MegaControls

BMG Series
BACnet MS/TP Gateways for Mega Controls Modbus RTU Networking Devices

General

The BMG Series is a BACnet network gateway which routes communication traffic between BACnet MS/TP network and Modbus RTU network.

While the gateway (master) communicates on a RS-485 network at its NET1 communication port using the BACnet MS/TP protocol, it can support up to 32 Mega Controls NT10, NT50, NTAF, NSM, NC24A or NC24T RS-485 networking devices (slaves) on a RS-485 network at its NET2 communication port using Modbus RTU protocol. The gateway spontaneously detects the presence of slaves that go online in its NET 1 network. However, these devices must not be mixed and must be of the same series or type in NET2 network trunk. NT10 Series and NT50 Series are treated as the same type of devices and can be mixed in the same network trunk.

The gateway has 2 addresses. NET 2 address is always 0 which is the address of the Modbus RTU network. NET 1 address is the MAC address of the BACnet MS/TP network which is set up for a maximum of 32 devices. The NET 1 address is set via DIP switches in the device.

If more than 32 masters are needed in the system, an additional network supervising device is required for the second BACnet MS/TP network.

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 with specific communication protocol to suit applicable networking devices.

Specifications

Gateway model numbers	BMG-1	Universal BACnet MS/TP 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
NET 1 communication port	Physical	RS-485 with opto-coupler Isolation
	Baud rate	Field selectable 9600, 19200, 38400 or 76,800 bps set via DIP switches (factory set 38,400 bps)
	Protocol	BACnet MS/TP
	Indicators	Red LED for data receiving and green LED for data transmitting
	Device MAC address	Set via DIP switches
	Maximum number	32 BMGs in one BACnet MS/TP network
	Service supported	WhoIs, ReadProperty, ReadPropertyMultiple, WriteProperty
	Objects supported	Device, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Multi-State Input, Multi-State Output
	Object names	Static
NET 2 communication port	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 0
	Maximum number	32 slaves in one Modbus RTU network
Ambient/storage temperature limits	0 to 55 $^{\circ}$C / -30 to 50 $^{\circ}$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 1 mm^2 or 18 AWG solid copper recommended	
Communication wires	Balanced 100 to 120 Ω nominal Impedance twisted shielded pair (TSP) cable	
Shipping weight	0.25 kg (1 lb)	
Dimensions	90 x 116 x 40 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, Gateway Instance ID and Communication Protocol 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	yyyyyy.AV1 (*2)	*1	None	Analog Variable	R/W	None
*** SYS VALUE	yyyyyy.AV2 (*2)	*1	None	Analog Variable	R	None

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

Write property value to ***SYS SELECT	Function Description
2012	**Change all descriptions to CHINESE.** New setting will take effect after entering a restart command 3003 followed by reloading descriptors at the BMG Manager.
2014	**Change all descriptions to ENGLISH.** New setting will take effect after entering a restart command 3003 followed by reloading descriptors at the BMG Manager.
3003	Restart
2004	**To set device instance ID.** 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≤n≤12799) to ***SYS SELECT. Assuming the DIP switches' MAC address is set as 'm', the device instance ID is 'n*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.

Derived Network Addressing (DNA)
The DNA DIP switch is set by factory default to ON position. This allows the gateway to automatically configure a BACnet instance ID number. This setting should not be changed unless an authorized agent is assigning a BACnet instance ID number through the system setup procedure. The BACnet instance ID number should not be confused with the gateway MAC address DIP switch setting, and each gateway must still have a unique DIP switch MAC address even when using software to define the gateway's instance ID number.
Example: If the MAC address of the upstream network router or controller is 8 and the gateway MAC address is set as 13, the gateway's DNA BACnet Instance ID is 80013 (8 x 10000 + 13).

 Notes:
 *1 When DNA function is turned on (DIP switch set as 1), 2004 function is disabled. When DNA function is turned off (DIP switch set as 0), 2004 function is enabled. Disconnect power supply before changing DNA switch position.
 *2 yyyyyy is the the BACnet instance ID number which can be either the DNA or a number assigned manually through the system setup procedure.

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 MS/TP network segment must have a unique DIP switch address.

Gateway Baud Rate Setting
Make sure that the baud rate of the gateway is set to match the network baud rate.
Example: If the network baud rate is 38,400 bps, set the DIP switches X2 and X4 to OFF and ON respectively.

### Network, Cabling and Step-down Transformer Requirements
To ensure network stability and reliable communications, particularly at high speeds on a BACnet MS/TP network for a number of devices, it is imperative that the following network and cabling requirements are adhered to:

| Item	Description
Cabling	It is recommended to use networking cabling that matches the following specifications: • Balanced 100 to 120 ohms nominal impedance, 22 or 24 AWG Twisted Shielded Pair (TSP) Cable • Nominal capacitance of 52 pF/m or lower • Nominal velocity of propagation of 66% or higher • 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.
Topology	Ensure both the BACnet MS/TP network cable and Modbus RTU network cable are installed as a daisy chain from one device to the next.
Maximum Nodes	The maximum number of devices is 32 per BACnet MS/TP or Modbus RTU network.
Terminator	A terminator of 120-ohm impedance must be installed at each end of each BACnet MS/TP or 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 more than 32 nodes is extended beyond 1,000 m.
Step-down Transformer	A separate isolated double-wound transformer is recommended for supplying 24 VAC power to each BMG. If and when the same transformer is shared with other devices, observe the polarities of the power supply of all devices including the BMG.

Network Configuration
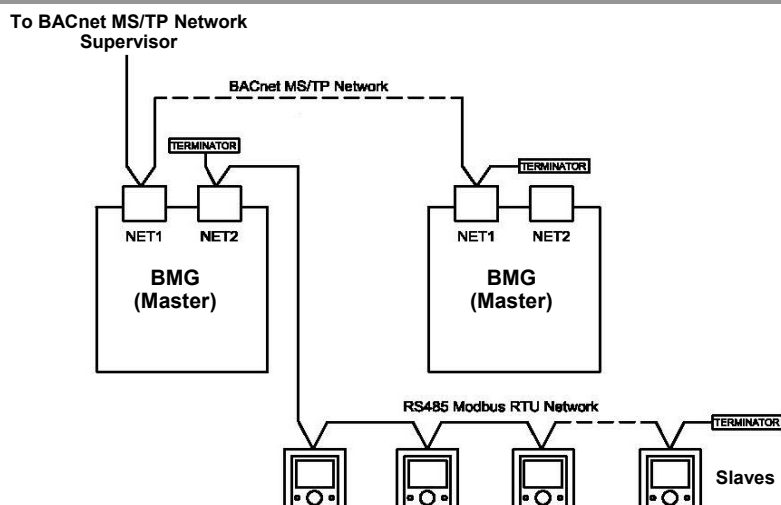
Termination Diagram
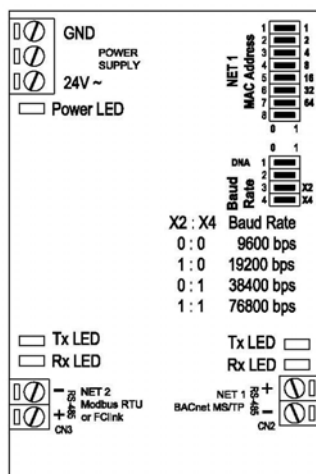
Dimensions in mm
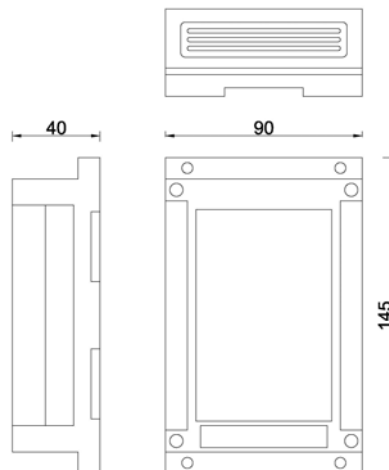
Dynamic Created Objects

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

For NT10 and NT50 Modbus RTU Networking Room Thermostats

If the NT10's or NT50's MAC address is xx, its associated objects are:

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

[a] The value of this object is displayed as Off/On for NT10 Series or None for NT50 Series thermostats.

For NTAF Modbus RTU Networking Room Thermostats

If the NT10's or NT50's MAC address is xx, its associated objects are:

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

For NSM Modbus RTU Networking Setpoint Modules

If the NSM's MAC address is xx, its associated objects are:

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

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

For NC24A Modbus RTU Networking Controllers

If the NC24A's MAC address is xx, its associated objects are:

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

For NC24T Modbus RTU Networking Controllers

If the NC24T's MAC address is xx, its associated objects are:

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