Installation
and
User Guide

Procon

MOD-IP/50

MITSUBISHI ELECTRIC

1. Product Overview

The Procon MOD-IP/50 unit allows a Modbus building management system (BMS) to monitor and control air-conditioning units attached to a Mitsubishi G-50A, GB-50A or AG-150 central controller (referred to as 'G-50' from now on).

The Modbus registers can be accessed via the serial comms interface using Modbus RTU on RS232 or RS485, or via the network interface using Modbus/TCP.

Depending on the air-conditioning configuration within the G-50, up to 50 groups can be monitored / controlled. The error state of up to 50 OC/BC units can also be monitored.
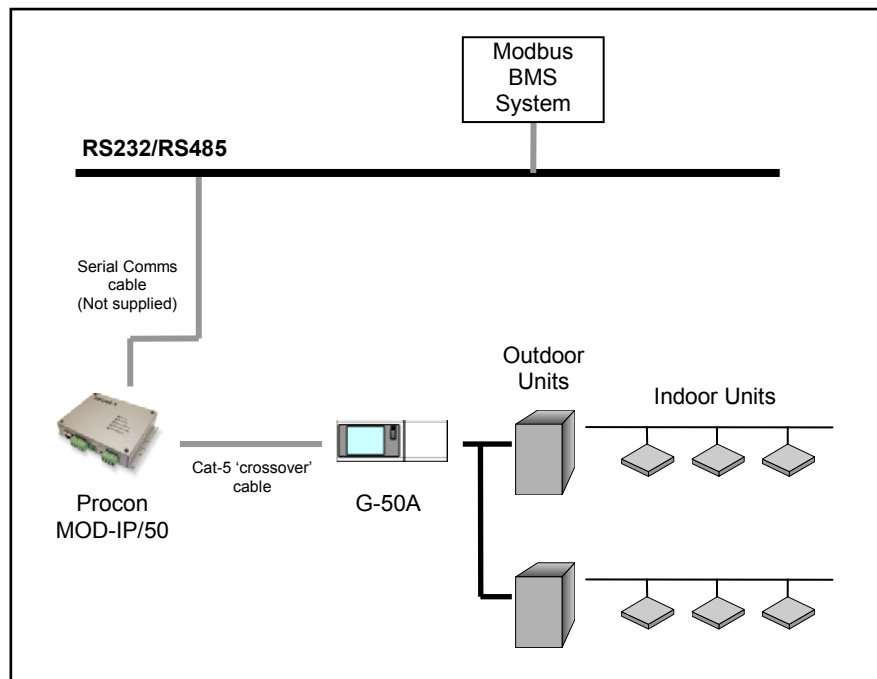
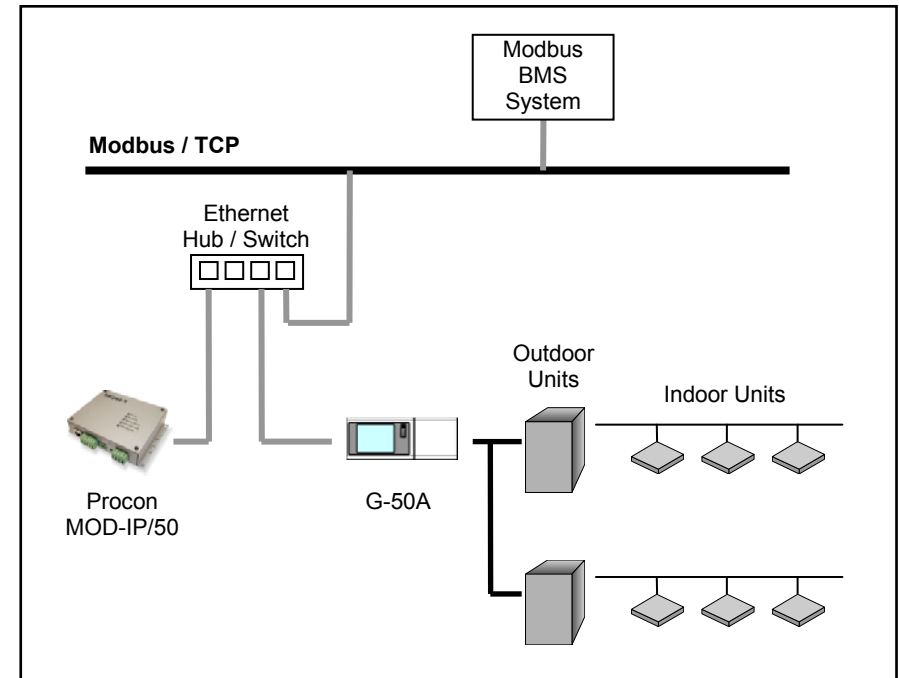

Fig.1a System Configuration Example Using RS232/RS485

Fig.1b System Configuration Example Using Modbus/TCP

1.1 Supplied Parts

No.	Part Name	Quantity
1	Procon MOD-IP/50	1
2	Cat-5 'Straight Through' Patch Lead	1
3	Cat-5 'Crossover' Patch Lead	1
4	Din-Rail Clips	2
5	Self-Tapping Screws for Din-Rail Clips	4
6	Installation Manual	1

2. Connection Details

> **All electrical work should be carried out by a competent person and wiring must be in accordance with the national electrical installation regulations.**
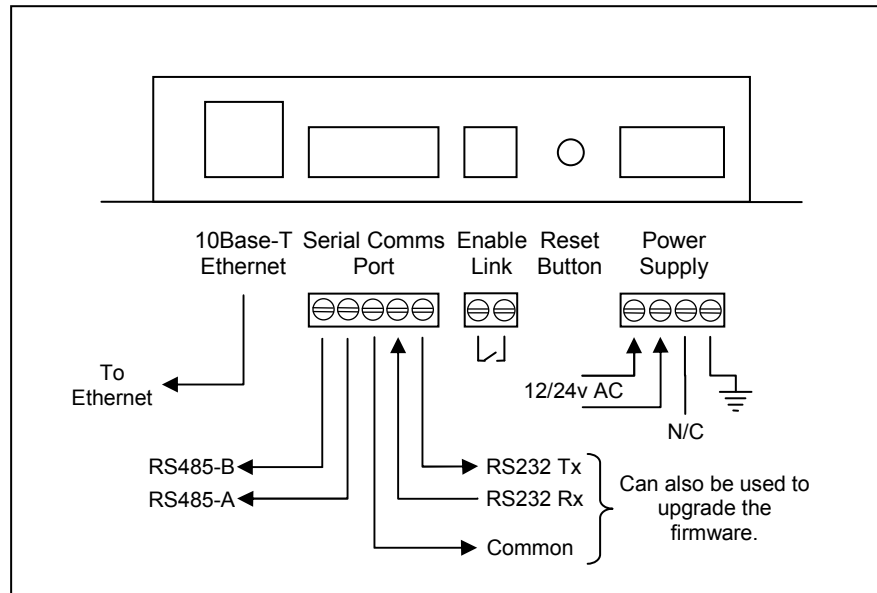

Fig.2 Connection Details

2.1 Ethernet

The Procon MOD-IP/50 is a 10Base-T half duplex device and needs to be connected to the G-50 and the local network (if Modbus/TCP is being used). Fig.1b shows the use of a hub / switch (not supplied) to make the connections, but the Procon unit and the G-50 could just as easily be connected directly to the network.
See Appendix C for port configuration.

> Note: a) The Procon MOD-IP/50 and the G-50 require separate
>   IP addresses which must be on the same subnet.
>   b) The MOD-IP/50 does not support Auto-Negotiation.

2.2 Serial Comms Port

This connector provides access to the modbus registers using RS232 or 2-wire RS485. The RS232 port can also be used for upgrading the firmware. See Appendix C for port configuration.
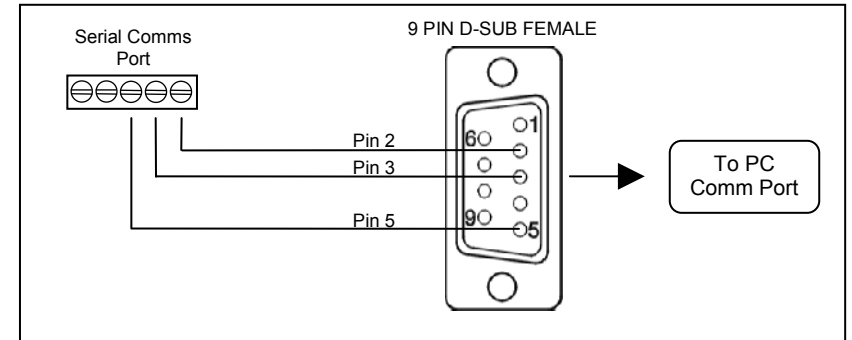

Fig.3a RS232 Comms Lead Wiring Diagram

The RS485 interface can be used on a compatible serial communications network shared by multiple RS485 devices. The Slave Address Offset parameter must be set to prevent multiple units using the same slave numbers.
It is recommended that screened twisted-pair cable is used.
RS485-A is the non-inverting signal and is also named RS485+
RS485-B is the inverting signal and is also named RS485-
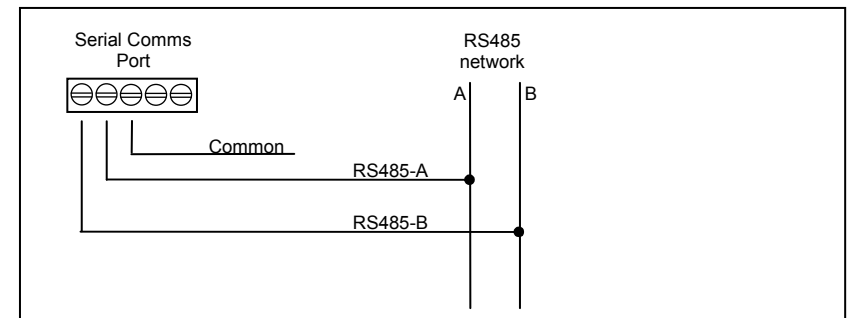Common should be connected to the cable screen.

Fig.3b RS485 Comms Wiring Diagram

2.3 Enable Link

Allows a normally-closed volt-free contact to set or reset the 'Forced-Off' feature in the G-50. While the 'Forced-Off' feature is enabled, all air-conditioning units are switched off and all remote-controllers are disabled.

Upon detection of the open contact, the Procon unit sends the 'Forced-Off' Set command to the G-50, and resends at 5 seconds intervals while the contact is open.
As soon as the contact closes, the Procon unit sends the 'Forced-Off' Reset command to the G-50 once only. This ensures that any subsequent 'Forced-Off' commands sent via the Modbus BMS system are not overridden.
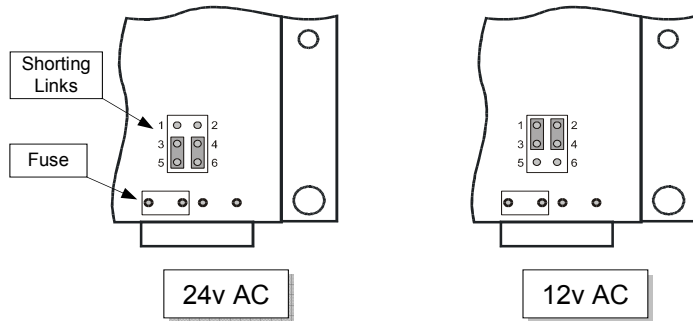
Note: The Procon MOD-IP/50 comes supplied with a wire link across the Enable Link terminals.

2.4 Power Supply

The Procon MOD-IP/50 will accept either 12v or 24v AC and has a consumption of 8VA. The unit is shipped setup for 24v AC. The internal fuse is rated T500mA.

THIS EQUIPMENT MUST BE EARTHED

Changing The Supply Voltage

24v AC   12v AC

Disconnect the supply and remove the top cover. Fit the 2 shorting links and the fuse in the appropriate positions detailed above.

3. Air-Conditioning Group Configuration
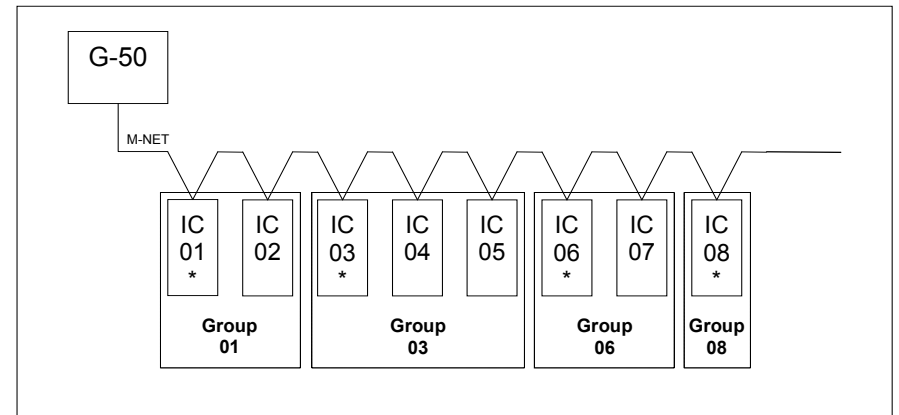
Fig.4 Grouping Example

The groupings set up in the G-50 determine which unit addresses can accept commands from the BACnet BMS system. The group number is defined as 'the lowest indoor unit address within the group'. This then becomes the 'master' address for the group, and is the only address within that group than can accept commands.
The other units within a group can be classed as 'slave' units and contain the same status parameter values as the 'master', apart from the Error Code, which is unique to each unit.
In the example above, addresses 01, 03, 06 and 08 are the 'master' units, and 02, 04, 05 and 07 are the 'slave' units.

Note: Attempting to write a command to a 'slave' unit will have no effect.

4. Unit Operation

At startup and provided a network cable is attached (the 'Ethernet Link' led should be lit), the Procon unit attempts to establish a connection with the G-50 using the appropriate IP address. Should the G-50 not be found, then a 'watchdog' feature will periodically reset the Procon unit, indicated by the 'Device Reset' led lighting up for 2 seconds.

> The Global parameter 'G50 Comms Status' can be read via Modbus to determine if the Procon unit is communicating with the G-50.

Once established, the G-50 is interrogated to determine the number of active groups. At this point the Procon unit begins its polling sequence, requesting the Mnet status, the status of all active groups, and the list of all current alarms. This sequence is continually repeated, with new control settings from the BMS transmitted to the G-50 by interleaving into the poll sequence.

> The time required to complete the polling sequence will depend on the number of active groups programmed in the G-50 and the frequency of new control settings sent via Modbus.

If the BMS is using RS232 or RS485 and provided a valid modbus message is received, then the 'Serial Tx' led will light to indicate that a Modbus reply has been sent. If Modbus/TCP is being used then there will be increased activity from the 'Ethernet Tx' led.

5. Modbus Registers

The Procon MOD-IP/50 behaves as 20 modbus slaves, each with 60 registers (Offset = 0 to 59).

By default the slave addresses are 1 – 20 but an address offset can be applied to provide ranges 21-40, 41-60, 61-80, 81-100, up to 201-220. This is useful to prevent address clashing when the Procon unit is attached to a communications network containing multiple Modbus devices.

The Procon MOD-IP/50 maps the data from the air conditioner units into Modbus registers accessed by two Modbus parameters 'Slave No.' and 'Offset'.

All slave numbers referred to in this document assume the default addresses - Add the 'offset' value where applicable.

Slaves 1 to 16 each represent 3 units, and slave 17 represents 2 units, with 'Unit C' of slave 17 used for various system settings. See Section 5.4 for details.
Each slave is organised as follows:

General Information			Extended Information		
Unit A	Unit B	Unit C	Unit A	Unit B	Unit C
Offset 0	Offset 10	Offset 20	Offset 30	Offset 40	Offset 50

General Information for a single unit		Extended Information for a single unit	
Register Offset	Stored Value	Register Offset	Stored Value
0	Return Air Temp	0	Air Direction (Read)
1	Error Code	1	Air Direction (Write)
2	Setpoint (Read)	2	Inhibit (Read)
3	Mode (Read)	3	Inhibit (Write)
4	Fan Speed (Read)	4	Ventilation (Read)
5	Setpoint (Write)	5	Ventilation (Write)
6	Mode (Write)	6	Filter Reset (Read)
7	Fan Speed (Write)	7	Filter Reset (Write)
8	On/Off (Read)	8	Unused
9	On/Off (Write)	9	Unused

Examples : 1) To read the current fan speed of unit 8, the required modbus message would contain Slave 3, Function 3, Offset 14.
2) To read the current mode of unit 48, the required modbus message would contain Slave 16, Function 3, Offset 23.

On/Off, Inhibit & Filter Reset can also be accessed via 'Coils'. Each slave contains 18 coils, organised as follows:

Coil Offset	Definition
0	Unit A On/Off (R)
1	Unit A On/Off (W)
2	Unit B On/Off (R)
3	Unit B On/Off (W)
4	Unit C On/Off (R)
5	Unit C On/Off (W)
6	Unit A Inhibit (R)
7	Unit A Inhibit (W)
8	Unit B Inhibit (R)
9	Unit B Inhibit (W)
10	Unit C Inhibit (R)
11	Unit C Inhibit (W)
12	Unit A Filter Reset (R)
13	Unit A Filter Reset (W)
14	Unit B Filter Reset (R)
15	Unit B Filter Reset (W)
16	Unit C Filter Reset (R)
17	Unit C Filter Reset (W)

5.1 OC/BC Error Codes

Slave 18 contains the error codes for units 51 to 80.
Slave 19 contains the error codes for units 81 to 100.

5.2 Additional Register Usage

Slave	Offset	Setting
17	20	Mnet Status
17	21	G-50 Status
17	22	Global Forced-Off (Read)
17	23	Global Forced-Off (Write)
19	20	Firmware Number
19	21	Firmware Version
19	22-27	MAC Address
20	7-10	IP Address
20	11-14	Gateway Address
20	15-18	Subnet Mask
20	20	Slave Address Offset
20	21	G-50 IP Address

5.3 Parameter Settings

Parameter	Settings	Notes
Return Air Temperature	0°C to 99°C	
Error Code	4 digit error code where 8000 = 'No Error'	
Setpoint Temperature	Air Conditioner : Cool/Dry : 19°C to 30°C Heat : 17°C to 28°C Auto : 19°C to 28°C Boiler : Heating : 30°C to 45°C Heating ECO : 30°C to 45°C Hot Water : 30°C to 70°C Anti-Freeze : 10°C to 45°C Cooling : 10°C to 30°C	
Operation Mode	00: Fan (Draft) 01: Cool 02: Heat 03: Dry 04: Auto 05: (Not Used)	
	06: AutoCool 07: AutoHeat	Not settable
	08: Heat Recovery 09: LC_Auto 10: Bypass	Lossnay Only
	11: Heating 12: Eco-Heating 13: Hot-Water 14: Anti-Freeze 15: Cooling	Heat-pump boiler only
Fan Speed	00: Low 01: Mid2 (Low Medium) 02: Mid1 (High Medium) 03: High	
On/Off	00: Off 01: On	
Air Direction	00: Horizontal 01: Mid1 02: Mid2 03: Vertical 04: Swing	
Local Inhibit	00: Not inhibited 01: Inhibited	
Ventilation	00: Off 01: Low 02: High	Lossnay / OA units only
Filter Sign	00: Filter Sign Off 01: Filter Sign On	Cleared by writing 00 to the Filter Sign register or coil.

Parameter	Settings	Notes
OC / BC Error Code	4 digit error code where 8000 = 'No Error'	
Mnet Status	00: Initialising 01: OK	See Appendix D
G50 Comms State	00: Not found 01: OK	See Appendix D
Global Forced-Off	00: Disabled 01: Enabled	See Appendix D

5.4 Modbus Table Overview

Unit Address	Slave	General Info Base Offset	Extended Info Base Offset	Coil Base Offsets		
				On/Off	Inhibit	Filter Sign
1	1	0	30	0	6	12
2	1	10	40	2	8	14
3	1	20	50	4	10	16
4	2	0	30	0	6	12
5	2	10	40	2	8	14
6	2	20	50	4	10	16
7	3	0	30	0	6	12
8	3	10	40	2	8	14
9	3	20	50	4	10	16
10	4	0	30	0	6	12
11	4	10	40	2	8	14
12	4	20	50	4	10	16
13	5	0	30	0	6	12
14	5	10	40	2	8	14
15	5	20	50	4	10	16
16	6	0	30	0	6	12
17	6	10	40	2	8	14
18	6	20	50	4	10	16
19	7	0	30	0	6	12
20	7	10	40	2	8	14
21	7	20	50	4	10	16
22	8	0	30	0	6	12
23	8	10	40	2	8	14
24	8	20	50	4	10	16
25	9	0	30	0	6	12
26	9	10	40	2	8	14
27	9	20	50	4	10	16
28	10	0	30	0	6	12
29	10	10	40	2	8	14
30	10	20	50	4	10	16
31	11	0	30	0	6	12
32	11	10	40	2	8	14
33	11	20	50	4	10	16
34	12	0	30	0	6	12
35	12	10	40	2	8	14
36	12	20	50	4	10	16
37	13	0	30	0	6	12
38	13	10	40	2	8	14
39	13	20	50	4	10	16
40	14	0	30	0	6	12
41	14	10	40	2	8	14
42	14	20	50	4	10	16
43	15	0	30	0	6	12
44	15	10	40	2	8	14
45	15	20	50	4	10	16
46	16	0	30	0	6	12
47	16	10	40	2	8	14
48	16	20	50	4	10	16
49	17	0	30	0	6	12
50	17	10	40	2	8	14

6. Special Functions

This section describes functions which can only be enabled via switches on the MOD-IP/50 circuit board.

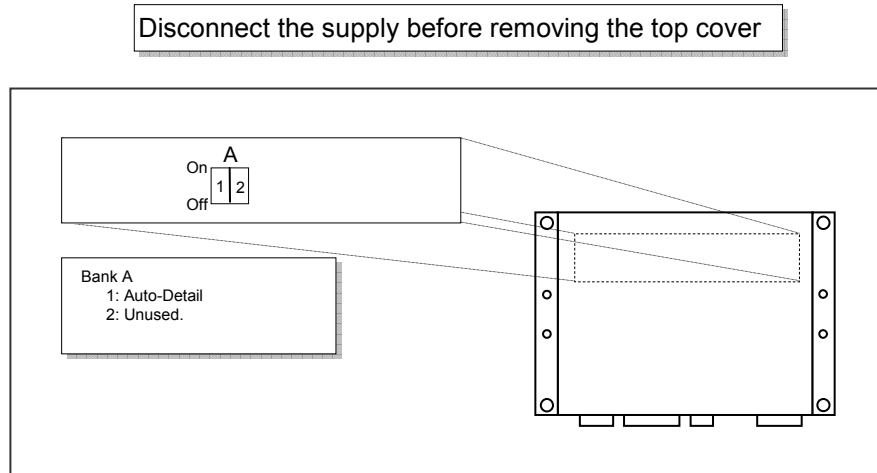Disconnect the supply before removing the top cover

Fig.5 Special Function Switches

6.1 Function Descriptions

Bank A-1:   Auto-Detail
  Off: Mode status reported as 'Auto', regardless of which 'Auto' mode is active.
  On: 'AutoHeat' or 'AutoCool' are reported, if active. (This is the factory default setting).

Bank A-2:   Not used at present.

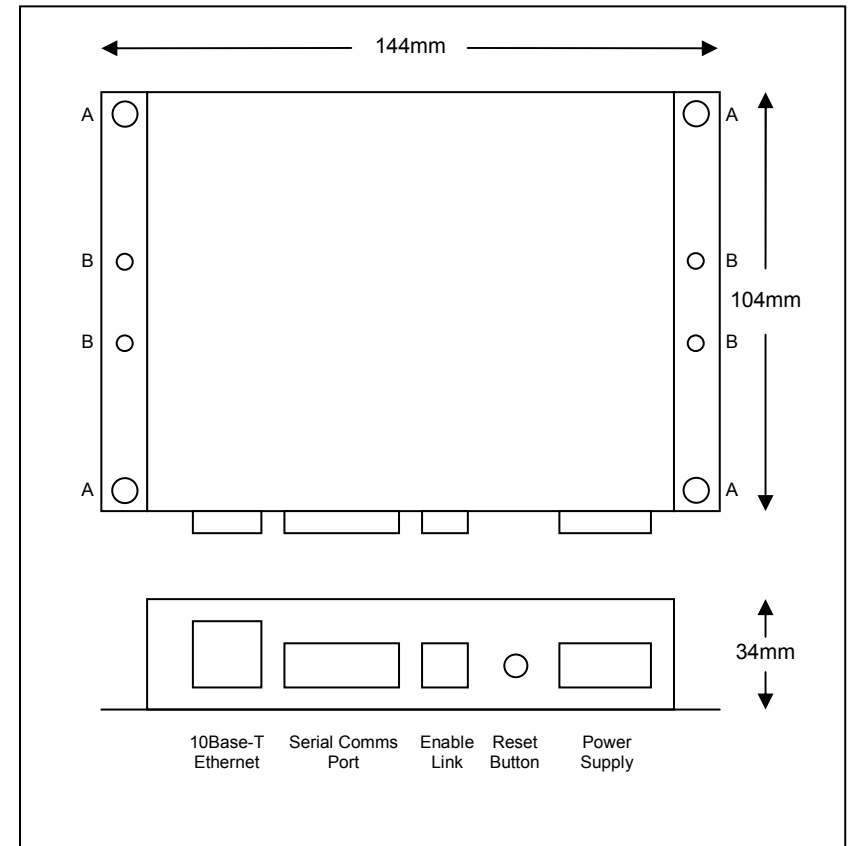## Appendix A : Physical Dimensions

Fig.6 Dimensions

The holes marked 'A' should be used when mounting the enclosure on a back panel.

The holes marked 'B' can be used to attach the supplied din-rail clips.

<u>**Appendix B : Reset Button**</u>

The Reset button has 2 functions :

1) To restore various internal settings to their factory defaults,

2) To force the unit into 'bootloader' mode ready for a firmware update.

<u>Function 1 – Restore Factory Defaults</u>

There are 2 levels to this function.

Level 1 :   With the unit already ON, press and hold in the reset button. After approximately 5 seconds the 'Device Reset' light will start to flash slowly. Releasing the reset button while the light is flashing slowly will activate Level 1, and then reset the unit.

Settings Restored: None

Level 2 :   With the unit already ON, press and hold in the reset button. After approximately 5 seconds the 'Device Reset' light will start to flash slowly. Continue to hold in the reset button until the light starts to flash rapidly. Releasing the reset button while the light is flashing rapidly will activate Level 2, and then reset the unit.

Settings Restored:

IP Address	192.168.1.11
Gateway Address	192.168.1.11
Subnet Mask	255.255.255.0
G50 IP Address	192.168.1.1
Slave Address Offset	0

<u>Function 2 – Enable 'Bootloader' Mode</u>

Bootloader mode allows the firmware to be updated from a PC.

Press and hold in the reset button while powering up the unit. Continue to hold in the reset button for approx. 5 seconds, until the 'Device Reset' light begins to flash (Long ON, Short OFF). The unit is now in bootloader mode.

<u>Note</u>: Enabling the bootloader in this way is only necessary if the firmware update software fails to automatically put the unit into bootloader mode.

Appendix C : Port Configurations

RS232/RS485 interface

- Modbus RTU
- 9600 baud, 8 data bits, no parity, 1 stop bit

Network interface

- Modbus/TCP
- TCP port 502
- 10base-T half-duplex
- Auto-negotiation not supported

Modbus Functions accepted

- Fn 1   Read Coils
- Fn 3   Read Holding Registers
- Fn 5   Write Single Coil
- Fn 6   Write Single Register
- Fn 16   Write Multiple Registers

Appendix D : Global Parameters

Global Parameter	Description
Mnet Comms Status	Provides an indication of the communication status between the G-50 and the Mitsubishi M-Net network. 00 : M-Net Initialising 01 : M-Net OK Note: While M-Net is initialising, the air-conditioning is effectively offline to control and monitoring requests.
G50 Comms Status	Provides an indication of the communication status between the Procon MOD-IP/50 and the G-50. 00 : G-50 not responding 01 : G-50 comms OK Note: 'G-50 not responding' either means the G-50 is switched off or is not connected to the network.
Global Forced Off	Enables and disables the Global Forced-Off command. This setting allows the BMS to provide functionality equivalent to the 'Enable Link' described in section 2.3

Document Revision History

Date	Document Ver	Firmware Ver	By	Comments
16/12/2009	v1.00	v1.02	mcb	First complete version.