

## BMGE Series

## BACnet-over-Ethernet (BACnet TCP/IP) Gateways for NT10 Series, NT50 Series, NTAF Series, NSM Series, NC24A and NC24T 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

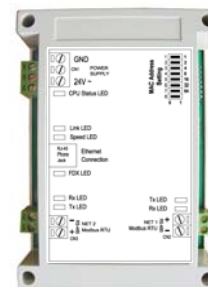
slaves that go online in its NET 1 and NET 2 networks. However, these devices must not be mixed and must be of the same series or type in both network trunks. NT10 Series and NT50 Series are treated as the same type of devices and can be mixed in the same network trunks.

**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, 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><br>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.

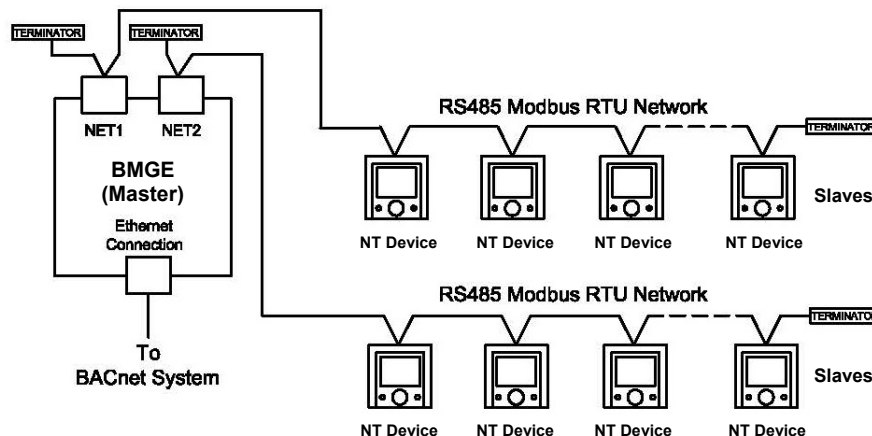
### Gateway MAC Addressing

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

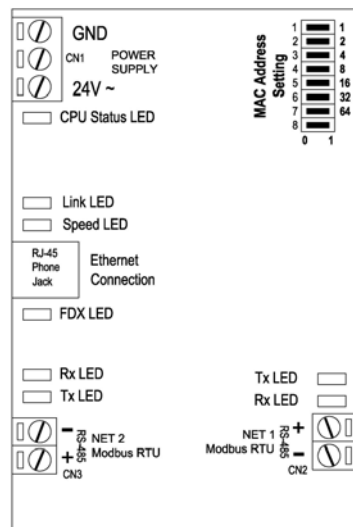


## Network, Cabling and Step-down Transformer Requirements

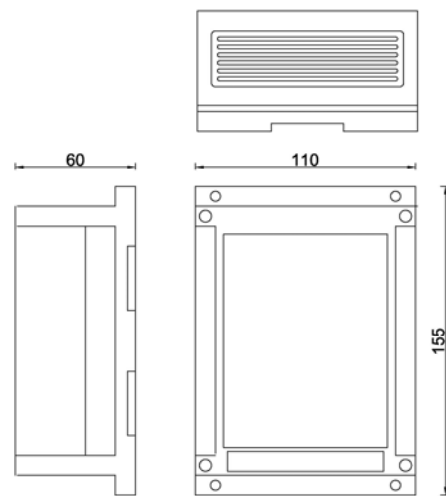
To ensure network stability and reliable communications, it is imperative that the following network, cabling and step-down transformer requirements are adhered to:

| 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=""/>  | High          |
| 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, 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 networking Room Thermostat with Modbus RTU Communication Protocol

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/<br>Fan Only/Auto | None | Multi-State Output | R/W        | 16             |
| #xxNT.y - Fan Speed Command        | 10123.MOxx2    | High/Medium/<br>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 Totalizer            | 10123.AVxx1    | 0-999999                    | hr   | Analog variable    | R/W        | None           |
| #xxNT.y - Cooling Totalizer        | 10123.AVxx2    | 0-999999                    | hr   | Analog variable    | R/W        | None           |
| #xxNT.y - Heating Totalizer        | 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 NC24A Networking Controller with Modbus RTU Communication Protocol

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 Networking Controller with Modbus RTU Communication Protocol

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 Setpoint Module with Modbus RTU Communication Protocol

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.

### Mega Controls Limited

Room 1521A, Star House

3 Salisbury Road, Tsimshatsui, Kowloon, Hong Kong

Phone: +852 6281 1320 Fax: +852 3741 7084 E-mail: sales@megacontrols.com Website: www.megacontrols.com