

## BMGE Series

### BACnet-over-Ethernet (BACnet TCP/IP) Gateways for Modbus RTU Devices

#### General

The BMGE Series BACnet-over-Ethernet (BACnet TCP/IP) gateways, which route communication traffic between BACnet network and Modbus RTU network, map registers in the Modbus RTU slave devices into standard BACnet objects, which are then accessible on a BACnet network via an Ethernet port.

The gateways, pre-loaded with a Modbus program, become masters to the connected Modbus slave devices and communicate using the Modbus RTU protocol on a RS-485 network.

Each gateway is available with two RS-485 networks. Each network can support up to 32 Mega Controls NT10/NT50 Series, NTAF Series, NSM Series and NC24A and NC24T Modbus RTU devices. The gateway spontaneously detects the presence of

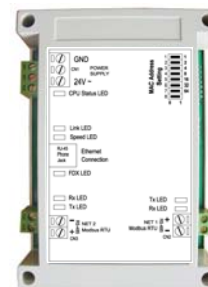
slaves that go online in its NET 1 and NET 2 networks. However, these devices must not be mixed and must be of the same series or type in both network trunks. NT10 Series and NT50 Series are treated as the same type of devices and can be mixed in the same network trunks.

#### Mounting

It is strongly recommended to mount the gateway inside a metal cabinet for EMI shielding protection, with 2 or 4 screws or rack-mounted in a DIN rail.

#### Ordering

To order, specify the complete gateway model number.



#### Specifications

Gateway model number	BMGE-1	Universal BACnet-over-Ethernet gateway for Mega Controls NT10/NT50 Series, NTAF Series, NSM Series, NC24A or NC24T
Power requirements	Voltage	22-28 V 50/60 Hz or 16-30 VDC
	Current	Maximum 200 mA
Technology	CPU	32-bit ARM at 48M clock
	ROM	256 kB Flash
	RAM	64 kB SRAM
	EEPROM	2 kB
Ethernet communication port	Physical	10Base-T via RJ-45 phone jack
	Protocol	BACnet-over-Ethernet in compliance with ISO-8802-3
	Indicators	Red LED for data receiving and green LED for data transmitting
	Device MAC address	Set via DIP switches
	Maximum number	32 BMGE devices in one BACnet platform
	Service supported	Whols, ReadProperty, ReadPropertyMultiple, WriteProperty
	Objects supported	Device, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Multi-State Input, Multi-State Output
NET 1 and NET 2 communication port	Object names	Static
	Physical	RS-485 with opto-coupler Isolation
	Baud rate	Fixed at 19,200 bps
	Protocol	Modbus RTU
	Indicators	Red LED for data receiving and green LED for data transmitting
	Device address	Always 1 for NET 1 and 2 for NET 2
Ambient/storage temperature limits	Maximum number	32 slaves in one Modbus RTU network
	0 to 55 °C / -30 to 50 °C, 10 to 90% RH Non-condensing	
	Wiring class	Class II for 24 VAC Power Supply
	Connectors	Removable screw-type terminal connectors
Power wires	Wire size	Wire size 1 mm <sup>2</sup> or 18 AWG solid copper recommended
	Ethernet communication wires	Cat 5e cable (twisted pairs)
NET 1 and NET 2 communication wires	Balanced 100 to 120 Ω nominal Impedance twisted shielded pair (TSP) cable	
Shipping weight	0.25 kg (1 lb)	
Dimensions	110 x 155 x 60 mm (W x L x D)	

*The performance specifications above are nominal and subject to tolerances and application variables of generally acceptable industry standards. The manufacturer shall not be liable for damages resulting from misapplication or misuse of its products.*

## Language and Gateway Instance ID Setup Procedure

### System Setting Objects

There are 2 objects for system setup defined as:

Object Name	Object	Value	Unit	Object Type	Read/Write	Priority Array
*** SYS SELECT	10123.AV1	*1	None	Analog Variable	R/W	None
*** SYS VALUE	10123.AV2	*1	None	Analog Variable	R	None

**Note:** \*1 System setting can be changed by writing value to \*\*\* SYS SELECT.

Write property value to ***SYS SELECT	Function Description
2012	<b>Change all descriptions to CHINESE.</b> New setting will take effect after entering a restart command 3003 followed by reloading descriptors at the BMGE Manager.
2014	<b>Change all descriptions to ENGLISH.</b> New setting will take effect after entering a restart command 3003 followed by reloading descriptors at the BMGE Manager.
3003	Restart
2004	<b>To set device instance ID.</b> This is a two-step operation: after writing 2004 to ***SYS SELECT, wait until *** SYS VALUE changes to -1, then write an integer 'n' (where $0 \leq n \leq 12799$ ) to ***SYS SELECT. Assuming the DIP switches' MAC address is set as 'm', the device instance ID is ' $n \times 100 + m$ '. New setting will take effect after entering a restart command 3003 followed by a discovering new devices at the BACnet workstation.
Notes:	After all new entries have taken into effect, the new data will be saved to the EEPROM. Power restart will resume all data saved before power failure.

### Auto Detect of Supported Slave Devices Connected to Network Ports

When BMGE is powered up first time and initialized, it will automatically detect the model numbers of slave devices connected to NET 1 and NET 2 ports, wait for response from these slave devices and implement communication based on the model numbers discovered. The slave device model numbers supported by the BMGE are those covered by the NT10/NT50 Series, NTAF Series, NSM Series, NC24 A and NC24T.

**Notes:** Both the NET 1 and NET 2 ports must be connected to the slave devices of the same series or type. Each network trunk supports 32 slave devices, totaling 64 slave devices in one BMGE. NT10 Series and NT50 Series are treated as the same type of devices and can be mixed in the same network trunks.

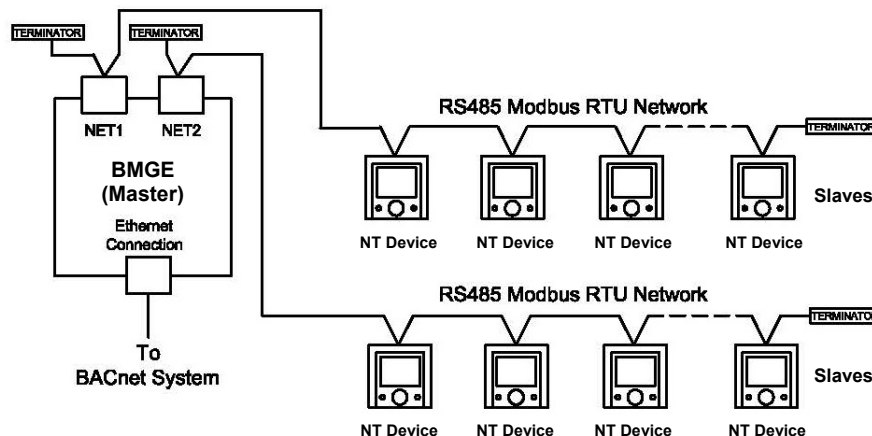
### Gateway MAC Addressing

The DIP switch is a binary switch. Each individual DIP switch represents a unique value, which forms the gateway MAC address when added together. To set the address, simply move the switches that add up to the gateway's desired address to the ON position.

**Example:** If the gateway is to be address 7 on the network, set the switches numbered 1, 2 and 4 (equals 7) to the ON position.

**Note:** Each gateway on the same BACnet network must have a unique DIP switch address.

Figure 1: Network Configuration

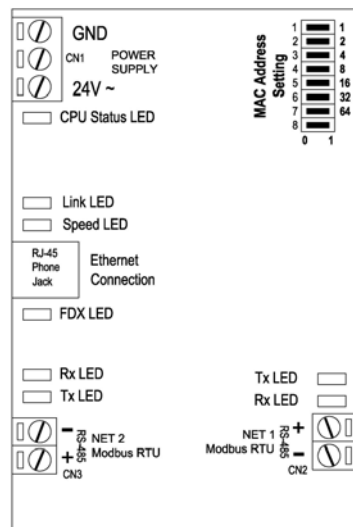


## Network, Cabling and Step-down Transformer Requirements

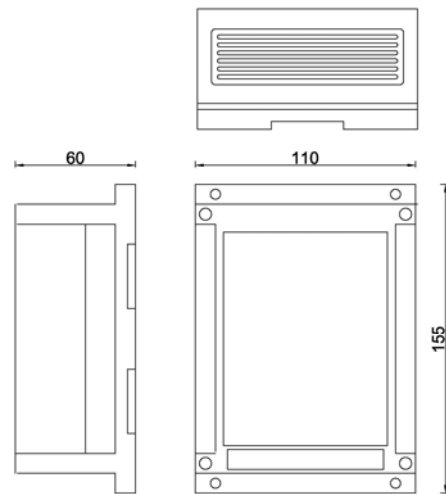
To ensure network stability and reliable communications, it is imperative that the following network, cabling and step-down transformer requirements are adhered to:

Item	Description
Network Trunk Cabling	It is recommended to use networking cabling that matches the following specifications: <ul style="list-style-type: none"> <li>Balanced 100 to 120 ohms nominal impedance, 22 or 24 AWG Twisted Shielded Pair (TSP) Cable</li> <li>Nominal capacitance of 52 pF/m or lower</li> <li>Nominal velocity of propagation of 66% or higher</li> <li>Terminating the shield to ground at one end only for each isolated segment will prevent ground loops in the shield and drain RF energy to ground. Grounding at the BACnet router or controller is preferred.</li> </ul>
10Base-T Cabling	Cat 5e cable with twisted pairs are recommended.
Topology	Ensure the Modbus RTU network cable is installed as a daisy chain from one device to the next.
Maximum Nodes	The maximum number of devices is 32 per Modbus RTU network and 64 per gateway.
Terminator	A terminator of 120-ohm impedance must be installed at each end of each Modbus RTU network. Ensure that this requirement is not overlooked in laying out the network architecture and when ordering product.
Cable Shielding	Use a shielded, twisted pair cable for communications. Never directly ground wire in more than one point on the shield. Doing so can induce large currents and result in communication problem.
Repeater	A repeater is not necessary unless the Modbus RTU network is extended beyond 1,000 m.
Step-down Transformer	A separate isolated double-wound transformer is recommended for supplying 24 VAC power to each gateway. If and when the same transformer is shared with other devices, observe the polarities of the power supply of all devices including the gateway.

### Termination Diagram



### Dimensions in mm



### IP Address Setting

Open internet browser and enter the IP address of 192.168.10.32 in the address field. Confirm after the following data are displayed:

BMGE Ethernet Device

Chip: DM9051 (DAVICOM)

MAC Address: xx: xx: xx: xx: xx: xx

IP: 192.168.10.32

Gateway: 192.168.10.1

Mask: 255: 255: 255: 0

- Notes:**
1. BACnet operator workstation's IP address and BMGE's IP address must be in the same network segment or otherwise the BMGE will not be discovered by the browser.
  2. When multiple BMGEs are connected to the same network and in service, the default IP address of each individual BMGE must be re-assigned online one by one and its new address must be unique in the network or otherwise there will be communication conflict.

The monitoring status and control commands of the Modbus RTU devices can be displayed and operated via an internet browser by means of its intranet read/write properties. For example, the input/output status of a NT50-1 Modbus RTU networking thermostat will be displayed as:

BMGE Ethernet Device		
Chip:	DM9091 (DAVICOM)	
MAC Address:	00::60:6e:90:51:00	
IP:	<input type="text" value="0.0.0.0"/>	192.168.10.6
Gateway:	<input type="text" value="0.0.0.0"/>	192.168.10.1
MASK:	<input type="text" value="0.0.0.0"/>	255.255.255.0
Slave Address:	<input type="text" value=""/>	01
Temperature Setpoint:	<input type="text" value=""/>	22.0
Operation Mode:	<input type="radio"/> Run <input checked="" type="radio"/> Stop	
Control Mode:	<input type="text" value=""/>	Cool
Fan Speed Command:	<input type="text" value=""/>	Auto
Ambient Temperature:	<input type="text" value=""/>	24.0
Valve 1 Output Status:	<input type="text" value=""/>	100
Valve 2 Output Status:	<input type="text" value=""/>	00.0
Temperature Eng. Unit:	°C	
Unoccupied Mode:	Off	
Binary Input:	Open	
Thermostat Keys:	<input type="radio"/> Locked <input checked="" type="radio"/> Unlocked	
Cooling Totalizator:	<input type="text" value=""/>	21.3
Heating Totalizator:	<input type="text" value=""/>	00.0
<input type="button" value="Submit"/>		

- Notes:**
1. Enter the desired value to the text box of a corresponding object to perform the "write" operation. Press "Submit" to confirm new entry.
  2. The value shown behind a text box is the object's current value, "read" only property.
  3. Object of multiple selection type such as Run/Stop has read/write properties. Click Run or Stop to effect the desired action. Press "Submit" to confirm.
  4. Object without the text box, such as ambient temperature, has the property of "read" only and its value cannot be changed.
  5. The slave device's address can be set at the "Slave Address" object from 1 to 64, with 1 to 32 at Net 1 and 33 to 64 at Net 2. Press "Submit" to confirm new entry.

### Dynamic Created Objects

The gateway spontaneously detects the presence of a NT10, NT50, NTAF, NSM, NC24A or NC24T slave that goes online in its NET 1 or NET 2 network and automatically creates a number of pre-defined objects associated with this slave's MAC address. When this slave goes offline, its objects will be automatically deleted.

**Notes:**

1. When the device is connected to NET 1 port, its #xx range is 01 to 32. Example: MAC address = 01 and y = 1, object name and object will be displayed as #01NT.1-Temperature Setpoint and 10123.AO11 respectively.
2. When the device is connected to NET 2 port, its #xx range is 33 to 64. Example: MAC address = 01 and y = 2, object name and object will be displayed as #33NT.2-Temperature Setpoint and 10123.AO331 respectively.

### For NT10 and NT50 Series Modbus RTU networking Room Thermostats

If the device's address is xx and its network port is y, where xx is 01 to 64 and y is either 1 or 2, its associated objects are:

Object Name	Object	Value	Unit	Type	Read/Write	Priority Array
#xxNT.y - Temperature Setpoint	10123.AOxx1	(5-35) / (41-95)	None	Analog Output	R/W	16
#xxNT.y - Operating Mode	10123.BOxx1	Stop/Run	None	Binary Output	R/W	16
#xxNT.y - Control Mode	10123.MOxx1	Heat/Cool/ Fan Only/Auto	None	Multi-State Output	R/W	16
#xxNT.y - Fan Speed Command	10123.MOxx2	High/Medium/ Low/Auto	None	Multi-State Output	R/W	16
#xxNT.y - Ambient Temperature	10123.AIxx1	(5-35) / (41-95)	None	Analog Input	R	None
#xxNT.y - Valve 1 Output Status	10123.AIxx2	(0-100)	%	Analog Input	R	None
#xxNT.y - Valve 2 Output Status	10123.AIxx3	(0-100)	%	Analog Input	R	None
#xxNT.y - Temperature Eng. Unit	10123.BIxx1	°C/°F	None	Binary Input	R	None
#xxNT.y - Unoccupied Mode	10123.BIxx2	Off/On	None	Binary Input	R	None
#xxNT.y - Binary Input	10123.BIxx3	Open/Closed	None	Binary Input	R	None
#xxNT.y - Window Mode <sup>a</sup>	10123.MIxx1	Off/On/None	None	Multi-State Input	R	None
#xxNT.y - Fan Totalizator	10123.AVxx1	0-999999	hr	Analog variable	R/W	None
#xxNT.y- Cooling Totalizator	10123.AVxx2	0-999999	hr	Analog variable	R/W	None
#xxNT.y - Heating Totalizator	10123.AVxx3	0-999999	hr	Analog variable	R/W	None
*** SYSTEM SELECT	10123.AV1	*1	None	Analog variable	R/W	None
*** SYSTEM SELECT	10123.AV2	*1	None	Analog variable	R	None
BMGE_MANAGER_10123	10123.DEV10123	Operational	None	Device	R	None

<sup>a</sup> This object is not applicable to and omitted in NT50 Series. Its value is displayed as Off/On in NT10 Series.

### For NTA Series Modbus RTU Networking Room Thermostats

If the device's address is xx and its network port is y, where xx is 01 to 64 and y is either 1 or 2, its associated objects are:

Object Name	Object	Value	Unit	Type	Read/Write	Priority Array
#xxNT.y - Temperature Setpoint	10123.AOxx1	(5-35) / (41-95)	None	Analog Output	R/W	16
#xxNT.y - Operating Mode	10123.BOxx1	Stop/Run	None	Binary Output	R/W	16
#xxNT.y - Control Mode	10123.MOxx1	Heat/Cool/ Fan Only/Auto	None	Multi-State Output	R/W	16
#xxNT.y - Fan Speed Command	10123.MOxx2	H1/2/3/4/5/6/7/ Auto	None	Multi-State Output	R/W	16
#xxNT.y - Ambient Temperature	10123.AIxx1	(5-35) / (41-95)	None	Analog Input	R	None
#xxNT.y - Valve 1 Output Status	10123.AIxx2	(0-100)	%	Analog Input	R	None
#xxNT.y - Valve 2 Output Status	10123.AIxx3	(0-100)	%	Analog Input	R	None
#xxNT.y - Temperature Eng. Unit	10123.BIxx1	°C/°F	None	Binary Input	R	None
#xxNT.y - Unoccupied Mode	10123.BIxx2	Off/On	None	Binary Input	R	None
#xxNT.y - Binary Input	10123.BIxx3	Open/Closed	None	Binary Input	R	None
#xxNT.y - Window Mode	10123.MIxx1	Off/On/None	None	Multi-State Input	R	None
#xxNT.y - Fan Totalizator	10123.AVxx1	0-999999	hr	Analog variable	R/W	None
#xxNT.y- Cooling Totalizator	10123.AVxx2	0-999999	hr	Analog variable	R/W	None
#xxNT.y - Heating Totalizator	10123.AVxx3	0-999999	hr	Analog variable	R/W	None
*** SYSTEM SELECT	10123.AV1	*1	None	Analog variable	R/W	None
*** SYSTEM SELECT	10123.AV2	*1	None	Analog variable	R	None
BMGE_MANAGER_10123	10123.DEV10123	Operational	None	Device	R	None

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### For NC24A Modbus RTU Networking Controllers

If the device's address is xx and its network port is y, where xx is 01 to 64 and y is either 1 or 2, its associated objects are:

Object Name	Object	Value	Unit	Type	Read/Write	Priority Array
#xxNC.y - Controller Setpoint	10123.AOxx1	-99 to 999	None	Analog Output	R/W	16
#xxNC.y - X1 Analog Input Value	10123.AIxx1	-99 to 999	None	Analog Input	R	None
#xxNC.y - X2 Analog Input Value	10123.AIxx2	-99 to 999	None	Analog Input	R	None
#xxNC.y - ECO Mode Status	10123.BIxx1	Off/On	None	Binary Input	R	None
#xxNC.y - Day/Night Mode Status	10123.BIxx2	Day/Night	None	Binary Input	R	None
#xxNC.y - Engineering Unit	10123.MIxx1	°C/°F/%/None	None	Multi-State Input	R	None
#xxNC.y - Application Number	10123.AVxx1	1 to 9	None	Analog Variable	R	None
#xxNC.y - Setpoint Differential	10123.AVxx2	(1 to 20)/(1 to 99)	None	Analog Variable	R	None
#xxNC.y - Control Bandwidth	10123.AVxx3	-99 to 99	None	Analog Variable	R	None
#xxNC.y - Y1 Output Status	10123.AVxx4	0 to 100	%	Analog Variable	R	None
#xxNC.y - Y2 Output Status	10123.AVxx5	0 to 100	%	Analog Variable	R	None
#xxNC.y - Q1 Output Status	10123.AVxx6	0 to 100	%	Analog Variable	R	None
#xxNC.y - Proportional Band	10123.AVxx7	(1 to 20)/(1 to 99)	K	Analog Variable	R	None
#xxNC.y - Integral Time	10123.AVxx8	0 to 30	min	Analog Variable	R	None
*** SYSTEM SELECT	10123.AV1	*1	None	Analog Variable	R/W	None
*** SYSTEM SELECT	10123.AV2	*1	None	Analog Variable	R	None
BMGE_MANAGER_10123	10123.DEV10123	Operational		Device	R	None

### For NC24T Modbus RTU Networking Controllers

If the device's address is xx and its network port is y, where xx is 01 to 64 and y is either 1 or 2, its associated objects are:

Object Name	Object	Value	Unit	Type	Read/Write	Priority Array
#xxNC.y - Controller Setpoint	10123.AOxx1	-99 to 999	None	Analog Output	R/W	16
#xxNC.y - X1 Analog Input Value	10123.AIxx1	-99 to 999	None	Analog Input	R	None
#xxNC.y - X2 Analog Input Value	10123.AIxx2	-99 to 999	None	Analog Input	R	None
#xxNC.y - ECO Mode Status	10123.BIxx1	Off/On	None	Binary Input	R	None
#xxNC.y - Day/Night Mode Status	10123.BIxx2	Day/Night	None	Binary Input	R	None
#xxNC.y - Engineering Unit	10123.MIxx1	°C/°F/%/None	None	Multi-State Input	R	None
#xxNC.y - Application Number	10123.AVxx1	1 to 12	None	Analog Variable	R	None
#xxNC.y - Setpoint Differential	10123.AVxx2	(1 to 20)/(1 to 99)	None	Analog Variable	R	None
#xxNC.y - Control Bandwidth	10123.AVxx3	-99 to 99	None	Analog Variable	R	None
#xxNC.y - Main Output Status	10123.AVxx4	0 to 100	%	Analog Variable	R	None
#xxNC.y - Secondary Output Status	10123.AVxx5	0 to 100	%	Analog Variable	R	None
#xxNC.y - Valve Stroke Time	10123.AVxx6	10 to 240	sec	Analog Variable	R	None
#xxNC.y - Proportional Band	10123.AVxx7	(1 to 20)/(1 to 99)	K	Analog Variable	R	None
#xxNC.y - Integral Time	10123.AVxx8	0 to 30	min	Analog Variable	R	None
*** SYSTEM SELECT	10123.AV1	*1	None	Analog Variable	R/W	None
*** SYSTEM SELECT	10123.AV2	*1	None	Analog Variable	R	None
BMGE_MANAGER_10123	10123.DEV10123	Operational		Device	R	None

### For NSM Series Modbus RTU Networking Setpoint Modules

If the device's address is xx and its network port is y, where xx is 01 to 64 and y is either 1 or 2, its associated objects are:

Object Name	Object	Value	Unit	Type	Read/Write	Priority Array
#xxNS.y - Module Setpoint	10123.AOxx1	-99 to 999	None	Analog Output	R/W	16
#xxNS.y - Operating Mode	10123.BOxx1	Stop/Run	None	Binary Output	R/W	16
#xxNS.y - Analog Input Type	10123.AIxx1	0 or 1^	None	Analog Input	R	None
#xxNS.y - Analog Input Value	10123.AIxx2	-99 to 999	None	Analog Input	R	None
#xxNS.y - Set Display Lower	10123.AVxx1	-99 to 999	None	Analog Variable	R/W	None
#xxNS.y - Set Display Upper	10123.AVxx2	-99 to 999	None	Analog Variable	R/W	None
#xxNS.y - Remote Set Lower	10123.AVxx3	-99 to 999	None	Analog Variable	R/W	None
#xxNS.y - Remote Set Upper	10123.AVxx4	-99 to 999	%	Analog Variable	R/W	None
*** SYSTEM SELECT	10123.AV1	*1	None	Analog Variable	R/W	None
*** SYSTEM SELECT	10123.AV2	*1	None	Analog Variable	R	None
BMGE_MANAGER_10123	10123.DEV10123	Operational		Device	R	None

**Notes:** ^ 0 denotes 0-10 VDC input and 1 denotes temperature sensor input.