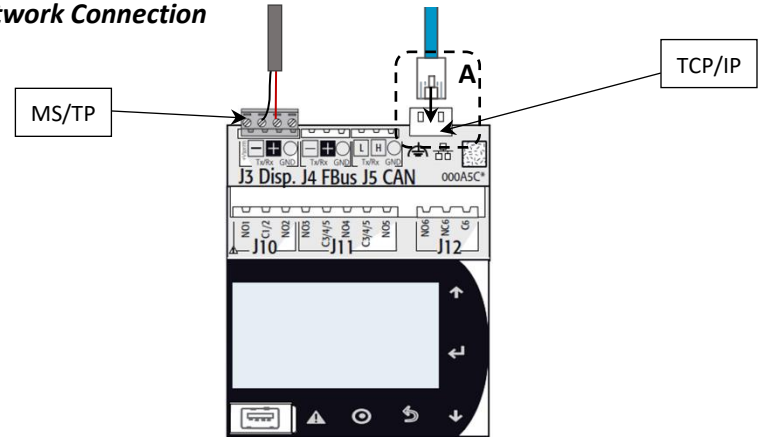
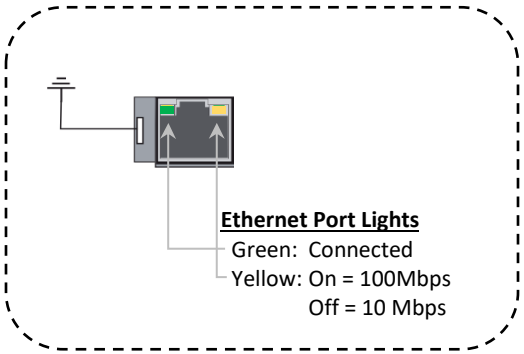
BACnet Quick Start Guide

1 – Wire Network Connection



c.pCO Mini Controller

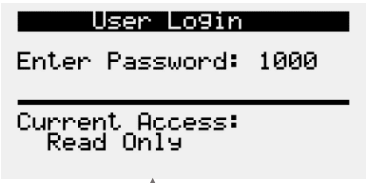
A – Ethernet Port Lights



2 – Adjust BACnet Network Settings

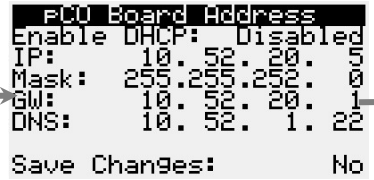
Menu Structure Reference
Main Menu
Ctrl Variables
Advanced
Login
Network Settings

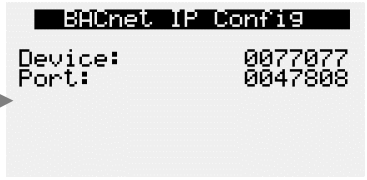
2.1 – Enter User Password



2.2 – BACnet MS/TP Settings

2.2 – BACnet IP Settings





3 – Command Unit Operation

1. Enable Unit
2. Control Occupancy
3. Reset Alarms
4. Global Alarm Notification
5. Control Temperature Setpoint (optional)

Object	Object Name	Object Description	Active Text	Inactive Text
			Variable Type	
BV-2	System_Enable	Master system enable/disable point.	Enabled	Disabled
BV-3	BMS_Occupancy_Command	Occupancy Command	Unoccupied	Occupied
BV-4	Reset_All_Alarms	Alarm Reset Command	Reset	Normal
BV-23	Global_Alarm	Alarm Notification (any alarm by default)	Alarm	Normal
AV-1	Temperature_Setpoint	Sets the active temperature set-point based on mode of operation (space setpoint, return setpoint or supply setpoint). Not applicable for outside reset.	Default = 72°F Min = 50°F; Max = 100°F	

Reference Guide for BACnet Integration

Please read and save these instructions for future reference. The information in this guide assumes the controller was already configured with BACnet based on the original sales configuration. If the controller does not have BACnet enabled, please contact the equipment representative to get the necessary licensing and configuration files to allow BACnet communication to be used.

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Basic Unit Integration

Below are the basic integration functions available on all equipment regardless of control mode. Some features are unit configuration dependent (heating type, cooling type, etc.). The controller's BMS points list is static regardless of configuration to accommodate field configuration changes, however, not all points are applicable to every unit. Once the required sensors are installed in the equipment, the only mandatory requirements to make the unit operational are to enable the unit, if it has not been enabled manually at the controller, and to command occupancy as desired.

Object	Variable	Description	Active Text	Inactive Text
Unit Enable/Disable Operation				
If desired, the unit can be enabled and disabled by the BMS system. In disabled mode, certain safety sequences may operate to protect the building and/or equipment but general heating, cooling and ventilation operation will not function.				
BV-2	System_Enable	Master system enable/disable command	Enabled	Disabled
Unit Occupancy Control				
By default, the unit occupancy is expected to be commanded by the BMS occupancy point. Alternatively, the unit occupancy can be controlled by an internal schedule, set to always unoccupied, always occupied or controlled by a digital input by changing the occupancy mode selection at the controller. If the controller is configured for warm-up/cool-down mode, after the occupancy command is received the unit will run in unoccupied recirculation mode until reaching the occupied temperature setpoint or the warm-up/cool down time expires (default 30 minutes) at which point the controller will enter normal occupied mode operation.				
BV-3	BMS_Occupancy_Command	Building Occupancy Command	Unoccupied	Occupied
Alarms				
The following points allow the notification of any alarm and the last alarm triggered to be read, as well as active alarms that to be manually reset remotely. See the unit's full BMS points list if specific alarm monitoring or trending is desired.				
BV-4	Reset_All_Alarms	Alarm Reset Command	Reset	Normal
BV-23	Global_Alarm	Global Alarm	Alarm	Normal
BV-29	Supply_Fan_1_Alarm.Active	Supply Fan Alarm Active	Alarm	Normal
BV-30	Exhaust_Fan_1_Alarm.Active	Exhaust Fan Alarm Active	Alarm	Normal
IV-5 or AV-93	LatestAlm	Most recent active alarm	See Alarm Table	
Monitoring Unit Operation				
Unit status				
AV-40	Unit_Status_Mode	Unit Operation Mode/State	See Status Mode Table	
Fans and Dampers				
BI-1	Exhaust_Fan_1_Status_Digital_Input	Exhaust Fan 1 Status	Active	Inactive
BI-2	Supply_Fan_1_Status_Digital_Input	Supply Fan 1 Status	Active	Inactive
AV-73	Exhaust_Fan_Speed_Analog_Output	Exhaust Fan Speed Analog Output	Real (%)	
AV-79	Supply_Fan_Speed_Analog_Output	Supply Fan Speed Analog Output	Real (%)	
Cooling				
IV-11 or AV-105	Cooling_is_On	Indicates that the unit is calling for cooling	See Binary Tables	
Heating				
IV-11 or AV-105	Heating_is_On	Indicates that the unit is calling for heating	See Binary Tables	
AV-51	Heating_Capacity	Heating Ramp	Real (%)	
Filters				
IV-10 or AV-102	Filter_Alarm_Digital_Input	Filter Alarm Digital Input Status	See Binary Tables	
Energy Recovery				
IV-10 or AV-102	Heat_Wheel_Enable_Digital_Output	Heat Wheel Enable Digital Output	See Binary Tables	
IV-10 or AV-102	Wheel_Rotation_Alarm	Heat Wheel Rotation Alarm		
AV-72	Energy_Recovery_Analog_Output	Energy Recovery Analog Output	Real (%)	

Object	Variable	Description	Active Text	Inactive Text
Chilled Water Systems				
AV-68	Chilled_Water_1_Valve_Analog_Output	Chilled Water 1 Valve Analog Output	Real (%)	
Hot Water Systems				
AV-74	Hot_Water_Valve_1_Analog_Output	Hot Water Valve 1 Analog Output	Real (%)	
Electric Post-Heat				
AV-70	Electric_Heater_1_Analog_Output	Electric Heater 1 Analog Output	Real (%)	
Electric Pre-Heat				
IV-10 or AV-102	PreHeat_Enable_Digital_Output	PreHeat Enable Digital Output	See Binary Tables	
Sensor Values (when equipped)				
AI-1	Space_Temp_Analog_Input	Space Air Temperature	Real (°F)	
AI-2	Supply_Temp_Analog_Input	Supply(discharge) Air Temperature	Real (°F)	
AI-3	Outside_Air_Temp_Analog_Input	Outside Air Temperature	Real (°F)	
AI-7	Return_Temp_Analog_Input	Return Air Temperature	Real (°F)	
AI-8	Exhaust_Temp_Analog_Input	Exhaust Air Temperature	Real (°F)	
AI-9	Space_RH_Analog_Input	Space Air Relative Humidity	Real (% RH)	
AI-10	Outside_RH_Analog_Input	Outside Air Relative Humidity	Real (% RH)	
AI-11	Return_RH_Analog_Input	Return Air Relative Humidity	Real (% RH)	
AI-12	Return_Duct_Static_Pressure_Analog_Input	Return Duct Static Pressure	Real (“wc)	
AI-13	Space_Static_Pressure_Analog_Input	Space Static Pressure	Real (“wc)	
AI-14	Supply_Duct_Static_Pressure_Analog_Input	Supply Duct Static Pressure	Real (“wc)	
AI-15	Space_CO2_1_Analog_Input	Space 1 CO2 ppm	Real (ppm)	
AI-17	Return_CO2_Analog_Input	Return CO2 ppm	Real (ppm)	
AV-64	Total_Exhaust_Fan_CFM_BMS	Total Exhaust Fan CFM	Real (cfm)	
AV-65	Total_Supply_Fan_CFM_BMS	Total Supply Fan CFM	Real (cfm)	
AV-66	OAD_CFM_BMS	Outdoor Air Damper CFM	Real (cfm)	
Active Setpoints				
AV-41	Supply_Temperature_Calculated_Setpoint	Active Supply Temperature Setpoint	Real (°F)	

Unpacking Bit-Packed Words into Binary Values

Binary values can be combined to create an integer and/or analog words. By doing this, more information is available to the BMS in a smaller number of points and less network traffic. These following words need to be "unpacked" once the BMS receives the value.

Integer Value	Analog Values	Variable	Description	Reference Table
IV-6	AV-94 & AV-95	Device_Enable_DO_Word	Device Enable DO Word	Bit Packed Word See Binary Tables
IV-8	AV-98 & AV-99	Device_Offline_Word	Device Offline Word	
IV-9	AV-100 & AV-101	Device_Alarm_Word	Device Alarm Word	
IV-10	AV-102 & AV-103	System_Word	System Word	
IV-11	AV-104 & AV-105	Unit_Status_Word	Unit Status Word	

To unpack the word into the binary values, the value needs to be converted to a binary number. The integer values are 32-bit and the analog value words are 16-bit. The number of bits indicates the potential max number of variables packed into a word. Each bit can either be a 0 (Inactive) or a 1 (Active). Both the integer values and analog values contain the same information. Some building automation systems may have an easier time integrating to one type versus the other.

The BMS may have a solution already intact to pull individual bits from an integer. A "read bit" function looks to return what value a certain bit is in an integer. Bit numbers are 0-31 in a 32-bit integer and 0-15 in a 16-bit analog value with 0 being the lowest bit and the furthest to the right. Bit 31 or bit 15 would be the largest bits and the furthest to the left.
Note: Bit 31 being a value of 1 (active) will result in the integer value being a negative. 16-bit analog values will always be positive.

If the BMS does not have a "read bit" or "bit extract" function, the binary value of individual bits can be determined by continually dividing the quotient of the integer by 2, the remainder of the division is the value of the bit (0 or 1). A function called Modulo or "mod" is commonly used to return the remainder of the division.

Equation: ***x*** = round down(***a/2^b^*** *mod* ***2****)*

- ***x*** is Boolean value for bit ***b****, where 0 is inactive and 1 is active.*
- ***a*** is the integer word value.
- ***b*** is the bit of the binary number used as an exponent.
- The result of ***a/2^b^*** maybe a decimal value, after taking the mod 2 (remainder of the value after diving by 2) round down the result, which will truncate the decimals leaving a 0 or a 1 for the bit.

Example:

If the Unit_Status_Word integer value (IV-11) has a decimal value of 524,754, the 32-bit integer value is 1000 0000 0001 1101 0010 in binary notation. The analog values (AV-104 & AV-105) have decimal values of 466 and 8, 16-bit words are 0001 1101 0010 and 1000 binary notation. This means the unit is in Occupied Start, Dampers Open, Exhaust Fan On, Supply Fan On, System On and Energy Recovery Active (value of 1 or active). The rest of the bits in the binary number would be a Boolean value of 0 (inactive). (Please see Binary Tables.)

Breakdown with equation for 32-bit integer example:

- Bit 1 = 524,754/2^1 *mod* 2… this results in a Boolean of *1 or Active* for bit 1.
- Bit 4 = 524,754/2^4 *mod* 2… this results in a Boolean of *1 or Active* for bit 4.
- Bit 6 = 524,754/2^6 mod 2… this results in a Boolean of 1 or Active for bit 6.
- Bit 7 = 524,754/2^7 mod 2… this results in a Boolean of 1 or Active for bit 7.
- Bit 8 = 524,754/2^8 *mod* 2… this results in a Boolean of *1 or Active* for bit 8.
- Bit 19 = 524,754/2^{19} *mod* 2… this results in a Boolean of *1 or Active* for bit 19.
- All other bits in the word result in a Boolean of *0 or Inactive*.

Table of integer and analog example

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
IV-11	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	**1**	**1**	**1**	0	**1**	0	0	**1**	0
AV-104																	0	0	0	0	0	0	0	**1**	**1**	**1**	0	**1**	0	0	**1**	0
AV-105																	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0

Modifying Equipment Operation

In addition to commanding unit occupancy, some system level sequences may require feedback from the BMS. Common BMS adjusted sequences include items like supply air temperature reset control, demand control ventilation for multiple zones, and duct static pressure reset.

HEATING AND COOLING OPERATION SETPOINTS

Adjusting Temperature Setpoints			
Controller Provided Sequences – Occupied Mode			
The controller has several stand-alone supply air temperature control modes with setpoints that can be modified by the BMS. These modes include a static supply air temperature setpoint (no-reset) or allows for the supply air temperature setpoint to be reset based on outside air temperature, space temperature, or return air temperature.			
Object	**Variable**	**Description**	**Default and Ranges**
IV-1	Temperature_Reset_Mode	Commands the reset mode during occupied operation.	1 = No Reset, 2 = Space Reset 3 = Return Reset, 4 = Outside Reset
AV-1	Temperature_Setpoint	Sets the temperature setpoint based on mode of operation (space setpoint, return setpoint or supply setpoint). Not applicable for outside reset.	Real, Default = 72°F *Min = 50°F; Max = 100°F
AV-2	Temperature_Heat_Cool_Deadband	Heat/Cool Setpt Deadband when Space or Return reset control is active. Htg Setpt = Temp Setpt - Deadband /2 Clg Setpt = Temp Setpt + Deadband /2	Real, Default = 4°F *Min = 0.5°F; Max = 20°F [Space/Return Heating = 70°F, Space/Return Cooling = 74°F]

* Typical range for standard configuration unit, please verify at point min and max properties.

Controller Provided Sequences – Unoccupied Mode			
When the unoccupied mode of operation is set to night setback temperature, normal operation with unoccupied setpoints, or recirculation with unoccupied setpoints, the following setpoints control unoccupied heating and cooling operation. If night setback is selected as the Unoccupied Mode of operation, the reset mode will not be available to change at the controller and should be set to Space Reset(2).			
Object	**Variable**	**Description**	**Default and Ranges**
IV-2	Temperature_Reset_Mode_Unoccupied	Commands the reset mode during occupied operation.	1 = No Reset, 2 = Space Reset 3 = Return Reset, 4 = Outside Reset
AV-3	Temperature_Setpoint_Unoccupied	Sets the temperature setpoint based on mode of operation (space setpoint, return setpoint or supply setpoint). Not applicable for outside reset.	Real, Default = 70°F *Min = 50°F; Max = 100°F
AV-4	Temperature_Heat_Cool_Deadband_Unoccupied	Heat/Cool Setpt Deadband when Space or Return reset control is active. Unooc Clg Setpt = Temp Setpt Unocc + (Deadband Unocc)/2 Unocc Htg Setpt = Temp Setpt Unocc + (Deadband Unocc)/2	Real, Default = 20°F *Min = 0.5°F; Max = 40°F [Space/Return Heating = 60°F, Space/Return Cooling = 80°F]
BMS Controlled Sequences			
BMS control over reset write to temp setpoint and have mode in No reset.			

* Typical range for standard configuration unit, please verify at point min and max properties.

AIRFLOW OPERATION SETPOINTS

Airflow Setpoints			
Airflow operation of supply fan, exhaust fan, and mixing dampers may use setpoints from duct pressure, space pressure, CO2 sensors, or airflow measuring stations to properly control airflow in an application. The Outside Air Damper Minimum Setpoint Occupied applies to all units with modulating outside air dampers. The setpoint is used to establish an absolute minimum position for ventilating the space while allowing other control modes to open the damper further as necessary. Outdoor and recirculating air dampers operate inversely using the same signal.			
Object	**Variable**	**Description**	**Default and Ranges**
AV-21	Return_Duct_Static_Pressure_Setpoint	Return Duct Static Pressure Setpoint	Default = -2.0”wc Min = 0.0”wc; Max = -5.0”wc
AV-22	Space_Static_Pressure_Setpoint	Space Static Pressure Setpoint	Default = 0.05”wc Min = -0.5”wc; Max = 0.5”wc
AV-23	Supply_Duct_Static_Pressure_Setpoint	Supply Duct Static Pressure Setpoint	Default = 1.0”wc Min = 0.0”wc; Max = 5.0”wc
AV-24	Space_CO2_Setpoint	Space CO2 Setpoint	Default = 1,000 ppm Min = 0 ppm; Max = 5,000 ppm

BMS Enabled Control

BMS WATCHDOG

When directly commanding fans speeds, damper positions, or sending sensor values, the unit controller requires the BMS Watchdog point to be written to on a recurring basis. This tells the unit controller that the BMS is still actively communicating.

BMS Watchdog				
The BMS Watchdog must be written to True (1) regularly to verify communication is established between the unit controller and the BMS headend system. If the BMS Watchdog value remains False(0) for longer than the Timeout Delay (15 minutes, adjustable), an alarm is generated and the controller falls back to local control and sensor values, as applicable, instead of using BMS commanded values.				
Object	**Variable**	**Description**	**Active Text**	**Inactive Text**
BV-1	BMS_Watchdog	BMS Watchdog command	Active	Inactive
BV-24	BMS_Watchdog_Active	Status of the BMS watchdog ping.	Active	Inactive

CONTROLLING AIRFLOW DEVICES

If desired, the speeds and positions of airflow devices can be controlled directly using BACnet commandable points. To control the devices via the BMS, the BMS Watchdog requirements must be satisfied.

Fan Controls				
Fan speeds can be controlled directly though BMS points. The binary points enable the BMS to take control and the analog values command the speeds as a percentage between the allowed minimum and maximum values set in the controller.				
Supply Fan				
Object	**Variable**	**Description**	**Active Text**	**Inactive Text**
BV-17	SF_Control_Source_BMS	Allows the BMS to control supply fan speed	BMS	Local
AV-36	SF_Control_Signal_BMS	Supply Fan Command Speed	Real (%) *Min=50%; Max=100%	
Exhaust Fan				
BV-18	EF_Control_Source_BMS	Allows the BMS to control exhaust fan speed	BMS	Local
AV-37	EF_Control_Signal_BMS	Exhaust Fan Command Speed	Real (%) Min=25%; Max=100%	

SENDING SENSOR VALUES

Sensor values required for sequence operation can be sent to the controller over dedicated BMS points in place of a sensor wired to the controller (local sensor). When values are communicated to the controller over BMS, the BMS Watchdog must be satisfied. If the watchdog is not satisfied, the controller reverts to the local sensor (if installed and valid) to control the unit or falls back to local control until the BMS watchdog is satisfied.

Object	**Variable**	**Description**	**Active Text**	**Inactive Text**
BMS Writeable Sensor Values				
To write the sensor values over BMS, first command the controller to use the BMS value using the corresponding binary value and then use the corresponding analog value to send the sensor value.				
Sensor Sources				
BV-7	Outside_RH_Source_BMS	Outside RH Source Selection	BMS	Local
BV-8	Outside_Temp_Source_BMS	Outside Temp Source Selection	BMS	Local
BV-9	Return_RH_Source_BMS	Return RH Source Selection	BMS	Local
BV-10	Return_Temp_Source_BMS	Return Temp Source Selection	BMS	Local
BV-11	Space_1_CO2_Source_BMS	Space 1 CO2 Source Selection	BMS	Local
BV-12	Space_2_CO2_Source_BMS	Space 2 CO2 Source Selection	BMS	Local
BV-13	Return_CO2_Source_BMS	Return CO2 Source Selection	BMS	Local
BV-14	Space_RH_Source_BMS	Space RH Source Selection	BMS	Local
BV-15	Space_Static_Source_BMS	Space Static Source Selection	BMS	Local
BV-16	Space_Temp_Source_BMS	Space Temp Source Selection	BMS	Local
Sensor Values				
AV-26	Outside_RH_from_BMS	Outside RH from BMS.	Real (% RH)	
AV-27	Outside_Temp_from_BMS	Outside Temp from BMS	Real (°F)	
AV-28	Return_RH_from_BMS	Return RH from BMS	Real (% RH)	
AV-29	Return_Temp_from_BMS	Return Temp from BMS	Real (°F)	
AV-30	Space_1_CO2_from_BMS	Space 1 CO2 from BMS	Real (ppm)	
AV-31	Space_2_CO2_from_BMS	Space 2 CO2 from BMS	Real (ppm)	
AV-32	Return_CO2_from_BMS	Return CO2 from BMS	Real (ppm)	
AV-33	Space_RH_from_BMS	Space RH from BMS	Real (% RH)	
AV-34	Space_Static_from_BMS	Space Static from BMS	Real (“wc)	
AV-35	Space_Temp_from_BMS	Space Temp from BMS	Real (°F)	

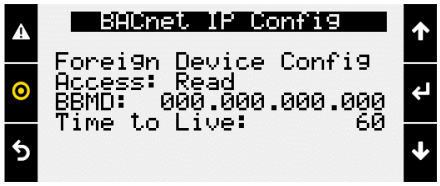
Advanced BACnet Settings

Menu Structure Reference

Main Menu
Control Variables
Advanced
Network Settings
Advanced Settings

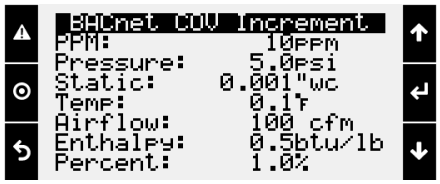
Additional settings can be accessed in the BACnet Advanced Settings menu including BACnet Broadcast Management Device (BBMD) configuration, relinquish default settings, Change of Value (COV) increments and restoring binary text values.

BBMD CONFIGURATION



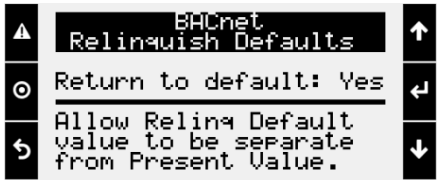
To configure the controller to operate with a BACnet Broadcast Management Device (BBMD) on IP networks, go to the advanced BACnet settings menu and enter the IP address of the BBMD, foreign device configuration, and time to live settings.

COV INCREMENTS

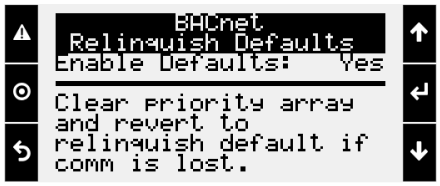


BACnet COV is an optional portion of BACnet that supports providing new values/information only after an increase or decrease of the value is at least the listed COV increment. The controller's COV increments are based on the unit of measure. All variables with the same unit of measure share the same COV increment value. Values can be adjusted on this screen, or by writing to the COV increment property of any BACnet object.

RELINQUISH DEFAULT SETTINGS



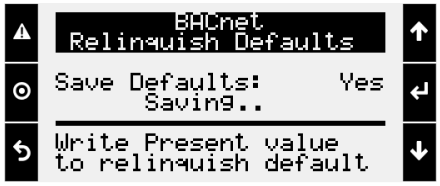
When the Return to Default function is enabled, the present value will not overwrite the relinquish default value and on a loss of power the controller will boot with last saved default values instead of last written values. This must also be enabled for the BACnet Comm Loss relinquish default to work.



When the Enable Relinquish Default function is enabled any value in the priority array for binary values or analog values will be cleared if a communication loss is detected. All commandable points will revert to the relinquish default value.

Communication loss is determined based on the BMS Watchdog. The watchdog function must be enabled. The function will execute 5 minutes after the watchdog status goes inactive.

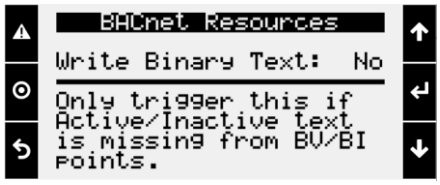
This may be desired if the BMS is running a reset routine on the setpoints and would like to revert to a default state if communication is lost. It is recommended to be used with return to default enabled, and a known relinquish default is saved.



When this box is checked by a user, the controller will write the present value of variables to the relinquish default for all binary and analog value BACnet objects that are commandable. The function operates in the background and takes approximately 30 seconds to complete.

This is desired to save any Test and Balance settings adjusted locally on the controller to be the BACnet relinquish default values. Alternatively, these values could be read and written to the relinquish default variables by the BMS system.

BINARY TEXT



If for any reason, the state text is missing from binary objects, checking this box will cause the controller to re-write the active and inactive text values.

STATUS MODE TABLE

The following analog values can appear in the point to tell the building automation the current mode of operation of the unit. Values may rotate every three seconds.

Status Mode Table (AV-40)					
Analog Value	Mode	Analog Value	Mode	Analog Value	Mode
0	Standby	13	Remote Off (S1 Open)	25	HGRH Purging
1	Unoccupied Start	14	System Shutdown Alarm	26	Energy Recovery Defrost Active
2	Occupied Start	15	Pressurization Only	27	Not Applicable
3	Opening Dampers	16	Exhaust Only	28	Not Applicable
5	Dampers Open	17	Fans Only Purge	29	Not Applicable
6	Fan Start Delay	18	Not Applicable	30	Overrides
7	Exhaust Fan Start	19	Fans Only	31	Expansion Offline
8	Supply Fan Start	20	Economizing	33	Energy Recovery Active
9	Startup Delay	21	Cooling	34	Not Applicable
10	System On	22	Heating	35	Morning Sequence Active
11	Soft Shutdown	23	Not Applicable	36	Not Applicable
12	System Disabled	24	Exhaust Econ Active	37	Winter Ramp Active

ALARM TABLE

This table displays the latest alarm that is active in the unit controller.

LatestAlm (Alarm) Table (BACnet IV-5/AV-93)			
0	Supply Fan 1 Run - Status Not Proven	65	Secondary Unit Offline - Unit 1
1	Freeze Protection - Thermostat Tripped	66	Secondary Unit Offline - Unit 2
2	High Supply Duct - Static Pressure	67	Secondary Unit Offline - Unit 3
3	Low Return Duct - Static Pressure	68	Secondary Unit Offline - Unit 4
4	Outside Air Temp - Sensor Value Not Valid	69	Primary Unit Offline -
5	Supply Air Temperature - Sensor Value Not Valid	71	Multi Devices per Ch - Contact Tech Support
9	Exhaust Air Temp - Sensor Value Not Valid	74	Shutdown Contact - In Alarm Position
10	Mixed Air Temperature - Sensor Value Not Valid	75	Comp Maint Alarm - Run Hours Spt Reached
11	Return Air Temperature - Sensor Value Not Valid	76	Supply Air Temperature - High Limit Shutdown
12	Space Temperature - Sensor Value Not Valid	77	Space High Static Pres - Shutdown
13	Return Air RH - Sensor Value Not Valid	78	Internal Board Temp - Exceeds -40F or 158F
14	Space RH - Sensor Value Not Valid	79	BMS Offline - Watchdog is FALSE
15	Outside RH - Sensor Value Not Valid	81	Sup Air Setpt Input - Value is not valid
24	Damper End Switch Fail - Dampers are not open	82	BACnet License - Not Installed
25	Exhaust Fan 1 Run - Status Not Proven	133	Space Thermostat 1 - Sensor Offline
26	Filters are Dirty - Replace Filters	134	Space Thermostat 2 - Sensor Offline
27	Cond Drain Pan Full - Check Drain	135	Space Thermostat 3 - Sensor Offline
28	Exp Board 1 Status - Board is Offline	136	Space Thermostat 4 - Sensor Offline
29	Exp Board 2 Status - Board is Offline	157	Outside Air Greentrol - Offline or Flow Error
30	Exp Board 3 Status - Board is Offline	158	Exhaust Air Greentrol - Offline or Flow Error
31	Exp Board 4 Status - Board is Offline	159	Supply Air Greentrol - Offline or Flow Error
32	BMS Frequent Writes - Reduce Num of Writes	169	ER Wheel High - Differential Pressure
33	Space 1 CO2 - Sensor Value Not Valid	170	OA Damper Fault - Not Econ and should be
34	Space Static Pressure - Sensor Value Not Valid	171	OA Damper Fault - Econ and shouldn't be
35	Supply Duct Stat Press - Sensor Value Not Valid	172	OAD Fault - Damper not Modulating
36	Return Duct Stat Press - Sensor Value Not Valid	173	OAD Fault - Excess Outdoor Air
39	Outside Damper AFMS - Sensor Value Not Valid	176	Supply Fan - VFD Offline
40	Space Setpt Adj Slider - Sensor Value Not Valid	177	Exhasut Fan - VFD Offline
41	Space 2 CO2 - Sensor Value Not Valid	181	SF VFD Alarm - Check VFD
42	Return CO2 - Sensor Value Not Valid	182	EF VFD Alarm - Check VFD
63	Supply Air Temperature - Low Limit Shutdown	188	Fire Shutdown Alarm - Building Fire Alarm
64	Heat Wheel Rotation - Not Detected	189	EA Damper End Switch - Damper is not open

BIT-PACKED WORD TABLES

The following tables are used to unpack integer and real words into Boolean values. (0 = Inactive; 1 = Active)

Device_Enable_DO_Word Table (IV-6/AV-94 & AV-95)									
IV	IV Bit	AV	AV Bit	Bit Description	IV	IV Bit	AV	AV Bit	Bit Description
6	0	94	0	Compressor 1 Start	6	16	95	0	Not Applicable
	1		1	Compressor 2 Start		17		1	Not Applicable
	2		2	Not Applicable		18		2	
	3		3	Not Applicable		19		3	
	4		4			20		4	Supply Fan Start
	5		5			21		5	Exhaust Fan Start
	6		6			22		6	
	7		7			23		7	
	8		8	Not Applicable		24		8	
	9		9	Not Applicable		25		9	
	10		10	Not Applicable		26		10	
	11		11			27		11	
	12		12	Not Applicable		28		12	
	13		13	Not Applicable		29		13	
	14		14	Not Applicable		30		14	
	15		15			31		15	

Device_Offline_Word Table (IV-8/AV-98 & AV-99)									
IV	IV Bit	AV	AV Bit	Bit Description	IV	IV Bit	AV	AV Bit	Bit Description
8	0	98	0	Space TStat 1 Offline	8	16	99	0	
	1		1	Space TStat 2 Offline		17		1	
	2		2	Space TStat 3 Offline		18		2	
	3		3	Space TStat 4 Offline		19		3	
	4		4	VFD Offline Supply Fan		20		4	
	5		5	VFD Offline Exhaust Fan		21		5	
	6		6			22		6	
	7		7			23		7	
	8		8	Expansion Board 1 Alarm		24		8	
	9		9	Expansion Board 2 Alarm		25		9	
	10		10	Expansion Board 3 Alarm		26		10	
	11		11	Expansion Board 4 Alarm		27		11	Primary Unit Offline Alarm
	12		12			28		12	Secondary Unit 1 Offline Alarm
	13		13			29		13	Secondary Unit 2 Offline Alarm
	14		14			30		14	Secondary Unit 3 Offline Alarm
	15		15			31		15	Secondary Unit 4 Offline Alarm

Device_Alarm_Word Table (IV-9/AV-100 & AV-101)									
IV	IV Bit	AV	AV Bit	Bit Description	IV	IV Bit	AV	AV Bit	Bit Description
9	0	100	0	Not Applicable	9	16	101	0	Space CO2 Sensor Alarm
	1		1			17		1	Space RH Sensor Alarm
	2		2	Mixed Temperature Sensor Alarm		18		2	Space Static Pressure Sensor Alarm
	3		3	Supply Duct Static Pressure Sensor Alarm		19		3	Space Temperature Sensor Alarm
	4		4	Not Applicable		20		4	Not Applicable
	5		5	Supply Air Temp Sensor Alarm		21		5	
	6		6	Not Applicable		22		6	Not Applicable
	7		7	Exhaust Temperature Sensor Alarm		23		7	
	8		8	Outside Air Temp Sensor Alarm		24		8	Not Applicable
	9		9	Outside RH Sensor Alarm		25		9	
	10		10	Not Applicable		26		10	SF VFD Alarm
	11		11	Greentrol OAD AFMS Alarm		27		11	EF VFD Alarm
	12		12	Return CO2 Sensor Alarm		28		12	
	13		13	Return Duct Static Pressure Sensor Alarm		29		13	
	14		14	Return Temperature Sensor Alarm		30		14	Greentrol Exhaust AFMS Alarm
	15		15	Return RH Sensor Alarm		31		15	Greentrol Supply AFMS Alarm

System_Word (IV-10/AV-102 & AV-103)									
IV	IV Bit	AV	AV Bit	Bit Description	IV	IV Bit	AV	AV Bit	Bit Description
10	0	102	0	Heat Wheel Enable	10	16	103	0	Shutdown Input Alarm
	1		1	Preheat Enable		17		1	Energy Recovery Wheel High Diff Pressure
	2		2	Reversing Valve (Cooling (0)/Heating(1))		18		2	Energy Recovery Wheel Rotation Alarm
	3		3			19		3	
	4		4	OA Damper End Switch Alarm		20		4	Not Applicable
	5		5	EA Damper End Switch Alarm		21		5	BMS Frequent Writes - Reduce Num of Writes
	6		6	Supply Temp Low Limit Alarm		22		6	BMS Offline Alarm
	7		7	Supply Temp High Limit Alarm		23		7	
	8		8	Supply High Duct Static Alarm		24		8	
	9		9	Supply Fan 1 Alarm		25		9	
	10		10	Exhaust Fan 1 Alarm		26		10	
	11		11	Drain Pan Alarm		27		11	
	12		12	Freeze Stat Alarm		28		12	
	13		13	Filter Alarm		29		13	
	14		14	Space High Static Alarm		30		14	
	15		15	Return Low Static Alarm		31		15	

Unit_Status_Word Table (IV-11/AV-104 & AV-105)									
IV	IV Bit	AV	AV Bit	Bit Description	IV	IV Bit	AV	AV Bit	Bit Description
11	0	104	0	Standby	11	16	105	0	Not Applicable
	1		1	Occupied Start		17		1	Fans Only
	2		2	Unoccupied Start		18		2	Economizing
	3		3	Opening Dampers		19		3	Energy Recovery Active
	4		4	Dampers Open		20		4	Cooling
	5		5	Fan Start Delay		21		5	Heating
	6		6	Exhaust Fan On		22		6	Not Applicable
	7		7	Supply Fan On		23		7	Not Applicable
	8		8	System On		24		8	Not Applicable
	9		9	Soft Shutdown		25		9	Not Applicable
	10		10	System Disabled		26		10	Energy Recovery Defrost Active
	11		11	Remote Off		27		11	Not Applicable
	12		12	System Shutdown Alarm		28		12	Morning Warm Up/Cool Down Active
	13		13	Supply Fan Only		29		13	Winter Ramp Active
	14		14	Exhaust Fan Only		30		14	
	15		15	Purge Mode (Supply and Exhaust Only)		31		15	Overrides Active