BLACK PEAR

MM-A20
BMS Interface for Mitsubishi Electric Split Air-Conditioning

Installation and User Guide

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Contents

1. Supplied Parts

Black Pear MM-A20

DIN-rail clips

2. Important Information

- **All electrical work should be carried out by a competent person and wiring must be in accordance with the national electrical installation regulations.**
- **Ensure that installation work is done correctly using the information contained in this manual.**
- **Make all connections securely so that any outside forces acting on the cables are not applied to the terminals.**
- **Never modify or repair the Black Pear by yourself.**
  Any attempt to do so will void the warranty.
- **To dispose of this product, consult your dealer.**

This unit will require setting up, using the free configuration software available on our website.
Please go to www.microtrol.co.uk and click on the 'Support' link.

3. Product Overview

The Black Pear MM-A20 allows a building management system (BMS) to monitor and control 'split type' air-conditioning units connected to a Mitsubishi M-Net system without the need for a central controller.

The unit incorporates a port which allows direct connection to the Mitsubishi M-Net network and allows up to 20 units to be monitored and controlled. Power can also be supplied to the M-Net wires if required. See Appendix C for details.

The MM-A20 provides Modbus RTU on either RS232 or RS485.

There is a variant called the MM-A20L, which does not include a 24v output to supply the M-Net system.

The Black Pear can also be used on systems where a G-50A, GB-50A or AG-150 central controller is already present, but only addresses in the range 1 to 20 will be detected.

Split air-conditioners require additional adapter cards fitting to be able to connect to an M-Net network:

HVAC Type	Adapters Currently Available
A-Control Mr Slim	Black Pear PIP Adapter Mitsubishi PAC-SF82MA
M,P,S Series	Mitsubishi MAC-399IF

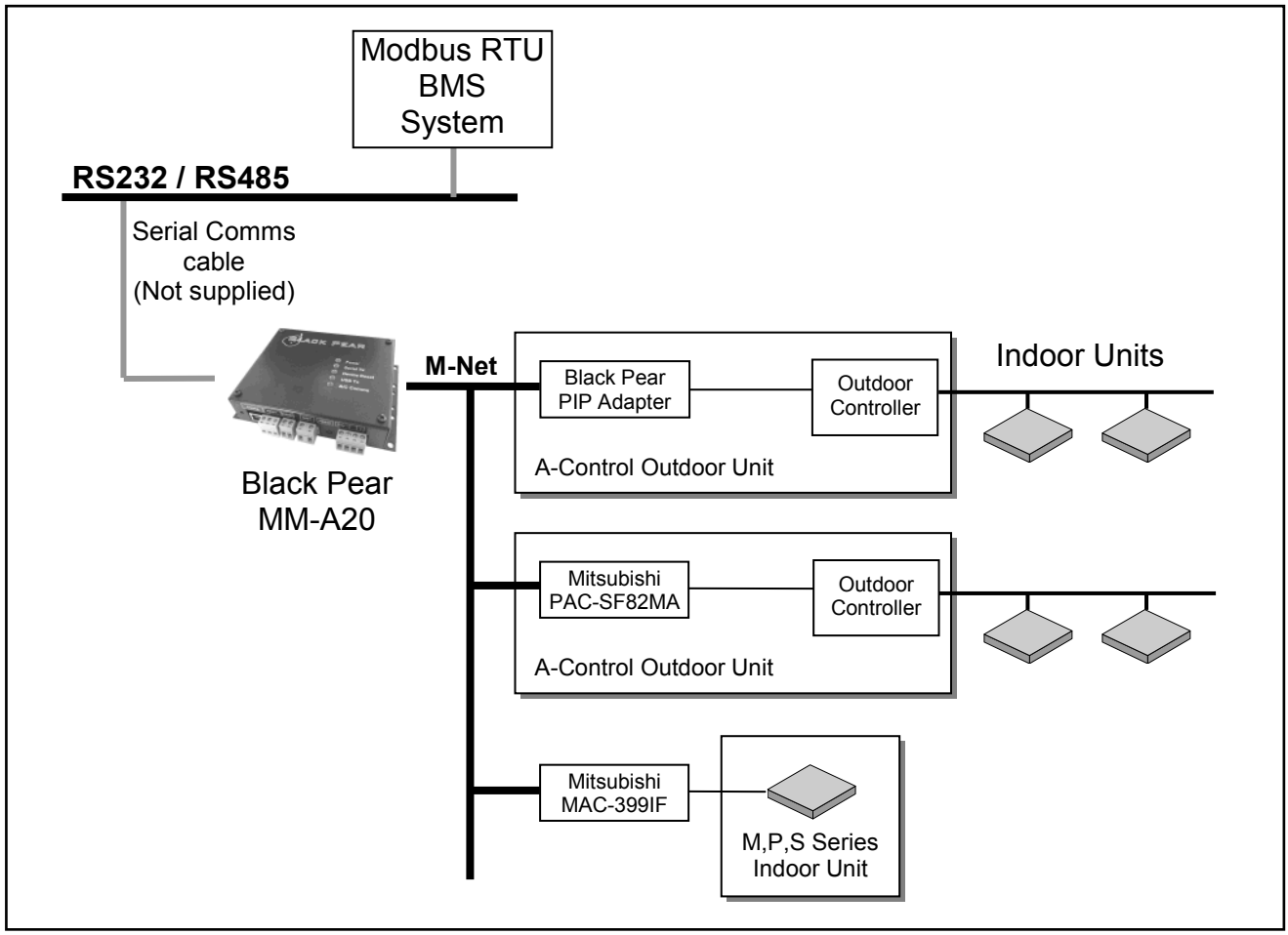

Fig. 1 System Configuration Examples

4. 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.

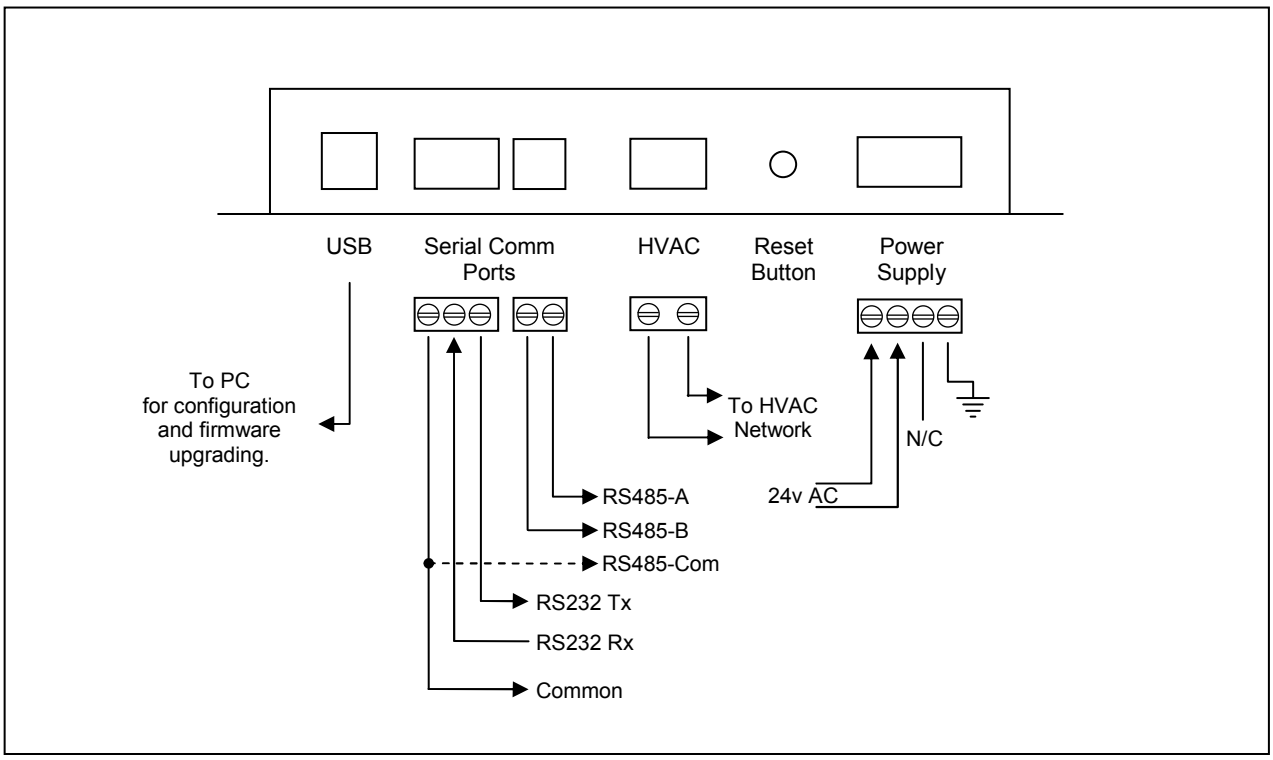

Fig. 2 Connection Details

4.1 Power Supply

The Black Pear requires a 24v AC supply and has a consumption not exceeding 5VA. The internal fuse is rated T630mA.

THIS EQUIPMENT MUST BE EARTHED

4.2 HVAC Communications Network (M-Net)

The Black Pear communicates with the Mitsubishi HVAC system using M-Net. 'Split type' air-conditioners will require additional interfaces fitting to convert them to M-Net.
The M-Net connections are non-polarized.

The MM-A20 can also supply 24v on the M-Net if required. See Appendix C for details.

4.3 Serial Communications Ports

These connectors provide access to the Modbus registers using RS232 or 2-wire RS485. The port configuration is as follows:

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

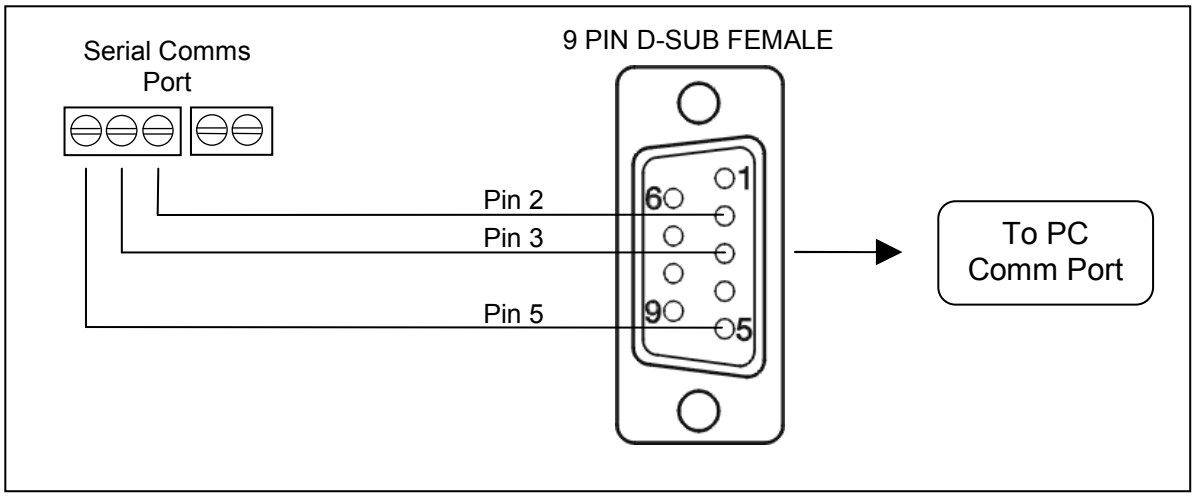

Fig. 3 RS232 Comms Lead Wiring Diagram

The RS485 interface can be used on a compatible serial communications network shared by multiple RS485 devices. The 'Base Slave Address' 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.

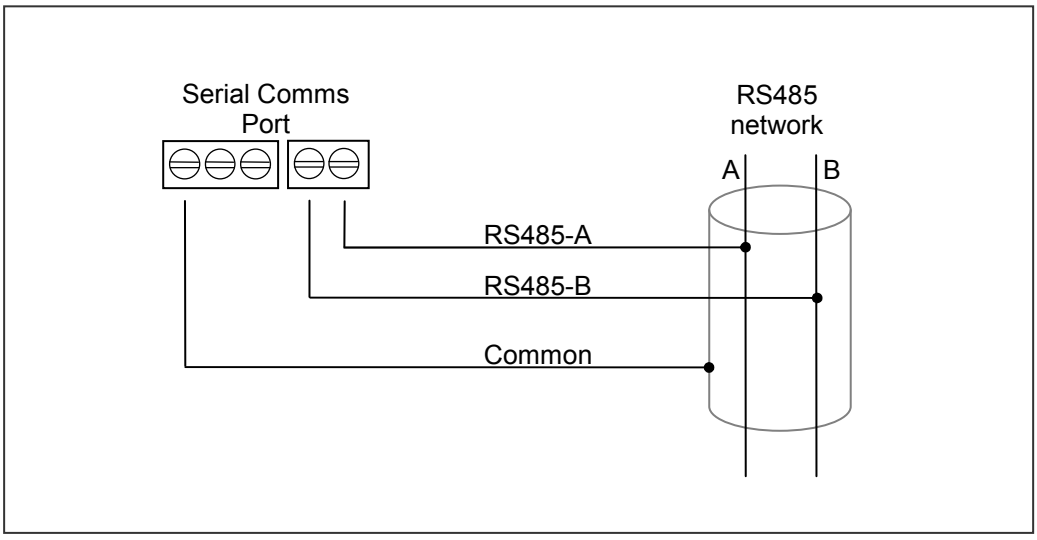

Fig. 4 RS485 Comms Lead Wiring Diagram

4.4 USB

The USB interface is used for configuration via a PC and for upgrading the firmware. Requires a standard USB-A to USB-B cable (not supplied).

Ensure that the correct USB driver has been installed prior to connecting the Black Pear to a PC.

5.Air-Conditioning Group Configuration (Mitsubishi)

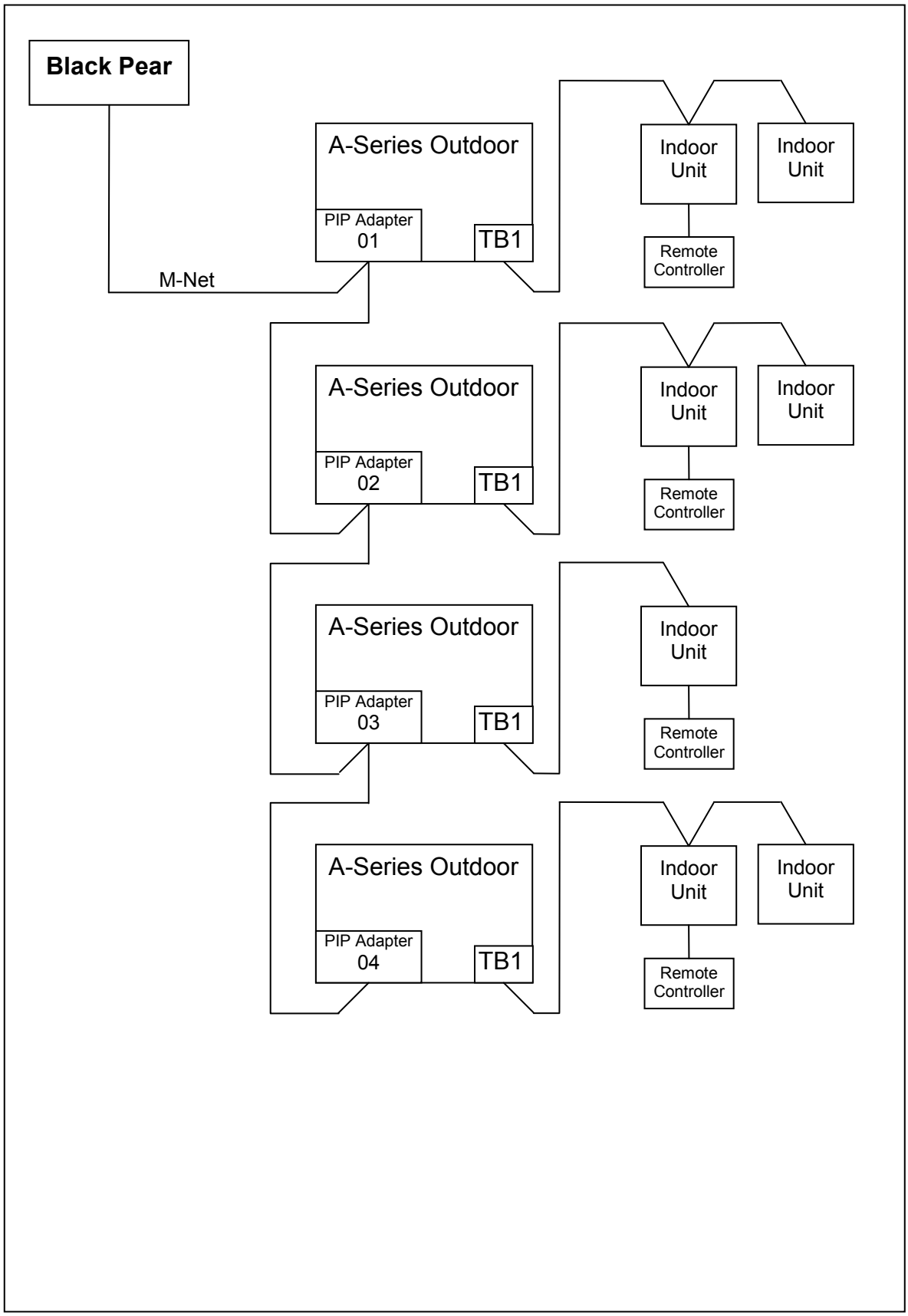

Fig. 5 HVAC Example

The groupings determine which unit addresses can accept commands from the 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 that 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 Return Air Temp and Error Code, which are unique to each unit.

Attempting to write a command to a ‘slave’ unit will have no effect.

In the example shown in Fig. 5, addresses 01, 02, 03 and 04 are available. Even though there are multiple indoor units attached to some of the outdoors, the Black Pear will treat each address as a single unit. It is possible to group these addresses within the Black Pear using the PC configuration software.

6.Modbus Interface

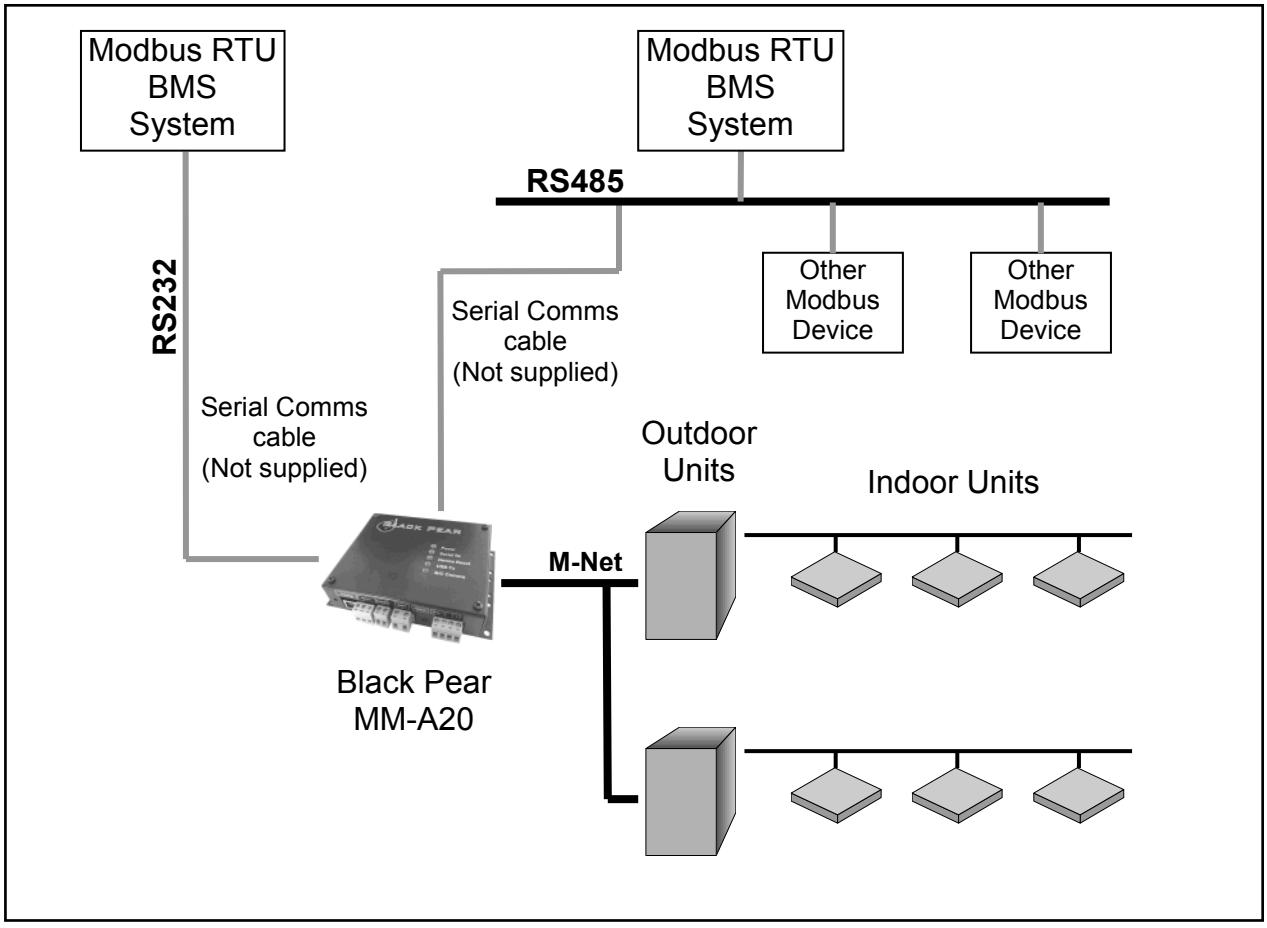

Fig. 6 Modbus System Example

6.1 Port Configurations

RS232/RS485 interface
Modbus RTU
9600 baud, 8 data bits, no parity, 1 stop bit

Modbus functions supported

Fn 1	Read Coils
Fn 3	Read Holding Registers
Fn 5	Write Single Coil
Fn 6	Write Single Register
Fn 16	Write Multiple Registers (Max. 16 registers at once)

6.2 HVAC Status and Control Registers

The Black Pear MM-A20 behaves as 24 modbus slaves. Slaves 1 to 22 each have 90 registers (Offset = 0 to 89). Slaves 23 and 24 are used for configuration.

Slaves 8 to 22 are not used by this version of the Black Pear. They are required for systems which have a maximum of 64 units.

The default 'Base Slave Address' is 1, meaning the Black Pear will respond to msgs for slaves 1 to 24. The Base Slave Address can be adjusted from 1 up to 200. A setting of 200 means the Black Pear will respond to msgs for slaves 200 to 223.
This is useful to prevent address clashing when the Black Pear unit is attached to a serial communications network containing multiple Modbus devices.

Some BMS systems have limited slave address resources, so the 'Single Slave Access' feature means the Black Pear can be configured to respond to just 1 slave address (i.e. the 'Base Slave Address' setting).

The Black Pear 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 Base Address.

Slaves 1 to 6 each represent 3 units, and slave 7 represents 2 units.
Each slave is organised as follows:

General Information		
Unit A	Unit B	Unit C
Offset 0	Offset 10	Offset 20

Extended Information		
Unit A	Unit B	Unit C
Offset 30	Offset 40	Offset 50

Extra Information		
Unit A	Unit B	Unit C
Offset 60	Offset 70	Offset 80

General information for a single unit	
Register Offset	Stored Value
0	Return Air Temp
1	Error Code
2	Setpoint (R)
3	Mode (R)
4	Fan Speed (R)
5	Setpoint (W)
6	Mode (W)
7	Fan Speed (W)
8	On/Off (R)
9	On/Off (W)

Extended information for a single unit	
Register Offset	Stored Value
0	Air Direction (R)
1	Air Direction (W)
2	Inhibit (R)
3	Inhibit (W)
4	Ventilation (R) ✶
5	Ventilation (W) ✶
6	Error Code (DispA)
7	Error Code (DispB)
8	CN32 state
9	Unused

Extra information for a single unit	
Register Offset	Stored Value
0	Unused
1	Unused
2	Unused
3	Unused
4	Unused
5	Unused
6	Unused
7	Unused
8	Unused
9	Unused

See Section 6.5 for an overview of Modbus slave and offset usage..

Examples:
1) To read the current fan speed of unit 8

Single Slave Access = Off		
Slave	Function	Offset
3	3	14

Single Slave Access = On		
Slave	Function	Offset
1	3	194

2) To read the current mode of unit 18

Single Slave Access = Off		
Slave	Function	Offset
6	3	23

Single Slave Access = On		
Slave	Function	Offset
1	3	473

✶ Not currently supported

On/Off and Inhibit can also be accessed via ‘Coils’. Each slave contains 12 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)

Note
Coil access is not available when ‘Single Slave Access’ is enabled.

6.3 Additional Register Usage

Slave	Offset	Single Slave Offset	Description	Valid Settings
22	150	2040	HVAC Network Status	00: Waiting 01: Searching 02: Ready 03: Unknown
22	151	2041	System Force Off ✶	00: Not active 01: Active

See Appendix D for a description of the various settings.

✶ Not currently supported

6.4 Parameter Settings

Parameter	Settings	Notes
Return Air Temperature	0°C to 99°C	
Error Code	4 digit error code where 8000 = 'No Error' 6999 = 'Unit Not Present'	
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 ✶

✶ Not currently supported

6.5 Modbus Table Overview

Unit Address	Slave	General Info Base Offset	Extended Info Base Offset	Extra Info Base Offset	Single Slave Access		Coil Base Offsets	
					General Info Base Offset	Extended Info Base Offset	On/Off	Inhibit
1	1	0	30	60	0	30	0	6
2	1	10	40	70	10	40	2	8
3	1	20	50	80	20	50	4	10
4	2	0	30	60	90	120	0	6
5	2	10	40	70	100	130	2	8
6	2	20	50	80	110	140	4	10
7	3	0	30	60	180	210	0	6
8	3	10	40	70	190	220	2	8
9	3	20	50	80	200	230	4	10
10	4	0	30	60	270	300	0	6
11	4	10	40	70	280	310	2	8
12	4	20	50	80	290	320	4	10
13	5	0	30	60	360	390	0	6
14	5	10	40	70	370	400	2	8
15	5	20	50	80	380	410	4	10
16	6	0	30	60	450	480	0	6
17	6	10	40	70	460	490	2	8
18	6	20	50	80	470	500	4	10
19	7	0	30	60	540	570	0	6
20	7	10	40	70	550	580	2	8

Appendix A : Physical Dimensions

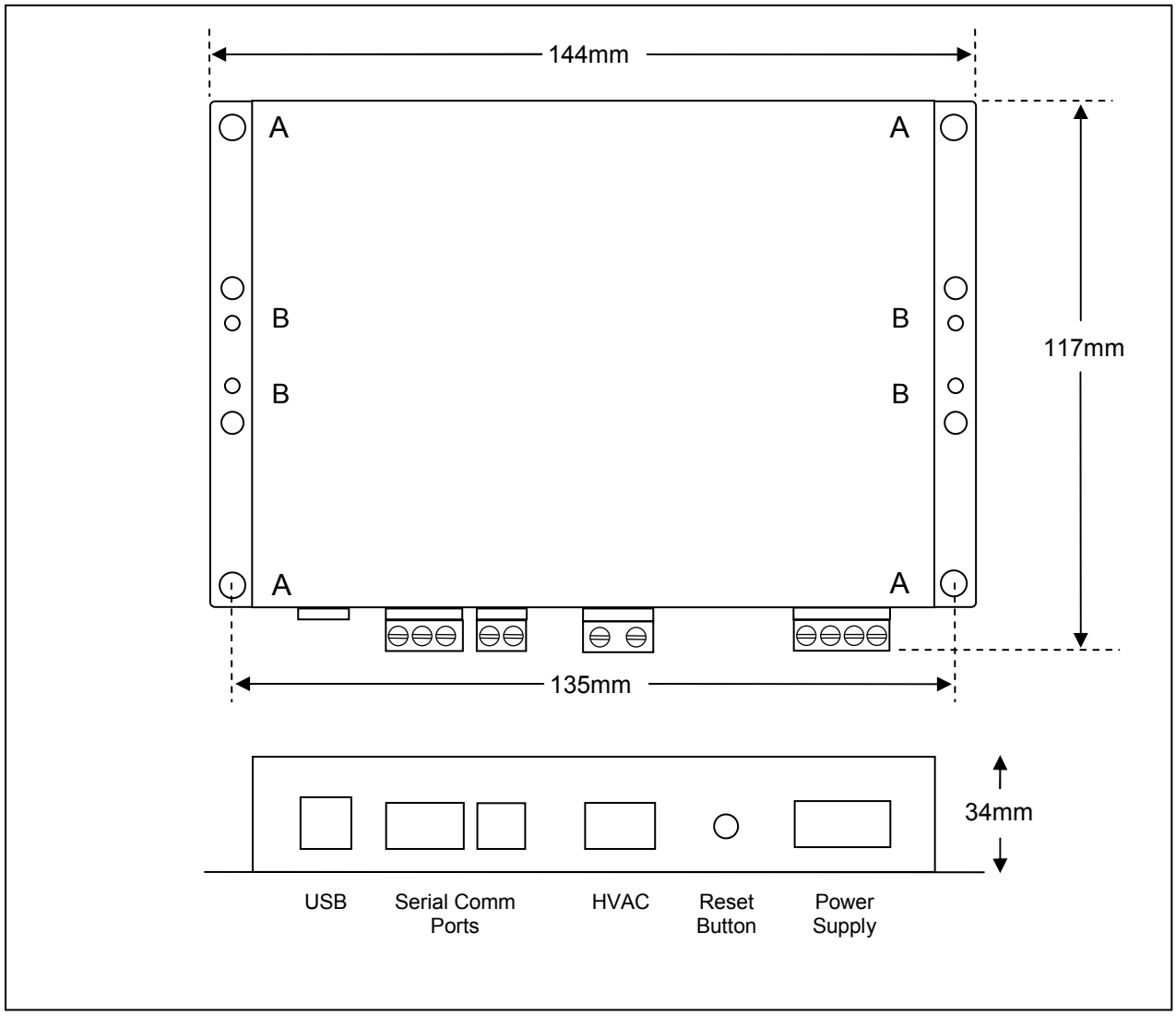

Fig. 7 Dimensions

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.

Appendix B : Reset Button and Factory Defaults

The Reset Button has 2 functions :

1) To restore various internal settings to their factory default,
2) To force the unit into 'bootloader' mode ready for a firmware update.

B.1 Function 1 : Restore Factory Defaults

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, and depending on the type of unit, either the 'Power' led will start to flash slowly (approx 3 per second) or the 'Level-1 Reset' message will be displayed. Releasing the reset button at this point 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, and depending on the type of unit, either the 'Power' led will start to flash slowly (approx 3 per second) or the 'Level-1 Reset' message will be displayed. Continue to hold in the reset button until either the 'Power' led starts to flash rapidly (approx 10 per second), or the 'Level-2 Reset' message is displayed. Releasing the reset button at this point will activate Level 2, and then reset the unit.

Settings Restored:

Device Name	'Black Pear MM-A20'
Base Slave Address	1
Single Slave Access	Off
HVAC Address	250
Central Controller	Present
Group Configuration	Cleared

B.2 Function 2 : Enable ‘Bootloader’ Mode

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. The unit is now in bootloader mode.

> Note:
> 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 : Supplying 24v on M-Net

The MM-A20 can be configured to supply power to the M-Net wires if required.

Before enabling this feature, ensure that 24v isn't already present on the M-Net cable. The Black Pear 24v output could be damaged if 24v is already being supplied by another device.

Disconnect the supply before removing the top cover

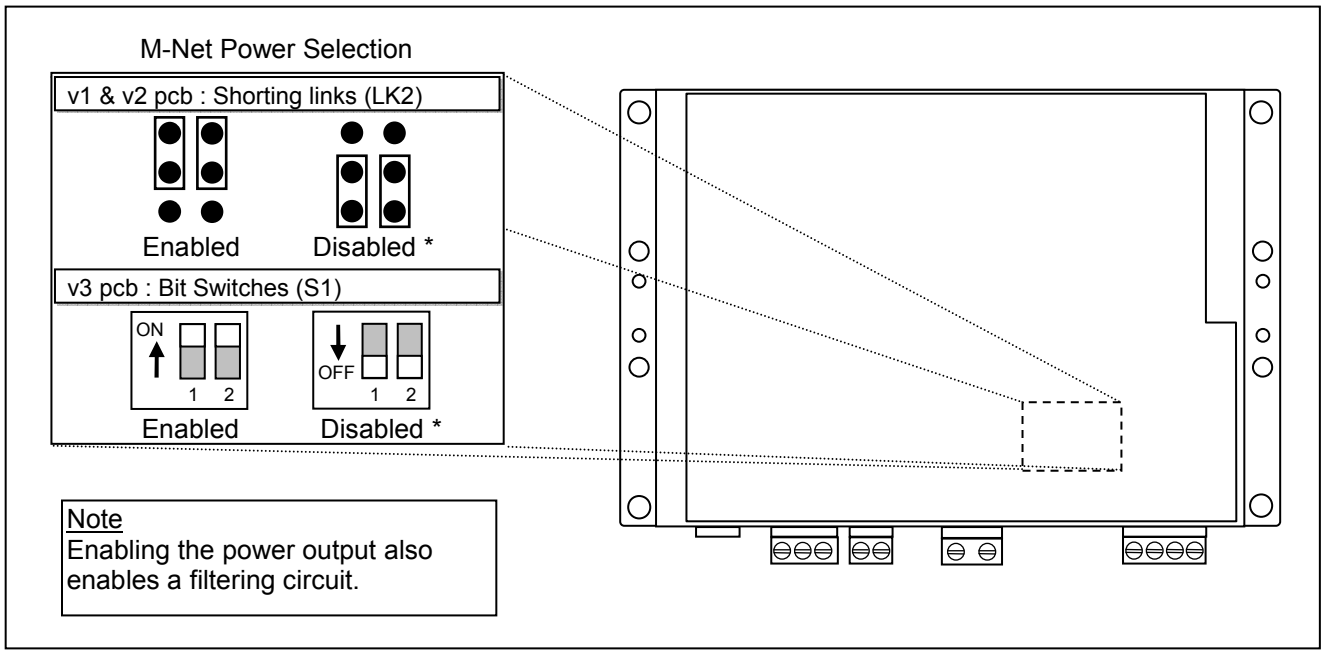

Fig. 8 M-Net Power Output Configuration

The output should be disabled if the M-Net power is being supplied by an external device.

The output should be enabled in all other cases.

Note: This also applies to the Black Pear MM-A20L.
Even though the 24v output is not fitted, enabling the output also enables the filtering circuit.

* Factory Default

Appendix D : 'Global Registers'

Global Register	Description
HVAC Network Status	Read-only register providing an indication of the communication status between the Black Pear and the HVAC network. The various states are defined as follows: Waiting: The Black Pear has been restarted and is preparing to start scanning the HVAC network. Searching: The Black Pear is performing its initial scan of the HVAC network, looking for active units with addresses in the range 1 to 50. Ready: The initial scan is complete and the Black Pear will now accept new commands. Unknown: An undefined state has been detected. Note: Until the status = 'Ready', commands sent to the Black Pear will be ignored.
System Force Off	Writeable register to enable and disable the global off command. Note: This function is currently disabled.

Appendix E : Document Revision History

Date	Document Ver	Firmware Ver	By	Comments
23/08/2013	v1.00	v2.04	mcb	First complete version.
22/05/2014	v1.01	v2.18	mcb	Important Information now includes comment about configuration software.

Notes

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