two iCM Master controllers must be equipped with BACnet over IP communication module: EKCMBACIP and the two modules must be connected to the same LAN network.
The following picture shows the cable connections and communication networks between unit controllers of the plant-room:

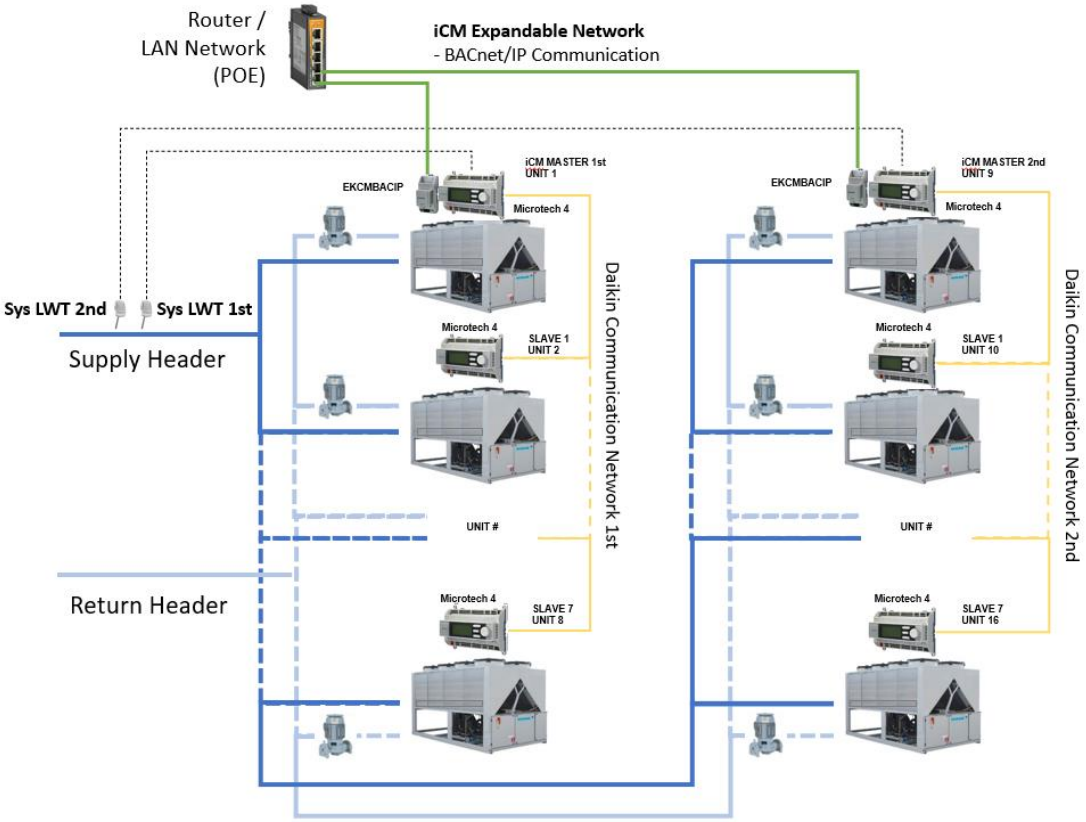


Figure 15 - iCM Expandable Cable Connections

iCM Expandable network is LAN Network, that can be created by using an external router or by connecting to customer LAN network switch the two EKCMBACIP modules.
It is important to respect the below limitation to avoid instability in the communication network:

- Cable type: Ethernet CAT6A LSZH
- Cable length between module and access point: Max. 90 m
- External router or LAN network (Customer Switch) must provide Power Over Ethernet (POE): BACnet modules must be power supplied by Ethernet cable

Each iCM Master must be connected to up to 7 slave units through a dedicated DCN (Daikin communication network) as explain in **paragraph 3.1.** Consequently, there will be two DCN for the two subsystems of units.

The cables of the two DCN must not be connected together.
The two DCN must be kept separated

Each iCM Master must be connected to a dedicated “System Leaving water temperature sensor”, as explained in **paragraph 3.2.** The two sensors provide redundancy on the controlled temperature and make the whole system reliable in case of fault of one of the two sensors.

4 HMI DESCRIPTION

4.1 Introduction

The following sections will go into the configuration and navigation of both iCM and Master/Slave. All the menus and submenus will be described in terms of purpose and contents. All the pages will be described in terms of parameters and settings. The two classes can be easily identified referring to the below table.

Description	Default	Range and function	AL	MS
This is a parameter	7.6°C	-15.0°C…30.0°C This is a parameter	4	Y
This is a setting	2	iCM: 2…8 M/S: 2…4	2	N
This is a link to a subpage	u		4	Y

Table 5: Example of parameter and setting representation

The description of any setting or parameter will also include the required Access Level (AL). Access level is defined by the password entered to access the different menus of the Microtech© 4. Please refer to the Unit's Operating Manual for more details.
The column MS will show if a setting or parameter is available
Access levels are the following:

AL	Profile	Access rights
6	Basic user	Limited access to settings and parameters
4	Maintenance	extended access to settings and parameters
2	Service	full access to configuration, settings and parameters

Table 6:Access levels

Some of the settings for the lower profile users can be limited to read only but can be changeable with a higher access level.

4.2 Preliminary configuration

Before being able to configure all the function of the iCM© or Master/Slave, it is needed to activate this additional control on the Units. To do this, it is needed to enter the *Commission Unit – Configuration* menu:

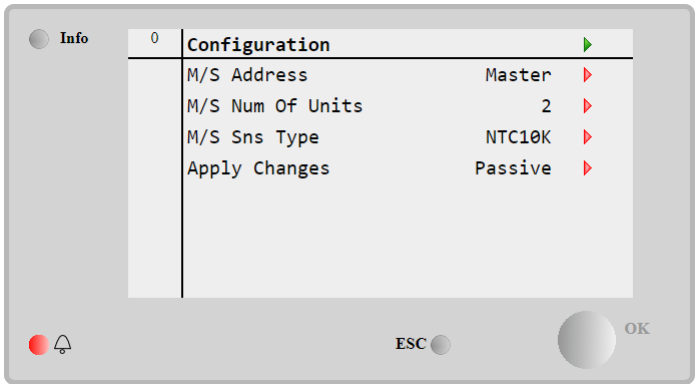


Figure 16: Basic system configuration

Description	Default	Range and function	AL	MS
M/S Address	None	iCM: Master, Slave1,…, Slave8 M/S: Master, Slave1,…, Slave4	4	Y
Defines the ID of each Unit inside the network.				
M/S Num Of Units	2	iCM: 2…8 M/S: 2…4	4	Y
Relevant on the Master Unit only to define the number of Units. This value is also used to set communication alarms on disconnected Units.				
M/S Sns Type	NTC10K	NTC10K, PT1000	4	Y
Defines the type of sensor connected to the Master Unit to monitor the supply water temperature to the System. In case of Return water temperature control this setting will not affect the regulation. In case of Supply water temperature control the sensor must be connected or an alarm will be generated				

Table 7:Basic configuration

The above settings if not properly adjusted may generate alarms on the Master controller. In this case check the settings on this page and on the corresponding page of each Slave controller. Refer to the Troubleshooting section for further details.

After a reboot of the controller the needed additional menus will be shown on the Master controller.

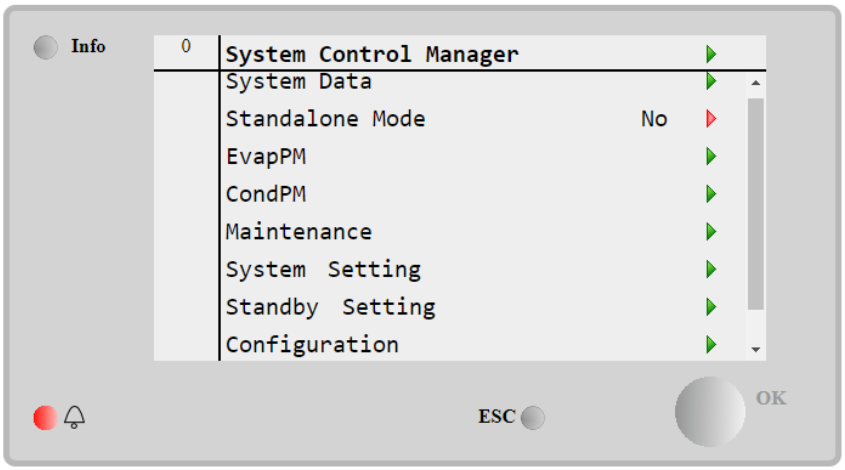


Figure 17: Extended configuration menu

A detailed description of all the sub-pages is in the following sections.

4.3 Main Menu

The Main Menu contains the links to all the configuration and visualization pages. The following table will list all the sections and the related contents.

Section	Content	AL
System Data	Operational data of the System	6
Evap PM	Evaporator Pump Manager menu contains data and setpoint exchanged between Master Controller and Pump Manager controller	
Cond PM	Condenser Pump Manager menu contains data and setpoint exchanged between Master Controller and Pump Manager controller	
iCT	Cooling Tower Manager menu contains data and setpoint exchanged between Master Controller and Cooling Tower manager	
iSM	Secondary Pump Manager menu contains the data about the secondary pump groups managed by iSM	
Maintenance	Information about running hours and number of starts for each Unit. It also allows to disable the sequencing functions or disable the heat recovery management.	
System Settings	Allows to define the relevant settings for the temperature control of the plant.	6
Standby Settings	Allows to define the Standby chiller management.	4
Configuration	Options configuration, allows to review the type of system, define the main control strategies and activate additional controls	6

Table 8: Main Menu

ⓘ	EvapPM, CondPM, iCT menu will display only if Evaporator or Condenser Pump Manager or Cooling Tower manager are enabled in the Configuration menu

From the Main Menu is possible to access one setting, described in the following table.

Description	Default	Range and function	AL	MS
Standalone Mode	No	No, Yes	4	Y
Unit, set in Standalone mode will work independently from iCM sequencing even if connected on Daikin Chiller network. Those Unit can be managed by Unit controller itself.				

Table 9: Additional settings in the Main Menu

ⓘ	If Master Unit is set “Standalone”, all the Units (Master and Slaves) will work independently from iCM sequencing.

4.4 System Data

This section will describe the parameters accessible in the Data page. It will also describe the links to other sub-sections.

Description	Default	Range and function	AL	MS
Sys State	Stop	Stop, Run	6	Y
This is the general System status. - Stop will mean that Logic is not doing any sequencing. This may be due to the Enable switch on the Master controller. - Run means that all the sequencing functions are running.				
Sys Mode	Cool	Cool, Ice, Heat, Multi	6	Y
This the actual System operating mode. It's defined by operating mode of the Master Unit unless a Multipurpose Unit is controlled. In that case the System Mode will be fixed to "Multi".				
Sys Defrost	Stop	Stop, Run	6	N
This status will display only in case Master controller is an Air-cooled Heat Pump. - Stop means that there are no unit with circuits in defrost mode. - Run means that Defrost managed by iCM is running				
Sys HeatRec State	Stop	Stop, Run	6	N
This is the general System Heat Recovery state. Stop will mean that Logic is not doing any sequencing. This may be due to the Heat Recovery is not enbaled on the Master controller. Run means that Heat Recovery function is running at system level				
Sys FreeClg Status	Off:Swi	Off:Swi, WaitOaT, Run, Off:Alm	6	N
This variable will disaply only if Master controller is equipped with Free-cooling option. This is the general System Free-cooling status. Possible statuses are: - Off:Swi: System free-cooling management is disabled by FC enable Switch on Master controller - WaitOaT: System free-cooling management is not running because condition on Outside air temperature is not achieved - Run: System Free-cooling management is enabled, condition on OaT is achieved and it is running - Off:Alm: System Free-cooling management is stopped because OaT sensor is in alarm.				
Sys DHW Status	Off:byTemp	Off:byTemp, Off,Dsbl, Start, Run, Off:Alm	6	N
This variable will disaply only if Master controller is equipped with Domestic Hot Water option. This is the general System Domestic Hot Water status. Possible statuses are: - Off:byTemp: : System DHW management is is not running because condition on DHW Temperature is not achived - Off:Dsbl: System DHW management is disabled by DHW enable Switch on Master controller - Start: System DHW management is enabled, condition on DHW Temperature Setpoint is achieved and the units with DHW option are waiting 3-way valve feedback - Run: System DHW management is enabled, condition on DHW Temperature Setpoint is achieved and the units with DHW option are running - Off:Alm: System DHW management is stopped because 3-way valve is in alarm.				
System Temperatures				
Sys Evap LWT	-.-°C		6	Y
This is the actual value of the system supply chilled water temperature. Its value may not be relevant in case of return water temperature control				
Sys Cond LWT	-.-°C		6	Y
This is the actual value of the system supply heated water temperature. Its value may not be relevant in case of return water temperature control in heating mode. It is available only for water cooled and multipurpose Units.				
Sys Evap EWT	-.-°C		6	Y
This is the average entering water temperatures of all the running Units. In normal condition is equivalent to the return water temperature from the System and can be used to control the staging if the additional water temperature sensor is not needed.				
Sys Cond EWT	-.-°C		6	Y
This is the average condenser entering water temperatures of all the running Units. In normal condition is equivalent to the return water temperature from the System and can be used to control the staging if the additional water temperature sensor is not needed. It is available only for water cooled and multipurpose Units.				
Sys Heat Rec EWT	-.-°C		6	N
This is the average of the heat recovery entering water temperatures of the Units equipped with this option. This data is available only on the iCM.				
Sys Outside Air	-.-°C		6	N

This is the outside air temperature of the Master controller when Units is equipped with Free-cooling option. This data is available only on the iCM.				
System Load	0%	0…100%	6	Y
This is the average of Capacity of running unit on the total number of Units.				
Cooling Load	0%	0…100%	6	Y
This is the average of Capacity of unit running in Cool or Ice mode on the total number of Units.				
Heating Load	0%	0…100%	6	Y
This is the average of Capacity of unit running in Heat mode on the total number of Units.				
Sys Demand Lim	100%	0…100%	6	Y
This is the value of Capacity limit set on Master controller that will be used to limit the System Capacity				
System Sequencing				
Next On	-	iCM: Master, Slave1,…, Slave7 M/S: Master, Slave1,…, Slave3	6	Y
This is the elected next on Unit. To understand how it is selected please refer to section @@@				
Next Off	-	iCM: Master, Slave1,…, Slave7 M/S: Master, Slave1,…, Slave3	6	Y
This is the elected next off Unit. To understand how it is selected please refer to section @@@				
Standby	-	iCM: Master, Slave1,…, Slave7 M/S: Master, Slave1,…, Slave3	6	Y
This is the elected standby Unit. To understand how it is selected please refer to section @@@. A link from this data will show a page with additional information related to date and time for the standby Unit change.				
System Staging				
Sys Ctrld Tmp	-.-°C		6	Y
This is the actual value of the controlled temperature. It may change according to the Unit type (Air Cooled or Water Cooled) and Unit mode (Cool or Heat). For an air cooled chiller or air cooled heat pump this will be always measured on the evaporator loop; while for a water cooled heat pump unit it may change if operating in Cool mode (evaporator side) or Heat mode (condenser side).				
Sys Act Setpt	-.-°C		6	Y
This is the actual value of setpoint for the system. It may change according to System mode (Cool or Heat). For air cooled or water cooled heat pump, this could be Hot Setpoint or Cool Setpoint according to System operating mode.				
Sys Ctrld Heat	-.-°C		6	Y
This is the actual value of the controlled Heat temperature. This value is available only in case of multipurpose Units.				
Sys Heat Setpt	-.-°C		6	Y
This is the actual value of the Heat setpoint for system. This value is available only in case of multipurpose Units.				
StageUp Left	0s		6	
This is the time left before the next stage up of the Next On Unit.				
StageDn Left	0s		6	
This is the time left before the next stage down of the Next Off Unit.				
Clear Timers	Off	Off, Reset		
Reset the Stage down and Stage Up inhibition timers.				

Table 10: System Data parameters

4.4.1 Units: States

This section will list the current status of each individual Unit connected in the Units network.

Item	Standalone	State	M/S
Mst	No	Off	Y
S_1	No	Off	Y
S_2	No	Off	Y
S_3	No	Off	Y
S_4	No	Off	N
S_5	No	Off	N
S_6	No	Off	N
S_7	No	Off	N
Possible values	No, Yes	Off, Run, Alarm, ComErr, N/Avail	

Table 11: Unit States overview

"*Standalone"* unit must be considered not available for the sequencing and thermostatic control. User can set the unit in Standalone mode through setting in menu: "System → Standalone".

The Unit State can assume the following values:

- *Off:* the Unit is currently Off
- *Run:* the Unit is currently running
- *Alarm*: the Unit has an active alarm
- *ComErr*: the Unit is not communicating with the Master controller and requires actions to re-establish a proper communication. When a Unit is in communication error, it will run autonomously and in local mode. Please refer to the **Troubleshooting section** for further details.
- *N/Av*: the Unit is "Not Available" and stopped by iCM, i.e out of sequencing and staging control, for one of the following conditions:
  - "Unit Switch" and all the "Circuit Switch" on unit electrical panel are turned OFF.
  - Unit has "available capacity" less than 5%, i.e. a shut-down alarm prevents unit from starting.
  - Unit is set with "Operation Mode" (Cool/Heat), different from Master Operation Mode. (This is applicable only in case system composed by Heat-pump units or in mixed system with Heat-pump and Chiller units).
  - Unit is elected in "Stand-by" on Master unit controller.

4.4.2 Units: ActMode

This section will list the current operating mode of each individual Unit connected in Daikin Communication Network (column ActMode) and of the circuits composing the unit

Description	Default			M/S
ModeChangerover	Disable	Disable, Enable		Y
In case of Master/Slave, this value is always disable In case of iCM, this value can be enabled in configuration menu, and iCM will be able to change Operating mode of all the connected unit				
	ActMode	**C1**	**C2**	
Mst	Cool	Off	Off	Y
S_1	Cool	Off	Off	Y
S_2	Cool	Off	Off	Y
S_3	Cool	Off	Off	Y
S_4	Cool	Off	Off	N
S_5	Cool	Off	Off	N
S_6	Cool	Off	Off	N
S_7	Cool	Off	Off	N
Possible values	Cool, Ice, Heat, Multi	Off, Water, Cool, Heat, N/Avail	Off, Water, Cool, Heat, N/Avail, N/Cfg	

Table 12:Units and circuits actual operating modes

ActMode shown the actual operating mode of each Unit as follow:

- *Cool*: actual mode is cooling
- *Ice*: actual mode is ice (this operating mode has an impact on the capacity control)
- *Heat*: actual mode is heat
- *Multi*: actual mode for multipurpose Units

The additional two columns show the possible circuit operating modes as follow:

- *Off*: Circuit is currently off
- *Water*: Circuit is currently running in water to water mode (only in case unit is a multipurpose)
- *Cool*: Circuit is currently running in cool mode
- *Heat*: Circuit is currently running in heat mode
- *N/Av*: Circuit is "Not Available" for:
  - turned off by "Circuit Switch"
  - circuit in alarm
- N/Cfg: only for ciurcuit C2: unit has only one circuit.

4.4.3 Unit: Defrost

Description	Default			M/S
Defrost Mngt	Disable	Disable, Enable		N
In case of Master/Slave, this value is always disable In case of iCM, this value can be enabled in configuration menu, and iCM will be able to manage the Defrost demand by each unit controller				
	DfrstDmd	**C1**	**C2**	
Mst	No	Off	Off	Y
S_1	No	Off	Off	Y
S_2	No	Off	Off	Y
S_3	No	Off	Off	Y
S_4	No	Off	Off	N
S_5	No	Off	Off	N
S_6	No	Off	Off	N
S_7	No	Off	Off	N
Possible values	No, Yes	Off, On	Off, On	

Defrost Demand shows the request for circuit defrost by each unit to iCM.
The additional two columns show if the circuit is in Defrost mode.

4.4.4 Units: Load

This section will list the current Unit capacities and circuit capacities.

Item	Load	C1	C2	M/S
Mst	0%	0%	0%	Y
S_1	0%	0%	0%	Y
S_2	0%	0%	0%	Y
S_3	0%	0%	0%	Y
S_4	0%	0%	0%	N
S_5	0%	0%	0%	N
S_6	0%	0%	0%	N
S_7	0%	0%	0%	N
Possible values	0…100%	0…100%	0…100%	

Table 13: Units and circuits actual capacities

The column Load refers to the Unit capacity and the two columns to individual circuit capacities.

4.4.5 Evap Water Temps

This section will list the evaporator water temperatures (entering and leaving) of each Unit.

Item	ELWT	EEWT	M/S
Mst	-.-°C	-.-°C	Y
S_1	-.-°C	-.-°C	Y
S_2	-.-°C	-.-°C	Y
S_3	-.-°C	-.-°C	Y
S_4	-.-°C	-.-°C	N
S_5	-.-°C	-.-°C	N
S_6	-.-°C	-.-°C	N
S_7	-.-°C	-.-°C	N
Possible values	-40°C…+70°C	-40°C…+70°C	

Table 14: Individual evaporator water temperatures (leaving and entering)

4.4.6 Cond Water Temps

This section will list the condenser water temperatures (entering and leaving) of the Unit. These temperatures are displayed only in case of water cooled or multipurpose Units.

Item	CLWT	CEWT	M/S
Mst	-.-°C	-.-°C	Y
S_1	-.-°C	-.-°C	Y
S_2	-.-°C	-.-°C	Y
S_3	-.-°C	-.-°C	Y
S_4	-.-°C	-.-°C	N
S_5	-.-°C	-.-°C	N
S_6	-.-°C	-.-°C	N
S_7	-.-°C	-.-°C	N
Possible values	-40°C…+70°C	-40°C…+70°C	

Table 15: Individual condenser water temperatures (leaving and entering)

4.4.7 Units: Heat Recovery

This section will list the heat recovery operating states of the Units equipped with this option. These states are displayed only if at least iCM Master Unit is equipped with the heat recovery option.

Item	Cnfgd	Avail	State	M/S
Mst	No	No	Stop	N
S_1	No	No	Stop	N
S_2	No	No	Stop	N
S_3	No	No	Stop	N
S_4	No	No	Stop	N
S_5	No	No	Stop	N
S_6	No	No	Stop	N
S_7	No	No	Stop	N
Possible values	No, Yes	No, Yes	Stop, Run	

Table 16: Individual heat recovery statuses



Master/Slave cannot manage systems which include chillers equipped with Heat Recovery option. This functionality is only managed by the iCM.

The three columns describe the possible operating states of heat recovery option of all the units manage by iCM

1. *Cnfgd:* shows if connected unit has heat recovery option configured. iCM will manage heat recovery at system level only for unit with heat recovery configured.
2. *Avail:* shows if a unit with configured heat recovery option is available for iCM management.
   Unit is considered “Not Available” for heat recovery if Heat recovery function is disabled by HR switch on unit cabinet or through BMS HR enabling.
3. *State:* show if heat recovery has been enabled by iCM and running.

4.4.8 Units: Free Cooling

This section will list the Free-cooling operating states of the Units equipped with this option. These states are displayed only if at least iCM Master Unit is equipped with the free-cooling option.

Item	Cnfgd	Avail	Mode	M/S
Mst	No	No	Off	N
S_1	No	No	Off	N
S_2	No	No	Off	N
S_3	No	No	Off	N
S_4	No	No	Off	N
S_5	No	No	Off	N
S_6	No	No	Off	N
S_7	No	No	Off	N
Possible values	No, Yes	No, Yes	Off, Mechanical, FC Start, Mixed, FC Full	



Master/Slave cannot manage systems which include chillers equipped with Free-cooling option. This functionality is only managed by the iCM.

The three columns describe the possible operating states of free cooling option of all the units manage by iCM

1. *Cnfgd:* shows if connected unit has free-cooling option configured.
2. *Avail:* shows if a unit with configured free-cooling option is available for iCM management.
   Unit is considered “Not Available” for free-cooling if this function is disabled by HR switch on unit cabinet or by HMI Free-cooling Enable setpoint or by BMS through Free-cooling Network Enable setpoint.
3. *Mode:* shows the actual mode of the circuits and consequently of the whole unit.
   a. *Off:* unit is shut down
   b. *Mechanical:* unit is generating cooling capacity using circuit compressors (free-cooling is stopped)
   c. *FC_Start:* Unit is starting one or both circuits in free-cooling (Free-cooling Valves are changing their position to activate the freecooling)
   d. *Mixed:* unit is generating cooling capacity with both Compressors and Free-cooling equipment
   e. *FC Full:* unit is generating cooling capacity only with Free-cooling equipment.

4.4.9 Units: DHW (Domestic Hot Water)

This section will list the Domestic Hot Water operating states of the Units equipped with this option. These states are displayed only if at least iCM Master Unit is equipped with the Domestic Hot Water option.

Item	Cnfgd	Mode	M/S
Mst	No	Off	N
S_1	No	Off	N
S_2	No	Off	N
S_3	No	Off	N
S_4	No	Off	N
S_5	No	Off	N
S_6	No	Off	N
S_7	No	Off	N
Possible values	No, Yes	Off, Run, Standby, N/Av, Alarm, N/Cfgd	



Master/Slave cannot manage systems which include chillers equipped with Domestic Hot Water option. This functionality is only managed by the iCM.

The three columns describe the possible operating states of Domestic Hot Water option of all the units manage by iCM

1. *Cnfgd:* shows if connected unit has free-cooling option configured.
2. *Mode:* shows the actual mode of the circuits and consequently of the whole unit.
   a. *Off:* unit is shut down
   b. *Run:* unit is operating in Domestic Hot Water mode
   c. *Standby:* unit is forced to work only in Domestic Hot Water mode
   d. *N/Av:* unit does not have DHW enabled by switch or BMS
   e. *Alarm:* unit has an alarm generated by the wrong 3 way valve valve position
   f. *N/Cfgd: Domestic Hot Water not configured in the unit*

4.4.10 iCM Expandable Data

This section will list the values exchanged by the two iCM Master when iCM Expandable function is configured and active. Following two tables show the data if an iCM Master is configured as First or as Second.

Description	Default	Range and function	AL	MS
Sys State	Stop	Stop, Run	6	N
This value is the general System status. - Stop: System is disabled due to the Enable switch on the Master controller. - Run: System is enabled. System State is communicated by iCM Master First to iCM Master Second to enable second subsystem				
Stage Type	None	None, StgUp, StgDwn, MinRun, MaxRun	6	N
This value is the Staging type requested by iCM Master First - None: No Staging request - StgUp: Stage Up request - StgDwn: Stage Down Request - MinRun: iCM Master subsystem has reached minimum number of running unit - MaxRun: iCM Master subsystem has reached maximum number of running unit				
iCM2 Stage Type	None	None, StgUp, StgDwn, MinRun, MaxRun	6	N
This status show the Stage Type request of iCM Master Second Read by iCM Master First.				
Stage Release	No	No, Yes	6	N
This value shows the release (resulting from iCM Expandable logic) for iCM first to perform the Stage Type request				
iCM2 Stage Rls	No	No, Yes	6	N
This value shows the release (resulting from iCM Expandable logic) for iCM Second to perform the Stage Type request sent by iCM First				
Sys LWT	-.-°C		6	N
This is the actual value of the system chilled leaving water temperature and it is used as System controlled temperature. This value corresponds to iCM First Common LWT if no fault is detected on sensor connected to iCM First This value corresponds to iCM Second Common LWT if a fault is detected on sensor connected to iCM First				
iCM1 LWT	-.-°C		6	Y
This is the actual value of the system chilled leaving water temperature measured by sensor connected to iCM First				
iCM1 LWT Alarm	NoFault	NoFault, NoSensor, OvrRange, UdrRange, OpenLp, ShortLp, NoOutput, Other, MultiFlt, CfgError	6	Y
This value shows what kind of alarm occurred on LWT sensor of iCM First				
iCM2 LWT	-.-°C		6	Y
This is the actual value of the system chilled leaving water temperature measured by sensor connected to iCM Second and read by iCM First.				
Sys Heat LWT	-.-°C		6	Y
iCM1 Heat LWT	-.-°C		6	N
iCM1 Heat LWT Alm	NoFault	NoFault, NoSensor, OvrRange, UdrRange, OpenLp, ShortLp, NoOutput, Other, MultiFlt, CfgError	6	Y
iCM2 Heat LWT	-.-°C		6	Y
iCM2 BACnet ComErr	None	None, Active	6	Y
This value shows if there is Communication Alarm on BACnet network between iCM First and iCM Second.				

Table 17 - iCM Expandable Data on iCM Master First

Description	Default	Range and function	AL	MS
Stage Type	None	None, StgUp, StgDwn, MinRun, MaxRun	6	N
This value is the Staging type requested by iCM Master Second and read by iCM Master First - None: No Staging request - StgUp: Stage Up request - StgDwn: Stage Down Request - MinRun: iCM Master subsystem has reached minimum number of running unit - MaxRun: iCM Master subsystem has reached maximum number of running unit				
Stage Release	No	No, Yes	6	N
This value shows the release (resulting from iCM Expandable logic) for iCM Second to perform the Stage Type request sent by iCM First				
Sys LWT	-.-°C		6	N
This is the actual value of the system chilled leaving water temperature, and it is used as System controlled temperature. This value corresponds to iCM First Common LWT if no fault is detected on sensor connected to iCM First This value corresponds to iCM Second Common LWT if a fault is detected on sensor connected to iCM First				
iCM1 LWT	-.-°C		6	Y

This is the actual value of the system chilled leaving water temperature measured by sensor connected to iCM First and sent to iCM Second				
iCM1 LWT Alarm	NoFault	NoFault, NoSensor, OvrRange, UdrRange, OpenLp, ShortLp, NoOutput, Other, MultiFlt, CfgError	6	Y
This value shows what kind of alarm occurred on LWT sensor of iCM First and sent to iCM Second				
iCM2 LWT	-.-°C		6	Y
This is the actual value of the system chilled leaving water temperature measured by sensor connected to iCM Second.				
Sys Heat LWT	-.-°C		6	Y
iCM1 Heat LWT	-.-°C		6	N
iCM1 Heat LWT Alm	NoFault	NoFault, NoSensor, OvrRange, UdrRange, OpenLp, ShortLp, NoOutput, Other, MultiFlt, CfgError	6	Y
iCM2 Heat LWT	-.-°C		6	Y
iCM1 BACnet ComErr	None	None, Active	6	Y
This value shows if there is Communication Alarm on BACnet network between iCM First and iCM Second.				

Table 18 - iCM Expandable Data on iCM Master Second

4.5 Evap / Cond PM (Evaporator or Condenser Pump Manager Menu)

This menu contains all the values communicated by the Pump Manager to iCM. Moreover, it contains the setpoint for Pump Speed control and Header Bypass Valve opening that iCM can set on the Pump Manager controller through Daikin Communication Network.

Description	Default	Range and function	AL	MS
Status	Off:Auto	Off:Auto, On:Auto, Off:Local, Off:SensAlarm, On:SensAlarm, Off:CommErr, On:CommErr, Configuration, Off:ConfigAlarm		N
This value indicated the Status of Pump Manager to iCM				
State	Off	Off, On		N
This value indicates the operating state of Pump Manager				
Alarm Active	None	None*Alarm		N
This value indicates that an alarm occurred on Pump Manager.				
Clear Alarm	Off	Off, On		N
This setting allows to send a reset of the active alarms on Pump Manager from iCM.				
Nr Pump Running	0	0…10		N
	▶	Access menu showing actual status of each pump		
This value indicates the number of running pump				
Pump Speed	0%	0%...100%		N
This value indicates the speed percentage of the pump				
Speed Control	Constant	Constant, DTemp, DifPres, AbsPres		N
This indicates controlled sensor used by Pump Manager for Pump Speed Control				
The following sensor measurement and related setpoints display according to Speed Control value and they are exclusive.				
_Delta Temp	-.-°Dc			N
This value indicates the controlled sensor measurement on Pump Manager				
_Actual Setpoint	-.-°Dc			N
This value indicates the actual setpoint on Pump Manager for pump speed control				
_Setpt iCM	5.0°Dc	0.5°Dc…20.0°Dc		N
This setting allows to send setpoint for speed control to Pump Manager from Local HMI on iCM				
_Setpt Ntwk	5.0°Dc	0.5°Dc…20.0°Dc		N
This value indicates the setpoint for speed control to Pump Manager sent by BMS when iCM is in Control Source = Network				
Alternatively. (Speed Control Value = Differential Pressure)				
_Diff Press	-.-kPa			N
This value indicates the controlled sensor measurement on Pump Manager				
_Actual Setpoint	50.0 kPa			N
This value indicates the actual setpoint on Pump Manager for pump speed control				
_Setpt iCM	50.0 kPa	0.0kPa…300.0kPa		N
This setting allows to send setpoint for speed control to Pump Manager from Local HMI on iCM				

_Setpt Ntwk	50.0 kPa	0.0kPa…300.0kPa		N
This value indicates the setpoint for speed control to Pump Manager sent by BMS when iCM is in Control Source = Network				
Alternatively. (Speed Control Value = Absolute Pressure)				
_Abs Press	-.-kPa			N
This value indicates the controlled sensor measurement on Pump Manager				
_Actual Setpoint	-.-kPa			N
This value indicates the actual setpoint on Pump Manager for pump speed control				
_Setpt iCM	50.0 kPa	0.0kPa…300.0kPa		N
This setting allows to send setpoint for speed control to Pump Manager from Local HMI on iCM				
_Setpt Ntwk	50.0 kPa	0.0kPa…300.0kPa		N
This value indicates the setpoint for speed control to Pump Manager sent by BMS when iCM is in Control Source = Network				
BypValve Opening	0%	0%...100%		N
This value indicates the opening percentage of header bypass valve				
BypValve Control	None	None, MinDP, Flow, Ewt		N
This value indicates controlled sensor used by Pum Manager for control of Header bypass valve				
The following sensor measurement and related setpoints display according to Header Bypass Valve Control value and they are exclusive.				
(Bypass Valve Control = DP)				
_MinDPonUnits	None	None, Active		N
This value indicates that Minimum pressure drop has been reached by one of the Units and force opening of the header bypass Valve				
Act Setpoint	-.-kPa			N
This value indicates the actual setpoint for bypass valve control based on differential pressure on Pump Manager				
Setp iCM	50.0kPa	0.0kPa…500.0kPa		N
This setting allows to send the setpoint for bypass valve control based on differential pressure to Pump Manager from Local HMI on iCM				
Setp Network	-.-kPa			N
This value indicates the setpoint for bypass valve control based on differential pressure to Pump Manager sent by BMS when iCM is in Control Source = Network				
Alternatively. (Bypass Valve Control = Flow)				
_Flow	-.- l/s			N
This value indicates the controlled sensor measurement on Pump Manager				
_Actual Setpoint	-.- l/s			N
This value indicates the actual setpoint on Pump Manager for Header bypass valve control				
_Setpt iCM	4.5 l/s	0.0l/s…200.0l/s		N
This setting allows to send setpoint for speed control to Pump Manager from Local HMI on iCM				
_Setpt Ntwk	4.5 l/s	0.0l/s…200.0l/s		N
This value indicates the setpoint for speed control to Pump Manager sent by BMS when iCM is in Control Source = Network				
Alternatively. (Bypass Valve Control = EvapEwt)				
_EvapEwt	-.-°C			N
This value indicates the controlled sensor measurement on Pump Manager				
_Actual Setpoint	-.-°C			N
This value indicates the actual setpoint on Pump Manager for Header bypass valve control				
_Setpt iCM	7.0°C	4.0°C…30.0°C		N
This setting allows to send setpoint for header bypass valve control to Pump Manager from Local HMI on iCM				
_Setpt Ntwk	7.0°C	4.0°C…30.0°C		N
This value indicates the setpoint for Header bypass valve control to Pump Manager sent by BMS when iCM is in Control Source = Network				
Alternatively. (Bypass Valve Control = CondEwt)				
_CondEwt	-.-°C			N
This value indicates the controlled sensor measurement on Pump Manager				
_Actual Setpoint	-.-°C			N
This value indicates the actual setpoint on Pump Manager for pump speed control				
_Setpt iCM	25.0°C	15.0°C…40.0°C		N
This setting allows to send setpoint for header bypass valve control to Pump Manager from Local HMI on iCM				
_Setpt Ntwk	25.0°C	15.0°C…40.0°C		N
This value indicates the setpoint for Header bypass valve control to Pump Manager sent by BMS when iCM is in Control Source = Network				
_Active Power	-.- kW			N
This value indicates the Active Electrical Power consumption				

Table 19 Evaporator or Condenser Pump Manager Menu

ⓘ	Pump Speed Controlled sensor and related setpoint will display only if Speed Control is different from "Constant"

ⓘ	Header by-pass Valve controlled sensor and setpoint will display only if BypValve Control is different from "None"

ⓘ	Active Power value will display only if Energy Mtr is configured on Pump Manager

iCM can set the values of control functions of the Pump Manager.
The values chosen depend on "Control Source" setting of Master Unit controller.

⚠

- ***If "Control Source" is Local:***
  _Setpt iCM: Local setpoint on HMI of Master controller will be communicated to Pump Manager
- ***If "Control Source" is Network***
  _Setpt Ntwk: Writeable setpoint by BMS through Modbus or BACnet communication with Master Unit controller, that will be communicated by iCM to the Pump Manager

4.6 Cooling Tower Manager

This menu contains all the values communicated by the Cooling Tower Manager (resident on Condenser Pump Controller) to iCM. Moreover, it contains the setpoint for Cooling tower management and Cooling tower speed control that iCM can set on the Condenser Pump Manager controller through Daikin Communication Network.

Description	Default	Range and function	AL	MS
Status	Off:Auto	Off:Auto, On:Auto, Off:Local, Off:SensAlarm, On:SensAlarm, Off:CommErr, On:CommErr, Configuration, Off:ConfigAlarm		N
This value indicated the Status of Pump Manager to iCM				
State	Off	Off, On		N
This value indicates the operating state of Pump Manager				
Alarm Active	None	None*Alarm		N
This value indicates that an alarm occurred on Pump Manager.				
Clear Alarm	Off	Off, On		N
This setting allows to send a reset of the active alarms on Pump Manager from iCM.				
Nr Tower Running	0	0…10		N
	▶	Access menu showing actual status of each Cooling tower		
This value indicates the number of running pump				
Leaving Water T	-.-°C			N
This value common leaving water temperature from cooling system				
_Actual Setpoint	-.-°C			N
This value indicates the actual setpoint for Cooling tower manager for Tower Staging and Tower speed control				
_Setpt iCM	-.-°C			N
This setting allows to send setpoint for Cooling Tower Manager from Local HMI on iCM				
_Setpt Ntwk	-.-°C			N
This value indicates the setpoint for Cooling Tower Manager sent by BMS to iCM Master if it is in Control Source = Network				
LwtSetpt Reset Type	None	None, Toa, Twb		N
This value indicates if leaving water temperature setpoint Reset function is enabled on Cooling tower controller and which type of reset is active: - None: Disabled - ToA: Reset based on Outside air temperature - Twb: Reset of LWT setpoint based on Web bulb temperature Setpoint Reset function affects the Actual Lwt Setpoint value				
Out Air Temp	-.-°C			N
This value indicates the outside air temperature read by Cooling Tower Manager				
Out Rel Humidity	- %rH			N

This value indicates the outside air relative humidity read by Cooling Tower Manager				
Out Wet Bulb T	-.-°C			N
This value indicates Wet bulb temperature based on Outside Air temperature and Relative Humidity calculated by Cooling Tower Manage				

Table 20 Cooling Tower Manager Menu

iCM can set the values of control functions of the Cooling Tower Manager.
The values chosen depend on "Control Source" setting of Master Unit controller.

- ***If "Control Source" is Local:***
  _Setpt iCM: Local setpoint on HMI of Master controller will be communicated to Pump Manager
- ***If "Control Source" is Network***
  _Setpt Ntwk: Writeable setpoint by BMS through Modbus or BACnet communication with Master Unit controller, that will be communicated by iCM to the Pump Manager

4.7 Secondary Pump Managers

This menu contains all the values communicated by the Secondar Pump Manager controller to iCM through Daikin Communication Network. Moreover, iSM controller communicates its own data and even the data of other two iSM controllers connected to it through Secondary Manager Network (Please refer to IOM of iSM). The menu contains all the relevant data from Secondary Managers.

Description	Default	Range and function	AL	MS
Cooling Thermal Power	kW			N
This value indicated the sum of cooling thermal power of all the pump groups communicated by all the iSM controller connected				
Heating Thermal Power	kW			N
This value indicated the sum of heating thermal power of all the pump groups communicated by all the iSM controller connected				
iSM0#		iSM01, iSM02, iSM03		N
This value indicates which iSM controller the data are referring to. iSM02 and iSM03 display only if iSM01 is iSM Master on Secondary Manager Network.				
PG0# Status	Off:Auto	Off:Auto On:Auto Off:Local Off:SensAlarm On:SensAlarm Off:ComErr On:ComErr ConfigSta Off:ConfigAlm Test Off:Remote Off:Network		N
This value indicated the Status of each secondary pump groups. Each iSM is able to manage up to 4 pump groups				

Table 21 – Secondary Pump Managers Menu

4.8 Maintenance

This section will describe the parameters accessible in the Maintenance page. It will also describe the links to other sub-sections. This section contains two settings and two sub-menus. The settings are the following:

Mst Enable	Yes	No, Yes	4	Y
It is used to stop the Master Unit and take it out from sequencing, but iCM function keeps on working and managing the other slave Units. This setting shall be used to stop the Master for maintenance or other purpose.				
Mst HeatRec Enable	No	No, Yes	4	N
It is used to stop heat recovery function on Master Unit and take it out from sequencing, but iCM function keeps on working and managing the other slaves Units. This setting shall be used to stop the Master for maintenance or other purpose.				
Mst FreeClg Enable	No	No, Yes	4	N
It is used to stop Free-ccoling function on Master Unit and take it out from sequencing, but iCM function keeps on working and managing the other slaves Units. This setting shall be used to stop the Master for maintenance or other purpose.				
Units Starts	▶		4	Y
Sub-page with the individual Units and circuits starts				
Units Run Hours	▶		4	Y
Sub-page with the individual Units and circuits run hours				
Evap LWT Sensor	-.-°C		4	Y
This value represents the actual reading of the common sensor on the evaporator loop.				
Evap LWT Offset	0.0°C	-5.0°C…5.0°C	4	Y
This setting represents the offset applied to the evaporator common sensor reading .				
Cond LWT Sensor	-.-°C		4	Y
This value represents the actual reading of the common sensor on the condenser loop. This sensor reading will be visible only in case of water cooled Units and multipurpose.				
Cond LWT Offset	0.0°C	-5.0°C…5.0°C	4	Y
This setting represents the offset applied to the condenser common sensor reading.				

Table 22: Maintenance page

ⓘ	iCM staging and sequencing is enabled through Unit switch and other enable settings on Master Unit controller. To stop the Master without stopping iCM functions, "Mst Enable" must be used

ⓘ	iCM staging and sequencing of heat recovery function is enabled through Unit switch and other enable settings on Master Unit controller. To stop the HR function on Master without stopping iCM functions, "Mst HeatRec Enable" must be used

ⓘ	iCM staging and sequencing of free-cooling function is enabled through Unit switch and other enable settings on Master Unit controller. To stop the FC function on Master without stopping iCM functions, "Mst FreeClg Enable" must be used

The sub-menus will be explained in the following sub-sections.

4.8.1 Units Starts

This section will list the number of starts of each Unit and each circuit.

Item	Starts	C1	C2	MS
Mst	0	0	0	Y
S_1	0	0	0	Y
S_2	0	0	0	Y
S_3	0	0	0	Y
S_4	0	0	0	N
S_5	0	0	0	N
S_6	0	0	0	N
S_7	0	0	0	N
Possible values	0…4294967295	0…4294967295	0…4294967295	

Table 23: Individual number of starts for Units and circuits

The column Starts refers to the number of starts of each Unit and the two remaining columns refers to individual circuit starts.

4.8.2 Units Run Hours

This section will list the count of the running hours of each Unit and each circuit.

Item	RunHours	C1	C2	MS
Unit Run Hours	0	0…4294967295	Set the Unit run hours	2
Mst	0	0	0	Y
S_1	0	0	0	Y
S_2	0	0	0	Y
S_3	0	0	0	Y
S_4	0	0	0	N
S_5	0	0	0	N
S_6	0	0	0	N
S_7	0	0	0	N
Possible values	0…4294967295	0…4294967295	0…4294967295	

Table 24: Individual running hours for Units and circuits

The first column refers to the number of running hours of each Unit and the two others refer to individual circuit running hours.

4.9 System Settings

This section will describe the parameters accessible in the System Settings menu.

Description	Default	Range and function	AL	MS
Priority	▶		4	Y
This is a sub-page where it's possible to set individual Unit priorities.				
Max Run Units	1	iCM: 1…8 M/S: 1…4	4	Y
This setting allows to define the maximum number of Units that can be started by the M/S or iCM.				
Min Run Units	0	iCM: 0…1 M/S: 0…1	4	Y
This setting allows to define the minimum number of Units that will always run in the system.				
Staging thresholds	▶		4	Y
This is a sub-page where it's possible to set individual staging thresholds.				
Stage for Temperature				
StageUp DT Cool	2.5°C	0.0°C…5.0°C	4	Y
This setting defines what is the delta temperature with setpoint to force a Unit stage up in Cool mode.				
StageDn DT Cool	1.5°C	0.0°C…5.0°C	4	Y
This setting defines what is the delta temperature with setpoint to force a Unit stage up in Cool mode.				
StageUp DT Heat	2.7°C	0.0°C…5.0°C	4	Y
This setting defines what is the delta temperature with setpoint to force a Unit stage up in Heat mode.				
StageDn DT Heat	1.5°C	0.0°C…5.0°C	4	Y
This setting defines what is the delta temperature with setpoint to force a Unit stage up in Heat mode.				
Dead Band	0.5°C	0.1°C…1.5°C	2	Y
This setting defines what is the temperature range around the actual setpoint in which the system manager will not do staging actions or capacity control.				
Stage Up Time	600s	60s…3600s	6	Y
This value indicates what is the actual stage up time to start the Next On Unit. This is a calculated value.				

Max Stage Up Time	600s	60s…3600s	2	Y
This setting defines what is the maximum delay between to Unit starts.				
Min Stage Up Time	300s	60s…3600s	2	Y
This setting defines what is the minimum delay between to Unit starts.				
Max StageUp Error	5.0°C	0.0°C…10.0°C	2	Y
This setting defines what is the error which corresponds to the minimum delay in a linear interpolation. The maximum delay is calculated at 0.0°C of error.				
Stage Dn Time	600s	60s…3600s	6	Y
This value indicates what is the actual stage up time to start the Next Off Unit. This is a calculated value.				
Max Stage Dn Time	600s	60s…3600s	2	Y
This setting defines what is the maximum delay between Unit stops.				
Min Stage Dn Time	300s	60s…3600s	2	Y
This setting defines what is the minimum delay between Unit stops.				
Max StageDn Error	5.0°C	0.0°C…10.0°C	2	N
This setting defines what is the error which corresponds to the minimum delay in a linear interpolation. The maximum delay is calculated at 0.0°C of error.				
Load Control Settings				
Delta Load	15%	0%...100%	2	N
This setting defines the capacity step that the unit needs to perform during load or unload of compressors, after iCM swaps to another unit to load or unload.				
Load Time	30 sec	5sec...600sec	2	N
This setting defines the wait time after each unit load before iCM swaps to another unit.				
Unload Time	30 sec	5sec...600sec	2	N
This setting defines the wait time after each unit unload before iCM swaps to another unit.				
Min Cool Tmp	4.0°C	-30.0°C…30.0°C	2	N
This setting defines what is the minimum acceptable cool setpoint for the Units in general.				
Max Heat Tmp	50.0°C	20.0°C…70.0°C	2	N
This setting defines what is the maximum acceptable heat setpoint for the Units in general.				
Defrost Setting				
Defrost Mngt	Disable	Disable, Enable	6	N
This value show if Defrost management of iCM is enabled				
Defr Inhibit Time	5min	0…15min	2	N
This setting defines the time that should expire since unit defrost demand before iCM allow the defrost on Unit				
Heat Recovery Settings				
Ht Rec StageTimer	15min		2	N
This setting defines the stage delay between any heat recovery activation commanded by the iCM.				
Ht Rec Max Run	0	iCM: 1…8 M/S: Not Available	2	N
This setting specified the maximum number of Units with activated Heat Recovery. After reaching up this number, iCM will stop activating heat recovery function on other units.				
FreeCooling Settings				
FC Max Run	0	iCM: 1…8 M/S: Not Available	2	N
This setting specified the maximum number of Units with activated Free-cooling. After reaching up this number, iCM will stop activating free-cooling function on other units.				
FC Approach	4.0°C	2.0°C…10.0°C	2	N
This Free-cooling setting on Master unit is used at system level. This setting represents the minimum delta temperature between System Actual setpoint and Outside air temperature to activate the Free-cooling at system level. This setting will update if it is changed in View/Set Unit → Freecooling → Setting menu of Master Units				
FC High Thresh	87%	60%...90%	2	N
This Free-cooling setting on Master unit is used at system level. This setting represents the capacity threshold of the running units with activated free-cooling to be exceeded to allow the changeover from Free-cooling to Mix Mode or from Mix Mode to Mechanical. This setting will update if it is changed in View/Set Unit → Freecooling → Setting menu of Master Units				
FC ChangeMode DT	1.5°C	0.5°C…2.5°C	2	N
This setting represents the DT from System actual setpoint to be exceeded to allow the changeover from Free-cooling to Mix mode or from Mix Mode to Mechanical				
FC ChangeMode Delay	15min	1min…60min	2	N
This setting represents the delay after each Free-cooling mode changeover that must expire before allowing the changeover of another unit.				

Table 25:System settings

4.9.1 Priority

This sub-page will allow to set the individual Units priorities for stage sequencing.

Description	Default	Range and function	AL	MS
Cooling Mode				
Master	1	1...4		N
Slave1	1	1...4		N
Slave2	1	1...4		N
Slave3	1	1...4		N
Slave4	1	1...4		N
Slave5	1	1...4		N
Slave6	1	1...4		N
Slave7	1	1...4		N
These settings are used to define the individual Unit priority when operating in cooling mode. If properly set, they will allow Units grouping.				
Heating Mode				
Master	1	1...4		N
Slave1	1	1...4		N
Slave2	1	1...4		N
Slave3	1	1...4		N
Slave4	1	1...4		N
Slave5	1	1...4		N
Slave6	1	1...4		N
Slave7	1	1...4		N
These settings are used to define the individual Unit priority when operating in heating mode. If properly set, they will allow Units grouping.				

Table 26: Priority settings for cooling and heating modes

ⓘ	In case the system includes multipurpose Units, those will always have the maximum priority and will be started first.

4.9.2 Staging thresholds

This sub-page will allow to set the individual staging thresholds for each individual Unit.

Description	Default	Range and function	AL	MS
Cooling Mode				
Stage Up Thresholds				
Master	100%	0%...100%		Y
Slave1	100%	0%...100%		N
Slave2	100%	0%...100%		N
Slave3	100%	0%...100%		N
Slave4	100%	0%...100%		N
Slave5	100%	0%...100%		N
Slave6	100%	0%...100%		N
Slave7	100%	0%...100%		N
Stage Down Thresholds				
Master	30%	0%...100%		Y
Slave1	30%	0%...100%		N
Slave2	30%	0%...100%		N
Slave3	30%	0%...100%		N
Slave4	30%	0%...100%		N
Slave5	30%	0%...100%		N
Slave6	30%	0%...100%		N
Slave7	30%	0%...100%		N
These settings are used to set the individual stage up and down thresholds on each Unit in cool mode. These thresholds are used for staging up and down the Units and, if properly set, can let the iCM achieve an improved system efficiency.				
Heating Mode				
Stage Up Thresholds				
Master	100%	0%...100%		Y
Slave1	100%	0%...100%		N
Slave2	100%	0%...100%		N
Slave3	100%	0%...100%		N
Slave4	100%	0%...100%		N
Slave5	100%	0%...100%		N
Slave6	100%	0%...100%		N
Slave7	100%	0%...100%		N

Stage Down Thresholds				
Master	30%	0%...100%		Y
Slave1	30%	0%...100%		N
Slave2	30%	0%...100%		N
Slave3	30%	0%...100%		N
Slave4	30%	0%...100%		N
Slave5	30%	0%...100%		N
Slave6	30%	0%...100%		N
Slave7	30%	0%...100%		N

Table 27: Stage up and stage down capacity thresholds for cooling and heating modes

ⓘ	In case of systems with multipurpose Units, the staging thresholds will not be managed as the iCM will control the individual circuits activation and operating modes.

4.10 Standby Chiller

This section will describe the settings needed to configure the standby function.

Description	Default	Range and function	AL	MS
Standby Chiller	No	No,Yes		Y
This setting is used to activate the Standby chiller management.				
Cycling Type	RunHour	RunHours,Sequence		Y
This setting is used to define how to select the standby Unit • Run Hours: the Unit with the higher number of run hours will be selected. • Sequence: the Unit with the next numeral id is selected. If the Unit in standby is the Slave 3 the next standby Unit will be Slave 4 and so on.				
Interval Time	7Day	1…365 days		Y
This setting is used to define after what number of days the standby Unit is rotated.				
Switch Time	00:00:00	00:00:00…23:59:59		Y
This setting is used to define at what time of the day the standby Unit is rotated. This might be useful to command the rotation of the standby Unit when the system is off.				
Tmp Comp	No	No, Yes		Y
This setting is used to activate the standby Unit for temperature compensation. If the active setpoint cannot be reached for multiple reasons different from a Unit alarm, the standby Unit can become operational and compensate the lack of capacity.				
Tmp Comp Time	120min	0min…600min		Y
This setting is used to define the how long the system manager should wait before activating the standby Unit to compensate the lack of capacity.				
Standby Reset	No	No, Yes		Y
This setting is used to reset the Standby Unit calculation. The elected Standby Unit will be re-defined if the reset is activated.				

Table 28: Standby chiller configuration

⚠	***If the switch time is improperly set, the Standby Unit changeover may have an impact on the water temperature stability. Please, check with the plant Manager if there are specific limitations on the changeover time (i.e. process applications).***

4.11 Configuration

Configuration of the “System Control” must be performed in two steps:

1) Through menu “Commission Unit → Configuration → System Control”
2) Only in case of Master Unit, though menu “System → Configuration”

4.11.1 System Control Configuration in Unit Commissioning

This section describes the parameters accessible in menu “Commission Unit → Configuration → System Control” That help the operator to set the unit in the System Control environment.

Description	Default	Range and function	AL	MS
M/S Address	None	None Master Slave1 Slave2 Slave3 Slave4 Slave5 Slave6 Slave7 Slave8*	2	Y
This parameter sets the role of the unit in the System Control environment - Master is the unit where System control logic operates and it manages all the units in the system - Slave is the unit that send its own information to Master and receive command and setpoints from System Control Logic NOTE: Slave 8 can be set only in case of iCM Advanced Option				
M/S Num of Units	0	0...8	2	Y
This parameter sets the number of unit that Master Unit is expecting connected to DCM (daikin Communication Network) and it have to manage The value 0 is automatically set for Slave unit				
M/S Sensor Type	NTC10K	NTC10K, Pt1K, None	2	Y
This parameter sets the kind of sensor used as “Common Leaving water Temperature sensor to be connected to Master unit. According to type of Master unit and Unit options of Master Unit, “None” value (corresponding to Sensorless configuration”) can be chosen. NOTE: this parameter has no effect of Slave Unit				
Plant Layout	2-pipe	2-pipe, 4-pipe	2	N
This setting specifies if the unit is working in a four-pipe plant-room or a two-pipe plant-room. - If Master unit is a Multipurpose, this setting is automatically fixed to “4-Pipe” - If Master unit is Air-cooled heatpump with iCM Standard, this setting can be chosen - If Slave 1 unit is Air-cooled chiller with heat Recovery option and iCM Standard, this setting can be chosen				

4.11.2 System Configuration

This section will describe the parameters accessible in the Configuration page.

Description	Default	Range and function	AL	MS
SCM Type	Mst/Slv	Mst/Slv, iCM Std, iCM Adv*	4	Y
This value indicates which type of system control is active on your Unit.				
Config Type	Undef	Undef, Only C/O, Only H/P, C/O_H/P, Only 4P, 4P_C/O	4	Y
This value indicates the type of system is being controlled. It includes the following: • Undef: Undefined mix of Units • Only C/O: system composed with cooling only Units • Only H/P: system composed with reversible (water side or refrigerant side) heat pumps only • C/O_H/P*: system composed with a mix of cooling only and heat pumps (all reversible refrigerant side or all reversible water side) • Only 4P: system composed with only multipurpose Units • 4P_C/O*: system composed with a mix of multipurpose and air-cooled cooling only Units *iCM only.				
Config Alarm	None	None, ModeErr, ComprErr,	4	Y

		CooledErr, UnitNotDef, iCMtypeErr PltErr		
This value indicates if configuration alarm of iCM has occurred (please refer to Troubleshooting)				
Control Tmp	Leaving	Leaving, Entering	4	Y
This setting indicates what temperature is used to stage up and down the Units: • Leaving: in this case the additional common water temperature sensor(s) is required • Entering: in this case the controlled temperature will be the average of the entering water temperature to the Units				
Load Control	Enable	Disable, Enable	2	Y
This setting specifies if the Unit capacity control shall be done by the iCM (Enable) or if a staging only control is needed (Disable).				
_Load Ctrl Mode	Fixed	Fixed, Regime	2	
This setting specifies the type of load control: • Fixed: iCM will control the load/unload of the Unit since start-up of the system • Regime: iCM will control the load/unload of the Units until the system temperature is inside Stage for Load/Unload temperature range.				
_Unload Type	Hi Load	Hi Load, Lo Load, Next Off	2	
This setting specifies the type of unload control: • Hi Load: the Unit with the higher capacity will be unloaded first • Lo Load: the Unit with the lower capacity will be unloaded first • Next Off: the elected Next Off Unit will be downloaded first				
ModeChangeover	Disable	Disable, Enable	4	N
This setting will display only if Master controller is a Heat pump unit In case of Master/Slave, this value is fixed to “Disable” In case of iCM, this value can be enabled and iCM will be able to change Operating mode of the connected unit				
Defrost Mngt	Disable	Disable, Enable	4	N
This setting will display only if Master Controller is an Air-Cooled Heat Pump In case of Master/Slave, this value is fixed to “Disable” In case of iCM, this value can be enabled and iCM will be able to manage start of defrost of the connected units				
HeatRec Configured	No	No, Yes		N
This value shows if Heat Recovery is managed at system level. If at least Master Unit is equipped with Heat Recovery option, then this value become automatically Yes.				
FreeClg Configured	No	No, Yes		N
This value shows if Free Cooling is managed at system level. If at least Master Unit is equipped with Free Cooling option, then this value become automatically Yes.				
DHW Configured	No	No, Yes		N
This value shows if Domestic Hot Water is managed at system level. If at least Master Unit is equipped with Domestic Hot Water option, then this value become automatically Yes.				
iCM Expandable	None	None, First, Second		N
This setting is used to activate iCM Expandable function and choose what type of iCM Master the controller is inside the BACnet communication network: - None: iCM Expandable is not configured - First: iCM Master is set as First in iCM Expandable Network. This iCM Master is the main manager of the two subsystems, writing “System setpoints” and collaborating in Staging logic with iCM Master “Second”. - Second: iCM Master is configured as Second in iCM Expandable Network. This iCM Master receive “System Setpoints” and collaborating in Staging logic with iCM Master First				
Evap PM Enable	No	No, Yes		N
This setting is used to activate communication and display values of the Evaporator Pump Manager				
Evap PM config	▶			N
This menu contains the configuration settings communicated by Evap. Pump Manager to iCM				
Cond PM Enable	No	No, Yes		N
This setting is used to activate communication and display values of the Condenser Pump Manager				
Cond PM config	▶			N
This menu contains the configuration settings communicated by Cond Pump Manager to iCM				
iCT Enable	No	No, Yes		N
This setting is used to activate communication and display values of the Colling Tower Manager				
iCT config	▶			N
This menu contains the configuration settings communicated by Cooling Tower Manager to iCM				
iSM Enable	No	No, Yes		N

This setting is used to activate communication and display values of the Secondary Pump Managers				
iSM config	▶			N
This menu contains the configuration settings communicated by iSM Master Manager to iCM				
Apply changes	No	No, Yes		N
This setting forces a reboot of the Unit controller to configure the HMI layout and parameters accordingly with the system configuration.				

Table 29: System configuration

4.11.3 Evaporator/Condenser Pump Manager Configuration (PM Config)

This menu reports the configuration values of Pump manager communicated to iCM.

Description	Default	Range and function	AL	MS
Type	Config	Config*Evap*Cond		N
This value indicates what kind of Pump Manager is connected to iCM				
Version	##.##			N
Application version of Pump Manager				
Pump Number	0	0…10		N
Number of pumps configured and managed by Pump Manager				
Speed Ctrl Type	Constant	Constant, DeltaTemp, DiffPress, AbsPress,		N
This value indicates which kind of sensor is used by Pump Manager to control speed of the pumps				
BypValve Ctrl Type	None	None, MinDiffPress, Flow, Ewt		N
This parameter specifies which kind of sensor is used by Pump Manager to control opening of Headers Bypass Valve				
Energy Mtr	No	No, Yes		N
This value indicates if Energy Meter is enabled on Pump Manager				

Table 30 Evaporator or Condenser Pump Manager Configuration menu

ⓘ	This menu is available only if “Evap or Cond PM” is enabled in Configuration Menu and after reboot of controller

4.11.4 Cooling Tower Manager Configuration (iCT Config)

This menu reports the configuration values of Cooling Tower manager communicated to iCM.

Description	Default	Range and function	AL	MS
Version	##.##			N
Application version of Cooling Tower Manager				
Tower Number	0	0…10		N
Number of cooling tower configured and managed by Cooling Tower Manager				
LwtSetp Reset Type	None	None, ToA, Twb		N
This value indicates which kind of sensor is used by Leaving water temperature setpoint Reset Function				
Fan Driver Type	CSD	CSD, VFD		N
This value indicates which kind of Cooling tower fan driver is configured on Cooling Tower				
Inlet Valve	None	None, Cfgd		N
This value indicates each Cooling tower has installed an inlet shut-off valve				

Table 31 Cooling Tower Manager Configuration menu

ⓘ	This menu is available only if “ICT” is enabled and after reboot of controller

4.11.5 Secondary Pump Managers Configuration (iSM Config)

This menu reports the configuration values of Cooling Tower manager communicated to iCM.

Description	Default	Range and function	AL	MS
Nr of iSMs	0	0…3		N
This value indicates the number of iSMs communicating with iCM. iCM is connected to iSM01 through DCN iSM02 and iSM03 are connected to iSM01 through Secondary Manager Network. iSM01 communicates to iCM the data of all the three iSM.				
iSM01 – Nr Pump Group	0	0…4		N
This value indicates the number of Pump Groups managed by iSM panel				
iSM02 – Nr Pump Group	0	0…4		N
This value indicates the number of Pump Groups managed by iSM panel				
iSM02 – Nr Pump Group	0	0…4		N
This value indicates the number of Pump Groups managed by iSM panel				

Table 32 Cooling Tower Manager Configuration menu

ⓘ	This menu is available only if “ISM” is enabled and after reboot of controller

5 SYSTEM COMMISSIONING

This section will try to explain how the M/S or iCM shall be set to provide proper control of the system. The aim of this section is not to cover each possible system configuration which may require a lot of pages and may create some confusion. The purpose would be to provide a guideline that, starting from some examples, can help to extend the same operations to any plant covered by the iCM.

5.1 Introduction

Before starting to read the following, it's strongly suggested to read the previous sections especially the HMI description and the functional description to get familiarity with some terminology and choices.

Before proceeding, please, read carefully paragraph 4.2 for the basic system configuration.

5.2 Before starting the Commissioning

It is fundamental to understand if the plant can be controlled by Master/Slave or if it requires the iCM. The decision can be driven by the following decision table:

Questions:
Are there more than 4 Units?
Is the system composed with a mix of multipurpose and A/C Unit?
Is the system a four-pipe plant room with A/C heat pump and A/C chiller with heat recovery?
Is the system composed with a mix of VFD and non VFD Units?
Is the system a two pipe system with chillers and heat pumps?
Is the system composed with screw, scroll and centrifugal units?
Is it needed to manage the Heat Recovery on air cooled chillers?
Is it needed to manage Freecooling on chillers?
Is the energy monitoring needed for the whole plant?
Does the customer expect energy saving?

If any of the above question is positive, then the iCM is needed. In this case, a license will be needed to unlock the iCM functionalities. A license can be purchased from the factory for each Unit in the system and inserted in each Unit controller following the procedure in paragraph 2.
As a second pre-check it is suggested to verify if an indirect control of the Entering Water Temperature (sufficient for comfort applications) can be accepted or if a direct control of the Leaving Water Temperature is needed (process applications may need to monitor and control directly the supply temperature to the system). In this second case an additional NTC sensor is required and should be carried at Commissioning.
A connection with DoS is also preferable to monitor and tune the iCM during the first period of operations. It is suggested to connect the Master controller to DoS without activating the iCM control and monitor how the load changes over the week. To do this in the Maintenance menu change the `Mst Enable` setpoint from Yes to no. DoS activation is done using the standard procedure on the Master controller. From the data recorded during this period of monitoring it might be possible to define some of the parameters required to complete the iCM commissioning.

Default settings are suitable for a plug'n'play commissioning once the iCM configuration is done. System will run but some optimization may not be provided.

5.3 How to configure the iCM

Configuration settings are divided in two different menu:

1) Main Menu Commission Unit → Configuration → OptionSW
2) Main Menu Commission Unit → Configuration → System Control
3) Main Menu → System → Configuration

5.3.1 Unit Configuration→OptionSW Menu

In Menu OptionSW is possible to insert the license key to enable “iCM Standard” option.
If iCM Standard option is not licensed, it is possible active the Master/Slave logic for free with the following menu

5.3.2 Unit Configuration→System Control Menu

In this menu operator can set the address on Daikin communication network.
Unit is configured as “Master”, operator can select

- Number of units managed by logic of Master/Slave or iCM Standard;
- Sensor type of Common Leaving water temperature
- Plant Layout to identify if iCM Standard is going to manage unit in a Two pipe or Four pipe plant-room

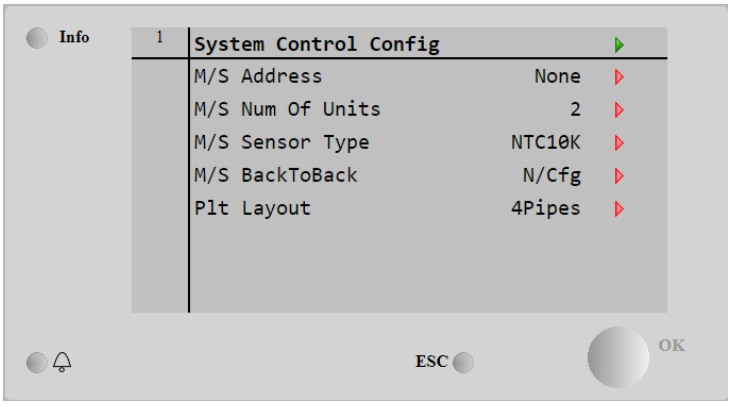


Figure 18 - Configuration -> System Control menu

ⓘ	Plant layout is set automatically to “Four Pipe” if Master unit is a Multipurpose.

ⓘ	Plant layout can be set “Four Pipe” only if unit is - Air-cooled heat pump - Slave 1 and Air-cooled chiller with Heat Recovery option

5.3.3 System→Configuration menu

Once M/S or ICM Standard is configured, “System” menu displays in the main page. In the menu “System→Configuration” parameter to configure Master/Slave or ICM Standard logic are available. Moreover, this page also gives some indication about the type of active license and the mix of Units connected. In the below example the license is for the iCM Standard and the configuration type is made of multipurpose and cooling only chillers Units (4P and C/O).

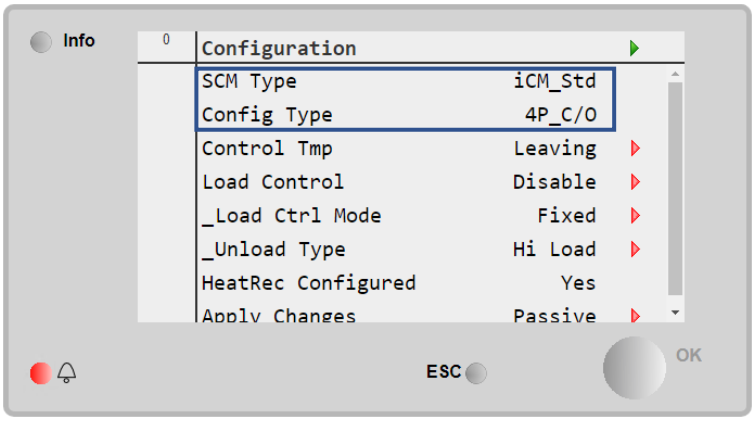


Figure 19: iCM license type and system configuration type indications

All the above settings are available also on Daikin on Site both as a dashboard and a web graphic with a more intuitive and helpful layout.

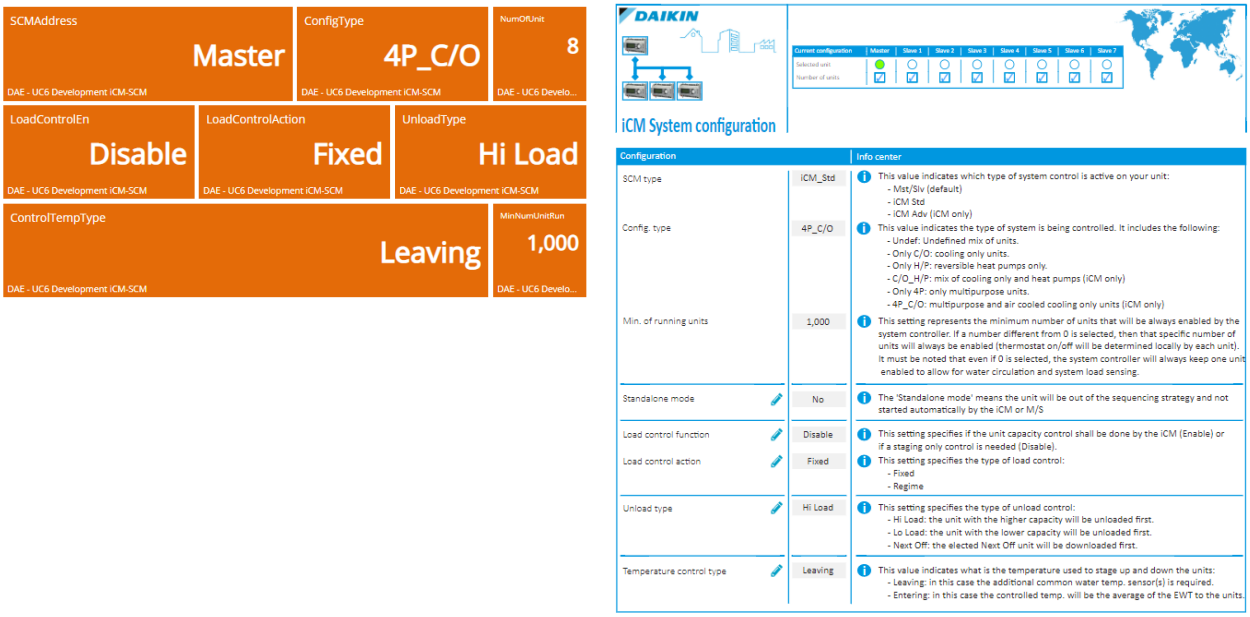


Figure 20: System Configuration from Daikin on Site

5.3.4 Configuration Check

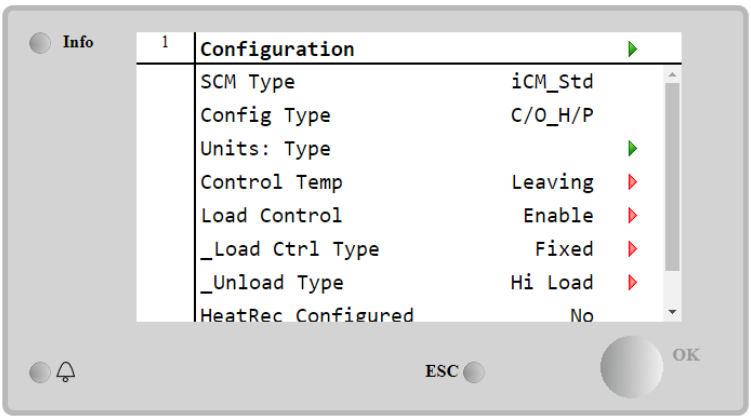


Figure 21 Configuration Status menu

At first start up, Master reports SCM Type (Master/Slave, iCM Standard, iCM Advanced) and detects the System Configuration (Undefined, Only Chiller, Only Heat pump, Chiller+HeatPump, Only Multipurpose, Chiller+Multipurpose) according to Unit Type (Menu: *"Units: Type"*) communicated by slaves.

Unit Type	Description
Undef	
AC C/O Screw	AirCooled Chiller Screw
AC H/P Screw	AirCooled Heat Pump Screw
Polyfun Screw	Multipurpose Screw
AC Modular	AirCooled Modular
WC C/O Screw	WaterCooled Chiller Screw
WC H/P Screw	WaterCooled Heat Pump Screw
AC C/O Scroll	AirCooled Chiller Scroll
AC H/P Scroll	AirCooled Heat Pump Scroll
Polyfun Scroll	Multipurpose Scroll
WC C/O Scroll	WaterCooled Chiller Scroll
WC H/P Scroll	WaterCooled Heat Pump Scroll
WC C/O Centrif	WaterCooled Chiller Centrifugal
WC H/P Centrif	WaterCooled Heat Pump Centrifugal

Table 33 Unit Types

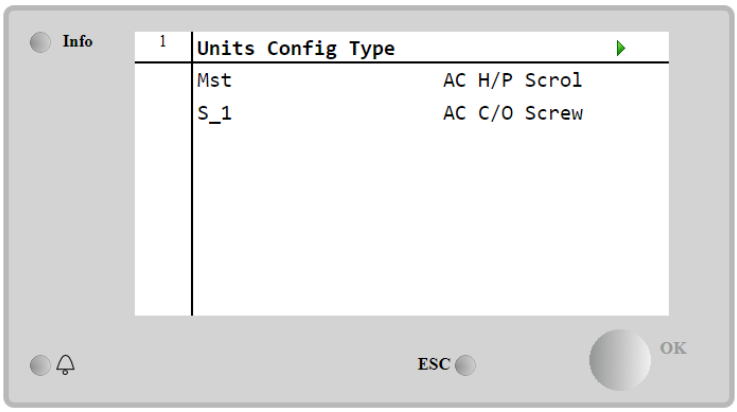


Figure 22 Unit types menu

If communication errors between Master and Slaves occur, network between controllers is not properly installed. Before keeping on configuring system, all communication issues MUST be solved.

If "Config Type" or "Units: Type" is Undef, "ConfigurationAlarm= UnitNotDef" is raised by Master. Reset of Master is needed before keeping on configuration.

5.3.5 Available Configurations and Configuration Alarm

As explained, Master detects the Unit Type of connected Units and SCM Type (Software Option enabled). If configuration is not allowed, Master raises an alarm.
In the following table Available configuration are described.

SCM Type	Units Type	Config Type	Configuration Alarm
Master: iCM_Std Slaves: Mst/Slv		Undef	ICM Type Error
Mst/Slv	Same Condensation (AC or WC) Mode (Chiller, Heat Pump, Polyfun) Compressor (Screw, Scroll)	OnlyCO OnlyHP Only4P	None
Mst/Slv	AC + WC or WC + Polyfun	-	CooledErr (Units differently cooled)
Mst/Slv	Heat Pump + Chiller	HP+CO	ModeErr (Units with different mode)
Mst/Slv	Multipurpose + Chiller	4P+CO	ModeErr
Mst/Slv	Multipurpose + Heat Pump	4P+HP	ModeErr
Mst/Slv	Multipurpose + Heat Pump + Chiller	4Z+HP+CO	ModeErr
Mst/Slv	Scroll + Screw or Scroll + Centrif	-	ComprErr (Units with different compressor)
iCM Std	AC + WC or WC + Polyfun	-	CooledErr
iCM Std	1) Master: Heat Pump + Slave: Chiller 2) Plant = 2pipe	HP+CO	None
iCM Std	1) Master Heat Pump + Slave Chiller 2) Plant = 4pipe	HP+CO	PlantErr (Slave 1 must be AC-CO+HeatRec)
iCM Std	Master Multipurpose + Slave:Chiller	4Z+CO	None
iCM Std	Master Multipurpose + Slave:Heatpump	4Z+HP	None
iCM Std	Master Multipurpose + Slaves: Chiller + Heat pump	4Z+HP+CO	None
iCM Std	1) Master: Heat Pump + Slave Chiller + Multipurpose 2) Plant = 4pipe	4Z+HP+CO	PlantErr (Master must be Multipurpose)

iCM Std	1) Master: Chiller + Slave Heat Pump + Multipurpose 2) Plant = 4pipe	4Z+HP+CO	PlantErr (Master must be Multipurpose)
iCM Std	Scroll + Screw	-	None
iCM Std	Scroll + Centrif	Undef	ComprErr

Table 34: Available configurations between Master/Slave and iCM

Some configurations that are not allowed with Mst/Slv, can be managed with iCM Software Option.

During configuration checks AC Modular Units are treated as AC HP Scroll units. In this case, the installation of an ATEX sensor is mandatory.

If Configuration Alarm is raised, Mst/Slv or iCM logic cannot be started.

5.3.6 Configuring the Controlled Temperatures

The first setting requires to select the controlled temperature between leaving and entering.

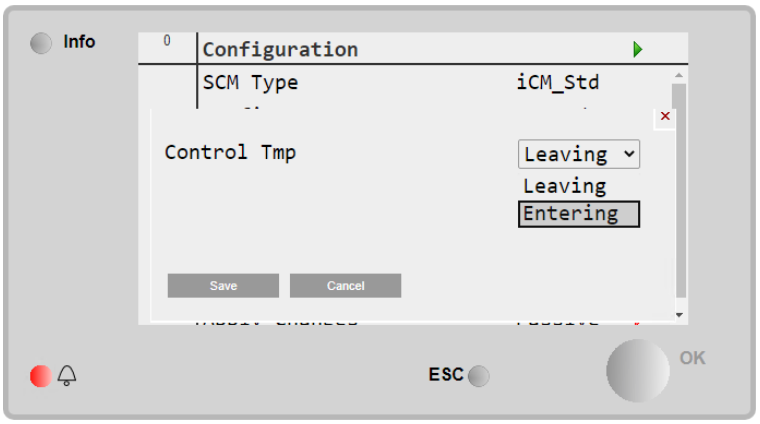


Figure 23: Selection of the controlled temperature

Selection of leaving water temperature will require to install the additional sensor on the supply header. On the other hand, selection of entering water temperature will not require any additional sensor as the iCM will calculate and use the average of the entering water temperature of all the running Units.
The decision between leaving and entering is mainly related to the application of the system. Leaving control tries to deliver exactly the temperature requested by the customer on supply header. On the other hand, with Entering control iCM will manage the load and unload of the running Units to achieve the entering water setpoint. In this case water temperature of supply header is not take in consideration and it can be higher or lower than default leaving water temperature setpoint of individual Unit. For this reason, selection of Entering water temperature control forces the enabling of Load Control (described in following paragraph).
Some applications, listed in paragraph 3.2, require Leaving Water Temperature sensor and Leaving water temperature control.

	In four-pipe plant-room, two Leaving water temperature sensors are configured and “Leaving” water temperature control is forced.

5.3.7 Configuring Unit Load Control function (only in Two pipe plant-room)

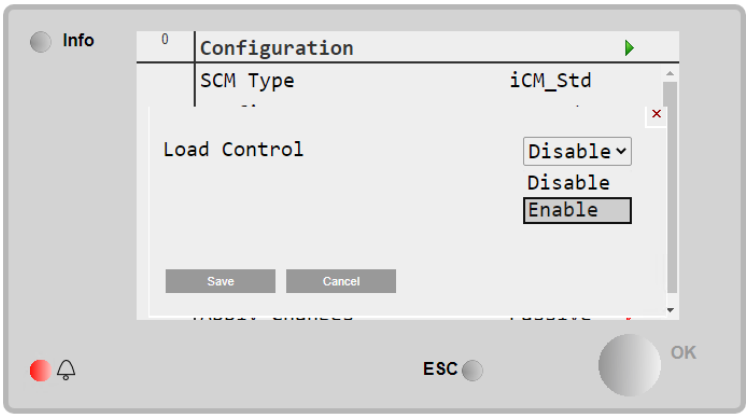


Figure 24: Load control Enable/Disable

ⓘ	If the iCM controls on the Entering Water Temperature the Load Control will be enabled by default.

ⓘ	In case of four-pipe plantroom, Unit Load Control is always disabled.

This setting will enable or disable the load control by the iCM. When the load control is enabled, iCM will force Units to load or unload basing on the water temperature error. Commands will be given to each Unit individually. This setting will try to share the system capacity on all the running Units when loading and unloading.
There is only one loading up strategy, and it is based on **Minimum Load**: iCM will force the load up of the running Unit with lower capacity time by time, up to stage up threshold. This strategy makes the Units load up one by one altogether, so that increase of system load will be shared homogeneously among the Units
On the other hand, there are three possible Loading down strategies each of those delivering different unloading profiles, described in the following paragraph.

5.3.7.1 Configuring the Load Control Mode

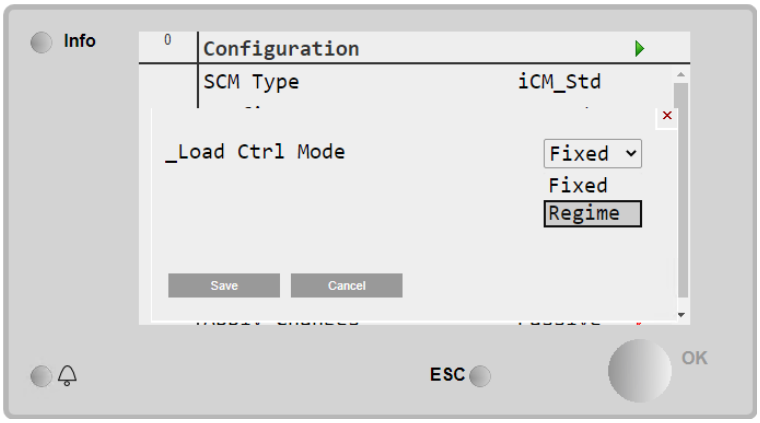


Figure 25: Load control mode selection

This setting will define when the Load Control will be used. Fixed will give the iCM the continuous load control of the Units. This might be good in case of comfort application and can help to get to the target sharing better the system load. When Regime is selected, the Load Control is activated only in Zone 2 while in Zone 1 the iCM will only control the staging of the Units. This second option is preferable when the Unit should get to the setpoint quickly and eventually starting more Units than in an optimal situation.

5.3.7.2 Configuring the Unloading Strategy

Configuration requires to select the unloading strategy.

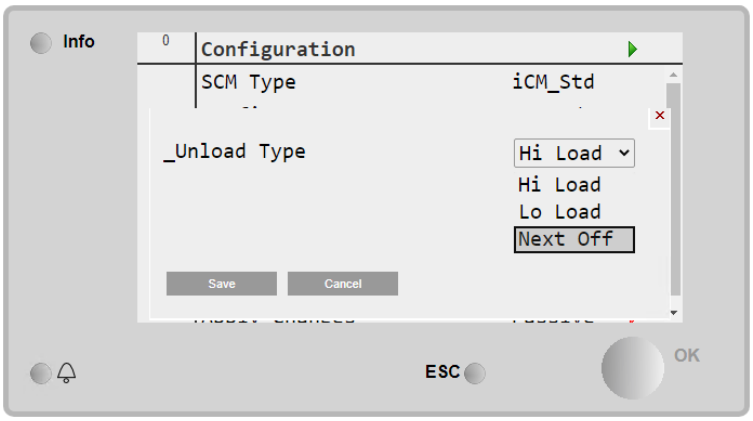


Figure 26: Unload Type selection

Unload can follow three different strategies that may lead to different distribution of the capacities as seen from the above picture.

With **Hi Load**, the iCM will force the unload of the running Units with higher load time by time. This strategy makes the Units unload one by one altogether, so that decrease of system load will be shared homogeneously among the Units during the unload. One application of this strategy could be the case of all non VFD Units with VFD pumps with variable.

The **Lo Load** strategy will force the unload of the Unit with lower capacity per time, down to its stage down threshold. In this case, decrease of system load will be compensated by one Unit at time and left running Unit will keep the achieved capacity. When all the Units will be unloaded to their stage down thresholds, then one Unit is disabled and switched off. This strategy fits well in applications with all VFD Units and VFD pumps with variable flow.

The **Next Off** strategy will unload the Next Off Unit and when the Unity capacity reaches the stage down threshold the Unit is switched off. The decrease of system load is compensated by one Unit at time till total shut-down. This strategy could be the right choice in case of fixed speed pumps (manifolded or dedicated) because it minimizes the number of running chillers so the number of running pumps.

5.3.8 Configuring System Mode Management

If Master controller is a heat pump, this setting allows operator to enable the System changeover (management of operating mode of the slave units by Master unit).

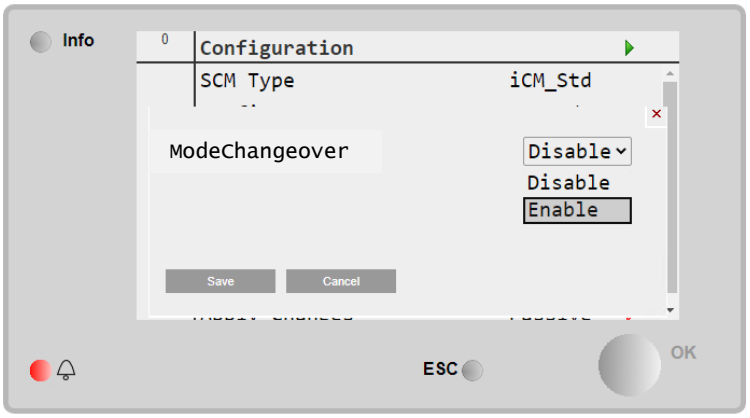


Figure 27 - Mode Changeover selection

ⓘ	System Mode Management can operate only if iCM option is configured on all the units.

ⓘ	If Master Unit is configured with “Collective Housing” option, this setting is fixed to “Enable”. Thus, Automatic System Changeover is configured.

ⓘ	In four-pipe plant-room, this setting does not display but Changeover of heat pump slaves unit is enabled.

5.3.9 Configuring System Defrost Management (only in Two pipe plant-room)

If Master controller is an Air-cooled heat pump, this setting displays in Configuration menu and allows operator to enable the System Defrost Management

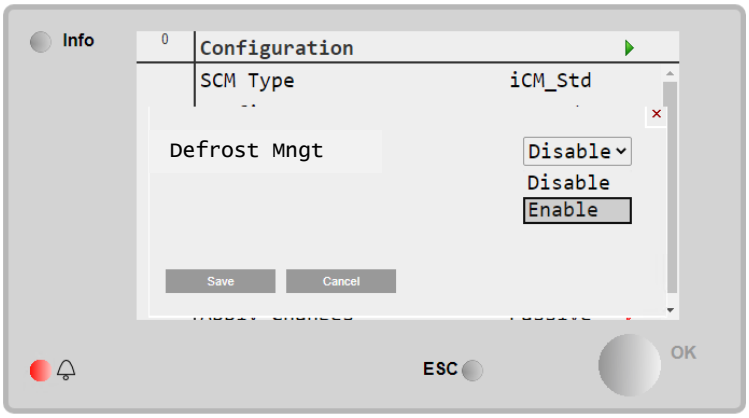


Figure 28 – Defrost Management selection

	Defrost Management can operate only if iCM option is configured on all the units and if there are no Multipurpose Unit in the system.

	In four pipe plant-room Defrost is managed by unit itself. If unit is working in defrost is considered “Not available for Staging and Mode Control

5.3.10 Heat Recovery Configured (only in Two pipe plant-room)

The highlighted item in this page confirms if the Heat Recovery is configured at system level. iCM Heat Recovery management is configured if Heat Recovery option is enabled at least on Master unit controller.

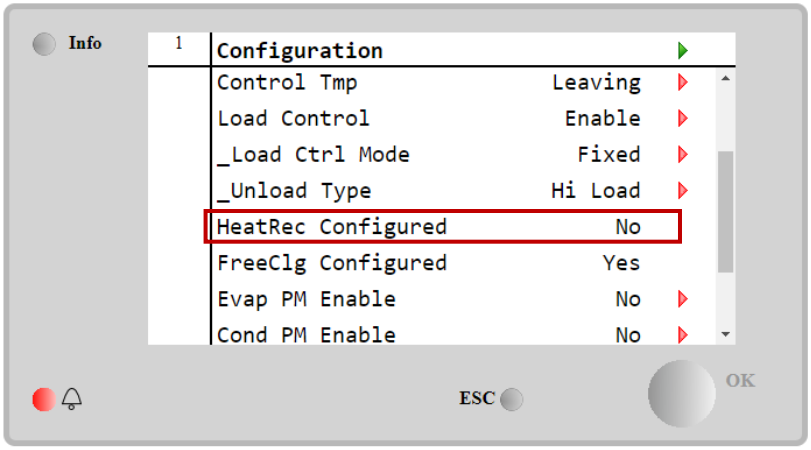


Figure 29: Activation status of Heat Recovery

	Heat Recovery Management can operate only if iCM option is configured on all the units and if there are no Multipurpose Units in the system.

	In four pipe plant room with A/C Heat pump and at least one A/C Chiller with Heat recovery option, heat recovery is automatically configured and managed by

5.3.11 Free-cooling Configured (only in Two pipe plant-room)

The highlighted item in this page confirms if the Free-cooling is configured at system level. iCM Free-cooling management is configured if Free-cooling option is enabled at least on Master unit controller.

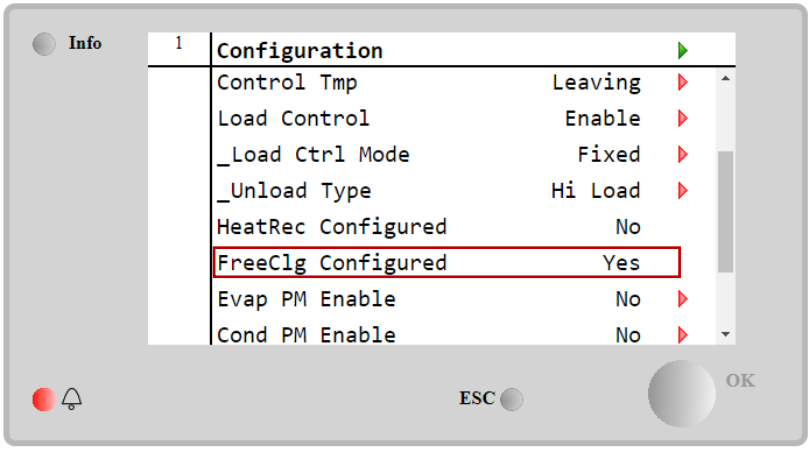


Figure 30: Activation status of Free-cooling

ⓘ	Free-cooling Management can operate only if iCM option is configured on all the units and if there are no Multipurpose Unit in the system. Moreover, Common leaving water temperature sensor is mandatory for free-cooling management at system level.

5.3.12 Configuring iCM Expandable (only in Two pipe plant-room)

If controller is configured as Master with iCM Option and EKCMBACIP (BACnet communication module) is connected, iCM Expandable function can be configured through the following parameter:

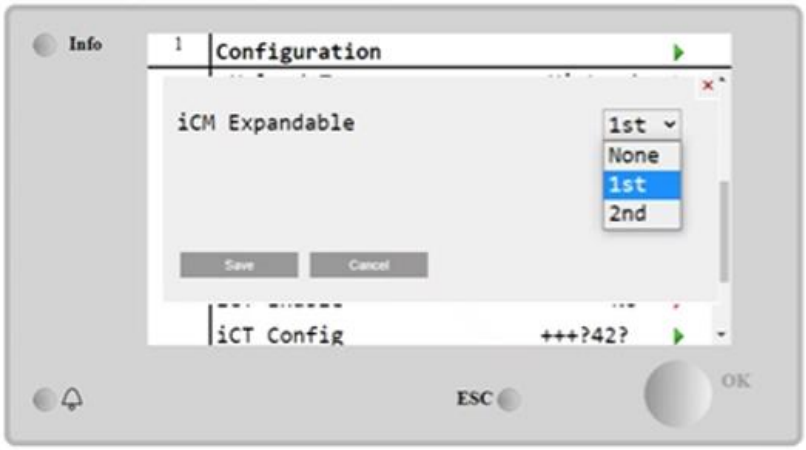


Figure 31 - Configuration of iCM Expandable

According to iCM Expandable layout (**paragraph 0**), in the first subsystem iCM Master must be configured as “First” and in the second subsystem the other iCM Master must be configured as “Second”.

ⓘ	There MUST NOT be more than one iCM Expandable 1st or iCM Expandable 2nd

To allow communication between the two iCM Master controllers with configured iCM Expandable function, specific BACnet parameters must be set in the unit menu:

- Main Menu → Commissioning Unit → BACnet IP Setup

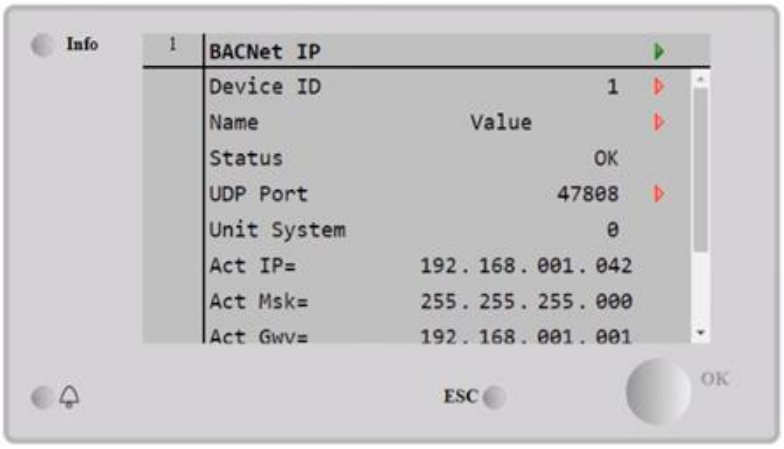


Figure 32 - Unit Menu: Commission --> BACnet IP

In this menu the following parameters must be set:

1. *Device ID* must be set as
   a. For iCM Master First: 4151
   b. For iCM Master Second: 4152
2. *Name* must be different between the two iCM Master controllers and unique among all the device in the BACnet Network
3. *Unit System* must be set to “Metric”

5.4 How to setup the System Settings

The System Settings page includes all the settings that define how the iCM will control the water temperature of the system. Most of those settings are quite intuitive to be set, few others may require some care.

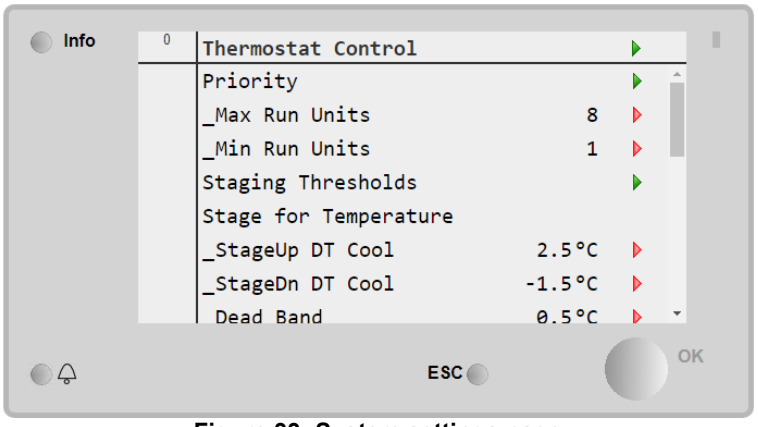


Figure 33: System settings page

Also, in this case the same settings can be done from Daikin on Site with two dedicated Dashboards for sequencing and staging.

5.4.1 Priority

Following the order of these settings, priorities must be defined first. iCM allows to set individual chiller priorities. When doing this it has to be considered that iCM accepts grouping of Units. Units with the same priority are sequenced only looking to run hours and starts. By default, all the priorities are set to 1 so all the Units are sequenced to balance run hours and starts.
In case the iCM must control VFD and non VFD Units, it is possible to let the VFD Units start first and the non VFD Units follow. Or let one VFD Unit start, then the non VFD and as last another VFD Unit using three different priority assignments. In the table below an example with 4 Units will be shown for the two scenarios.

Unit Type	Default	Case 1	Case 2
EWAD-CZ	1	1	1
EWAD-CZ	1	1	3
EWAD-C	1	2	2
EWAD-C	1	2	2

Table 35: Setting the priorities

Changing the priorities will have an impact on the balancing of the run hours. Different priorities will be available for cool and heat mode.

ⓘ	Some specific configuration (mixed systems or heat recovery for example) may override the HMI settings.

5.4.2 Min and Max Run Units

Min and Max Run Units are used to define the minimum and maximum number of Units that can run.
With Min Run Units is possible to define a number of Units that will be always running. This can be useful in case of process application where part of the system load is fixed. In this case the iCM will always keep this number of Units enabled.
Operator cannot be set which units will be kept enabled, but they depend on sequencing function (at the start up the Next On Units; at system low demand the running Next Off Units)
The Max Run Units defines the maximum number of Units that can run at the same time. With this setting is possible to define a number of Units as backup of the others whose are started in case of alarm. For example, in a system of 6 Units this setting can be set to 5. These 5 Units will be started following the sequence function among the available 6 units. If one Unit fails, the logic will start the 6th Unit to integrate the capacity request.

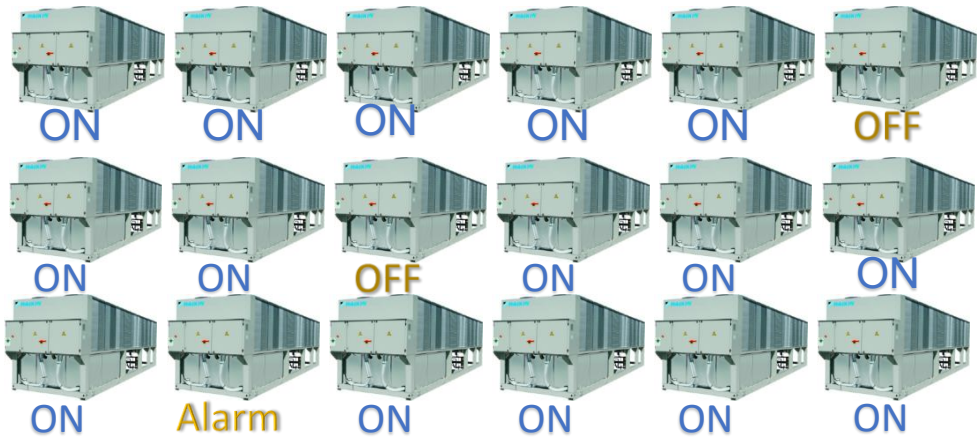


Figure 34: Max number of Units running equal 5

5.4.3 Staging Settings

Staging Settings affect the staging functions in different ways:

- Staging Thresholds determine the behaviour of Staging for Capacity Range (only in two pipe system)
- Staging Differential temperatures determines different behaviour according to plant layout:
  - In two pipe system, they force staging on temperature when the deviation from setpoints is too far
  - In four pipe system: they determine the deviation from setpoint outside a deadband and consequently the evaluation of operating mode needed to supply both cool and heat demand in a certain moment
- Staging delay: are used by iCM logic to stabilize the behaviour of staging function to changes in the system demand.

The following picture shows how the settings of Staging Thresholds, Staging Delta temperature, Staging Delays affects Unit Staging function and Unit Load Control function in a Two-pipe plantroom:

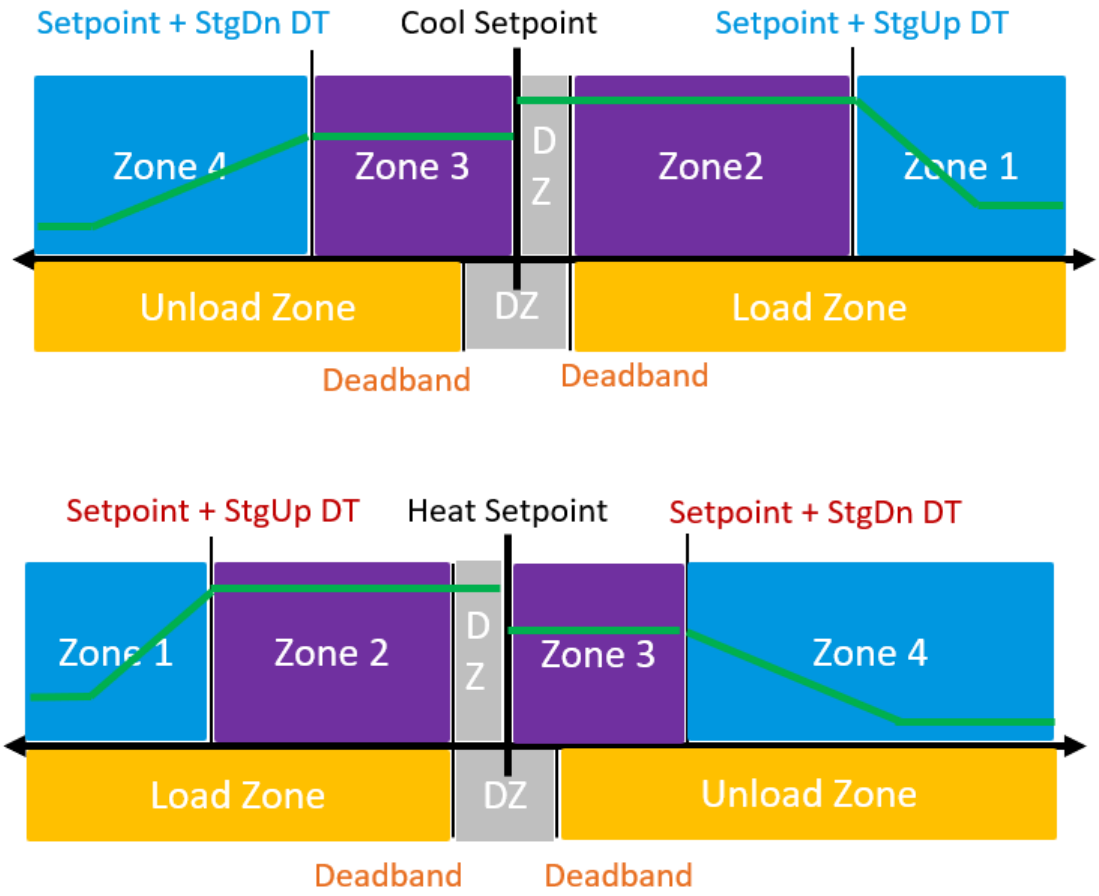


Figure 35 - Staging Setting effects in two pipe plant room

In zone 2 and 3, Staging on Capacity Range is active; in zone 1 and 4 Staging on temperature takes over the staging on Capacity Range. Outside the Dead zone around the setpoint, Unit Capacity control is working.

ⓘ	Thresholds are chosen after a process of fine tuning: during iCM commissioning, service engineer needs to test the response of the iCM to system load request and consequently refine the values.

The following picture shows how the setting of Staging Delta temperature and Staging Delays affects the Staging and Mode Control functions in four-pipe system:

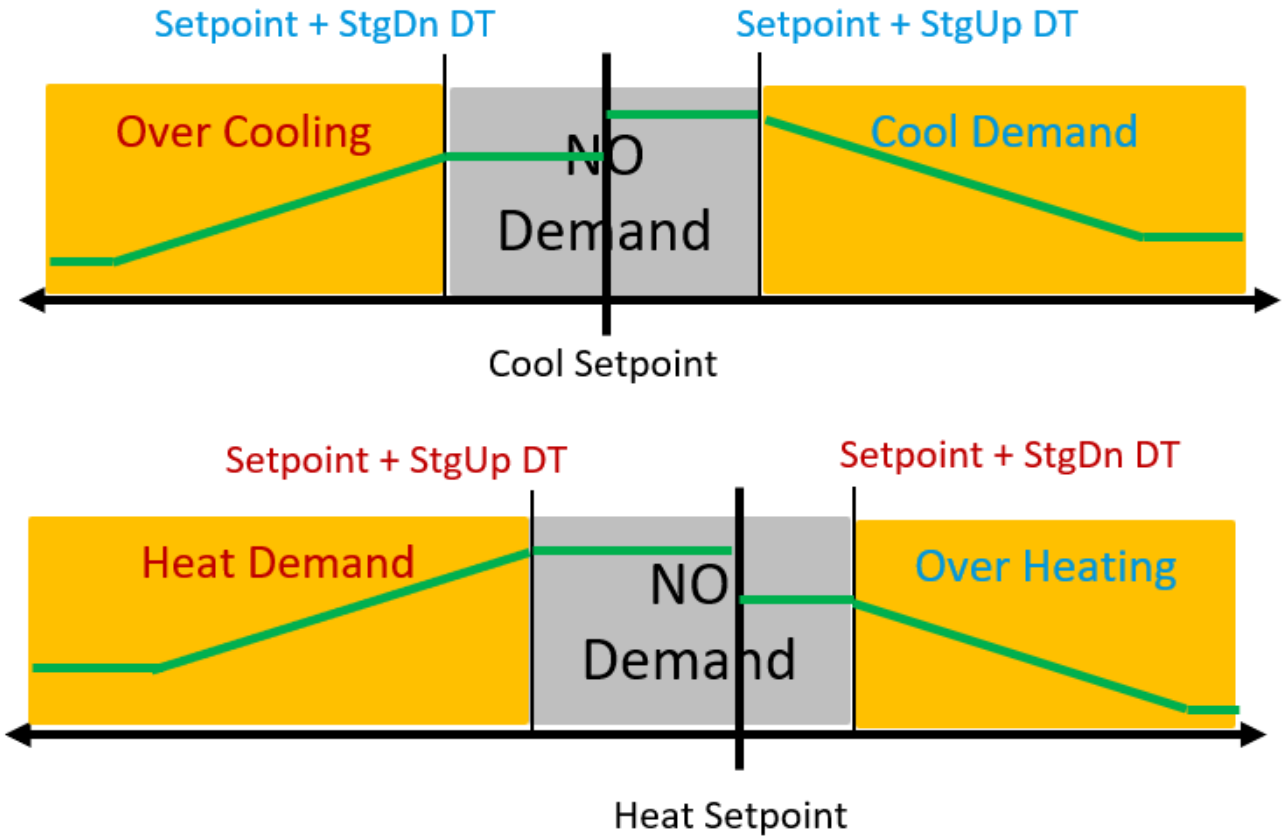


Figure 36 Staging Setting effects in four pipe Plant room

The comparison between the cool and heat demand determines the Start/stop of a unit or a Changeover mode of AC heat pump or circuit of a multipurpose or the enable/disable of heat recovery function of AC Chiller

5.4.4 Staging Capacity Thresholds (only in Two-Pipe Plant-room)

The staging Up and Down Thresholds define the management of the start and stop strategy of the Units and, if Unit Load control function is enabled, the management of load up and load down range of the Units.
Before proceeding it's very important that what explained in paragraph **Errore. L'origine riferimento non è stata trovata.** has been fully understood.

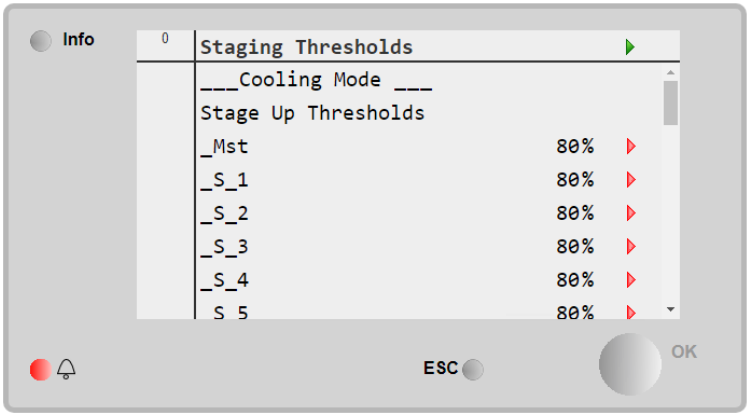


Figure 37: Staging thresholds

Selection of optimal Staging thresholds depends on several factors: number and size of Unit, type of compressor, etc.
In general, Stage Up and Stage down thresholds are set in order to make the Unit work inside a capacity range in which the specific Unit has the higher efficiency.
For example, in case of Units with Non-Inverter screw compressor Stage up should be set about 80%, whereas in case of Units with Inverter Screw compressor these thresholds should be set about 60%. Moreover, it is worth noting that the lower is staging up threshold, the higher will be the number of started Units, leading to a partial load sharing, whereas the higher is the staging up threshold, the lower will be the number of started Units, leading to a full load step staging.

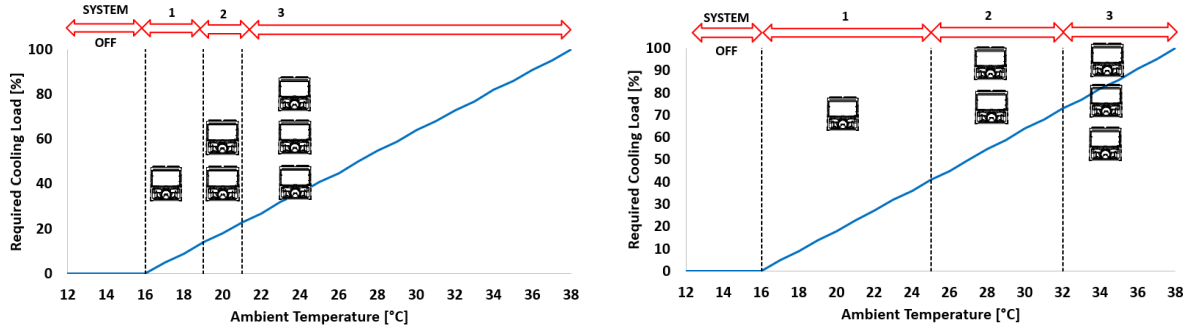


Figure 38 Load Sharing VS Minimum running Units

It's important to consider that the overall system efficiency is not only achieved letting the Units work in their best efficiency range, but it depends on other systems that have electrical consumption and own efficiency that shall be considered.
For example, in system with dedicated fixed speed pumps, starting an additional Unit leads to start one additional pump and consequently to an increase of power consumption. On the other hand, with a VFD pump, each start-up will correspond to a speed increase with a smaller increase in power consumption compared with fixed speed.
Concerning the stage down capacity thresholds, this determines when a running Unit must be stopped: the higher is the value, the smaller is the number of running Unit, whereas the lower is the value, the larger will be the number of running Units at partial load. For example, with Non-VFD screw Unit, Stage Down Threshold can be set about 40%, whereas with VFD screw Unit, the threshold can be set about 30% to enhance the load sharing.
Moreover, it is worth noting that this parameter has an impact on the setpoint stability. In fact, a too high value (for example above 50%) can lead to an anticipated shut-down of a running Unit and it can force iCM to load up the remaining running Units to compensate the requested system load and even to start again another stopped Unit. That can cause a fluctuation of leaving water temperature and unnecessary start and stop of the Units.
For example, in case of process application, to decide how to set the stage down thresholds, note down the minimum capacity percentage of each Unit and use this value to configure the thresholds. This will permit the iCM to unload the Units down to the minimum and have a smoother effect on the water stability. In case of process application, it might be also suggested to use the Next Off load control.
The thresholds are available for both cooling and heating.

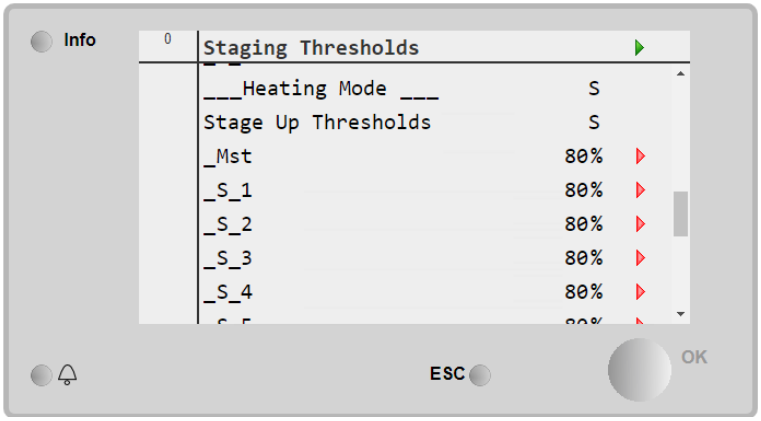


Figure 39: Staging thresholds for heat

In heating it can be convenient to have more Units at part load because this may mean less defrosts over time. So, it is better to set a lower capacity range.
Moreover, the Stage up and down threshold has an impact on the Load Control. In fact, iCM will load up each running Unit up to stage up threshold. So, a too low Stage up threshold will force the system to start all the Units and reach the stage up threshold before releasing the loading up to maximum system capacity.
In case of decrease of system load, iCM will load down the Units down to stage down capacity before stopping a running Unit (if unload type is high load or Low load) or iCM will load down the Next Off Unit to stage down capacity before stopping the Unit and start to load down the new next off. For this reason, a too high load down threshold can lead to unnecessary shut-down that cannot be afforded by remaining running Units.

5.4.5 Staging Temperature Differentials

The staging temperature thresholds and deadband are used to define:

- In two-pipe plant-room, the regulation zones for iCM when Staging on Capacity Range and/or Unit Load Control (If enabled) and Staging for temperature are active
- in four-pipe plantroom, the regulation zones for iCM when Staging for temperature and Mode Control are active

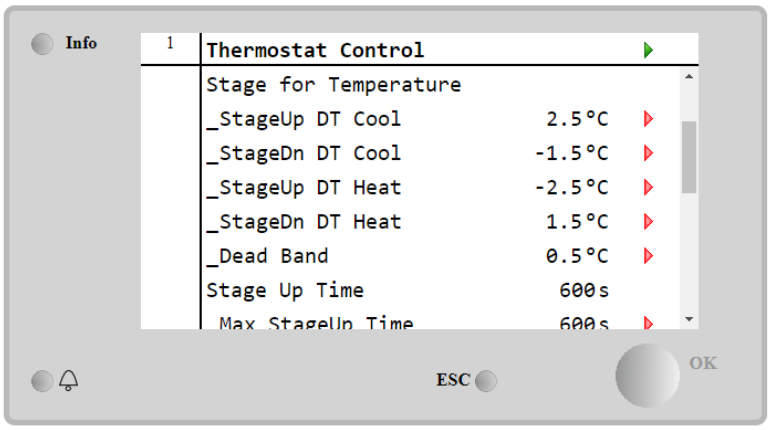


Figure 40: Staging temperature thresholds configuration

In case of two pipe system, if controlled temperature is higher than setpoint + Stage Up DT, iCM starts an additional Unit without considering actual capacity of running Units, whereas if the controlled temperature is lower than setpoint + Stage Down DT, iCM stops a running Unit without considering actual capacity of the running Units. This represents a back-up logic to compensate a sudden increase or decrease of system load, as faster as possible.
Those values must be set quite wide from setpoint to allow Staging on Capacity to start/stop the unit efficiently. In fact, a too low Stage Up DT can lead to unnecessary start-up of Unit and a too low Stage Down DT can lead to unnecessary shut down of a Unit.
Regarding the deadband, this parameter affects Unit Capacity Control logic, if enabled. When controlled temperature is inside range between setpoint and setpoint + deadband, iCM will stop to load or unload the Unit. So, the higher is this value the higher is the deviation from setpoint that can be afforded. For example, in comfort application it can be set at 0,7...1,0°C. On the other hand, the lower is the parameter, the higher is the precision of iCM to follow controlled temperature fluctuations, which might be needed in process application when operator can set 0,3...0,5°C.
The Stage Up and Down delta temperatures are available in both cooling and heating if there is a heat pump in the system.

In case of four pipe system, where Staging on Capacity and Unit Capacity Control are disabled, staging is based only on temperature control and iCM Start/stop/ mode changeover of all the Units to satisfy the cooling and heating requests. So, stage up and stage down DT are used to evaluate the deviation from cooling and heating setpoint. Inside the range between Stage up and down DTs, iCM will keep the system as it is, whereas outside this temperature range, iCM decides to start/stop/change mode of units and/or of circuits multipurpose. For this reason, those parameters can be lower and the range of regulation around the two setpoints can be narrower. Usually, this range can be set about 2,0°C around the two setpoint, so that stage up and down delta temperature are set to 1,0°C and –1,0°C.

5.4.6 Staging Delays

The stage up and down of a Unit are defined also following delays. The delays are introduced to limit the simultaneous starts of different Units in the system and to let the Units load up or down to have an effect on the water temperature.
The delays depend on the distance from the Stage temperature Threshold, the farther is the controlled temperature from the target, the lower is the delay. The delays are started at each start up or shut down of a Unit.
The delay profiles for stage up and down are split to maximize the iCM configuration flexibility.

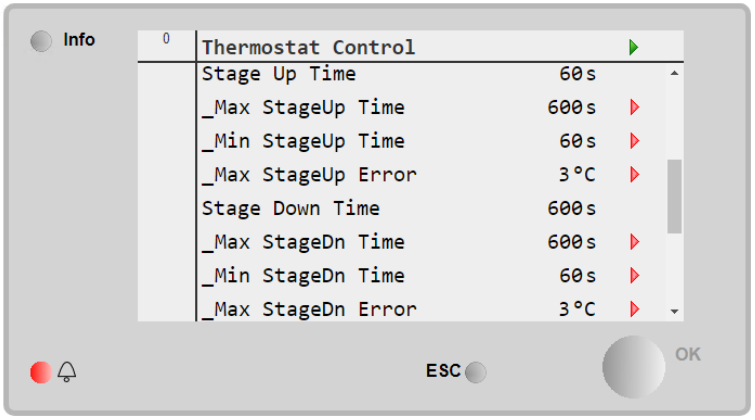


Figure 41: Stage delays configuration

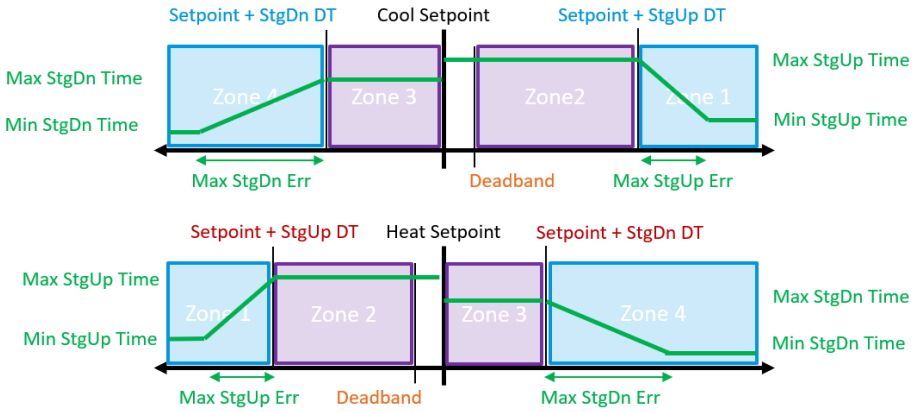


Figure 42: Staging delays calculations

Considering as example the default values, it results that if the controlled temperature is higher than 3°C (Max StageUp Error) from Stage Up temperature the delay is calculated at 60 seconds; in any temperature between stage up temp and 3°C, the delay is calculated using a linear interpolation so that at the StageUp Threshold the delay becomes 600 seconds. The same applies to stage down delay so that as the controlled temperature drops below stage down threshold in cooling or raise above stage down threshold in heating the stage delay can range between 600s and 60s accordingly.
So, the staging delays are affected by kind of Unit on system, kind of enabled iCM functions, kind of controlled temperature and temperature dynamic of the whole system.

In Two-pipe Plant-room, Staging on Capacity and Unit Capacity Control logics are enabled. When controlled temperature is inside stage delta temperature, iCM checks and manages the actual capacity of the Unit, so that a too long “Max Stage Up Time” could delay the start-up of an additional Unit, whereas a too short “Max Stage down Time” could cause shut-downs of Units too close in time. In the same way, when controlled temperature is outside stage delta temperature, where staging on temperature works as back up logic for sudden increase or decrease in load demand, a too long “Min Stage Up time” or a too high “Stage Error” could delay the start-up, whereas a too short “Min Stage down Time” can cause unnecessary shutdowns of Units.
Generally, Max Stage Up time is set at 5 minutes and Min Stage Up time at 2 minutes with a short Stage Up Error, about 1°C, because Stage Up DT is still quite high (default, 2,5°C). For the shut-down, Max Stage Down is set at 6 minutes, Min Stage Down time at 3 minutes and a short Stage down Error (about 0,5°C).
It is important to mention the case of Entering water temperature as controlled temperature. In this case, start/stop of Units can be evaluated after a certain delay due to dynamic of water in the system. For this reason, Stage Delays should be higher compared with the case of control with the leaving water temperature.

On the other hand, in Four-pipe plant-room, iCM manages individual Strat/Stop/Changeover of Units/Circuits according only to deviation from leaving water temperature setpoint (Cool and Heat), set with Stage Up and Down DTs. So, More time is needed to appreciate the effect of Staging and Mode Control function on controlled temperature, and consequently Staging delays and Stage Error must be longer. For this reason, Max Stage Time could be set at 10 minutes, Min Stage time at 1 minutes and Stage Error at 3°C.

5.4.7 Unit Capacity Control (only for Two-pipe Plant-room)

The last parameters to set are the ones related to Unit Capacity control.

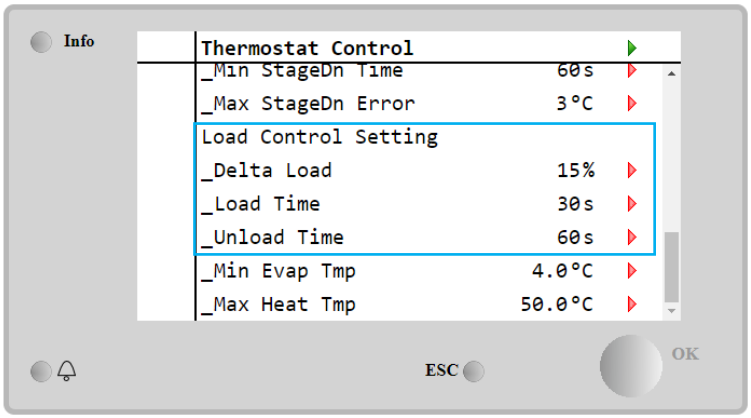


Figure 43: Unit Capacity Control Settings

When load control is enabled and active, iCM controls the load up and load down of the Units one by one. The Delta Load represents the percentage of capacity that loading/unloading Unit must generate from its actual capacity before iCM switches to load/unload the next Unit. In case of Load up (controlled temperature is higher than setpoint + deadband), after each capacity step of the loading Unit, iCM will wait for Load time to expire and then it commands the load up of the next Unit. During Load down (controlled temperature is below setpoint - deadband), after each unload step, iCM will wait for Unload time to expire before commanding to unload the next Unit. Inside the deadband, Unit will keep the reached capacity. The Load/Unload timers should provide to iCM the time to evaluate the impact of each delta capacity increase or decrease on controlled temperature and, at the same time, prevent iCM from delaying the load Up or shortening the load down with consequently system capacity fluctuation. In fact, a too short Load timer can cause an increase of Units' capacity too close in time; whereas a too long Load time can bring to an increase of temperature. Unload time can have the same effect with an excessive capacity generation or an unnecessary capacity decrease and possible shut down of the Unit.
Generally, Capacity unload of the Unit is faster than load up, so Load time can be set at 30sec and Unload time at 60sec. It is worth noting that controlled temperature has an impact on the choice. In fact, if controlled temperature is the Entering water temperature, a capacity change of the Units has a delayed effect on the controlled temperature, so timers must be increased and fine-tuned according to plant-room inertia.
Regarding the temperature ranges, Min Cool Temp and Max Heat Temp must be set according to specific Unit parameters and system application. For example, in case of brine applications, the Min Cool Temp shall be reduced accordingly with the system setpoint. The same will happen with the Max Heat Temp and High temperature heat pumps.

5.4.8 Heat Recovery (only for Two-pipe Plant-room)

iCM can control the staging of Heat Recovery of all the Units with this option installed.

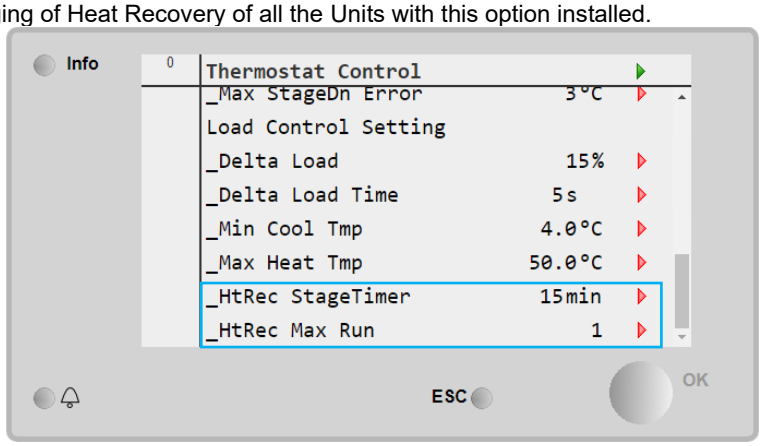


Figure 44: Heat Recovery settings

The settings allow to configure the maximum number of Units with Heat Recovery to be activated to reach the required temperature. If the total Heat Recovery available capacity exceeds the maximum required load, then this number can be set lower than the number of heat recovery Units. In case of doubts or to easily configure this function, it's suggested to set this value equal to the number of Units with heat recovery. What is important to remember is that the activation of heat recovery influences the Unit efficiency and capacity so in order to try to keep high the overall efficiency, when possible, the HtRec Max Run should be set at the minimum possible value.
That said, iCM will stage up the number of Units needed to reach the Heat Recovery target trying not to exceed the Heat Recovery system load and maximizing the system efficiency.
The HtRec Stage Timer represents the delay between activations of heat recovery across the different Units.

5.4.9 Free-cooling (only for Two-pipe Plant-room)

iCM is able to manage the activation/deactivation in sequence of Freecooling function among managed units. The below picture show settings used to iCM that affects this staging logic.

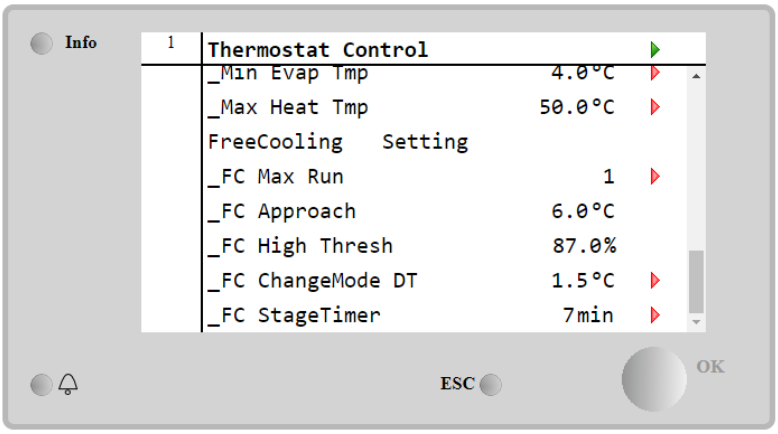


Figure 45 - Freecooling settings

The settings allow to configure the max number of running unit with activated free-cooling function. According to plantroom design and unit design, user can decide to set this parameter equal to number of unit with equipped FC option or decide to set a lesser number in case of whole free-cooling capacity has been oversized comparing to the cool load request.
The other important parameter is the Freecooling Approach, i.e. minimum difference between System Actual setpoint and Outside air temperature. This parameter defines when the free-cooling can be activated because cooling capacity generate with this option is able to afford the load request. Consequently, the value of this parameter is strictly related to the size and number of fan on the units. The higher is the number of fan, the higher is the cooling capacity generated and the lower is the FC Approach. It is also through that this value should never be set less than 4°C (minimum Free-cooling approach).
The FC Approach is set on Master unit “View/Set Unit” menu and it will be used at system level by iCM and displayed in “System Setting” menu.
The other three parameter are used by iCM to manage the Free-cooling mode changeover of the units. In other words are used by iCM to allow the transition from Full Free-cooling mode to Mixed Mode (free-cooling and mechanical generation of capacity) or from Mixed Mode to Full mechanical (cooling capacity generated only from compressors).
FC High threshold is calculated automatically according to “FC Max Fan speed” set on View/Set Unit menu of Master unit controller. This defines the Capacity threshold that all the units in Freecooling mode must exceed to let iCM to allow the changeover to Mixed mode or to full mechanical mode of one unit.
FC Change Mode DT represents the condition on system leaving water temperature to allow the transition to Mix Mode or to Full mechanical of one unit. It is highly recommended to set this value between “Stage Up DT” and “Start Up DT” of the unit.
FC Change Mode delay, is a stabilizing timer that prevents from unit changeovers in too short time. This value should be set at least equal to the “Hold Time” of the unit Free-cooling setting.

5.4.10 Standby Unit

iCM and Master/Slave both include the management of Standby Unit.
Only one unit can be elected as “Standby” at time. iCM can start the stand-by unit only in case of alarm of the one running units or if all the units are running and System temperature setpoint is not achieved (temperature compensation).

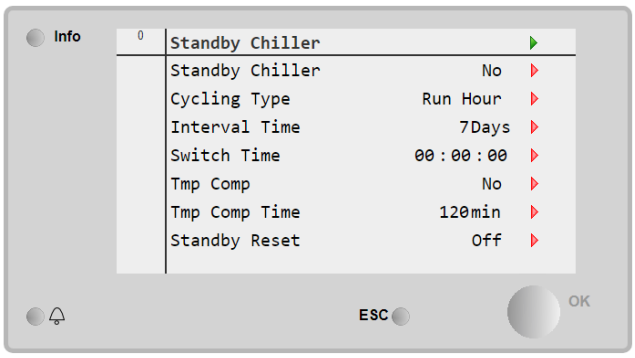


Figure 46: Standby chiller configuration

First setting is to activate the Stand-by function selecting a value different from “No”.

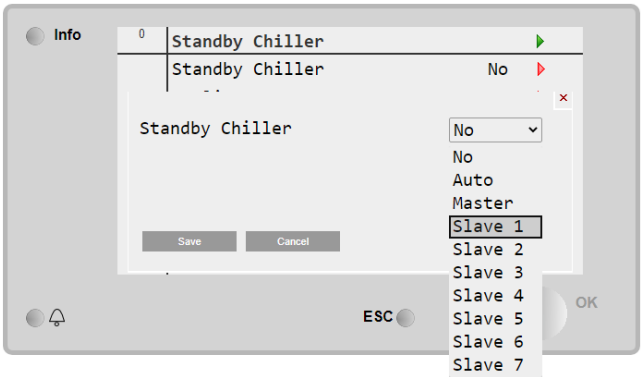


Figure 47: Selection of the Standby chiller mode

The configuration parameter allows to set a fixed Standby Unit among all the units. In this case no rotation of the stand-by is active. Usually, an older unit or with lower efficiency than the others should be set as Stand-by.
The same configuration allows to set Auto rotation of the Standby Unit chosen by iCM according to two strategies:

- Unit with More running hours; this strategy can be used to balance the running hour of the unit.
- Sequence number of unit: (for example, Slave1, then Slave 2, then Slave 3, etc): too assure that every unit in the system will become Stand-by unit.

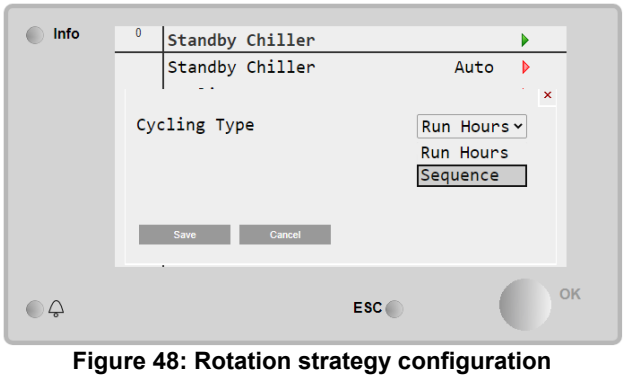


Figure 48: Rotation strategy configuration

It is possible to select the period and time when rotation of the Standby unit will occur. Selecting properly this time the changeover can be executed when the system is off so not affecting the system stability.

The Standby function can also start the Standby Unit for temperature compensation which is, by default, not active.

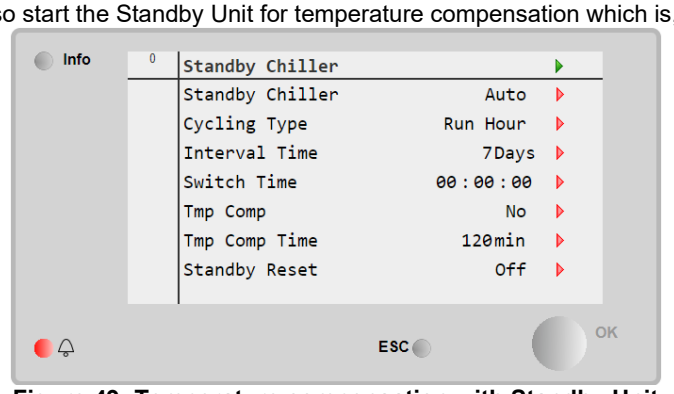


Figure 49: Temperature compensation with Standby Unit

Activating Temperature Compensation, iCM will start the Standby Unit if the system setpoint is not reached after a compensation timer. This delay can be increased or reduced to fit the application. In case of process application this delay can be reduced below default 120 min. This setting should be evaluated on the basis of the system requirements.

5.4.11 iCM Expandable

iCM expandable function does not need further settings after been configured.
On the other hand, the two iCM Master controllers must respect some settings to allow the correct management of the whole system (two subsystem).

- System→Setting→Staging setting must be the same (staging temperature differential and staging delays).
- System→Setting→Mode Changeover: must be enabled on both Master controllers if system include Heat pump units.
- System→Setting→Heat recovery setting must be the same (HR Stage timer).
- System→Setting→Free-cooling setting must be the same (HR Approach, FC Threshold, FC ChangeMode DT and FC ChangeMode Delay).

Moreover, 2nd Master accepts the commands and setpoints from 1st Master through BACnet network only if communication is configured correctly and the following parameter is set:

- 2nd Master MainMenu→View/Set Unit→Network Control→"Control Source" = Network (or Remote).

If 2nd Master is set with Control Source = Network, 1st Master can write "Enable Command", "Unit Operating mode", "Temperature Setpoints", "Heat Rec Enable Command" and "Free-cooling Enable Command" on 2nd Master to coordinate the staging and the other functions.

6 SYSTEM OPERATING

This chapter explains how to interact with controllers where iCM is configured.
Firstly, it must be highlighted that iCM logic is embedded in the unit controller. When a unit is elected as “Master” in plant-room, main setpoints on Master unit controller will be used as “System Setpoints”. On the other hand, the “Slave” units are under iCM control that will communicate the operating setpoints. If “Slave” unit is not communicating anymore with “Master” or it is set in “Standalone” mode through HMI setting, “Slave” will work using its own setpoints.

6.1 System Enable setpoint

The enabling conditions on Master unit controller, generally checked to enable a unit, must be satisfied to enable iCM logic and consequently the system sequencing and staging. Those conditions are the following:

1. “Unit Enable” = ON on unit controller HMI
2. “Unit Switch” turned ON on the unit cabinet
3. “Netwrk En Sp” on unit controller HMI (only if “Control Source” = Network, i.e. Master is commanded by third party BMS though protocol communication with object “Chiller Enable Setpoint – Network”)

If all the above conditions are true on Master Unit controller, in menu

- “System → Data → Sys State” = “Run”

and iCM sequencing and staging logic will be performed.

If one of the above conditions is false on Master Unit, iCM sequencing and staging logic is stopped and all the units will be stopped by Master controller.

6.1.1 Master Disable

If user would like to stop the Master unit and take it out of sequence, keeping iCM logic running, he should operate on the setpoint in menu

- “System → Maintenance → Mst Enable” = No

In this way, state of Master unit will become “Not Available”, iCM stops the Master unit and it keeps on sequencing the other available units.

6.1.2 Slave Disable

If user would like to stop a Slave unit and take it out of sequence, he should set one of the enabling conditions to false, mentioned in paragraph 6.1.
When Slave unit is disabled, iCM will consider it as “Not available” and consequently, out of sequencing logic. iCM will send stop command to unit and it will show in menu

- “System → Data → Units: State → Slv# State” = N/Av (not available)

6.2 System water temperature setpoints

To set temperature setpoints, used by iCM for sequencing and staging logic, user should operate on Cool or Hot setpoint on Master Unit controller.

6.2.1 System Cool Setpoint

It must be highlighted that iCM can sequence the units according to System Leaving water temperature or according to System Entering water temperature, depending on setting in menu “System→Configuration→ Control Tmp”. In both cases of controlled temperature, user must change the setpoint of the Master unit controller HMI:

- “Cool LWT 1”

6.2.2 System Heat Setpoint

If the Master is a Heat-pump or a Multipurpose unit, user should operate on the setpoint of the Master controller HMI:

- “Heat LWT 1”

The Heat setpoint on Master becomes “System Heat Setpoint” in both cases of temperature control based on System Leaving water temperature or System Entering water temperature.

6.2.3 System Heat Recovery EWT Setpoint in Two-pipe plantroom

In two-pipe plantroom with more than two units equipped with Heat recovery option, to set Heat Recovery setpoint, used by iCM for heat recovery management at system level, user needs to operate on the setpoint of Master controller HMI:

- "HR EWT"

The Heat Recovery on Master will become the "System Heat Recovery Setpoint".

6.2.4 System Heat Recovery EWT Setpoint in Four-pipe plantroom

In four-pipe system with A/C heat pump as Master and A/C Chiller with Heat Recovery as Slaves, "System Heat Setpoint" of A/C Heat pump is set as Heat Recovery Setpoint of Chiller units.

6.2.5 System Setpoints by Network communication

It worth noting that if Master controller is connected to a third party BMS and "Control Source = Network" on Master controller HMI, BMS can write the temperature setpoints on Master; those setpoints will become the "Active setpoints" on Master unit controller and consequently for iCM logic.
BMS should operate on

- Cool Setpoint – Network
- Heat Setpoint – Network

on Master Unit protocol communication (Please refer to specific Unit Protocol Communication Mapping).
Those setpoints can be used to set System Temperature Setpoints Cool or Heat for both controlled temperatures (System LWT or System EWT) in iCM logic.

If Master unit is equipped with Heat recovery option, BMS should operates on

- Heat Recovery EWT setpoint – Network

on Master Unit protocol communication.

The above setpoints set by BMS on Master unit controller can be checked on HMI:

- View/Set Unit → Network Control → Netwk Cool LWT
- View/Set Unit → Network Control → Netwk Heat LWT
- View/Set Unit → Network Control → Netwk HR EWT

6.2.6 System Active Setpoint

Once Temperature setpoints and Operation Mode (Cool/Heat) are set on Master controller, "Active setpoint" of Master will become "System Active Setpoint".
Master unit controller sends the "System Active Setpoint" to all the Slaves units. This setpoint overwrites the "Local" setpoints of the Slave units and it can be visualized in each unit in main page

- "Main Menu → Setpoints".

6.3 System mode and System mode setpoint

6.3.1 System Mode in Two Pipe Plant-room

In two pipe system with only Heat-pump units or a mix of Heat-pump and Chiller units, iCM can sequence the unit in order to achieve System Cool temperature setpoint or System Heat temperature setpoint. To allow changeover of the operation mode in the sequencing and staging logic of iCM, user should operate on setpoints on Master unit controller.
The following conditions trigger the mode-changeover from Cool mode to Heat Mode:

1. "Unit Available Mode = Cool/Heat" on controller HMI (showing that unit is a heat-pump and changeover is possible)
2. "Mode Switch" is turned on "Heat" on Unit cabinet
3. "Network Mode" = Heat" on controller HMI (only if "Control Source" = Network, i.e. Master is commanded by third party BMS through protocol communication with object "Unit Mode Setpoint – Network").

If one of the aforementioned conditions should become "Cool", Master change System operation mode in "Cool".
System Operation Mode can be checked in menu

- "System → Data → Sys Mode"

ⓘ	If a Slave unit should not be set with same operation mode of the Master, iCM will consider it "Not Available" and stop it.

6.3.2 Changeover management on Slave units

In case of Master/Slave option, Master does not set the System Operation Mode on the Slave units.

ⓘ	The changeover should be performed manually on all the unit satisfying the aforementioned conditions (through switch and/or Network mode setpoint)

In case of iCM Option and "Mode Changeover Management" is configured, iCM Master will set the System mode on all the connected heat pump slaves.

ⓘ	System Mode Setpoint by iCM takes over the aforementioned conditions on the slave units (Mode Switch and Network mode setpoint are ignored by Slave unit controller).

6.3.3 System Mode in Four pipe Plant

In Four-pipe system, Staging and Mode Control function are always active and decides which unit/circuit to start/stop/change mode and which operating mode is needed.
System Operating Mode will be always "Multi" (Multipurpose).

ⓘ	Operating mode decided by iCM logic takes over the aforementioned conditions on the slave units (Mode Switch and Network mode setpoint are ignored all the unit controller).

ⓘ	To force a different operating mode on Heat pump or Multipurpose units, operator needs to set them in Standalone mode and set the local condition

6.4 System controlled temperature

This variable represents the temperature at system level that iCM tries to affect with sequencing and staging of the units to achieve the system temperature setpoint. The variable is shown in menu:

- "System → Data → Sys Ctrld Temp"

The table below shows the values that "System Controlled temperature" can assume according to configuration of Common LWT sensor, type of unit (Air-cooled/Water Cooled/Multipurpose) and System Operation Mode:

Common LWT Config	Unit Type	Sys Op. Mode	Sys Ctrl Temp
NTC10K (sensor is installed)	A/C	Cool	Common Leaving WT sensor
NTC10K	A/C	Heat	Common Leaving WT sensor
NTC10K	W/C	Cool	Common Evaporator Leaving WT sensor
NTC10K	W/C	Heat	Common Condenser Leaving WT sensor
NTC10K	Multipurpose	Multi	1) Common Cool Leaving WT sensor 2) Common Heat Leaving WT sensor
NTC10K	4Pipe: AC-HP + AC-CO_HR	Multi	1) Common Cool Leaving WT sensor on AC-CO 2) Common Heat Leaving WT sensor on AC-HP
No Sensor	A/C	Cool	Average Entering WT sensors of running units
No Sensor	A/C	Heat	Average Entering WT sensors of running units
No Sensor	W/C	Cool	Average Evaporator Entering WT sensors of running units
No Sensor	W/C	Heat	Average Condenser Entering WT sensors of running units

Table 36: System controlled temperature based on system layout

6.5 System Heat Recovery (iCM option only)

6.5.1 System Heat Recovery Enable in Two Pipe Plant-room

In two pipe plant-room with more than two units equipped with Heat recovery option, Master unit controller can manage sequencing and staging of the units in order to maximize Heat Recovery at system level.

ⓘ	Master controller must be an Air Cooled Chiller with "Heat recovery with control" option

The enabling conditions on Master unit controller, generally checked to start heat recovery management on a unit, must be satisfied to enable heat recovery management on iCM logic. Those conditions are the following:

1. "Heat Recovery Switch" is turned ON on unit cabinet
2. "Network HR Enable" on Unit controller HMI (only if "Control Source" = Network, i.e. Master is commanded by third party BMS through protocol communication with object "Heat Recovery Enable Setpoint – Network")

If all the above conditions are true on Master Unit controller, in menu

- "System → Data → Sys HeatRec State" = Run

and iCM sequencing and staging logic to satisfied Heat recovery load will be performed.

If one of the above conditions is false on Master Unit Controller, Heat Recovery function is disabled on Master and all the Slave units.

6.5.2 Heat Recovery Disable on Master

If user would like to stop heat recovery on the Master unit, keeping Heat Recovery management by iCM, he should operate on the setpoint in menu

- "System → Maintenance → Mst HeatRec Enable" = No

In this way, Heat Recovery state of Master unit will become "Not Available", iCM stops Heat Recovery function on Master unit and it keeps on sequencing other units with available Heat Recovery to satisfied Heat load demand.

6.5.3 System Heat Recovery Enable in four-pipe plant

In four pipe plantrooms, composed by Air Cooled Heat pump and Air Cooled Chiller with heat Recovery, iCM logic decided which unit should Start/Stop/Change Mode or enable the Heat Recovery function.
Heat Recovery option on the Chiller units is managed by iCM to satisfy the System heat demand. The management is always active without any "Enable Setpoint" on iCM logic.

ⓘ	At least one Air Cooled chiller must have Heat Recovery option equipped and enabled by Switch or Network. Disabling the Heat Recovery Option on all the Air-cooled unit may lead to malfunctioning in iCM Logic

6.5.4 Heat Recovery Disable on Slave

If user would like to stop Heat Recovery function on Slave unit and take it out of sequence, he should set one of the enabling conditions to false, mentioned in paragraph 6.5.
When Slave unit is disabled, iCM will consider it as "Not available" and consequently, out of sequencing logic. iCM will send stop command to heat recovery function of unit and it will show in menu

- "System → Data → Units: HeatRecovery → Slv# Avail" = No (not available)

ⓘ	When Heat Recovery function is disabled on a unit, iCM keeps on taking in consideration the unit to satisfy load on cooling side.

6.6 System Free Cooling Enable (iCM option only in two pipe plant-room)

In system with more than two units equipped with Free Cooling option, Master unit controller can manage sequencing and staging of the units in order to maximize cooling capacity generated by free-cooling at system level.
The enabling conditions on Master unit controller, generally checked to start free cooling management on a unit, must be satisfied to enable free cooling management on iCM logic. Those conditions are the following:

1. "Free Cooling Switch" is turned ON on unit cabinet
2. "Netwrk HR Enable" on Unit controller HMI (only if "Control Source" = Network, i.e. Master is commanded by third party BMS through protocol communication with object "Heat Recovery Enable Setpoint – Network")
3. "Free Cooling Enable" is Yes on Master Unit HMI
4. Outside air temperature (OAT) is less than Sys Actual setpoint minus FC Approach (configurable setting)

If all the above conditions are verified on Master Unit controller, in menu

- "System → Data → Sys FreeClg Status" = Run

and iCM start to perform the sequencing and staging logic to satisfied cooling load request through free-cooling.
Moreover "Sys FreeClg Status" can assume different values as explained below:

a) *Off:Switch:* Free-cooling is stopped because one of the enabling setpoints on Master Unit controller is not satisfied
b) *Wait for OAT:* Free-cooling is stopped because even if the option is enabled, condition on OAT is not satisfied.
c) *Run:* Free-cooling is running because all the conditions are satisfied.
d) *Off:Alm:* Free-cooling is stopped because the outside air temperature sensor on Master unit controller (use by iCM at system level) is broken or it is not working properly.

6.6.1 Free-cooling Disable on Master

If user would like to stop free-cooling on the Master unit, keeping Free-cooling management by iCM, he should operate on the setpoint in menu

- "System → Maintenance → Mst FreeClg Enable" = No

In this way, Free-cooling availability of Master unit will become "No", iCM stops free-cooling function on Master unit and it keeps on sequencing other units with available Free-cooling to satisfied cooling demand.

6.6.2 Free-cooling Disable on Slave

If user would like to stop Free-cooling function on Slave unit and take it out of sequence, he should set one of the enabling conditions to false, mentioned in paragraph 6.6.
When Slave unit is disabled, iCM will consider it as "Not available" for free-cooling and, consequently, out of free-cooling sequencing logic. iCM will send stop command for free-cooling function and it will show in menu

- "System → Data → Units: FreeClg → Slv# Avail" = No (not available)

ⓘ	When Free-cooling function is disabled on a unit, unit will change its not in Full mechanical and it can keep on generating cooling capacity through circuit compressor. Beside that, iCM can stop the unit if staging conditions on unit capacity or system controlled temperature will be satisfied.

6.7 Standalone Mode

In any moment, setting a unit in “Standalone” mode allows to operate the unit independently from iCM control. User needs to set the related setpoint in menu:

- “System → Standalone” = Yes

When a unit is set in “Standalone” mode, iCM cannot manage the unit that is considered out of sequencing logic. Moreover, unit starts to work with local settings: Enable setpoint, Temperature setpoints, Operation Mode setpoint.
User can check the unit set “Standalone” on master unit controller in menu:

- “System → Data → Units: Status”

6.7.1 Setting Slave in Standalone

If a Slave unit is set “Standalone”, it cannot become Next On or Next Off unit and user has to operate locally.
Once a unit is set again under iCM control (setting “Standalone” = No), iCM starts to operate the unit in the last found status. In other words, if the unit previously in “Standalone”, was running, iCM lets the unit running and stops it only if Stage Down conditions are satisfied. Likewise, if the unit previously in “Standalone”, was stopped, iCM leaves the unit stopped and available for sequencing and staging.

6.7.2 Setting Master in Standalone

If Master unit is set “Standalone”, all the units in the system start to work in “Standalone” mode and iCM cannot manage them.
Moreover, Slaves units notify that Master is “Standalone” raising an alarm of “Master Disconnect”.
Only when Master is set back to “Not standalone”, iCM start to manage the units, keeping them in the last operating status and start the sequencing and staging logic.

6.8 iCM Expandable Operating (only in Two-pipe Plant-room)

In system with more than eight unit, iCM Expandable function allows to manage up to sixteen units.
As explained in **paragraph 1.2**, the solution consists in two subsystems composed each by one iCM master unit and related slave units; the two iCM master controllers communicate each other and collaborate to manage the whole system of units.
As mentioned in **paragraph 1.4.1**, the two Master units in iCM Expandable configuration can provide the most relevant management functions for the system, such as Unit Staging and sequencing, System Mode Changeover with Heatpump units, Heat recovery Management, Free-cooling Management.

	It is mandatory that iCM2nd is set with “Control Source = Network”.

6.8.1 iCM Expandable Enable setpoint

To start iCM Function on both subsystem and consequently the units, the conditions described in paragraph 6.1 must be achieved on 1st Master.
Once 1st Master is started, it communicates the enable to 2nd Master and the Next On unit among all the units in the system is started.

	It is mandatory that “Unit Enable Switch” and “Unit Enable” on HMI of 2nd Master are both set “Yes”, otherwise iCM Staging logic will not run.

To stop the whole system and all the unit, at least one of the conditions described in paragraph 6.1 must be false on 1st Master. Consequently, 1st Master disable 2nd Master and all the Staging logic.

	To disable one of the two master units without stopping the iCM logic, user must use the parameter: - System→ Maintenance→ MstEnable

6.8.2 iCM Expandable Mode Setpoint and System Changeover

Once the Mode setpoint is changed on 1st Master, following the condition described in paragraph 0, the system actual mode is communicated to 2nd Master that will perform the changeover on itself and all the unit connected.

ⓘ	If second subsystem is composed by Heat pump units, it is mandatory that - 2nd Master is an Heat pump - "Mode Switch" on cabinet is switched on "Heat". Otherwise mode changeover will not be performed on second system

ⓘ	To perform the System changeover (master and slaves) the following setpoint must be enabled on both Master units: - System→ Configuration→ Mode Changeover Management = Yes

6.8.3 iCM Expandable Temperature setpoint

All the temperature setpoint set on 1st Master will be set on 2nd Master:

- Cool setpoint
- Heat setpoint.
- Heat Recovery Setpoint

6.8.4 iCM Expandable Heat Recovery Function

When Heat Recovery function is active on 1st Master, following the conditions described in paragraph 6.5, the function will be enabled on 2nd Master.

ⓘ	If second system is composed by unit with Heat Recovery option, It is mandatory that - 2nd Master is equipped with heat recovery option - "Heat Recovery Enable Switch" is set Yes otherwise HR Function will not run on second sybsystem.

6.8.5 iCM Expandable Freecooling Function

When Freecooling function is active on 1st Master, following the conditions described in paragraph 6.6, the function will be enabled on 2nd Master.

ⓘ	If second system is composed by unit with freecooling option, It is mandatory that: - 2nd Master is equipped with freecooling option - "Freecooling Enable Switch" is set Yes, - Freeccoling Enbale on Unit HMI is set Yes otherwise the function will not run on second sybsystem.

6.9 System Overview

On Master unit controller HMI, Main menu shows an overview of the status of the units through icons:

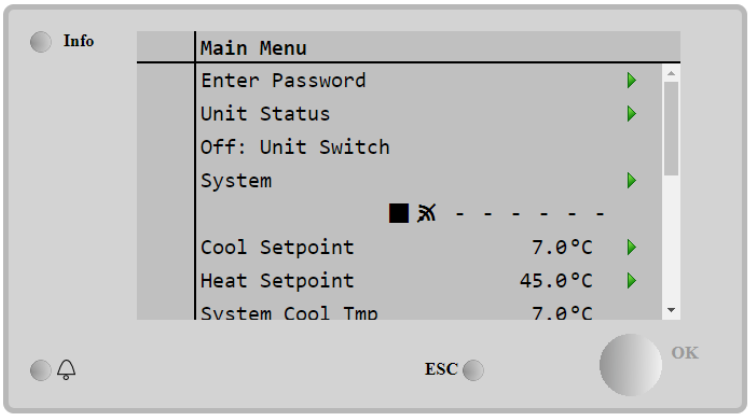


Figure 50: System Overview on Main menu of Master unit HMI

The icons represent the different status of the units:

- *Off:* the Unit is currently Off
- *Run:* the Unit is currently running
- *Alarm*: the Unit has an active alarm
- *ComErr*: the Unit is not communicating with the Master controller and requires actions to re-establish a proper communication. When a Unit is in communication error, it will run autonomously and in local mode.
- *N/Av*: the Unit is "Not Available" and stopped by iCM, i.e out of sequencing and staging control, for one of the following conditions:
  - "Unit Switch" or all the "Circuit Switch" on unit electrical panel are turned OFF.
  - Unit is set with "Operation Mode" (Cool/Heat), different from Master Operation Mode. (This is applicable only in case system composed by Heat-pump units or in mixed system with Heat-pump and Chiller units).
  - Unit is elected in "Stand-by" on Master unit controller.
- \- N/Cfg: unit does not exist.

At any moment, user can check all the information about system management and unit statuses on Master unit HMI in menu:

- "Main Menu → System → Data"

7 TROUBLESHOOTING

This chapter will try to explain the alarms and events generated by the iCM and Master/Slave and guide to resolution.
In the following sections all the alarms will be described. Alarms will disable the iCM and Master/Slave or will reduce their ability to control the system properly.

7.1 iCM Master Alarms

7.1.1 iCM Configuration Alarm

This alarm on **Master** controller can occur during configuration of System Control and it indicates that kinds of Unit (Unit Type) or kind of System Control Type (M/S or iCM Std) from Units on process network is not correct.

ⓘ	The reason of configuration alarm can be checked in menu: *System --> Configuration --> ConfigAlarm*.

Available configurations and possible configuration alarms are explained on Paragragh 1.3

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *iCMConfigAlm: Multistate* System does not start even if enabled by Master Unit Switch NOTE: reason of configuration alarm can be read in menu: *System→Configuration→ConfigAlarm*	*System→Configuration→ ConfigAlarm = Undef* Connected slaves did not send the "Unit Type".	Check if Communication Error with slaves occurred. Reboot Master controller when all the communication errors with slaves are fixed.
	System→Configuration→ ConfigAlarm = iCMTypeError System Control Type (Software Option: Master/Slave or iCM Standard) is different among connected Units.	Check if iCM Standard (software option) is not unlocked on all the connected Units. Contact Factory for Unlock Key
	System→Configuration→ ConfigAlarm = CooledError WaterCooled + AirCooled Chiller or WaterCooled + Multipurpose Unit are connected to Master	Configuration NOT supported. Contact Factory
	System→Configuration→ ConfigAlarm = ModeError Multipurpose + HeatPump Units are connected to Master	Configuration NOT supported Contact Factory
	System→Configuration→ ConfigAlarm = ModeError Unit with Master/Slave option Chiller + HeatPump or Chiller + Multipurpose Unit are connected to Master	iCM standard option must be unlocked on all the Units Contact Factory for Unlock Key.
	System→Configuration→ ConfigAlarm = ComprError Scroll + Centrifugal compressor Units are connected to Master	Configuration NOT supported Contact Factory
	System→Configuration→ ConfigAlarm = ComprError Unit with Master/Slave Option Scroll + Screw compressor Units are connected to Master	iCM standard option must be unlocked on all the Units Contact Factory for Unlock Key.
	System→Configuration→ ConfigAlarm = PltError In Four-pipe Plant layout, configuration of units is not supported	Only to two type of 4Pipe Plant supported: a) *Multipurpose + AC Heat Pump + AC Chiller*: iCM Master must be a Multipurpose b) *AC Heat Pump + AC Chiller*:

		iCM Master must be a AC Heat Pump iCM Slave 1 must be a AC Chiller with HR option
Reset	**.**	**Notes**
Local HMI Network	□ □	

7.1.2 System Lwt Sensor Fault

This alarm indicates that the sensor for the Cool/Heat water header on Evaporator side is not working properly. This alarm can occur if CommonLWT sensor is configured on all the Unit

Symptom	**Cause**	**Solution**
Bell icon is moving on controller's display. String in the alarm list: *Common EvapLWT* Forced Start of all Units, Load control disabled, All Units in Local.	Sensor is broken.	Check for sensor integrity. according table and allowed kOhm (kΩ) range.
		Check correct sensors operation
	Sensor is shorted.	Check if sensor is shorted with a resistance measurement.
	Sensor is not properly connected (open).	Check for absence of water or humidity on electrical contacts.
		Check for correct plug-in of the electrical connectors.
		Check for correct sensors wiring also according electrical scheme.
Reset		**Notes**
Local HMI Network	□ □	

7.1.3 System Heat Lwt Sensor Fault

This alarm indicates that the sensor for the hot water header on condenser side is not working properly. This alarm can occur if CommonLWT sensor is configured only on WaterCooled heat-pump and Multipurpose Units.

Symptom	**Cause**	**Solution**
Bell icon is moving on controller's display. String in the alarm list: *Common HeatLWT* Forced Start of all Units, Load control disabled, All Units in Local.	Sensor is broken.	Check for sensor integrity. according table and allowed kOhm (kΩ) range.
		Check correct sensors operation
	Sensor is shorted	Check if sensor is shorted with a resistance measurement.
	Sensor is not properly connected (open).	Check for absence of water or humidity on electrical contacts.
		Check for correct plug-in of the electrical connectors.
		Check for correct sensors wiring also according electrical scheme.
Reset		**Notes**
Local HMI Network	□ □	

7.1.4 Slave Communication Error

This alarm on the **Master** controller, indicates that the communication with one Slave is not working properly. There is the possibility that this alarm can be related to several Units in case of wrong wiring.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *Slave# CommErr.* *# identifies the Slave number* Unit Not available for sequencing and staging.	Process bus network is not properly cabled.	Check the continuity of the RS485 network with the Unit which is not communicating.
	Process bus communication is not running properly.	Check Units' addresses in the Process bus network. All the addresses must be different.
	EM noise over the process bus	Check the cabling. It's required to use shielded twisted pairs to connect the different Units with the shield properly connected to the system ground. See section related to field wiring for further details.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.1.5 Slave Missing

This alarm on the **Master** controller, indicates that some of the Slaves are not visible in the network. This can happen during the system configuration if the Master is configured first.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *Slave# Missing* *# identifies the Slave number* Unit Not available for sequencing and staging.	Wrong configuration of the system.	Check the number of configured Units and the corresponding individual Units' configurations. All the Units must be configured with a different address and the number of Units configured on the Master matches the number of Units in the system.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.2 Slave Alarms

7.2.1 Master Communication Error

This alarm on the **Slave** controller, indicates that the communication with the Master is not working properly. There is the possibility that this alarm can be related to several Units in case of wrong wiring.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *CommError* Each Unit starts working in Local according to Unit logic, Enable setpoints and Temperature setpoints.	Process bus network is not properly cabled.	Check the continuity of the RS485 network with the Unit which is not communicating.
	Process bus communication is not running properly.	Check Units' addresses in the Process bus network. All the addresses must be different.
	EM noise over the process bus	Check the cabling. It's required to use shielded twisted pairs to connect the different Units with the shield properly connected to the system ground. See section related to field wiring for further details.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.2.2 Master Missing

This alarm on the **Slave** controller, indicates that the Master is not visible in the network. This can happen during the system configuration if the Slaves are configured first.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *Master Missing* Each Unit starts working in Local according to Unit logic, Enable Setpoints and Temperature setpoints	Wrong configuration of the system.	Configure the Master address and the number of Units on the Master.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.2.3 Master Disconnect

This alarm on the **Slave** controller, indicates Unit is not managed by Master anymore.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *Master Disconnect* Each Unit starts working in Local according to Unit logic, Enable Setpoints and Temperature setpoints	1) Parameter "Disconnect" on Master Unit controller is set "Yes" 2) An Alarm of System controlled sensor has occurred.	1) Set "Disconnect" = "No" on Master. 2) Fix the alarm of LWT sensor on Master
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.3 Evaporator/Condenser Pump Manager Alarms

7.3.1 Pump Manager Communication Error

This alarm can occur only on **iCM Master** if Evaporator pump Manager or Condenser pump manager has been configured but communication is not working properly.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *EvapPM CommErr.* Or *CondPM CommErr* Staging Up of the Units is inhibited.	Process bus network is not properly cabled.	Check the continuity of the RS485 network with the Unit which is not communicating.
	Process bus communication is not running properly.	Check Units' addresses in the Process bus network. All the addresses must be different.
	EM noise over the process bus	Check the cabling. It's required to use shielded twisted pairs to connect the different Units with the shield properly connected to the system ground. See section related to field wiring for further details.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.3.2 Pump Manager Missing

This alarm on the **iCM Master** controller indicates that Pump managers are not visible in the network. This can happen during the system configuration if the Master is configured first.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *EvapPM Missing* Or *CondPM Missing* System does not start even if enabled by Master Unit Switch	Wrong configuration of the system.	Check that iPM has been configured (on iPM controller). Check that same iPM has been configured on iCM.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.3.3 Pump Manager Configuration Error

This alarm on the **iCM Master** controller when Pump Manager is configured and in communication, but configuration of pump system as not been received. This can happen during the system configuration if the Master is configured first.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *EvapPM Config Error* Or *CondPM Config Error* System does not start even if enabled by Master Unit Switch	Configuration from Pump Manager has not been received through Daikin Network and applied on iCM.	Check that no communication error is active and that iPM have sent its own configuration parameters to iCM. Then reboot iCM controller
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established, and controller is reboot.

7.3.4 Pump Manager Sensor Fault

This alarm on the **iCM Master** controller when Pump Manager communicates the alarm of connected sensor used for pump speed control.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *EvapPM Sensor Fault* Or *CondPM Sensor Fault* Staging Up of the Units is inhibited.	On iPM sensor is broken.	Check for sensor integrity. according table and allowed kOhm (kΩ) range.
		Check correct sensors operation
	On iPM sensor is shorted	Check if sensor is shorted with a resistance measurement.
	On iPM sensor is not properly connected (open).	Check for absence of water or humidity on electrical contacts.
		Check for correct plug-in of the electrical connectors.
		Check for correct sensors wiring also according electrical scheme.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when sensor issue is fixed.

7.3.5 Pump Manager Available Pump Alarm

This alarm on the **iCM Master** controller when Pump Manager communicates a cumulative alarm of the pumps.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *EvapPM NotAvail Pumps* Or *CondPM NotAvail Pumps* Staging Up of the Units is inhibited.	On iPM number of alarmed pumps exceed the number of Daikin Units.	Check pumps connected to iPM controller and solve the cause of alarm.
Reset		**Notes**
Local HMI Network Auto	□ □ □	This alarm clears automatically when pump issue is fixed.

7.4 Cooling Tower Manager Alarms

7.4.1 Cooling Tower Manager Communication Error

This alarm can occur only on **iCM Master** if Condenser Manager controller and Cooling Tower Manager is not communicating.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *iCT CommErr.*	Process bus network is not properly cabled.	Check the continuity of the RS485 network with the Unit which is not communicating.
	Process bus communication is not running properly.	Check Units' addresses in the Process bus network. All the addresses must be different.
	EM noise over the process bus	Check the cabling. It's required to use shielded twisted pairs to connect the different Units with the shield properly connected to the system ground. See section related to field wiring for further details.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.4.2 Cooling Tower Manager Missing

This alarm on the **iCM Master** controller indicates that Condenser Pump controller and Cooling Tower manager are not visible in the network.
This can happen during the system configuration if the Master is configured first.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *iCT Missing*	Wrong configuration of the system.	Check that iCT has been configured (on Condenser PM controller). Check that same iCT has been configured on iCM.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established.

7.4.3 Cooling Tower Configuration Error

This alarm on the **iCM Master** controller when Cooling Tower Manager is configured and Condenser Pump Manager is communicating, but configuration of Cooling Tower system has not been received. This can happen during the system configuration if the Master is configured first.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *iCT Config Error* System does not start even if enabled by Master Unit Switch	Configuration from Pump Manager has not been received through Daikin Network and applied on iCM.	Check that no communication error is active with Cond iPM and that Cooing Tower Manager has sent its own configuration parameters to iCM. Then reboot iCM controller
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when the communication is re-established, and controller is reboot.

7.4.4 Cooling Tower Manager Sensor Fault

This alarm on the **iCM Master** controller when Cooling Tower Manager communicates the alarm of connected sensor used for Cooling tower control.

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *iCT LWT SensorFault*	On iCT Main Board sensor is broken.	Check for sensor integrity. according table and allowed kOhm (kΩ) range.
		Check correct sensors operation
	On iCT Main Board sensor is shorted	Check if sensor is shorted with a resistance measurement.
	On iCT Main Board sensor is not properly connected (open).	Check for absence of water or humidity on electrical contacts.
		Check for correct plug-in of the electrical connectors.
		Check for correct sensors wiring also according electrical scheme.
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when sensor issue is fixed.

7.5 iCM Expanded Alarm

In system with iCm Expanded, Two iCM Amster controller are connected through BACnet/IP and collaborate to manage up to 16 units. Each iCM Master has its own "Common LWT sensor", but the "Expanded" Function forces the 2nd Master to use the Common Temperature Communicated by 1st iCM Master.

7.5.1 iCM Expanded BACnet Communication Error

Symptom	Cause	Solution
Bell icon is moving on controller's display. String in the alarm list: *iCMexp BACnetCommErr*	Ethernet Cable is not properly connected.	Check if Ethernet cable is properly connected to EKDBACIP module of both iCM Maters
		Check if Ethernet cable is properly connected to Ethernet Switch or Customer LAN network
	EKDBACIP settings are not correct	Please select specific Device ID and different Object Name for the two iCM Masters
		Please select different IP Address and same Subnet Mask and Gateway
	EKDBACIP module	
Reset		**Notes**
Local HMI Network Auto	□ □ □	The alarm clears automatically when BACnet communication work properly.

7.5.2 iCM Expanded Leaving water temperature alarm on 1st iCM Master

Symptom	Cause	Solution
Bell icon is moving on controller's display (ONLY on 1st iCM). String in the alarm list: *iCM Lwt SensAlm* Common Leaving water temperature is not working properly 1st iCM Master works reading Common LWT from 2nd iCM Master	Sensor is broken	Check for sensor integrity. according table and allowed kOhm (kΩ) range.
		Check correct sensors operation
	Sensor is shorted.	Check if sensor is shorted with a resistance measurement.
	Sensor is not properly connected (open).	Check for absence of water or humidity on electrical contacts.
		Check for correct plug-in of the electrical connectors.
		Check for correct sensors wiring also according electrical scheme.
Reset		**Notes**
Local HMI Network	□ □	

7.5.3 iCM Expanded: Leaving water temperature alarm on 2nd iCM Master

Symptom	Cause	Solution
Bell icon is moving on controller's display (ONLY on 2nd iCM). String in the alarm list: *iCM1st Lwt SensAlm* Common Leaving water temperature is not working properly on 1st iCM Master 2nd iCM Master works with its own Common LWT Sensor without reading Common LWT from 2nd iCM Master	Sensor is broken	Check for sensor integrity. according table and allowed kOhm (kΩ) range.
		Check correct sensors operation
	Sensor is shorted.	Check if sensor is shorted with a resistance measurement.
	Sensor is not properly connected (open).	Check for absence of water or humidity on electrical contacts.
		Check for correct plug-in of the electrical connectors.
		Check for correct sensors wiring also according electrical scheme.
Reset		**Notes**
Local HMI Network	□ □	

7.6 Events

In this section all the events will be described. Events are situation where some functionality cannot be started or managed by the iCM for a wrong configuration of the system.

7.6.1 Heat Recovery Configuration Error

This alarm on the Master controller, indicates that the system configuration would require the use of the iCM option, but the Master/Slave option has been configured

Symptom	Cause	Solution
No alarm bell is shown on controller display The event will be shown in the event log. String in the event log: *HeatRec Config Error* Heat Recovery managed by iCM is inhibited. NOTE: Heat Recovery can be managed by HR unit according to unit logic	Wrong configuration of the system to be managed by iCM.	Check if the selected Master controller has the heat recovery installed. If not, a different Master controller shall be chosen and this must have the heat recovery installed. Check if Master unit and Slave units have iCM Option configured

7.6.2 Free-cooling Configuration Error

This event on the Master controller, indicates that the system configuration would require the use of the iCM option, but the Master/Slave option has been configured.

Symptom	Cause	Solution
No alarm bell is shown on controller display The event will be shown in the event log. String in the event log: *FreeClg Config Error* Free cooling managed by iCM is inhibited. NOTE: Free-cooling can be managed by FC unit according to unit logic	Wrong configuration of the system to be managed by iCM.	Check if the selected Master controller has the free-cooling installed. If not, a different Master controller shall be chosen and this must have the free-cooling installed. Check if Master unit and Slave units have iCM Option configured Check that “Common LWT sensor” is configured, installed on supply header and connected to Master controller

7.6.3 Energy Monitoring Configuration Error

This event on the Master controller, indicates that the system configuration would require the use of the iCM option, but the Master/Slave option has been configured.

Symptom	Cause	Solution
No alarm bell is shown on controller display The event will be shown in the event log. String in the event log: *EnergyMon Config Error* Energy monitoring at system level is not available	Wrong configuration of the system to be managed by iCM.	Check if the selected Master controller has the heat recovery installed. If not, a different Master controller shall be chosen and this must have the heat recovery installed.

The present publication is drawn up by of information only and does not constitute an offer binding upon Daikin Applied Europe S.p.A.. Daikin Applied Europe S.p.A. has compiled the content of this publication to the best of its knowledge. No express or implied warranty is given for the completeness, accuracy, reliability or fitness for particular purpose of its content, and the products and services presented therein. Specification are subject to change without prior notice. Refer to the data communicated at the time of the order. Daikin Applied Europe S.p.A. explicitly rejects any liability for any direct or indirect damage, in the broadest sense, arising from or related to the use and/or interpretation of this publication. All content is copyrighted by Daikin Applied Europe S.p.A..

DAIKIN APPLIED EUROPE S.p.A.
Via Piani di Santa Maria, 72 - 00072 Ariccia (Roma) - Italia
Tel: (+39) 06 93 73 11 - Fax: (+39) 06 93 74 014
http://www.daikinapplied.eu