HPE-BNMR10 – Modbus RTU Gateway to BACnet MS/TP

FW4.01 140121

The HPE-BNMR10 is a fixed capacity gateway for integration of one (1) Modbus RTU slave in to a BACnet MS/TP network. The HPE-BNMR10 acts as network Master for read/write access of up to 10 data-points of the connected device.

All points may be individually scaled and multiple points representing Modbus registers which use multiple Words may be combined so that only one Object Instance representing the scaled multiple Word register value needs to be read up by the BMS.

When used with an electricity meter, the points may be further scaled by way of dedicated BACnet objects for application of metering PT and CT ratios. Each metering related data register may then be set to have the PT and/or the CT ratio applied if required.

Typical Applications

BACnet MS/TP network integration of any Modbus RTU 485 device. For example:

- Electricity meters
- Chillers
- HVAC controls
- PLC's

Feature Summary

- 10 Modbus registers of Long Integer or IEEE Floating Point type, or 20 Integer type, from one Modbus slave
- Coils, Discretes, Holding Registers, Input Registers
- Integers, Long Integers, Signed Integers, IEEE Floating Point
- Scaling of integers
- Combining and scaling of sequential registers allowing one only BACnet object to represent the Modbus derived original value
- Meter PT & CT ratio setting for adaption of secondary values in to primary readings
- IEEE Floating point Word order swap
- BACnet application services; Single-Read, Multiple-Read, Single-Write, Who Is, I Am, Who Has, I Have
- BACnet priority array

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Operation Overview

The gateway comprises two sections; the BACnet MS/TP device and the Modbus network reading data base.

BACnet Device

The gateway is BTL listed, conforming to the BACnet standard's requirements for device & object discovery and network communication initiations and responses.

During commissioning the following should be configured:

- Node # (local network unique number)
- Device Instance (system-wide unique number)
- MS/TP network baud rate
- Maximum Master (MM), set to the highest node number existing on the network, for limiting network traffic to only those devices that exist on the network
- Up to 10 AV objects relating to the Modbus device's data points being read, AV4…AV13
- 4 AV objects for setting of metering CT & PT rations (if required), AV14…AV17

Modbus Network Gateway

10 device data points may be configured. Each data point constitutes a BACnet object (AV).

It is important to have the Modbus device manufacturer's manual available to assist with point address settings although the gateway's Diagnostic and Find functions mean the available data points can be identified without the manufacturer's manual if need be.

For each required data point the gateway data base point configuration consists of:

1. Modbus device address
2. Register address of the point required to be read
3. Scaling Type selection for manipulation of the read raw data before passing to the BACnet side
4. Point Type selection for proper interpretation of the received raw data before further manipulation

BACnet Priority Array

The BACnet protocol utilises a Priority Array for each object to enable various network devices to take control of a device's object based on the level of need. The priorities are in the range 1 (high priority) to 16 (Auto operation).

In respect of this device:

- The point database objects are NULL priority, signified by '17' when viewing the points in engineering Terminal mode
- Manually overriding a point value via terminal mode invokes priority level 9
- Release of a manual results in an object reverting to NULL priority level
- For normal reading of the network, points should always be at NULL priority
- When the BMS commands (writes) a Modbus register the write will be at priority 9 and after confirmation of successful write the gateway point will revert to Null priority

Terminal Mode

An HPECOMU (USB) data cable is used for terminal mode between the gateway and a PC running a terminal program. HyperTerminal or Indigo Terminal Emulator from Shade Blue are recommended.

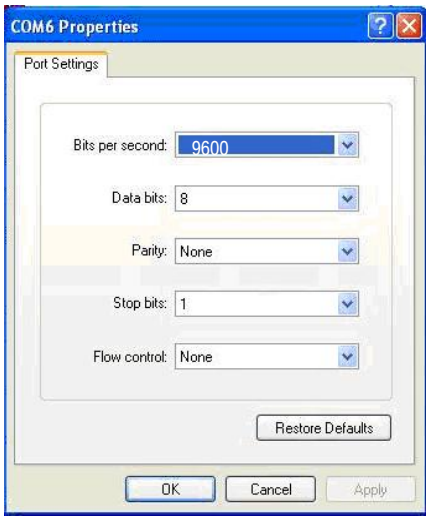
The USB driver for the HPECOMU may be found on our web site.

The following settings reflect HyperTerminal. Please contact us if you require assistance setting up Indigo.

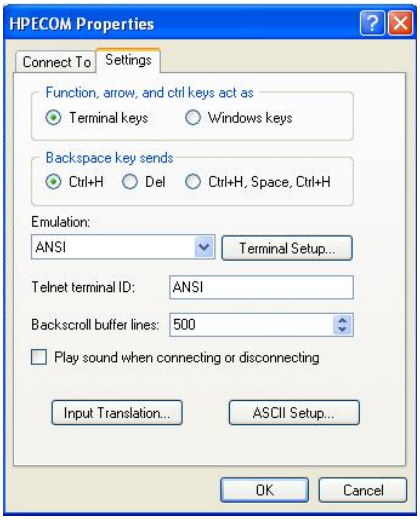
HyperTerminal Settings

For successful communication between HyperTerminal and the device, initial Properties setup of HyperTerminal should be as per the screen prints below.

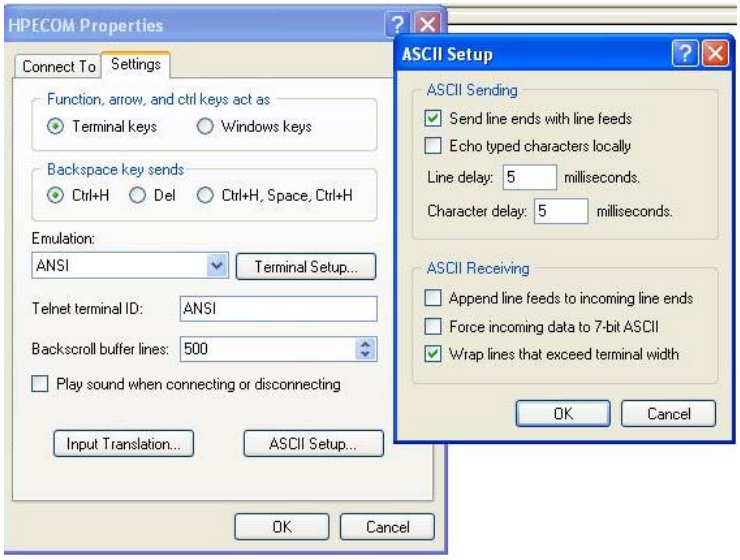
'Connect to' Comm Configuration:



'Settings' General:



'Settings' ASCII Setup:



Additional Settings

Some PC platforms may need keyboard response adjustment for initial Terminal Mode success. These settings may be done via the PC Control Panel >> Keyboard Settings:

- Fastest Repeat rate
- Shortest Delay time
- Fastest Cursor Blink rate

Connecting at 76800 Baud Rate

Because HyperTerminal does not support 76800 baud then after setting to 76800 the device baud rate will remain at 9600 baud for HyperTerminal communication and switch to 76800 after Writing the new baud rate and eXiting terminal mode.

To allow later terminal communication a device set with 76800 baud will operate at 9600 baud for the first 5 seconds after a power-up. If no attempt to connect the terminal at 9600 baud is made within 5 seconds of a power-up then the device will automatically switch to 76800 for normal network operation.

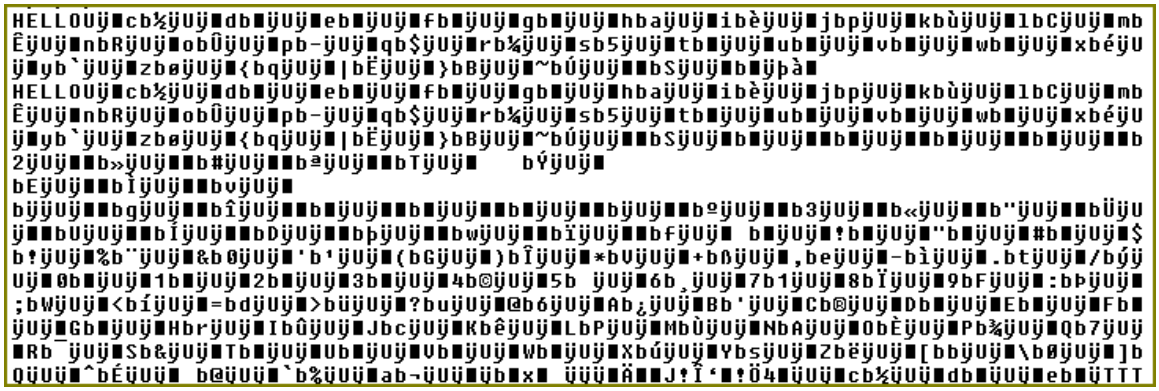
Saving HyperTerminal Settings

For ease of connection it is recommended to save the HyperTerminal setup for each baud rate you may wish to use with an easily recognised configuration name. For example:

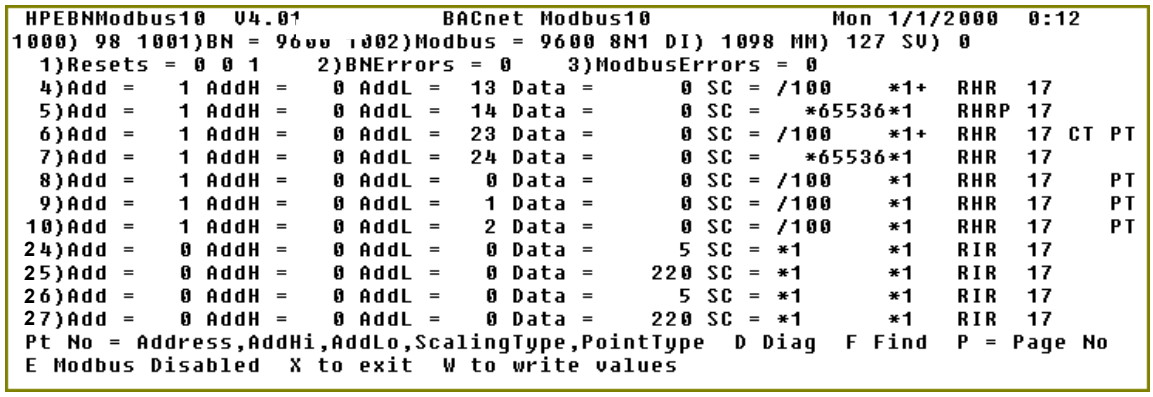
- HPECOM 48 (4800)
- HPECOM 96 (9600)
- HPECOM 19.2 (19200)
- HPECOM 38.4 (38400)
- HPECOM 57.6 (57600)

Break in to Terminal Mode

When HyperTerminal is running and the HPECOM cable is connected to the device the initial terminal screen will be receiving an ASCII character dump which is the BACnet transmission from the device. The ASCII dump will appear differently with different device address setting and if HyperTerminal baud rate is different to the baud rate set in the device. Below is an illustration of how the ASCII dump will look for a device at default settings; address 98 and 9600 baud.



To break in to terminal mode set Caps Lock on and hold the **'T'** character key continuously (TTTTTTT…). After five (5) T's have been sent to the device it will switch to terminal mode. At this point the BACnet activity on the network will be halted and the device will display the default user screen, an example of which follows:



Factory Default Settings

The default point configuration is an example only, based on use of the **PMAC903-C-1-5** three-phase, CT connected, DIN rail mount, electricity meter. These point configurations, for points 4…10 (4…23 are available), may be changed to suit any other Modbus RTU device.

The default CT & PT points, 24…27 result in a 1:1 ratio (no impact) and these may be changed to apply typical metering CT & PT ratios. The CT & PT ratio result may then be applied to any of the reading points, 4…23. In the default example the points are as follows:

Point/AV	Description	Comments
4 (5)	kWh	kWh
6 (7)	kW	CT & PT ratio applied
8	Voltage Ph1	PT ratio applied
9	Voltage Ph2	PT ratio applied
10	Voltage Ph3	PT ratio applied
24	CT Primary	1…65535
25	PT Primary	1…65535
26	CT Secondary	1…65535
27	PT Secondary	1…65535

PMAC903 Series Electricity Meter

BACnet Configration Commands

Once in terminal mode the following list of command lines may be used for setting up the BACnet

Function	Enter	Result	Options / *Comments*
Start communication	TTTTT(TTT…)	Break in to Terminal mode	*With the Caps Lock on, hold the T key down until the screen updates with HPE data. It is not necessary to press the enter key to start communication.*
Set node address (MAC)	1000=1…98, 100…127 (master) 1000=128…247 (slave)	Network node number is assigned	*Example: 98=25* *1…127 the device will be a 'token passing master'. Address 99 may not be used* *128… 247 the device will become a network slave* ***after power reset***
Set system Device Instance	DI=0…4194303	Unique Device Instance is assigned	*Example: DI=401025 (building 4, network 1, node 25)*
Set BACnet baud rate	1001=…	Network comms speed is set	2400, 4800, **9600**, 19200, 38400, 57600, 76800 *Example: 1001=38400* ***After changing comm. speed it will be necessary to reconnect with HyperTerminal at the new comm. speed to save (write) the change!***
Set Maximum Master address	MM=1…127	Highest Master device address on the network is registered	*Next address searching limited to MM address*
Set Sys. Vendor ID (**S**ys**V**id)	SV=0…255	System vendor specific features may be available	*SV=0 applies generic BACnet operation. If an entered ID is not implemented then the generic operation will be applied*
Zero the Reset counters	1=0	All Reset counters are zeroed	*Factory diag. In order as displayed:* *Rx timeout, Tx timeout, Hardware reset*
Zero the BACnet comms error counter	2=0	BACnet comms error counter is reset	*Example: 2=0*
Zero the SMA comms error counter	3=0	SMA comms error counter is reset	*Example: 3=0*
Write values as default	W	Changes written.	***Always do this after making changes that you wish to be permanent***
Exit communication	X	Communication with HyperTerminal no longer active	*Auto X after 240sec without key entry.* ***After eXit unplug the HPECOM cable to allow network communication to take place***

Modbus Configuration Commands

Function	Enter	Result	Options / *Comments*
Start communication	TTTTT(TTT…)	Break in to Terminal mode	*With the Caps Lock on, hold the T key down until the screen updates with HPE data. It is not necessary to press the enter key to start communication.*
Set Modbus baud rate	1002=…	Network comms speed is set	1200, 2400, 4800, **9600**, 19200 *Example: 1002=19200*
Set Modbus subnet comms configuration	1002=…	Subnet comms data configuration is set	7N1, 7N2, **8N1**, 8N2 *Example: 1002=8N1* 7O1, 7O2, 8O1, 8O2 7E1, 7E2, 8E1, 8E2
Diagnostic display	D	Point by point response codes are displayed	*For data stream analysis between the HPE and the SMA devices. Also displays scaled data results within the point listings*
Prepare for point data base text file download	DE	'Ready' will be displayed at which time the relevant text file should located and sent to the gateway	*Data base lines may also be manually entered, one by one*
Delete current point data base	DE followed by 10000=1	Any configuration of AV4…AV253 is deleted	*Download of a text file with new data base will delete an old existing data base as a matter of course*
Find Modbus point detail	F	Point data structure is revealed from a specified starting point	*Refer to the description* *on page 12*
Set CT Primary	24=1…65535	CT primary value	*Default 5amps*
Set PT Primary	25=1…65535	PT primary value	*Default 220Volts*
Set CT Secondary	26=1…65535	CT secondary value	*Default 5amps*
Set PT Secondary	27=1…65535	PT secondary value	*Default 220Volts*
Apply CT ratio	C4…C23=1	Ratio of point 14 ÷ point16 is applied	*C4…C13=0 removes the CT ratio*
Apply PT ratio	P4…P23=1	Ratio of point 15 ÷ point17 is applied	*P4…P13=0 removes the PT ratio*
IEEE Reversed	IR=1	IEEE Floating Point Word order is reversed	To switch back to default Word order enter: *IR=0*
Scroll page display	P=1…10	Scroll to specific page if more data-points are present than can be displayed on one screen	*Example: P=2* *The second page of database settings are displayed*
Priority Release all points to NULL	R	All points are Released to NULL priority	*17 will be displayed at the extreme right of each data point configuration line to signify NULL priority*
Priority Release individual point to NULL	R=4…27	Specified point is Released to NULL priority	*17 will be displayed at the extreme right of the target data point configuration line to signify NULL priority*
Enable Modbus subnet communication	E	Toggles Enabled/Disabled of M-Bus Subnet communication	*Default Disabled to allow easy configuration when no M-Bus devices are connected.* ***Always 'Enable' when M-Bus devices are connected and points are configured!***
Write values as default	W	Changes written.	***Always do this after making changes that you wish to be permanent***
Exit communication	X	Communication with HyperTerminal no longer active	*Auto X after 240sec without key entry.* ***After eXit unplug the HPECOM cable to allow network communication to take place***

User Point Configuration

Each data point must be configured to access the Modbus device and data register within the device. The Function Types associated with Modbus devices is a key part of locating the correct data location within the device.

Point Types

HPE Point Type	Programming Value	Description
N/A	0	Not Used
Read/Write Input Coil (RIC)	1	Function 01 (F01)
Read Input Discrete (RID)	2	Function 02 (F02)
Read/Write Holding Register (RHR)	3	Function 03 (F03)
Read Input Register (RIR)	4	Function 04 (F04)
RHR - IEEE 754 (RHE + RHEP)	5	F03 2 Word (IEEE floating point)
RIR - IEEE 754 (RIE + RIEP)	6	F04 2 Word (IEEE floating point)
RHR 2 Word Pair (RHR+RHRP)	7	F03 2 Word (integer)
RIR 2 Word Pair (RIR+RIRP)	8	F04 2 Word (integer)
RHR Signed Integer (RHRS)	9	F03 -32767…+32767
RIR Signed Integer (RIRS)	10	F04 -32767…+32767

Using a point type 5 or 6 will generate two data points with in the HPE device of either F03 or F04 respectively for registers using IEEE floating-point data format which are always 2 Word registers. The first point address is entered in the point configuration string and the second point is automatically generated. These two points are then always read together when the Modbus network is polled.

Using a point type 7 or 8 will generate two data points with in the HPE device of either F03 or F04 respectively for registers which are 2 Word integers (typically energy registers in electricity meters). The first point address is entered in the point configuration string and the second point is automatically generated. If a register is more than 2 Words then additional single or pair points can be added sequentially. In any case, the value result of multiple Word points may be compiled by the HPE using the Scaling feature as described in the next section.

When point pairs are generated (types 5…8) the first of the pair has a normal type tag, such as RHR, whereas the second of the pair has a 'P' tag suffix, for instance RHR**P** (**P**aired with the preceding point).

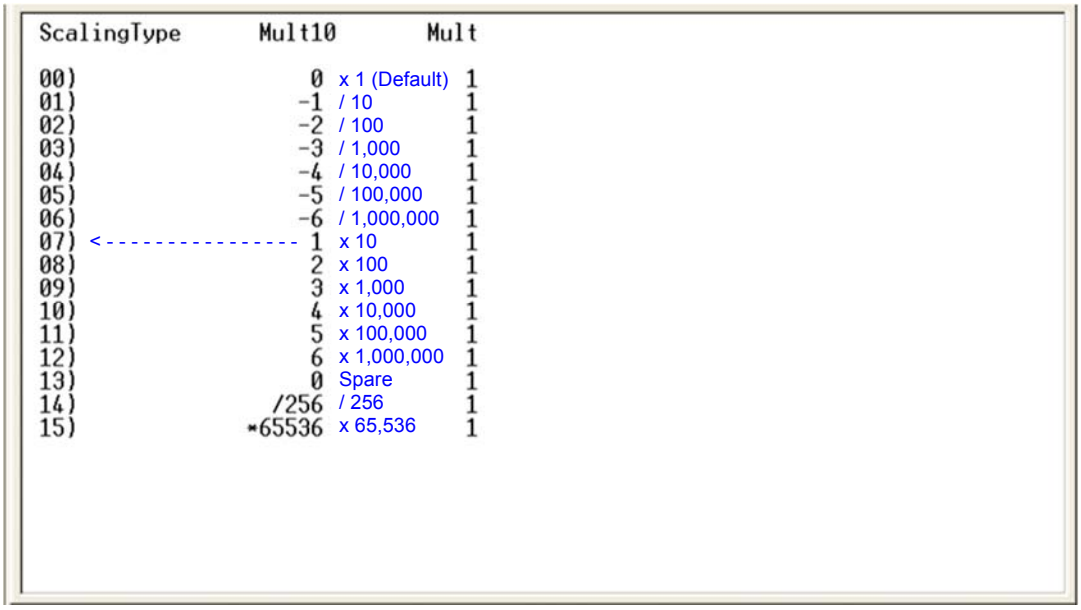
Point Scaling & Combining

Each point may be individually SCaled and/or combined with sequential points where Modbus registers are comprised of more than 1 Word and therefore use more than one HPE point. This is helpful when, for example, the 1st Word of a register may be units and the 2nd Word may require a multiplier of 65,536 or some other scaling before combining with the 1st Word.

In any case where two or more Words are combined then only the first HPE point (object) of the sequence of Words needs be read up by the BMS as this first point of the sequence contains the final result of the scaling and combining.

Scaling Types

Scaling types may be viewed in HyperTerminal by entering **S** to display the scaling table:



ScalingType	Mult10	Mult
00)	0 x 1 (Default)	1
01)	-1 / 10	1
02)	-2 / 100	1
03)	-3 / 1,000	1
04)	-4 / 10,000	1
05)	-5 / 100,000	1
06)	-6 / 1,000,000	1
07) <----------	1 x 10	1
08)	2 x 100	1
09)	3 x 1,000	1
10)	4 x 10,000	1
11)	5 x 100,000	1
12)	6 x 1,000,000	1
13)	0 Spare	1
14)	/256 / 256	1
15)	*65536 x 65,536	1

Scaling types may be assigned to an HPE point either as a part of the Point Programming string as outlined in the following section or individually after initial point configuration. To scale an individual point as being x10 then a Scale type value of **7** must be assigned to that point, as referenced in the left-hand column of the table above. If the next sequential point is to be combined with any point then the Scale type value +100 configures the preceding point accordingly. For instance:

An eight digit Wh register with value 12,345,678 Wh comprised of 2 Words needs the 2 Word's HPE points to be combined to represent the register value of 12,345.678 kW at one only BACnet AV Object. The 1st Word is configured at HPE-BNMOD point 4 (with value 5678) and the 2nd Word is configured sequentially at point 5 (with value 1234).

SC4=103 Object AV4 = (5,678 + AV5) / 1,000 = 12,345.678 kWh
Scale type 3 for /1000. Scale type 103 for 'add next point result then /1000'

SC5=10 Object AV5 = 1,234 * 10,000 = 12,340,000 wh
Scale type 10 for x10,000 (if also required to add next sequential point before x10,000 then Scale type 110)

Customised Scaling

It is possible to change the table position of the **Mult10** scaling multipliers and dividers (column 1) so as to use a particular Mult10 value applied with different **Mult** values (column 2).

Mult10 (10's Multiplier)
These values are fixed as decimal shift magnitude in the range -6…6
Some Mult10 setting values however have a fixed application:

- -7 applies /256
- 7 applies x 65536

Objects defined as Pairs are automatically assigned Type 15 as the high Word multiplier as it is assumed that 2 Word pairs will be Word 1 + (Word 2 * 65536) so Type 15 settings should not be changed.

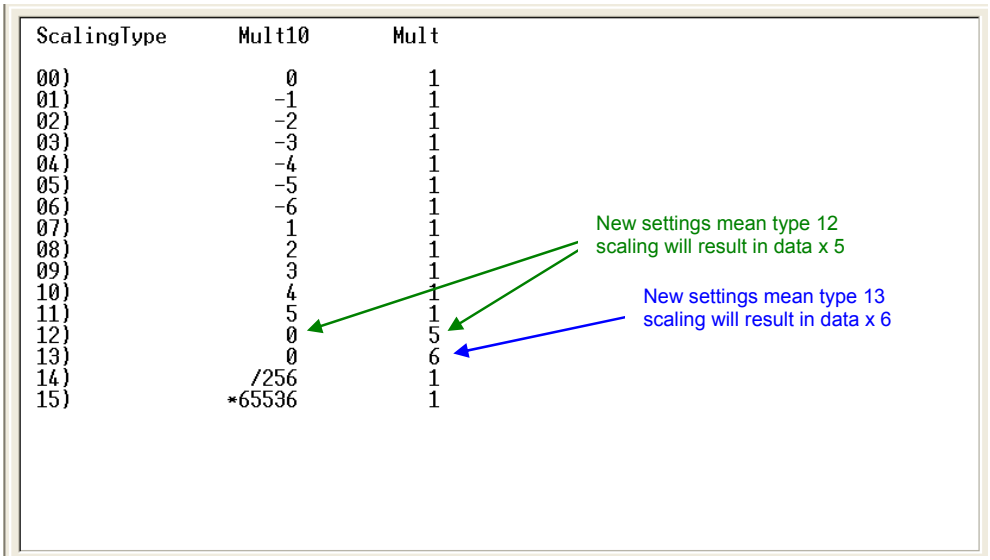
Mult (Units Multiplier)
These values may be in the range -32768…32768

Example – To change scaling type 12 so as to deliver a multiplier of 5:

Change Mult10 to 0 with Type 12 / column 1 matrix: 121=0
Change Mult to 5 with Type 12 / column 2 matrix: 122=5

Example – To change scaling type 13 so as to deliver a multiplier of 6 then:

Mult10 already 0 by default so no change required
Change Mult to 6 with Type 13 / column 2 matrix: 132=6



It follows that if type 8 Mult is changed to x7 (82=7) then the existing type 8 Mult10 (x100) when combined with the new Mult of 7 would result in object data multiplier of 700 when applied to a specific data object (data value x 100 x 7)

Point Programming

Manual Entry

The structure for manual entry of point configuration over HyperTerminal is as follows:

<Point #>=<Modbus Device Addr>,<Table #>,<Row #>,<Scaling >,<PointType>
(Address) (AddHi) (AddLo) (SC) (e.g. 4 [RIR])

Each Table consists of 256 Rows, 0…255. A register address value 0 is Table 0, Row 0. An address of 256 is Table 1, Row 0. An address of 300 would be Table 1, Row 44.

Using a Voltage register with Modicon F03 type (holding register, which are in the 40001 range), address 0 (40001 – 40001 = 0) we know the Table and Row must be 0, 0.

In the case of the PMAC903 the phase 1 voltage requires scaling of 0.01 (HPE scaling type 2) and is a holding register, 1 Word integer (HPE point type 3).

8=1,0,0,2,3

To apply the PT ratio:

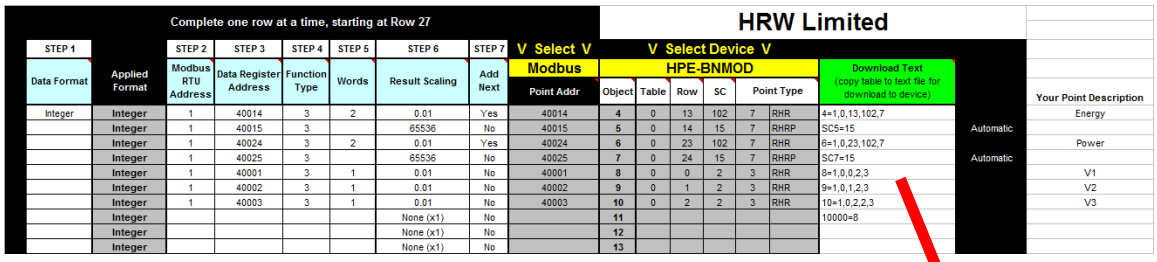
P8=1

```
 HPEBNModbus10  V4.01          BACnet Modbus10             Mon 1/1/2000  0:12
1000) 98 1001)BN = 9600 1002)Modbus = 9600 8N1 DI) 1098 MM) 127 SV) 0
  1)Resets = 0 0 1    2)BNErrors = 0    3)ModbusErrors = 0
  4)Add =    1 AddH =    0 AddL =  13 Data =       0 SC = /100    *1+  RHR  17
  5)Add =    1 AddH =    0 AddL =  14 Data =       0 SC =   *65536*1   RHRP 17
  6)Add =    1 AddH =    0 AddL =  23 Data =       0 SC = /100    *1+  RHR  17 CT PT
  7)Add =    1 AddH =    0 AddL =  24 Data =       0 SC =   *65536*1   RHR  17
  8)Add =    1 AddH =    0 AddL =   0 Data =       0 SC = /100    *1   RHR  17    PT
  9)Add =    1 AddH =    0 AddL =   1 Data =       0 SC = /100    *1   RHR  17    PT
 10)Add =    1 AddH =    0 AddL =   2 Data =       0 SC = /100    *1   RHR  17    PT
 24)Add =    0 AddH =    0 AddL =   0 Data =       5 SC = *1      *1   RIR  17
 25)Add =    0 AddH =    0 AddL =   0 Data =     220 SC = *1      *1   RIR  17
 26)Add =    0 AddH =    0 AddL =   0 Data =       5 SC = *1      *1   RIR  17
 27)Add =    0 AddH =    0 AddL =   0 Data =     220 SC = *1      *1   RIR  17
 Pt No = Address,AddHi,AddLo,ScalingType,PointType  D Diag  F Find  P = Page No
 E Modbus Disabled  X to exit  W to write values
```

Address Mapping Tool

The address mapping tool is an MS Excel tool designed to assist in building the point database in conjunction with a Modbus RTU's technical manual. Consult the Modbus RTU's manual for register address and data format information and enter the detail in the tool notes.

After creation of the point database the resultant settings table may be copied to a text file for download to the device.



Complete one row at a time, starting at Row 27

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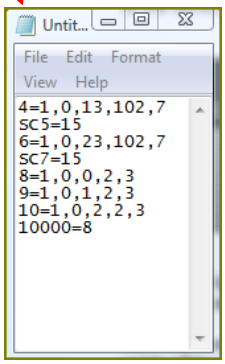
STEP 1		STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	V Select V	V Select Device V								
Data Format	Applied Format	Modbus RTU Address	Data Register Address	Function Type	Words	Result Scaling	Add Next	Modbus Point Addr	HPE-BNMOD Object	Table	Row	SC	Point Type		Download Text (copy table to text file for download to device)		Your Point Description
Integer	Integer	1	40014	3	2	0.01	Yes	40014	4	0	13	102	7	RHR	4=1,0,13,102,7		Energy
	Integer	1	40015	3		65536	No	40015	5	0	14	15	7	RHRP	SC5=15	Automatic	
	Integer	1	40024	3	2	0.01	Yes	40024	6	0	23	102	7	RHR	6=1,0,23,102,7		Power
	Integer	1	40025	3		65536	No	40025	7	0	24	15	7	RHRP	SC7=15	Automatic	
	Integer	1	40001	3	1	0.01	No	40001	8	0	0	2	3	RHR	8=1,0,0,2,3		V1
	Integer	1	40002	3	1	0.01	No	40002	9	0	1	2	3	RHR	9=1,0,1,2,3		V2
	Integer	1	40003	3	1	0.01	No	40003	10	0	2	2	3	RHR	10=1,0,2,2,3		V3
	Integer					None (x1)	No		11						10000=8		
	Integer					None (x1)	No		12								
	Integer					None (x1)	No		13								

Once the information is properly entered in the tool the resultant point configuration data, in Column T, may be copied to Notepad for saving as a text file and download to the HPE-BNMOD.

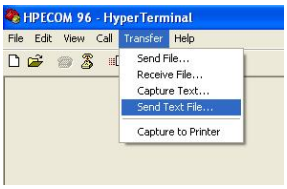


Note that the second point of 2 Word pairs is generally indicated as 'Automatic' because the second point will be automatically created at time of download. The Scale factor will be included for those automatic points in the case that it differs from the Paired point default of x65536.

The last row of the download data, 10000=8, is a line count for a validity check as part of the download process. If manually entering the configuration text lines 10000=*n* should be ignored.

Download Procedure

To download a new data base text file:



- Prepare the HPE device to receive the text file by entering **DE**
- Select 'Send Text File' from the HyperTerminal Transfer menu item
- Browse to the folder containing the required database text file and select the relevant file

After the download process you will see a check of line numbers expected and line numbers actually received and the HPE device will indicate 'restarting' should the line check be correct.

After a successful download enter **E** to toggle between Disabled/Enabled Modbus communication. Once toggled to Enabled press enter again to invoke a live scan of the Modbus network. Enter **W** to Write the enabled state to ensure the comms remains enabled after a power reset.

Note that if there are a number of points wrongly configured (nonexistent devices or data points on the Modbus network) the live scan may take longer than usual to complete while invalid registers are requested from the network. In this situation you may TTTTTTT… to stop the scanning activity and **E** to toggle to Disabled for checking point setups.

To delete all existing point data without downloading a new text file enter **DE** then enter **10000=1**

Find Function

If the Modbus RTU documentation is not clear, then the **Find** function of the HPE device may be used to reveal the Modbus RTU point addresses together with detail required to enter the points in to the HPE device.

The Find function is linked to point # 4 and is activated by keystroke **F** (enter). *It is recommended to set HyperTerminal to buffer the maximum 500 lines of displayed data to assist in reviewing the data received during activation of the Find function, or use the Capture Text feature of HyperTerminal to save the result as a text file.*

Example 1: If you wish to reveal the point detail and activity of all points starting from Modbus address 40014, Read holding Register (Table 0/Row 13, F03) of a connected Modbus RTU device with address 1 then set up point 4 as follows:

4=1,0,13,0,3 (enter)

Example 2: If you wish to reveal the point detail and activity of all points starting from 42817 (Table 11/Row 0, RHR/F03) of a connected Modbus RTU device with address 25 then set up point 4 as follows:

4=25,11,0,0,3 (enter)

Once you have set up point 4 according your search criteria then enter **F** the points from the starting Table/Row will be sequentially displayed as illustrated below. To Exit the Find sequence enter TTTTTTTT… to revert back to the normal point listing.

Note: When you exit the Find sequence the Table/Row detail at the scanning point at which you exit will be inserted in to the point data of point 4. Please ensure the setup of point 4 is as you require it before Writing (W) the configuration.

```
E Modbus  Enabled  X to exit  W to write values F

4)  1, 0,13,V =  40014 D =      0 RHR
4)  1, 0,14,V =  40015 D =      0 RHR
4)  1, 0,15,V =  40016 D =      0 RHR
4)  1, 0,16,V =  40017 D =      0 RHR
4)  1, 0,17,V =  40018 D =      0 RHR
4)  1, 0,18,V =  40019 D =      0 RHR
4)  1, 0,19,V =  40020 D =      0 RHR
```

V
V
V
V

```
4)  1, 0,44,V =  40045 D =      0 RHR
4)  1, 0,45,V =  40046 D =      0 RHR
4)  1, 0,46,V =  40047 D =   3855 RHR
4)  1, 0,47,V =  40048 D =   3840 RHR
4)  1, 0,48,V =  40049 D =   3855 RHR
4)  1, 0,49,V =  40050 D =     16 RHR
4)  1, 0,50,V =  40051 D =      1 RHR
```

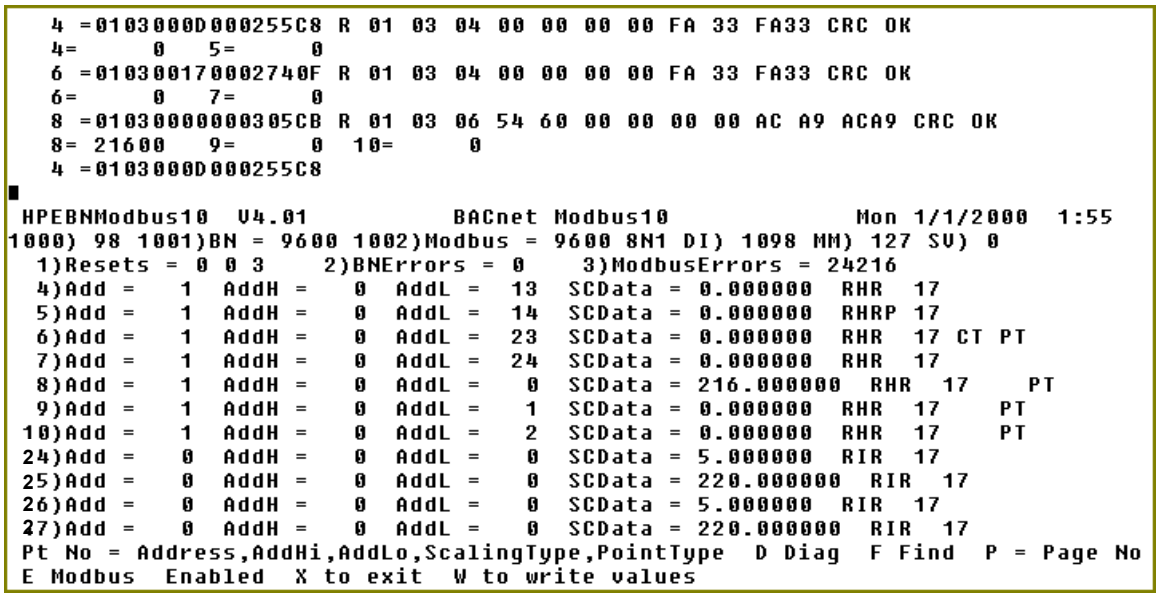
You will see that even without adequate Modbus RTU device documentation, in parallel with checking against the Modbus device's own displayed readings, it is possible to integrate your devices using the HPE-BNMOD's Find function to reveal the point data of a series of point addresses.

Diagnostic Function

For trouble shooting the Diagnostic function allows a clear view of the Modbus network data requests and replies.

Enter **D** to activate the Diag function. Now, each time you force a scan with Enter you will see the full HEX request and reply including checksum detail or error messages if applicable. When a valid device/data register is communicated with then the point data value will also be displayed.

After screen refresh when in Diag mode all Data point results will display in respect of any Scaling settings (BACnet AV value).



Installation & Commissioning

- This is an RS485 network device designed for indoor mounting, in a dry electrical panel. Ideally it should be mounted to the panel backplane in a horizontal position (RJ11 sockets on the lower side and communications ports on the upper side)

- Each 24Vac power supply transformer should have the neutral (24Vac N) connection grounded at the electrical panel earth connection to ensure the device grounding is at the same potential as the network master's grounding

- Where more than one device is connected to a common transformer ensure that the 24Vac phasing is the same to each device ('A' connects to 'A', 'N' connects to 'N' in all cases)

- If the red comms light adjacent to the RS485 terminals emits an obvious flash every time 24Vac power is applied to the device then the micro-processor may be corrupted. The micro processor should be replaced

- RS485 multi-drop cable should be used for the network connections, complete with end of line terminating resistors (120Ω). Belden 9841 or equivalent is recommended. The recommended cable is a low capacitance twisted pair with braid and foil screen

- The RS485 cables should be terminated directly at each device in a daisy-chain configuration, avoiding 'laterals' or 'spurs'

- The RS485 screen should be connected at the network master's ground terminal. The incoming and outgoing screen at each device should be continuously connected via the S terminal of the device (note that the device's S terminal has no electrical connection to the device, it merely acts as a junction terminal for the purpose of screen continuity)

- The RS485 cable should avoid cable routes that run with power cables. Where the RS485 cable must cross power cables then they should cross at 90° avoiding parallel runs beside power cables

- Prior to connection of the slave devices to the RS485 network check that no AC voltage is present. Double check the network for short circuits between the twisted pair cores and between the cores and the screen. Ensure continuity of the twisted pair cores and the screen

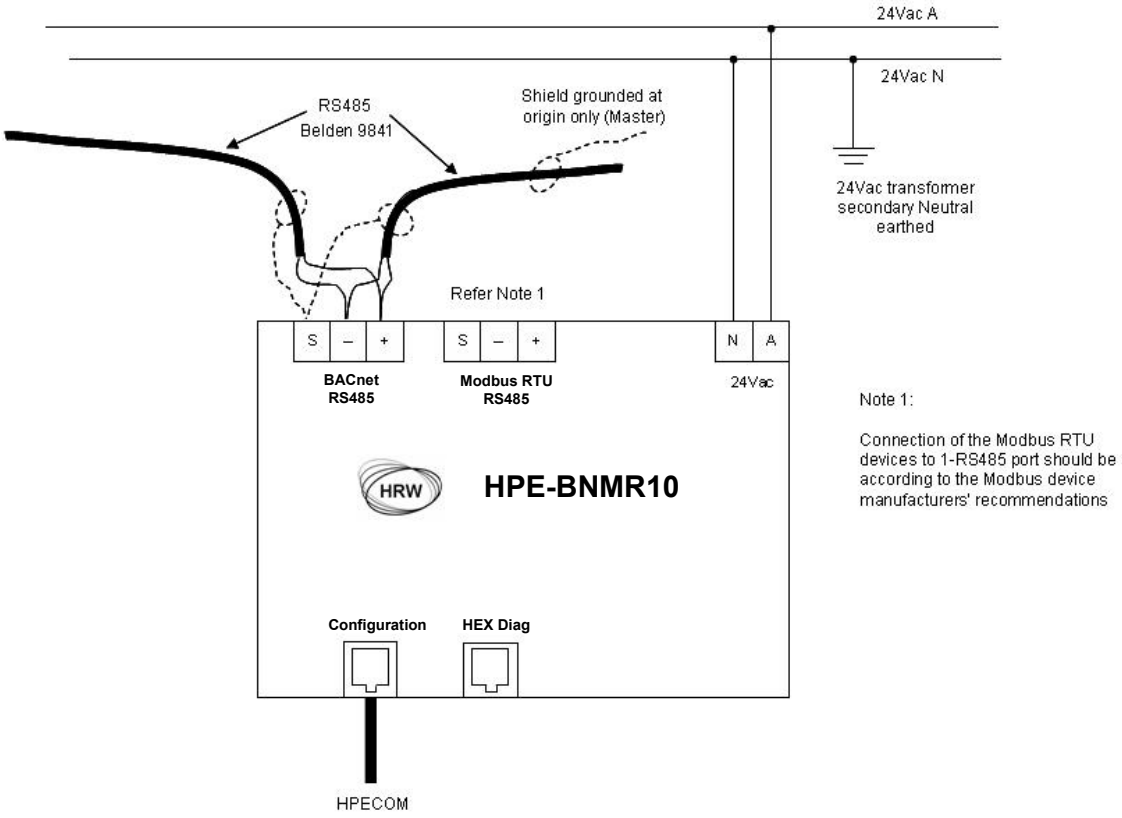
- Check the network master's +/- terminals for correct voltages to ground (approx. 2.5Vdc) and connect the RS485 network cable to the network master's RS485 port

- At each device assign an individual address and the baud rate specific to the network. Write the changes, eXit the terminal application and remove the HPECOM cable

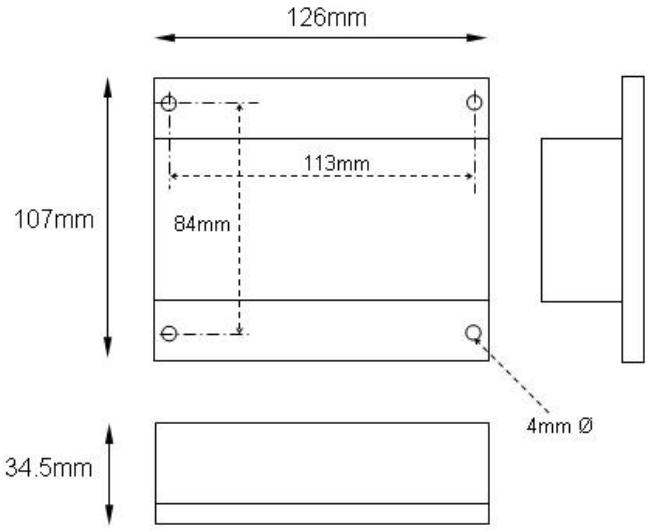
- Verify network voltage at the RS485 connector (between +/- and ground) and connect to the device. Communication can be verified by flashing of the red comms LED adjacent the 3 terminal RS485 connector). Frequency of comms LED flash is baud rate dependant. At higher baud rates the LED flash may not be obvious, the LED appearing to be continuously on

- Where a network runs between buildings and zero earth potential difference between individual panel 24Vac power supplies cannot be guaranteed, we recommend that a repeater be used to provide isolation of the sections of the network having differing earth potential

Connections



Dimensions



If using HDA0002 DIN rail adapter brackets the overall depth from the gear plate to the front surface of the device is 45.5mm

Technical Data

RS485 Network Wiring	Shielded twisted pair (shield grounded) Belden 9841 low capacitance twisted pair for RS485 networks (braided + foil shield, shield continuous throughout the network and grounded at network origin)
RS485 Comms Speed	2400, 4800, 9600, 19200, 38400, 57600, 76800 baud
Modbus Network Capacity	1 node over max. 1.2km without repeater
Power Supply	24Vac, 50/60 Hz, max. 7.5VA
Conformity & approvals	
Operating Temperature Range	0…50ºC (32…122ºF)
Storage Temperature Range	-5…75ºC (-40…167ºF)
Humidity Range	10…95%rH (non-condensing)
Dimensions	126mm (W) x 107mm (H) x 34.5mm (D)

Ordering Information

HPE-BNMR10

Description: 10 (20) point gateway – BACnet MS/TP integration of one Modbus RTU device - for control panel mounting

Standard package: 40 units per carton

Accessories

HDA0002	DIN rail adapter brackets, factory fitted
HPECOMU	Configuration cable (USB <> RJ11)

Other HP_BN Series Devices

HPC0662BN	Universal Controller, 12 Point, BACnet MS/TP, 24Vac
HPC8884BN	Universal Controller, 28 Point, BACnet MS/TP, 24Vac
HPD0440BNMR	Network HMI / Universal Ctrl / Scheduler / Modbus RTU gateway 8 Point, BACnet MS/TP, 24Vac
HPD0460BN	Network HMI, 12 Point, BACnet MS/TP, 24Vac
HPD0460BNC	Network HMI / Universal Controller, 10 Point, BACnet MS/TP, 24Vac
HPD0460BNCT	Network HMI / Universal Ctrl / Scheduler, 10 Point, BACnet MS/TP, 24Vac
HPD0460BNT	Network HMI / Scheduler, 10 Point, BACnet MS/TP, 24Vac
HPE8884BN	I/O expansion, 28 Point, BACnet MS/TP, 24Vac
HPV0662BN	VAV / Universal Controller, 13 Point, BACnet MS/TP, 24Vac
HPE-BNMBUS	BACnet gateway for M-Bus devices, 250 point, 24Vac
HPE-BNMOD	BACnet gateway for Modbus devices, 250 points, 24Vac
HPE-BNPMAC	BACnet module for PMAC770 Electricity meter / analyser