BLACK PEAR

MXB-50

BACnet Interface for Mitsubishi Air-Conditioning

Installation and User Guide

microtrol

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1. Product Overview

The Black Pear MXB-50 allows a BACnet/IP 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).

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.

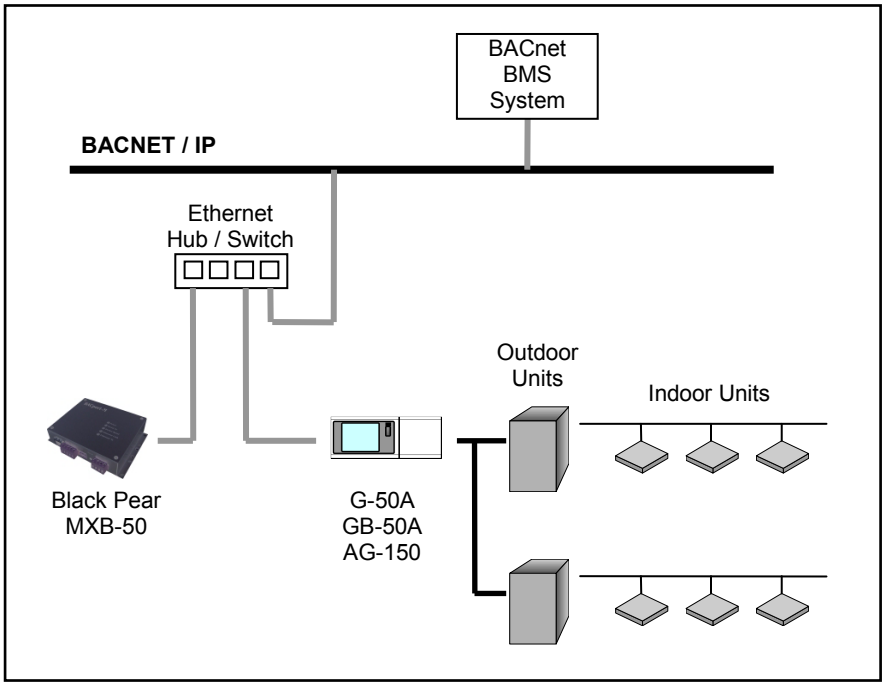

Fig.1 System Configuration Example

1.1 Supplied Parts

No.	Part Name	Quantity
1	Black Pear MXB-50	1
2	Cat-5 'Straight Through' Patch Lead	1
3	Din-Rail Clips	2
4	Self-Tapping Screws for Din-Rail Clips	4
5	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.

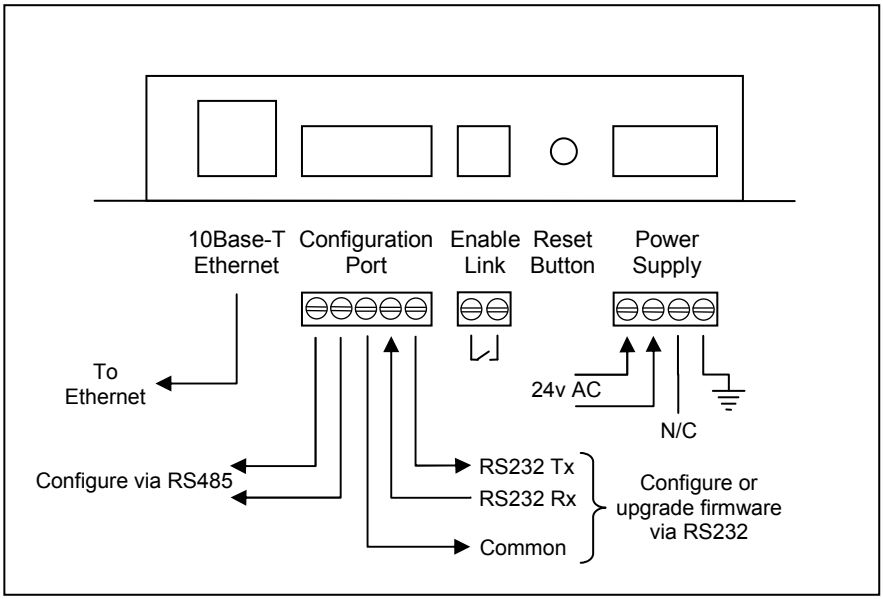

Fig.2 Connection Details

2.1 Ethernet

The Black Pear MXB-50 is a 10Base-T half duplex device and needs to be connected to the G-50 and the BACnet/IP network. Fig.1 shows the use of a hub / switch (not supplied) to make the connections, but the MXB-50 unit and the G-50 could just as easily be connected directly to the BACnet/IP network.

Note: a) The Black Pear MXB-50 and the G-50 require separate IP addresses which must be on the same subnet.
b) The MXB-50 does not support Auto-Negotiation.

2.2 Configuration Port

This connector is only to be used for unit configuration (via RS485 or RS232) and updating the firmware (via RS232 only).

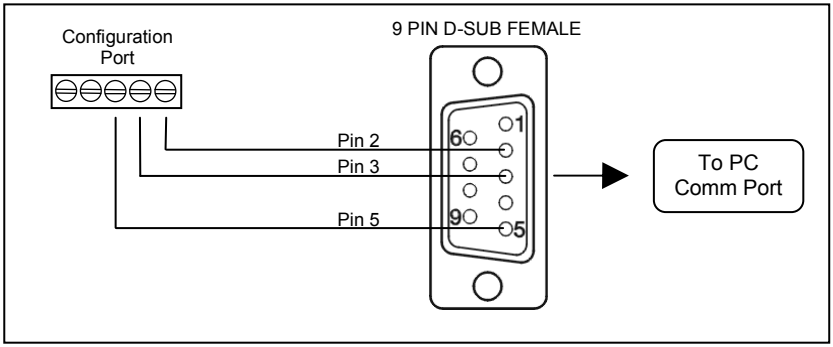

Fig.3 RS232 Comms Lead Wiring Diagram

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 MXB-50 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 MXB-50 unit sends the 'Forced-Off' Reset command to the G-50 once only. This ensures that any subsequent 'Forced-Off' commands sent via the BACnet BMS system are not overridden.

Note: The Black Pear MXB-50 comes supplied with a wire link across the Enable Link terminals.

2.4 Power Supply

The Black Pear MXB-50 will accept 24v AC and has a consumption of 8VA. The internal fuse is rated T500mA.

THIS EQUIPMENT MUST BE EARTHED

3. Air-Conditioning Group Configuration

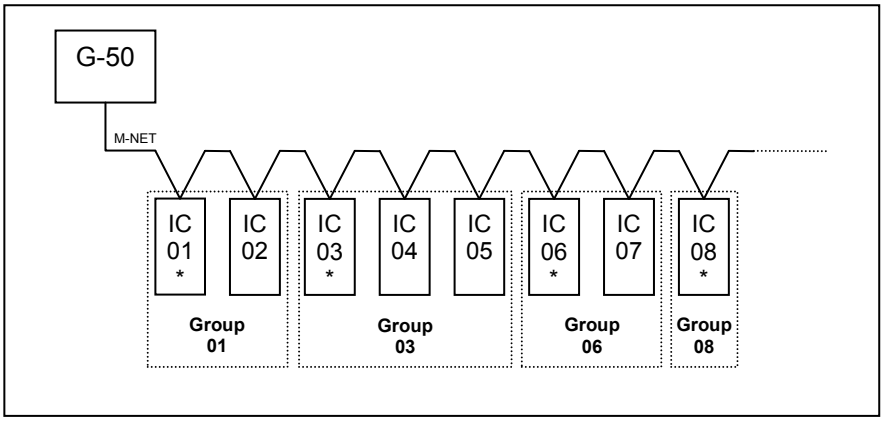

Fig.4 Grouping Example

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. BACnet Specification

The Black Pear MB-50 is designed to work with a BACnet/IP network as described in the ANSI/ASHRAE Standard 135-2004.

Property	Setting
Segmentation	Not Supported
Maximum APDU length supported	206 octets
Object List	Supported
Device ID	User settable (1)
Device Name	User settable (1)
Object Names	User settable (1)

Notes: (1) Only settable via PC configuration program.

4.1 Object Types

Object Type		Supported
Analog Input	0	Yes
Analog Output	1	Yes
Analog Value	2	
Binary Input	3	Yes
Binary Output	4	Yes
Binary Value	5	Yes
Calendar	6	
Command	7	
Device	8	Yes
Event Enrollment	9	
File	10	
Group	11	
Loop	12	
Multi-State Input	13	Yes
Multi-State Output	14	Yes
Notification Class	15	
Program	16	
Schedule	17	
Averaging	18	
Multi-State Value	19	
Trend Log	20	

4.2 Service List

Supported Services	
Read Property	12
Read Property Multiple	14
Write Property	15
Write Property Multiple	16
Who-Has	33
I-Have	27
Who-Is	34
I-Am	36

4.3 Object List

Object	Object Type	Instance No.	'Present Value' Settings	Notes
On/Off (Setup)	Binary Output	1xxx01	Inactive:Off Active:On	
On/Off (State)	Binary Input	1xxx02	Inactive:Off Active:On	
Error Code	Analog Input	1xxx03	4 digit error code where 8000 = 'No Error'	
Operation Mode (Setup)	Multi-State Output	1xxx04	01: Fan (Draft) 02: Cool 03: Heat 04: Dry 05: Auto 06: (Not Used)	
			07: AutoCool 08: AutoHeat	Not settable
			09: Heat Recovery 10: LC Auto 11: Bypass	Lossnay Only ◊
			12: Heating 13: Eco-Heating 14: Hot-Water 15: Anti-Freeze 16: Cooling	Heat-pump boiler only ◊
Operation Mode (State)	Multi-State Input	1xxx05	01: Fan (Draft) 02: Cool 03: Heat 04: Dry 05: Auto 06: (Not Used)	
			07: AutoCool 08: AutoHeat	
			09: Heat Recovery 10: LC Auto 11: Bypass	Lossnay Only ◊
			11: Heating 12: Eco-Heating 13: Hot water 14: Anti-Freeze 15: Cooling	Heat-pump boiler only ◊
Fan Speed (Setup)	Multi-State Output	1xxx06	01: Low 02: Mid2 03: Mid1 04: High	
Fan Speed (State)	Multi-State Input	1xxx07	01: Low 02: Mid2 03: Mid1 04: High	
Room Temperature	Analog Input	1xxx08		

Object	Object Type	Instance No.	'Present Value' Settings	Notes
Setpoint Temperature (Setup)	Analog Output	1xxx09	Cool/Dry : 19°C to 30°C Heat : 17°C to 28°C Auto : 19°C to 28°C	
			Boiler : 10°C to 70°C	
Setpoint Temperature (State)	Analog Input	1xxx10	Cool/Dry : 19°C to 30°C Heat : 17°C to 28°C Auto : 19°C to 28°C	
			Boiler : 10°C to 70°C	
Filter Sign (State)	Binary Input	1xxx11	Inactive:Sign Off Active:Sign On	◊
Filter Sign (Setup)	Binary Output	1xxx12	Inactive:Clear Sign Active:No Action	◊
Local Inhibit (Setup)	Binary Output	1xxx13	Inactive:Off Active:Inhibit	
Local Inhibit (State)	Binary Input	1xxx14	Inactive:Off Active:Inhibited	
Air Direction (Setup)	Multi-State Output	1xxx15	01: Horizontal 02: Mid1 03: Mid2 04: Vertical 05: Swing	
Air Direction (State)	Multi-State Input	1xxx16	01: Horizontal 02: Mid1 03: Mid2 04: Vertical 05: Swing	
Ventilation (Setup)	Multi-State Output	1xxx17	01: Off 02: Low 03: High	Lossnay / OA units only ◊
Ventilation (State)	Multi-State Input	1xxx18	01: Off 02: Low 03: High	Lossnay / OA units only ◊
(Unused)		1xxx19		
(Unused)		1xxx20		
(Unused)		1xxx21		
OC / BC Error Code	Analog Input	1yyy22	4 digit error code where 8000 = 'No Error'	◊
New_Setting_Compare	Binary Value	100027	Inactive:Off Active: On	
Device	Device	zzz		zzz = 1 to 4194302

where xxx represents unit address 001 to 050
and yyy represents unit address 051 to 100

4.4 Object Names

Object	Object Name	Notes
On/Off (Setup)	nnn_ON_w	
On/Off (State)	nnn_ON_r	
Error Code	nnn_ECode	
Operation Mode (Setup)	nnn_MD_w	
Operation Mode (State)	nnn_MD_r	
Fan Speed (Setup)	nnn_FS_w	
Fan Speed (State)	nnn_FS_r	
Room Temperature	nnn_RA	
Setpoint Temperature (Setup)	nnn_SP_w	
Setpoint Temperature (State)	nnn_SP_r	
Filter Sign (State)	nnn_FL_r	◊
Filter Sign (Setup)	nnn_FL_w	◊
Local Inhibit (Setup)	nnn_LI_w	
Local Inhibit (State)	nnn_LI_r	
Air Direction (Setup)	nnn_AD_w	
Air Direction (State)	nnn_AD_r	
Ventilation (Setup)	nnn_VN_w	Lossnay / OA units only ◊
Ventilation (State)	nnn_VN_r	Lossnay / OA units only ◊
(Unused)		
(Unused)		
(Unused)		
OC/BC Error Code	nnn_ECode	◊
System Forced Off (Setup)	Sys_Forced_Off_w	◊
System Forced Off (State)	Sys_Forced_Off_r	◊
New_Setting_Compare	Sys_New_Setting_Compare	

where ‘nnn’ is the unit name entered via the configuration program.

◊ Not currently supported

5. Special Functions

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

Disconnect the supply before removing the top cover

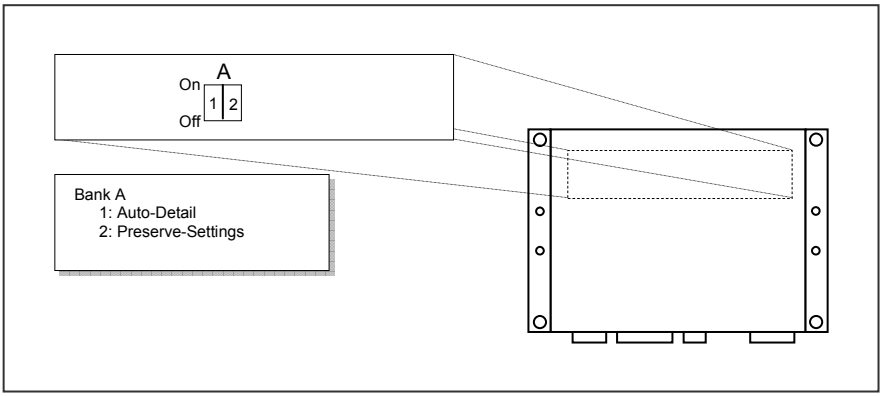

Fig.5 Special Function Switches

5.1 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.

Bank A-2: Preserve-Settings

- Off: All BACnet object properties are initialised at power-up.
- On: All BACnet object properties except Present-Value and Priority-Array are initialised at power-up.
  Also, all 'Input' object Present-Values are stored in the Present-Value of the corresponding 'Output' object.

Appendix A : Physical Dimensions

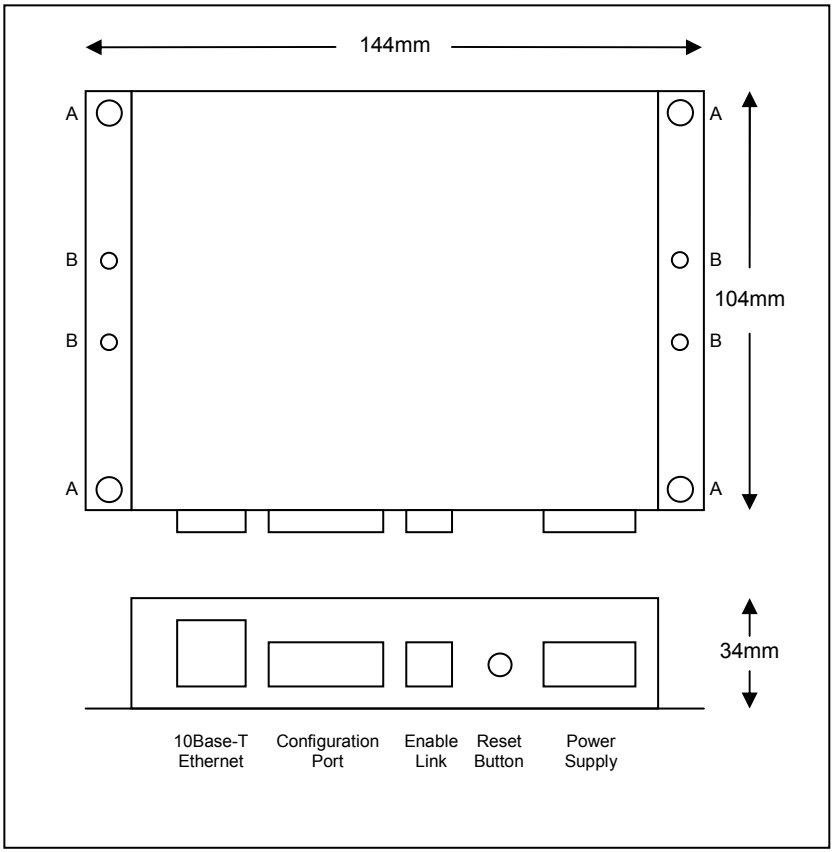

Fig.6 Dimensions

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.

Appendix B : Reset Button

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.

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 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:

Configuration via network	Enabled

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	192.168.1.10
Gateway Address	192.168.1.10
Subnet Mask	255.255.255.0
G50 IP Address	192.168.1.1
BACnet Device ID	10
BACnet Device Name	Black Pear MXB-50
Foreign Device Reg TTL	1800

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, until the ‘Device Reset’ light begins to flash (Long ON, Short OFF). 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 : System Objects

There are 5 'System' objects contained within the Black Pear MXB-50. A description of each is detailed below.

System Object	Description
Mnet Comms State	Provides an indication of the communication status between the G-50 and the Mitsubishi M-Net network. Inactive : M-Net Initialising Active : M-Net OK Note: While M-Net is initialising, the air-conditioning is effectively offline to control and monitoring requests.
System Forced Off (Setup)	Writeable object to enable and disable the global on/off command.
System Forced Off (State)	Readable object giving indication of the global on/off command.
G50 Comms State	Provides an indication of the communication status between the MXB-50 and the G-50. Inactive : G-50 not responding Active : G-50 comms OK Note: 'G-50 not responding' either means the G-50 is switched off or is not connected to the network.
New_Setting_Compare	Selects the way in which the MXB-50 handles new command settings. Inactive : New command values are written regardless of the current setting. Active : New command values are only written if the new setting is different to the current setting. (Useful for systems which continuously write to the command parameters).

Appendix D : PICS

BACnet Protocol Implementation Conformance Statement (page 1)

Date: 02th April 2012
Vendor Name: Microtrol Limited
Product Name: Black Pear MXB-50
Product Model Number: RM2516
Product Version: 1.00 and later
BACnet Protocol Version: 1
BACnet Protocol Revision: 4

Product Description:

The Black Pear MXB-50 provides a gateway between a Mitsubishi Electric G-50A,GB-50A or AG-150 central controller and a BACnet/IP network. It allows for the direct control and monitoring of up to 50 air conditioners.
The MXB-50 may be set to update the air conditioner parameters either on demand or only on change of setting value. The unit also incorporates a global On/Off command.

BACnet Standardized Device Profile (Annex L):

☐ BACnet Operator Workstation (B-OWS)
☐ BACnet Building Controller (B-BC)
☐ BACnet Advanced Application Controller (B-AAC)
☑ BACnet Application Specific Controller (B-ASC)
☐ BACnet Smart Sensor (B-SS)
☐ BACnet Smart Actuator (B-SA)

BACnet Interoperability Building Block Supported:

☐ Data Sharing-ReadProperty-A (DS-RP-A)
☑ Data Sharing-ReadProperty-B (DS-RP-B)
☐ Data Sharing-ReadPropertyMultiple-A (DS-RPM-A)
☑ Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)
☐ Data Sharing-ReadPropertyConditional-A (DS-RPC-A)
☐ Data Sharing-ReadPropertyConditional-B (DS-RPC-B)
☐ Data Sharing-WriteProperty-A (DS-WP-A)
☑ Data Sharing-WriteProperty-B (DS-WP-B)
☐ Data Sharing-WritePropertyMultiple-A (DS-WPM-A)
☑ Data Sharing-WritePropertyMultiple-B (DS-WPM-B)
☐ Data Sharing-COV-A (DS-COV-A)
☐ Data Sharing-COV-B (DS-COV-B)
☐ Data Sharing-COVP-A (DS-COVP-A)
☐ Data Sharing-COVP-B (DS-COVP-B)
☐ Data Sharing-COV-Unsolicited-A (DS-COVU-A)
☐ Data Sharing-COV-Unsolicited-B (DS-COVU-B)

Segmentation Capability: None

BACnet Protocol Implementation Conformance Statement (page 2)

BACnet Standard Object Types Supported:
None of the objects are dynamically creatable or deletable

Object Type	Properties Supported	Writeable Properties
Analogue Input	object-identifier object-name object-type present-value status-flags event-state out-of -service units	None
Analogue Output	object-identifier object-name object-type present-value status-flags event-state out-of -service units priority-array relinquish-default	present-value
Binary Input	object-identifier object-name object-type present-value status-flags event-state out-of -service polarity	None
Binary Output	object-identifier object-name object-type present-value status-flags event-state out-of -service priority-array relinquish-default	present-value
Binary Value	object-identifier object-name object-type present-value status-flags event-state out-of -service priority-array relinquish-default	present-value

BACnet Protocol Implementation Conformance Statement (page 3)

Object Type	Properties Supported	Writeable Properties
Device	object-identifier object-name object-type system-status vendor-name vendor-identifier model-name firmware-revision application-software-version protocol-version protocol-services-supported protocol-object-types-supported object-list max-APDU-length-supported segmentation-supported apdu-timeout number-of APDU-retries device-address-binding database-revision	None
Multi-State Input	object-identifier object-name object-type present-value status-flags event-state out-of -service number-of-states state-text	None
Multi-State Output	object-identifier object-name object-type present-value status-flags event-state out-of -service number-of-states state-text priority-array relinquish-default	present-value

BACnet Protocol Implementation Conformance Statement (page 4)

Data Link Layer Options:

☑ BACnet IP, (Annex J)
☑ BACnet IP, (Annex J), Foreign Device
☐ ISO 8802-3, Ethernet (Clause 7) (10Base2, 10Base5, 10 BaseT, Fiber)
☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8),baud rate(s)
☐ MS/TP master (Clause 9), baud rate(s):
☐ MS/TP slave (Clause 9), baud rate(s):
☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s)
☐ Point-To-Point, modem (Clause 10), baud rate(s)
☐ LON Talk (Clause 11), medium:
☐ Other:

Device Address Binding:

☐ Support for Static Address Binding

Network Options:

☐ Router
☐ Annex H, BACnet Tunnelling
☐ BACnet/IP Broadcast Management Device (BBMD)
☐ BBMD support of registrations by foreign devices

Character Sets Supported:

☑ ANSI X3.4

non-BACnet Equipment Supported by this Unit:

The unit supports the Mitsubishi G-50A, GB-50A and AG-150 central controllers, all of which are elements of the Mitsubishi City-Multi M-Net structure.

Document Revision History

Date	Document Ver	Firmware Ver	By	Comments
02/04/2012	v1.00	v1.00	mcb	First complete version.

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