Integration of PMAC770Hmetering data in to BACnet MS/TP networks

The PMAC770H has two communication protocols, MODBUS and BACNET, in the main RS485#1. Only one of the two communication protocols can be selected at the same time

The module is preconfigured, requiring only that the protocol type, network addressing and baud rate settings need be done. These settings are available via the display & keypad of the PMAC770Hmeter.

Network wiring to the module is according to the RS485 specification. The network cable type and installation practices should be meet such specification.

Feature Summary

- Network configuration via the meter keypad / display interface
- User switchable as BACnet MS/TP
    - BACnet MS/TP
        - MAC (address), baud rate
        - Maximum Master (MM)，Default 130. Cannot be modified
- 135 registers available over the network
    - Cumulative including tariff registers
    - Instantaneous values
    - Demands c/w timestamps
    - Resetting facilities
    - Meter information

Configuration

RS485-1 uses MODBUS by default. If you want to use the BACNET protocol, refer to the Module Set-up section.
Access code for changing protected settings is 01

General Information for Keys

PMAC770H has a back-light LCD, user-friendly display.
Users can query/ set different information by 4 keys according to the menu prompt.
If press the keys, the back-light will be on lasting for 60s. If no continue pressing key, the back-light will be off.

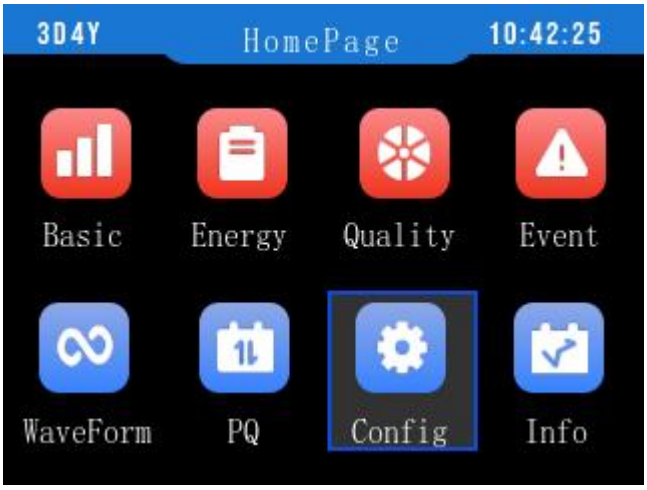
Meter Display

Module Set-up

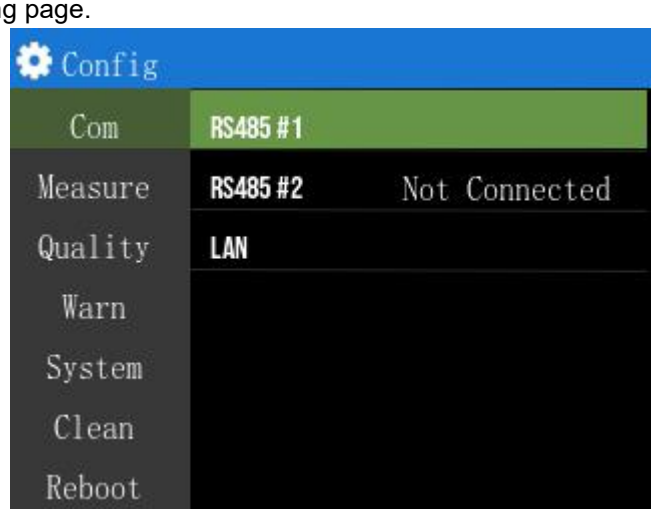
Set Protocol:
BACnet (optional)

Input password
Default password:01

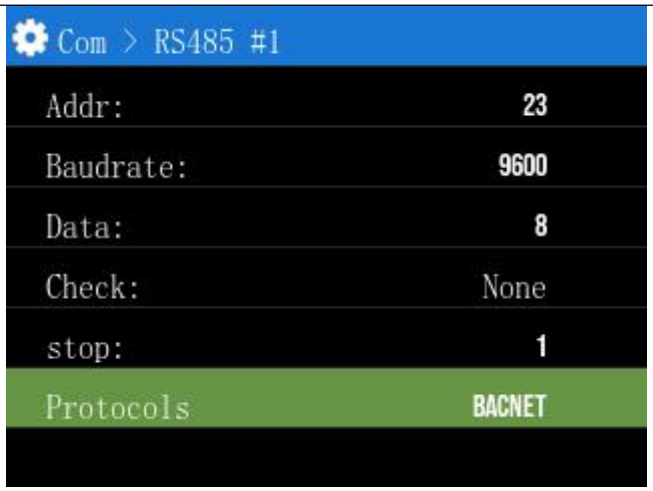
1、On the home page press “ < ” or press “ > ” o select 【Config】and press “ ↩ ”



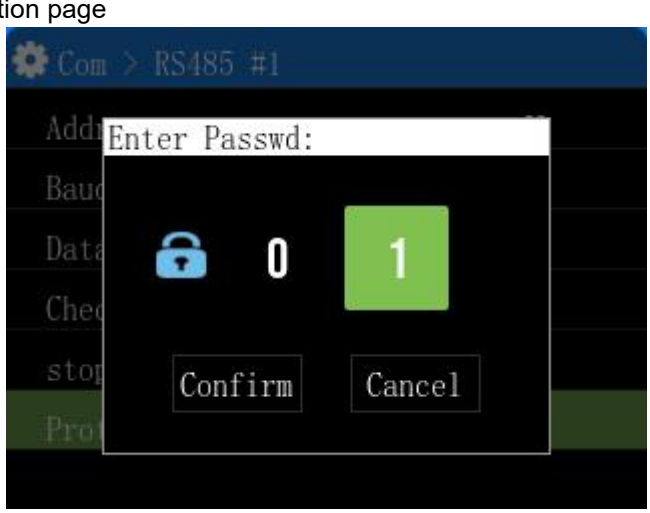
2、Go to the [Config] page and press “ ↩ ” to go to 【RS485#1】, Then press again “ ↩ ” to go to【RS485#1】setting page.



3、Go to the【RS485#1】setting page，press “ > ” click 【Protocols】



4、Enter password 01 and click [Confirm] to go to the [Protocols] selection page

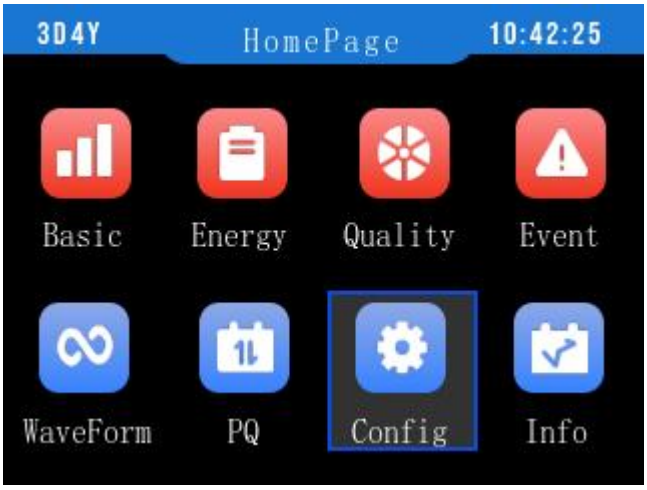


5、Press “↩” to go to the【Protocols】selection page,select “BACNET ” from the drop-down list box, ， and click【Confirm】to select the“BACNET”protocol.

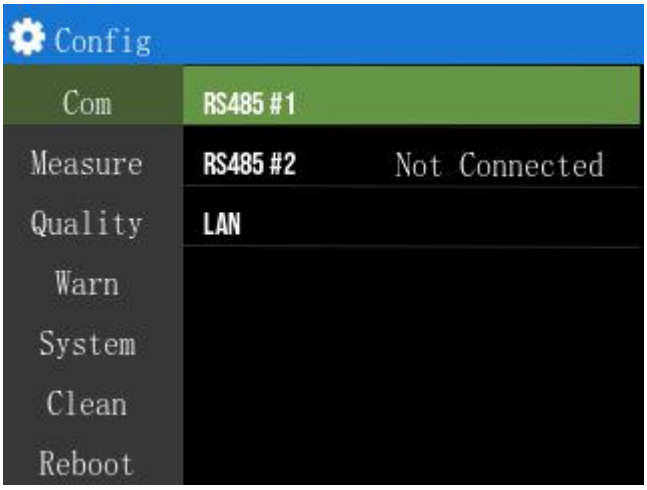
Set module network address

For BACnet Protocol, network address rage is 1…127

1、On the home page press “ < ” or press “ > ” to select【Config】and press “ ↩ ”.

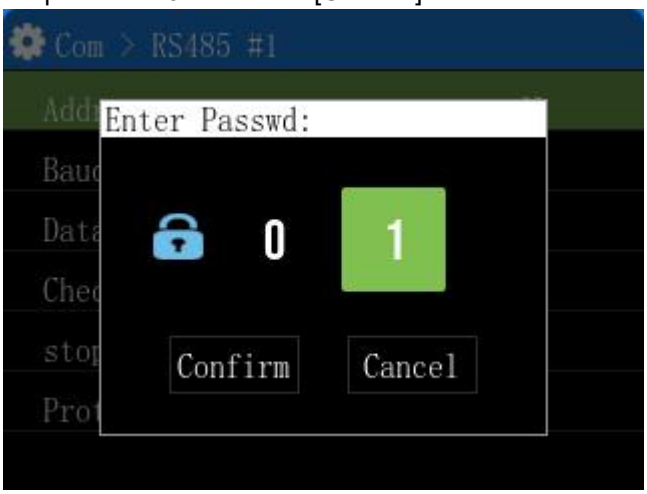


2、Go to the [Config] page and press “ ↩ ” to go to【RS485#1】, Then press again “ ↩ ” to go to【RS485#1】setting page.

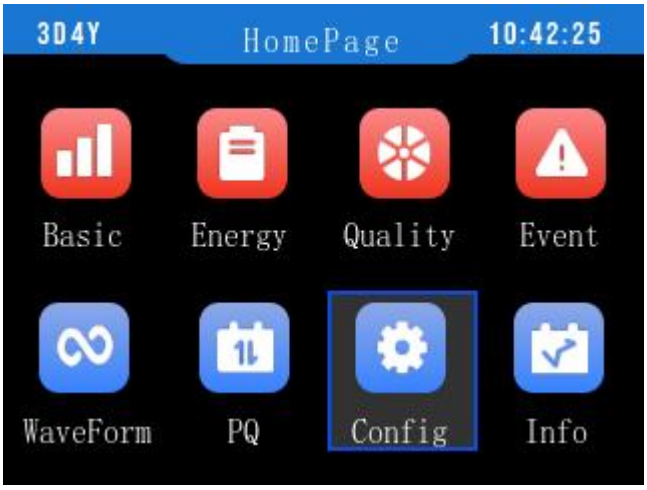
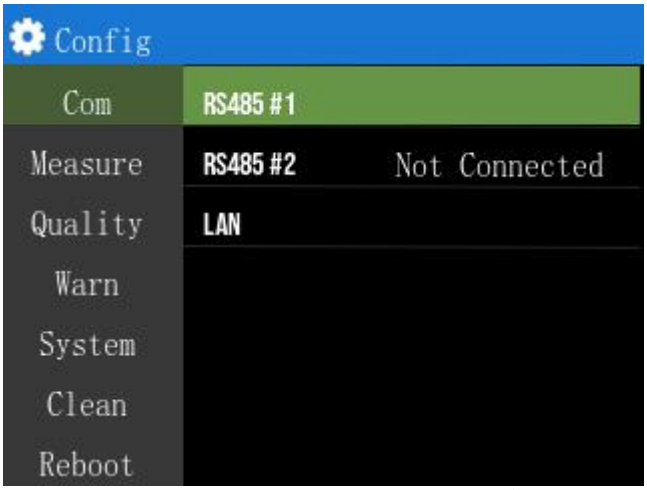


3、Go to the [RS485#1] setting page and press "or" to select [Addr].

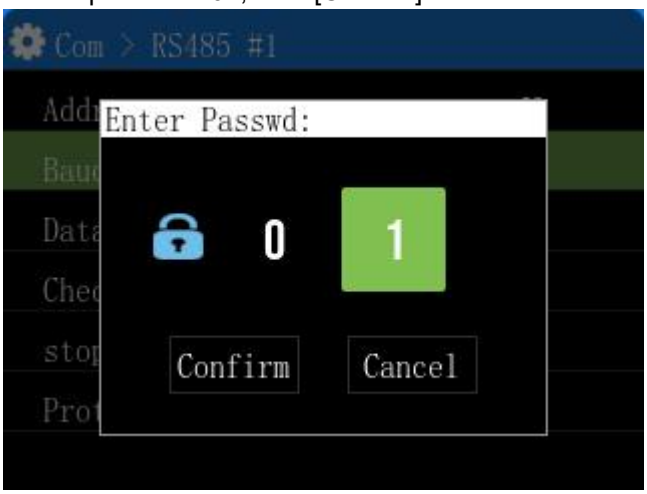
4、Enter password 01 and click [Confirm].



5、Press the key “↩” to enter the [Addr] selection page, enter the address in the input box, and click [Confirm] to set the device address

Set Module Baudrate	1、On the home page, press “ < ” or press “ > ” to select [Config] and press “ ↩ ” .  2、Go to the [Config] page and press “ ↩ ” to go to [RS485#1]. Then press again press “ ↩ ” to enter the [RS485#1] setting page.  3、Go to the [RS485#1] setting page, press or " > " press to select [Baudrate]

4、Enter the password 01, click [Confirm]



5、Press the "↩" key to enter the [Baudrate] selection page, select the baud rate from the drop-down box, and click [Confirm] to select the baud rate

Protocol Notes

BACnet MS/TP

- Use AV # directly
  - Unit resolution is automatically applied
  - CT & PT ratio set in AV174 & AV175

Network Data List

BACnet AV	Description	Remark	Access	Type
4	Va (ph-N)	× 0.01, unit: V	RO	U16
5	Vb (ph-N)	× 0.01, unit: V	RO	U16
6	Vc (ph-N)	× 0.01, unit: V	RO	U16
7	Reserved		RO	
8	Average phase voltage (ph-N)	× 0.01, unit: V	RO	U16
9	Vab (ph-ph)	× 0.01, unit: V	RO	U16
10	Vbc (ph-ph)	× 0.01, unit: V	RO	U16
11	Vca (ph-ph)	× 0.01, unit: V	RO	U16
12	Reserved		RO	
13	Average line voltage (ph-ph)	× 0.01, unit: V	RO	U16
14	Positive sequence voltage	× 0.01	RO	U16
15	Negative sequence voltage	× 0.01	RO	U16
16	Neutral voltage	× 0.01, unit: V	RO	U16
17	Ia	× 0.0001, unit: A	RO	U16
18	Ib	× 0.0001, unit: A	RO	U16
19	Ic	× 0.0001, unit: A	RO	U16
20	Reserved		RO	
21	Average current	× 0.0001, unit: A	RO	U16
22	Reserved		RO	
23	Reserved		RO	
24	Reserved		RO	
25	Reserved		RO	

26	Reserved		RO	
27	Positive sequence current	× 0.0001,	RO	U16
28	Negative sequence current	× 0.0001,	RO	U16
29	Neutral current	× 0.0001, unit: A	RO	U16
30	Phase A active power	× 0.1, unit: W	RO	S16
31	Phase B active power	× 0.1, unit: W	RO	S16
32	Phase C active power	× 0.1, unit: W	RO	S16
33	Total active power	× 0.1, unit: W	RO	S32

BACnet AV	Description	Remark	Access	Type
35	Phase A reactive power	× 0.1, unit: var	RO	S16
36	Phase B reactive power	× 0.1, unit: var	RO	S16
37	Phase C reactive power	× 0.1, unit: var	RO	S16
38	Total reactive power	× 0.1, unit: var	RO	S32
40	Phase A apparent power	× 0.1, unit: VA	RO	U16
41	Phase B apparent power	× 0.1, unit: VA	RO	U16
42	Phase C apparent power	× 0.1, unit: VA	RO	U16
43	Total apparent power	× 0.1, unit: VA	RO	U16
44	Phase A power factor	× 0.001	RO	S16
45	Phase B power factor	× 0.001	RO	S16
46	Phase C power factor	× 0.001	RO	S16
47	Total power factor	× 0.001	RO	S16
48	Frequency	× 0.01, unit: Hz	RO	U16
49	Digital input status		RO	U16
50	Relay output status		RO	U16
51	Reserved		RO	
52	Reserved		RO	
53	Analog input 1	× 0.01	RO	U16
54	Analog input 2	× 0.01	RO	U16
55	Pulse input		RO	U16
56	Phase A voltage deviation	× 0.01, unit: %	RO	S16
57	Phase B voltage deviation	× 0.01, unit: %	RO	S16
58	Phase C voltage deviation	× 0.01, unit: %	RO	S16
59	Frequency deviation	× 0.01, unit: Hz	RO	S16
60	Vph-N unbalance rate	× 0.01, unit: %	RO	U16

BACnet AV	Description	Remark	Access	Type
61	1st quadrant, total kWh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kWh	RO	S32
63	1st quadrant, total kvarh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kvarh	RO	S32
65	2nd quadrant, total kWh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kWh	RO	S32
67	2nd quadrant, total kvarh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kvarh	RO	S32
69	3rd quadrant, total kWh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kWh	RO	S32
71	3rd quadrant, total kvarh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kvarh	RO	S32
73	4th quadrant, total kWh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kWh × 0.1, unit: kvarh	RO	S32
75	4th quadrant, total kvarh (Invalid in 3 Phase 3 Wires)	× 0.1, unit: kvarh	RO	S32
77	Total kWh (of 4 quadrant)	× 0.1, unit: kWh	RO	S32
79	Total kvarh (of 4 quadrant)	× 0.1, unit: kvarh	RO	S32

BACnet AV	Description	Remark	Access	Type
81	Phase A voltage crest factor	× 0.001	RO	U16
82	Phase B voltage crest factor	× 0.001	RO	U16
83	Phase C voltage crest factor	× 0.001	RO	U16
84	Phase A current K factor	× 0.001	RO	U16
85	Phase B current K factor	× 0.001	RO	U16
86	Phase C current K factor	× 0.001	RO	U16
87	THD for Va	× 0.001	RO	U16
88	THD for Vb	× 0.001	RO	U16
89	THD for Vc	× 0.001	RO	U16
90	THD for Ia	× 0.001	RO	U16
91	THD for Ib	× 0.001	RO	U16
92	THD for Ia	× 0.001	RO	U16
93	TEHD for Va	× 0.001	RO	U16
94	TEHD for Vb	× 0.001	RO	U16

95	TEHD for Vc	× 0.001	RO	U16
96	TEHD for Ia	× 0.001	RO	U16
97	TEHD for Ib	× 0.001	RO	U16
98	TEHD for Ic	× 0.001	RO	U16
101	TOHD for Va	× 0.001	RO	U16
102	TOHD for Vb	× 0.001	RO	U16
103	TOHD for Vc	× 0.001	RO	U16
104	TOHD for Ia	× 0.001	RO	U16
105	TOHD for Ib	× 0.001	RO	U16
106	TOHD for Ic	× 0.001	RO	U16

BACnet AV	Description	Remark	Access	Type
107	Demand for Ia	× 0.0001, unit: A	RO	U16
108	Demand for Ib	× 0.0001, unit: A	RO	U16
109	Demand for Ic	× 0.0001, unit: A	RO	U16
110	Demand for Ptot	× 0.1, unit: W	RO	S32
112	Demand for Qtot	× 0.1, unit: var	RO	S32
114	Demand for Stot	× 0.1, unit: VA	RO	U16

BACnet AV	Description	Remark	Access	Type
115	Max. demand for Ia	× 0.0001, unit: A	RO	U16
116	Time	Unix system time	RO	U32
118	Max. demand for Ib	× 0.0001, unit: A	RO	U16
119	Time	Unix system time	RO	U32
121	Max. demand for Ic	× 0.0001, unit: A	RO	U16
122	Time	Unix system time	RO	U32
124	Max. demand for Ptot	× 0.1, unit: W	RO	S32
126	Time	Unix system time	RO	U32
128	Max. demand for Qtot	× 0.1, unit: var	RO	S32

130	Time	Unix system time	RO	U32
132	Max. demand for Stot	× 0.1, unit: VA	RO	U16
133	Time	Unix system time	RO	U32

BACnet AV	Description	Remark	Access	Type
135	Import kWh of tariff 1#	× 0.1, unit: kWh	RO	U32
137	Export kWh of tariff 1#	× 0.1, unit: kWh	RO	U32
139	Import kvarh of tariff 1#	× 0.1, unit: kvarh	RO	U32
141	Export kvarh of tariff 1#	× 0.1, unit: kvarh	RO	U32
143	Import kWh of tariff 2#	× 0.1, unit: kWh	RO	U32
145	Export kWh of tariff 2#	× 0.1, unit: kWh	RO	U32
147	Import kvarh of tariff 2#	× 0.1, unit: kvarh	RO	U32
149	Export kvarh of tariff 2#	× 0.1, unit: kvarh	RO	U32
151	Import kWh of tariff 3#	× 0.1, unit: kWh	RO	U32
153	Export kWh of tariff 3#	× 0.1, unit: kWh	RO	U32
155	Import kvarh of tariff 3#	× 0.1, unit: kvarh	RO	U32
157	Export kvarh of tariff 3#	× 0.1, unit: kvarh	RO	U32
159	Import kWh of tariff 4#	× 0.1, unit: kWh	RO	U32
161	Export kWh of tariff 4#	× 0.1, unit: kWh	RO	U32
163	Import kvarh of tariff 4#	× 0.1, unit: kvarh	RO	U32

165	Export kvarh of tariff 4#	× 0.1, unit: kvarh	RO	U32

BACnet AV	Description	Remark	Access	Type
167	CT primary NOT USED IN PMAC770H	1 to 9999 (× 1A)	RW	U16
168	Connection mode	0 to 1 0--3-phase 4-wire 1--3-pase 3-wire	RW	U16
169	PT primary NOT USED IN PMAC770H	1 to 650 (× 0.1kV)	RW	U16
170	Address of RS485 COM 1	1 to 127	RW	U16
171	Baudrate of RS485 COM 1	2400,4800,9600,19200,38400	RW	U16
172	Parity check of RS485 COM 1	0 to 2 0—No parity 1—Odd 2--Even	RW	U16
173	Stop bit of RS485 COM 1	1 to 2 1—1 bit stop 2—2 bit stop	RW	U16
174	CT ratio	1-10000 × 0.01	RW	U32
175	PT ratio	1-6900 × 0.01	RW	U32

BACnet AV	Description	Remark	Access	Type
178	Clear energy data (kWh & kvarh)	Write 888	WO	U16
179	Clear SOE event log	Write 888	WO	U16
180	Clear Max./ Min. data	Write 888	WO	U16
181	Clear voltage unbalance event at present day NOT USED IN PMAC770H	Write 888	WO	U16
182	Clear voltage unbalance event at present month NOT USED IN PMAC770H	Write 888	WO	U16
183	Clear voltage unbalance event in history	Write 888	WO	U16

	NOT USED IN PMAC770H			
184	Clear voltage deviation event NOT USED IN PMAC770H	Write 888	WO	U16
185	Clear frequency deviation event NOT USED IN PMAC770H	Write 888	WO	U16
186	Clear Max. demand data	Write 888	WO	U16
188	Clean memory module data	Write 888	WO	U16

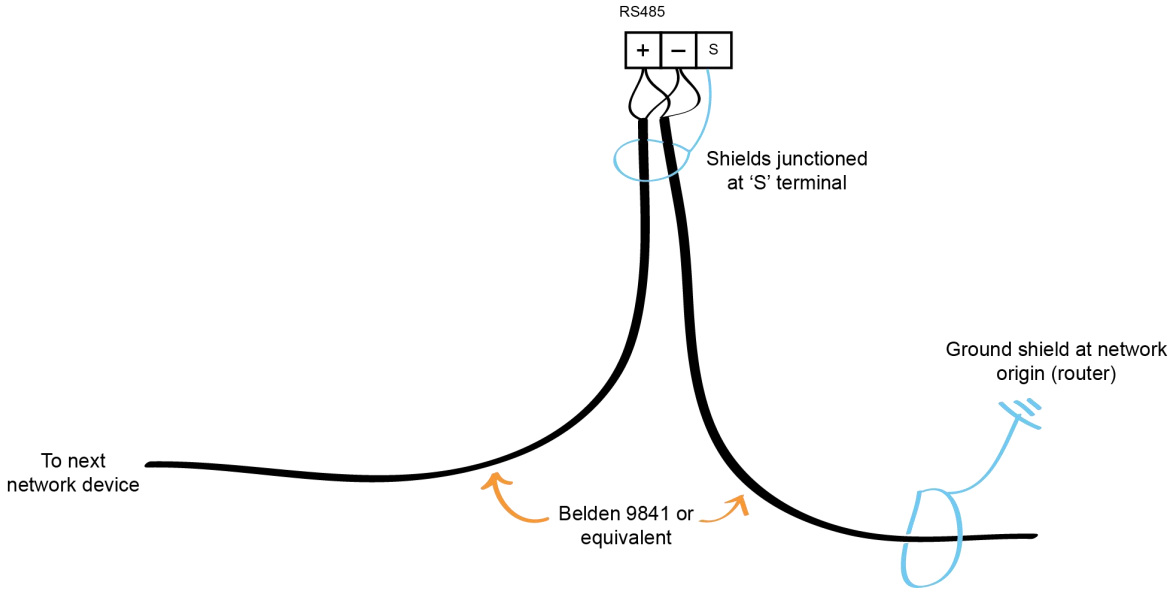
BACnet AV	Description	Remark	Access	Type
189	Device ID	770	RO	U32
191	Manufacturing No.	770	RO	U32
193	Hardware version	100	RO	U16
194	Software version	100	RO	U16
195	Timing, low word Timing, high word	The Num. of second from Jan. 1, 1970, Greenwich mean time, support radio command	RW	U32

BACnet AV	Description	Remark	Access	Type
197	CT Secondary NOT USED IN PMAC770H	Default 5 (5 Amp). User must set according to the meter's CT input (CT secondary) rating. Typically will be 5 but may also be 1	RW	U16
198	PT Secondary NOT USED IN PMAC770H	Default 220 (220V). User must set according to the meter's nominal voltage rating if direct connected. If PT connected type then user must set according to the meter's PT input (PT secondary) rating which would typically be 110	RW	U16
199	Time Zone NOT USED IN PMAC770H	If required, GMT +/-, in Minutes	RW	S16
200	Line AB voltage deviation	× 0.01, unit: %	RO	S16
201	Line BC voltage deviation	× 0.01, unit: %	RO	S16
202	Line CA voltage deviation	× 0.01, unit: %	RO	S16

Installation & Commissioning

- Power down the meter before removal or fitting of the module
- 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
- 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
- At each device assign an individual address and the baud rate specific to the network

Connections



Technical Data

Network Wiring	Shielded twisted pair (shield grounded at origin) Belden 9841 low capacitance twisted pair for EIA RS485 network applications (braided + foil shield, shield continuous throughout the network and grounded at network origin)
BACnet MS/TP Comms	EIA RS485, 1/8th Load (256 node) 2400, 4800, 9600, 19200, 38400 baud
Operating Temperature Range	0…50ºC (32…122ºF)
Storage Temperature Range	-5…75ºC (-40…167ºF)
Humidity Range	10…95%rH (non-condensing)
Dimensions	H - 54mm, W – 30mm, D – 37mm including connection terminals (Depth should be added to PMAC770H depth for overall installed depth of the meter/module combination)

BACnet PICS

A Protocol Implementation Conformance Statement (PICS) identifies the attributes of particular BACnet devices.

Device Profile

B-ASC
Maximum APDU = 480

1. BACnet Conformance Class Supported

☐ Class 1	☐ Class 2	☑ Class 3
☐ Class 4	☐ Class 5	☐ Class 6

2. BACnet Functional Groups Supported

☑ Clock	☐ Files
☐ HHWS	☑ Reinitialise
☐ PCWS	☐ Virtual Operator Interface
☐ Event Initialisation	☐ Virtual Terminal
☐ Event Response	☑ Device Communications
☐ COV Event Initialisation	☐ Time Master
☐ COV Event Response	

3. BACnet Standard Application Services Supported

Application Service	Initiates Request	Executes Request
Acknowledge Alarm	☐	☐
Confirmed COV Notification	☐	☐
Confirmed Event Notification	☐	☐
Get Alarm Summary	☐	☐
Get Enrollment Summary	☐	☐
Subscribe COV	☐	☐
Unconfirmed COV Notification	☐	☐
Unconfirmed Event Notification	☐	☐
Atomic Read File	☐	☐
Atomic Write File	☐	☐
Add List Element	☐	☐
Remove List Element	☐	☐
Create Object	☐	☐
Delete Object	☐	☐
Read Property	☐	☑
Read Property Conditional	☐	☐
Read Property Multiple	☐	☑
Write Property	☐	☑
Read Range	☐	☐
Write Property Multiple	☐	☑
Device Communication Control	☐	☑
Confirmed Private Transfer	☐	☐
Unconfirmed Private Transfer	☐	☐
Reinitialize Device	☐	☑
Confirmed Text Message	☐	☐
Unconfirmed Text Message	☐	☐
Time Synchronization	☐	☑

4. BACnet Standard Application Services Supported *(continued)*

Application Service	Initiates Request	Executes Request
Who-Has	☐	☑
I-Have	☑	☐
Who-Is	☐	☑
I-Am	☑	☐
VT-Open	☐	☐
VT-Close	☐	☐
VT-Data	☐	☐
Authenticate	☐	☐
Request Key	☐	☐

5. Standard Object Types Supported

Object-Type	Supported	Dynamically Creatable	Dynamically Deletable	Optional Properties Supported	Writeable Properties
Analog Input	☑	☐	☐		
Analog Output	☑	☐	☐	☐	☑
Analog Value	☑	☐	☐	☐	☑
Binary Input	☑	☐	☐		
Binary Output	☑	☐	☐	☐	☑
Binary Value	☑	☐	☐	☐	☑
Calendar	☐	☐	☐		☐
Command	☐	☐	☐	☐	
Device	☑				☑
Event Enrollment	☐	☐	☐		
File	☐	☐	☐		
Group	☐	☐	☐		
Loop	☐	☐	☐		
Multi-state Input	☐	☐	☐		
Multi-state Output	☐	☐	☐		
Notification Class	☐	☐	☐		
Program	☐	☐	☐		
Schedule	☐	☐	☐	☐	☐

6. Data Link Layer Option

- ☐ ISO 8802-3 10BASE5
- ☐ ISO 8802-3 10BASE2
- ☐ IS 8802-3 10BASET
- ☐ ISO 8802-3 Fibre
- ☐ Other - BACnet/IP as defined in Annex J

- ☐ ARCNET, coax star
- ☐ ARCNET, coax bus
- ☐ ARCNET, twisted pair star
- ☐ ARCNET, twisted pair bus
- ☐ ARCNET, fibre star

- ☑ MS/TP master, baud rate 1200, 2400, 4800, 9600, 19200, 38400
- ☑ MS/TP slave, baud rate 1200, 2400, 4800, 9600, 19200, 38400
- ☐ Point-to-Point, EIA 232, baud rate
- ☐ Point-to-Point, modem, baud rate
- ☐ LonTalk

7. Character Sets Supported

- ☑ ANSI X3.4
- ☐ IBM/Microsoft DBCS
- ☐ JIS C 6226
- ☐ ISO 10646 (ICS-4)
- ☐ ISO 10646 (UCS2)
- ☐ ISO 8859-1

8. Special Functionality Support

Not supported

- ☐ Segmented Requests
  Window Size:
- ☐ Segmented Responses
  Window Size:

9. Router

No routing capability

10. BACnet Interoperability Building Blocks (BIBBS)

The HP-BN series of devices are designed around the BACnet Application Specific Controller (B-ASC) profile. A B-ASC is a control device with a set of attributes for specific applications. The attributes of the HP-BN devices are described in the sections which follow

i) Data Sharing

Application Service	Initiates Request	Executes Request	BIBBS
Read Property	☐	☑	**D-RP-B**
Read Property Multiple	☐	☑	**D-RPM-B**
Write Property	☐	☑	**D-WP-B**
Write Property Multiple	☐	☑	**D-WPM-B**

ii) Alarm and Event Management

Not supported

iii) Scheduling

Not supported

iv) Trending

Not supported

v) Device and Network Management

Application Service	Initiates Request	Executes Request	BIBBS
Who-Is	☐	☑	**DM-DDB-B**
I-Am	☑	☐	**DM-DDB-B**
Who-Has	☐	☑	**DM-DOB-B**
I-Have	☑	☐	**DM-DOB-B**
Reinitialize Device	☐	☑	DM-**RD-B**
Device Communication Control	☐	☑	DM-**DCC-B**

Notice:

- PILOT reserves the right to modify this manual without prior notice in view of continued improvement.
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