

SAGE^{MAX}
BACNET
USER GUIDE



SAGE^{MAX}BACnet User Guide

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TABLE OF CONTENTS

SECTION 1: INTRODUCTION AND INSTALLATION

| | |
|------------------------------------------------|-----|
| INTRODUCTION | 1-1 |
| INSTALLATION..... | 1-1 |
| SAGE ^{MAX} USAGE (CLIENT/SERVER)..... | 1-2 |

SECTION 2: SERVER SET UP

| | |
|-----------------------------|-----|
| INSTANCE NUMBER (IN) | 2-1 |
| POINT | 2-1 |
| ATTRIBUTE (AT) | 2-2 |
| OBJECT TYPES (OT) | 2-2 |
| 1. ANALOG..... | 2-2 |
| 2. BINARY..... | 2-2 |
| CHANGE OF VALUE (COV) | 2-2 |
| UNITS (UNT)..... | 2-3 |
| BACNET NAME | 2-3 |
| PRIORITY ARRAY (PA) | 2-3 |

SECTION 3: BACNET DRIVER CONFIGURATION

| | |
|--------------------------------------------------------|-----|
| CONFIGURATION..... | 3-1 |
| BACNET PROTOCOL DRIVER ENABLE..... | 3-1 |
| CLIENT SERVICE ENABLE | 3-1 |
| ENABLE BACNET/IP PROTOCOL | 3-1 |
| ENABLE BACNET OVER ETHERNET PROTOCOL | 3-1 |
| BROADCAST WHO-IS | 3-2 |
| BROADCAST WHO-IS STARTUP TIMER (SEC)..... | 3-2 |
| BROADCAST WHO-IS INTERVAL TIMER (MIN)..... | 3-2 |
| BROADCAST I-AM | 3-2 |
| STOP LISTENING FOR I-AM | 3-2 |
| BROADCAST I-AM STARTUP TIMER (SEC) | 3-2 |
| WHO-IS LOW LIMIT AND WHO-IS HIGH LIMIT | 3-3 |
| BACNET DEVICE NAME | 3-3 |
| DEVICE INSTANCE # | 3-3 |
| TRANSMISSION TIME-OUT (MS)..... | 3-3 |
| IP NETWORK NUMBER AND RAW ETHERNET NETWORK NUMBER..... | 3-3 |
| DEFAULT PRIORITY ARRAY..... | 3-4 |
| UPLOADING POINTS | 3-5 |

SECTION 4: BACNET DRIVER OPTIONS

| | |
|----------------------------|-----|
| VIEWING/MODIFYING | 4-1 |
| NAME..... | 4-1 |
| INSTANCE NUMBER | 4-1 |
| OBJECT TYPE | 4-1 |
| CREATE/MODIFY OBJECTS..... | 4-2 |

TABLE OF CONTENTS

| | |
|------------------------------------------------------------------------|-----|
| ERASING OBJECTS..... | 4-3 |
| MONITORING OBJECTS | 4-3 |
| SUBSCRIPTIONS | 4-3 |
| ADVANTAGES OF COV | 4-3 |
| | |
| APPENDIX A: UNIT LIST | A-1 |
| APPENDIX B: PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS) | B-1 |
| APPENDIX C: BACNET INTEROPERABILITY BUILDING BLOCKS (BIBB)..... | C-1 |

SECTION 1: INTRODUCTION AND INSTALLATION

INTRODUCTION

This document details the installation, setup and configuration of the Building Automation and Control Network (BACnet) driver. BACnet is a communications standard developed to meet the widespread demand for interoperability—the ability of building automation equipment of one vendor to communicate with the building automation equipment of another vendor.

BACnet achieves interoperability by creating a common ground between different vendor's building automation equipment. This common ground is a collection of objects, each with a different property that is passed along to allow communication between the devices. American Auto-Matrix's BACnet driver supports analog and binary input, output and value objects.

A device residing on a BACnet network may act as a client, server or both a client and a server. When a device acts as a **Server**, it behaves externally as a BACnet device for a particular service request instance. The server provides service to the client. A **Client** is a system or device that makes use of a BACnet device for some particular purpose via a service request instance. A client requests service from the server.

INSTALLATION

NOTE

To use the BACnet driver files, the user must have SAGE^{MAX} IP v1.3 installed. Follow the instructions for installing IP as outlined in the *SAGE IP Upgrade* addendum.

Insert the BACnet driver installation diskette into the SAGE^{MAX}. A screen appears prompting you to install BACnet drivers, remove BACnet drivers or exit to DOS. See Figure 1-1: Installation. Select 1 to install BACnet drivers. This will download four files into the SAGE^{MAX}.

1. **bacnet.exe:** This file contains the BACnet driver, handling the in going and out going packets and is downloaded into the SAGE^{MAX}.exe directory.

2. **scov.exe:** This file handles Change of Value subscriptions and is downloaded into the SAGE^{MAX} .exe directory.
3. **cfgbac.obl:** This file handles the terminal screen configurations and is downloaded into the .exe directory of the SAGE^{MAX}.
4. **mapbacn.cfg:** This file allows mapping between BACnet objects and SAGE^{MAX} points and is downloaded into the .cfg directory of the SAGE^{MAX}.

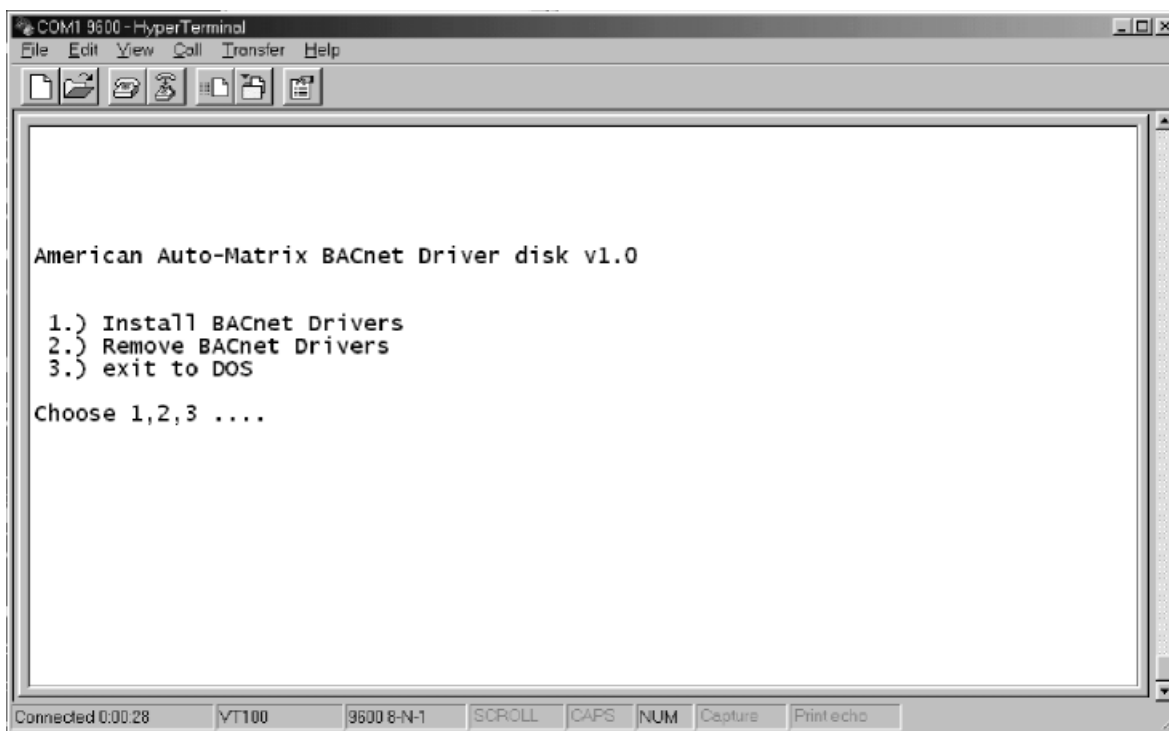


Figure 1-1 Installation

When the installation procedure is complete, remove the installation diskette and reboot the SAGE^{MAX}. Before you begin to setup and configure the driver make sure you set up your IP network to match the other IP networks. See the *Ethernet IP Connectivity for the SAGE^{MAX}* and *SAGE IP Upgrade* addendums for information on IP networks.

SAGE^{MAX} USAGE (CLIENT/SERVER)

After installing the BACnet files, you must determine if the SAGE^{MAX} will be used as a client, server or both a client and server.

If the SAGE^{MAX} will be accessed by another BACnet device, it will be used as a server. For example, another manufacturer's device will access the SAGE^{MAX} for AAM device information.

If the SAGE^{MAX} will access an existing BACnet device, it will be used as a client. For example, retrieving points from a manufacturer's fire system through the SAGE^{MAX} to report to groups in the SAGE^{MAX}.

When using the SAGE^{MAX} as both a client and server it will be accessed by and will access the BACnet network.

If you are using the SAGE^{MAX} as a server or both a client and server, you must set up the BACnet mapping file next. The setup instructions for this file are in Section 2: Server SetUp. If you are using BACnet as a client only, go to Section 3: BACnet Driver Configuration.

SECTION 2: SERVER SETUP

The BACnet mapping file (mapbacn.cfg) allows mapping of SAGE^{MAX} points, variables and programs. Using a text editor, you must enter the correct information into each field beginning with the **Instance Number**. Each field is given a position range in which the information for that field must be entered. Between each field position spaces, not tabs must be used.

See Figure 2-1 and read the following description for more information on the different fields in the mapping file.

NOTE

This file setup is used only when the SAGE^{MAX} will be used as a server.

NOTE

When setting up the BACnet driver mapping file do not use tabs to move from one field to another. Fill all empty areas between fields with spaces.

Instance number (IN) (positions 1-4)

A number that uniquely identifies an object within a device. This number must range from 0 to 9999. This range of 10,000 places a limitation on the amount of mapped information within the SAGE^{MAX}.

Point (positions 6-29)

A database name in the SAGE^{MAX} created for points, variables or SPL programs. See Section 8.6 in the SAGE^{MAX} *User Manual* for more information.

Attribute (AT) (positions 31-32)

A two character alphanumeric name that represents the property of an object and forms the interface between the object and users of the object. This name is the same as the unitary controller channel attribute or the SAGE^{MAX} SPL program attribute.

An attribute name is not used if you entered a variable name in the Point field.

Object Types (OT) (positions 34-35)

Object Types are used by a BACnet device to describe the type of value represented by the SAGE^{MAX} point.

1. Analog

These are properties that describe the external characteristics of the following analog objects:

- a. Inputs: these are physical inputs.
- b. Outputs: these are physical outputs.
- c. Value: these are virtual points within the SAGE^{MAX}. A setpoint is an example of an analog value.

2. Binary

These are properties that describe the external characteristics of the following binary objects and can be in only one of two states:

- a. Inputs: this object type would be used to tell whether or not a fan is running.
- b. Outputs: this object type would be used to turn a fan on or off.
- c. Value: this is a binary value represented by a 0 or 1.

Each object type is represented by a numeric value that is placed in the **Object Type** field of the mapping file:

| | |
|---------------|----|
| analog input | 00 |
| analog output | 01 |
| analog value | 02 |
| binary input | 03 |
| binary output | 04 |
| binary value | 05 |

Change of Value (COV) (positions 37-41, 38 must equal ".")

A COV is an event that occurs when a measured or calculated analog value changes by a pre-defined amount. The COV determines how much a value **MUST** change before the SAGE^{MAX} recognizes that change. The COV must be between 0.001-9.999. AAM recommends using a value of no less than 0.100.

If you are using an analog object type you must enter a change of value. Binary object types do not use the COV field.

WARNING

Do not enter a value below the accuracy of your device.

NOTE

The value must be entered in the form of 0.000.

Units (UNT) (positions 43-45)

These units (engineering units) indicate the measurement units of an object. See Appendix A: Unit List, for a complete list of unit numbers.

BACnet Name (positions 47-76)

This is a unique name used by a BACnet device, other than the SAGE^{MAX}, to access this point mapped in the file. The name can be up to 30 characters in length.

Priority Array (PA) (positions 78-79)

This field contains values that indicate an objects priority. Objects will be serviced beginning with the highest priority (the lower the number the higher the priority). This field is constantly monitored to find an entry with the highest priority.

```

; THIS CONFIGURATION FILE MAPS THE BACNET OBJECTS, AND
; DATA POINT ID TO THE SAGE POINT NAME AND ATTRIBUTE, AND OBJECT TYPE.
;
; NOTE: COMMENT LINES BEGIN WITH A SEMICOLON. TABS CANNOT BE USED.
; FILL WILL SPACES IF NOT USED.
; FIELD          POS  SIZE  DESCRIPTION
; -----
; IN              1    4    INSTANCE # FOR THE
; POINT          6   24    ASSOCIATED SAGEMAX POINT NAME
; AT             31    2    ATTRIBUTE FOR THE ABOVE POINT
; OT             34    2    OBJECT TYPE
; COV            37    5    COV INCREMENT
; UNT            43    3    ENG UNITS IF NO UNITS LEAVE BLANK OR SPACES
; BACNET NAME    47   30    BACNET OBJECT NAME (IF LEFT BLANK DEFAULTS TO
;                          POINT)
; PRIORITY ARRAY 78    2    WILL DEFAULT TO 8 IF LEFT BLANK
; -----
; ANALOG IN      00
; ANALOG OUT     01
; ANALOG VALUE   02
; BINARY IN      03
; BINARY OUT     04
; BINARY VALUE   05
;
; IN POINT          AT OT COV  UNT BACNET NAME          PA
; -----
0001 GX_FE01          CV 01 0.250 064 TEMP 1          02
0002 GX_FE02          CV 01 0.500 063 TEMP 2          04
0003 GX_FE03          CV 01 1.000 063 TEMP 3          05
0004 GX_FE04          CV 02 2.000 063 TEMP 4
0009 GX_FB01          AM 05          DIGITAL 1 VALUE AM
0010 GX_FB01          CV 04          DIGITAL 1 OUT VALUE          03
0011 GX_FB02          CV 04          DIGITAL 2 OUT          06
0012 GX_FB03          CV 03          DIGITAL IN
0013 GX_FB04          CV 04          DIGITAL 4
0014 GX_FB05          CV 03          DIGITAL 5
0015 GX_FB06          CV 04          DIGITAL 6
0016 GX_FB07          CV 04          DIGITAL 7
0017 GX_FB08          CV 03          DIGITAL 8
0018 GX_FE01          OI 02 0.100  OVERRIDE

```

Figure 2-1 BACnet Mapping File

SECTION 3: BACNET DRIVER CONFIGURATION

CONFIGURATION

You can enter and edit the BACnet driver configuration through the SAGE^{MAX} ports menu. Choose option **(B) BACnet driver configuration** and then **(E) Edit Current Configuration**. If you did not install the files mentioned in Section 1: Introduction and Installation there will not be an option B. You must install all four files.

The following describes each field in the configuration file.

BACnet Protocol Driver enable

This option triggers a software switch that turns the BACnet protocol on and off. Select **Yes** to use this driver. This option defaults to **No (Off)**.

Client Service enable

To run the client portion of BACnet select **Yes (On)**. If you are using the SAGE^{MAX} as a server only select **No**. This option defaults to **No (Off)**. The maximum number of devices a client can handle is 100.

Enable BACnet/IP protocol

To run the BACnet/IP protocol select **Yes (On)**. This option defaults to **Yes (On)**. If you select No you must run the BACnet over Ethernet protocol.

Enable BACnet over Ethernet protocol

To run BACnet over Ethernet protocol select **Yes (On)**. This option defaults to **No (Off)**. If you did not enable BACnet/IP protocol, you must select Yes here.

NOTE

At least one protocol—BACnet/IP or BACnet over Ethernet—must be enabled. You also can enable both protocols.

NOTE

Consult other manufacturers to determine whether they are using BACnet/IP or BACnet Ethernet protocol.

Broadcast WHO-IS

Enter Yes here to initiate communication to other servers. The Broadcast WHO-IS determines specifications of BACnet devices on the same network. This must be used in the initial configuration to find devices. The default for this option is **No**.

Broadcast WHO-IS startup timer (sec)

This option will wait a given number of seconds after startup before sending out the WHO-IS broadcast. The seconds must be from 1 to 255 with the default being **12 seconds**.

Broadcast WHO-IS interval timer (min)

After the broadcast WHO-IS startup timer is complete, the WHO-IS interval timer sends out the WHO-IS broadcast in minute intervals. The timer must be set between 0 and 255 minutes. A 0 will turn the timer off and is the default.

Broadcast I-AM

This option broadcasts an I-AM to acknowledge the servers. This is used to respond to the WHO-IS broadcast request, but the broadcast can occur at any time and does not require the receipt of a WHO-IS broadcast. If you select No for this option, the I-AM startup timer will still respond to a WHO-IS request. The default for this option is **No**.

Stop Listening for I-AM

After the broadcast WHO-IS, the SAGE^{MAX} will receive I-AMs for a given number of seconds. The SAGE^{MAX} will not receive any more I-AMs after that amount of time. This value must range from 1-255 seconds with a default of **10 seconds**.

Broadcast I-AM startup timer (sec)

This option will wait a given number of seconds (1-255) after startup before sending out the I-AM broadcast. The default is **7 seconds**.

WHO-IS Low Limit and WHO-IS High Limit

This allows you to select a group of devices to send the WHO-IS broadcast to. Select a range by entering a low limit device number and a high limit device number (0-65535). If you enter a 0 for both the high and low limit numbers the broadcast will be global. The default is **0**. To select one device, enter the same device number in both the high and low limit fields.

BACnet Device Name

Enter the device name in 24 characters or less. This should be a unique name and will identify the SAGE^{MAX} to other devices on the BACnet network.

NOTE

The device name will be displayed in all capitals.

Device Instance #

This number must be unique from other BACnet devices on the BACnet network and must range from 0 to 65535. The default is **100**.

Transmission time-out (ms)

Enter the amount of time (0-10000ms) between transmissions before a time-out occurs and packets are re-sent. The default time is **3000ms**. For a more reliable communication set all device transmission time-outs to the same value.

IP Network Number and Raw Ethernet Network Number

These numbers allow a connection in which messages can be relayed between two different BACnet networks—an IP and Ethernet network—through a router. This connection allows messages to be directed to a single remote device, broadcast on a remote network or broadcast globally to all devices on all networks. These numbers must range from 1-65534 with defaults of 888 (IP) and 1111 (Ethernet).

All devices on a network must have the same number, but each network must have a different, unique number.

NOTE

You **cannot** use 0 or 65,535 as a network number.

Default Priority Array

Enter the priority between 1-16 with 1 being the highest priority and 16 being the lowest. The system will default to an **8** if nothing is entered in the mapping file. The following are the assignments for each priority level.

| Priority Level | Application |
|----------------|----------------------------|
| 1 | Manual Emergency |
| 2 | Fire |
| 3 | Available |
| 4 | Available |
| 5 | Critical Equipment Control |
| 6 | Minimum On/Off |
| 7 | Available |
| 8 | Normal (default) |
| 9 | Available |
| 10 | Available |
| 11 | Available |
| 12 | Available |
| 13 | Available |
| 14 | Available |
| 15 | Available |
| 16 | Available |

See Monitoring Objects in Section 4 for more information.

After you have completed the configuration, you must make the changes by selecting **(M) Make these changes NOW...** from the Port Setup menu.


```

BACnet Configuration:
key      to do
E        Edit Current Configuration
S        Save Changes in Configuration File
M        Make these changes NOW...
PF1      Return to previous menu
Press key for desired action:E
BACnet Protocol Driver Enable      [No  ]:
Client Service Enable              [No  ]:
Enable BACnet/IP Protocol          [Yes ]:
Enable BACnet over Ethernet Protocol [No  ]:
Broadcast WHO-IS                   [No  ]:
Broadcast I-AM                     [No  ]:
Broadcast WHO-IS Startup Timer (sec) [    12]:
Broadcast WHO-IS Interval Timer (min) [    0]:
Stop Listening for I-AM (1-255 sec)  [   10]:
WHO-IS Low Limit                   [    0]:
WHO-IS High Limit                  [    0]:
Broadcast I-AM Startup Timer (sec)  [    7]:
BACnet Device Name                 [SAGEMAX_BACNET      ]:
Device Instance #                  [   100]:
IP Network Number                  [   888]:
Raw Ethernet Network Number        [  1111]:
Transmission Timeout (ms)         [  3000]:
Default Priority Array              [    8]:
Dev#- IP Address----- MAC Address- Inst#-- Net# Device Name-----
----- 000.000.000.000 000000000000 0000100 ---- SAGEMAX_BACNET
00001 255.255.255.255 FFFFFFFFFFFFFFFF -----
00002 255.255.255.255 FFFFFFFFFFFFFFFF -----
00003 255.255.255.255 FFFFFFFFFFFFFFFF -----
00004 255.255.255.255 FFFFFFFFFFFFFFFF -----
00005 255.255.255.255 FFFFFFFFFFFFFFFF -----
00006 255.255.255.255 FFFFFFFFFFFFFFFF -----
00007 255.255.255.255 FFFFFFFFFFFFFFFF -----
00008 255.255.255.255 FFFFFFFFFFFFFFFF -----
00009 255.255.255.255 FFFFFFFFFFFFFFFF -----

```

Figure 3-1 BACnet Driver Configuration

UPLOADING POINTS

After saving changes in the Ports menu, the objects will automatically upload to the SAGE^{MAX} database. A device list appears on the configuration screen, allowing you to see all the objects that were uploaded. This is a read-only list.

If a device uses BACnet-IP, the MAC address field will be filled with Fs. If a device uses BACnet Ethernet protocol, the IP Address field will be 255.255.255.255. The network field will contain a value only if the device is located on another network.

To confirm the upload of points, follow the steps in the next section. If no points appear, check the configuration and Ports setup.

SECTION 4: BACNET DRIVER AND MENU OPTIONS

VIEWING/MODIFYING

You can view a list of all the BACnet Objects that are in the database. To do so select **(D) Database** then **(L) List** then **(B) BACnet Objects**. The following describes the fields that are displayed in the BACnet Objects list. See Figure 4-1 for more information.

Name

This is a unique BACnet Object name uploaded from a device on the BACnet network. The SAGE^{MAX} supports names up to 24 characters in length. The names will be entered in the form of DXX_Device Name with DXX = Device Number. The device number must be between 1-100. If the Device Number is 1-9, it should appear as DX_Device Name (D3_Device Name). Device 100 is entered as D00_Device Name.

Instance Number

A number that uniquely identifies an object within a device.

Object Type

Object Types are represented by a numeric value that can be viewed in the **Object Type (OT)** field of the BACnet Objects list. The OT and the numeric value that it represents are:

| | |
|---------------|----|
| analog input | 00 |
| analog output | 01 |
| analog value | 02 |
| binary input | 03 |
| binary output | 04 |
| binary value | 05 |

For more information see the Object Types descriptions in Section 2: Server Set Up.

ERASING OBJECTS

If you want to remove an object from the database you can do so through **(D) Database Functions** followed by **(E) Erase**, then **(B) BACnet**. Enter the name of the point you want to erase and press enter. A prompt appears stating “Erase this object from the database (Y/N).” Select Yes if you want to erase the object.

MONITORING OBJECTS

Monitoring an object enables you to view or change an object’s value. You can only change an object’s value if BACnet supports write property and the Priority Array in the BACnet driver is less than the Priority Array of the BACnet object. Priorities can range from 1-16 with 1 being the highest priority and 16 being the lowest priority. See Default Priority Array in Section 3 for priority assignments. To change an object’s value:

1. Select **(M) Monitor Objects**.
2. Enter the object name you want to monitor.
3. Press **Enter** to display and update the value.
4. To change the value, use the equal sign and manually enter a new number.
5. When you are complete viewing/changing the value select **(R) Relinquish Control**. Relinquishing Control puts a NULL value in the priority array allowing the next lower, non-NULL, position to take control of the object.

To keep control of the object, press the escape button. You will remain in control of the object until another user enters a higher priority.

SUBSCRIPTIONS

The purpose of the subscription service is for a client to receive notifications of changes that occur to the properties of an object. This cuts down the amount of traffic on the system because clients are not continuously pulling data from the system. Instead, when an objects current value changes by the COV increment, which is specified in the COV field of the mapping file, a notification of this change is sent to the client. The SAGE^{MAX} supports confirmed and unconfirmed subscriptions as long as the other BACnet devices supports them. The maximum number of SubscribeCOVs that can be handled is 100.

Advantages of COV

The COV event has advantages over the alternative method of continuously pulling data from the system:

- Less traffic
- Less overhead for the client.

APPENDIX A: UNIT LIST

| Description | Unit # | | Description | Unit # |
|-----------------------------|--------|--|-----------------------------------|--------|
| Area | | | Currency | |
| square-meters | 0 | | currency 1 | 105 |
| square-feet | 1 | | currency 2 | 106 |
| | | | currency 3 | 107 |
| | | | currency 4 | 108 |
| | | | currency 5 | 109 |
| | | | currency 6 | 110 |
| | | | currency 7 | 111 |
| | | | currency 8 | 112 |
| | | | currency 9 | 113 |
| | | | currency 10 | 114 |
| Electrical | | | Energy | |
| milliamperes | 2 | | joules | 16 |
| amperes | 3 | | kilojoules | 17 |
| ohms | 4 | | kilojoules-per-kilogram | 125 |
| kilohms | 122 | | megajoules | 126 |
| megohms | 123 | | watt-hours | 18 |
| volts | 5 | | kilowatt-hours | 19 |
| millivolts | 124 | | btus | 20 |
| kilovolts | 6 | | therms | 21 |
| megavolts | 7 | | ton-hours | 22 |
| volt-amperes | 8 | | | |
| kilovolt-amperes | 9 | | | |
| megavolt-amperes | 10 | | | |
| volt-amperes-reactive | 11 | | | |
| kilovolt-amperes-reactive | 12 | | | |
| megavolt-amperes-reactive | 13 | | | |
| degrees-phase | 14 | | | |
| power-factor | 15 | | | |
| Enthalpy | | | Entropy | |
| joules-per-kilogram-dry-air | 23 | | joules-per-degree-Kelvin | 127 |
| btus-per-pound-dry-air | 24 | | joules-per-kilogram-degree-Kelvin | 128 |

| | | | | |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Frequency cycles-per-hour cycles-per-minute hertz kilohertz megahertz per-hour | 25 26 27 129 130 131 | | Humidity grams-of-water-per-kilo-gram-dry-air percent-relative-humidity | 28 29 |
| Length millimeters meters inches feet | 30 31 32 33 | | Light watts-per-square-foot watts-per-square-meter lumens luxes foot-candles | 34 35 36 37 38 |
| Mass kilograms pounds-mass tons | 39 40 41 | | Mass Flow kilograms-per-second kilograms-per-minute kilograms-per-hour pounds-mass-per-minute pounds-mass-per-hour | 42 43 44 45 46 |
| Power milliwatts watts kilowatts megawatts btus-per-hour horsepower tons-refrigeration | 132 47 48 49 50 51 52 | | Pressure pascals hectopascals kilopascals millibars bars pounds-force-per-square-inch centimeters-of-water inches-of-water millimeters-of-mercury centimeters-of-mercury inches-of-mercury | 53 133 54 134 55 56 57 58 59 60 61 |
| Temperature degrees-Celsius degrees-Kelvin degrees-Fahrenheit degree-days-Celsius degree-days-Fahrenheit | 62 63 64 65 66 | | Time years months weeks days hours minutes seconds | 67 68 69 70 71 72 73 |

| | | | | |
|-----------------------------|-----|--|--------------------------------|-----|
| Velocity | | | Volume | |
| meters-per-second | 74 | | cubic-feet | 79 |
| kilometers-per-hour | 75 | | cubic-meters | 80 |
| feet-per-second | 76 | | imperial-gallons | 81 |
| feet-per-minute | 77 | | liters | 82 |
| miles-per-hour | 78 | | us-gallons | 83 |
| Volumetric Flow | | | Other | |
| cubic-feet-per-minute | 84 | | degrees-angular | 90 |
| cubic-meters-per-second | 85 | | degrees-Celsius-per-hour | 91 |
| cubic-meters-per-hour | 135 | | degrees-Celsius-per-minute | 92 |
| imperial-gallons-per-minute | 86 | | degrees-Fahrenheit-per-hour | 93 |
| liters-per-second | 87 | | degrees-Fahrenheit-per-minute | 94 |
| liters-per-minute | 88 | | kilowatt-hour-per-square-meter | 137 |
| liters-per-hour | 136 | | kilowatt-hours-per-square-foot | 138 |
| us-gallons-per-minute | 89 | | megajoules-per-square-meter | 139 |
| | | | no-units | 95 |
| | | | parts-per-million | 96 |
| | | | parts-per-billion | 97 |
| | | | percent | 98 |
| | | | percent-per-second | 99 |
| | | | per-minute | 100 |
| | | | per-second | 101 |
| | | | psi-per-degree-Fahrenheit | 102 |
| | | | radians | 103 |
| | | | revolutions-per-minute | 104 |
| | | | watts-per-square-meter | 141 |
| | | | degree-kelvin | |

APPENDIX B: PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS)

A PICS is a list of options that identify the specifics of a particular manufacturers BACnet device. This PICS details the options available when the SAGE^{MAX} is used as a BACnet device.

The American Auto-Matrix SAGE^{MAX} is a high-performance multi-tasking area controller. The SAGE^{MAX} has extensive trend generation and storage, custom reports, alarm management, custom programming and integration capability. It seamlessly converts American Auto-Matrix unitary controller devices and objects to BACnet objects.

BACNET CONFORMANCE CLASS SUPPORTED

| | |
|---------------------------------------------|----------------------------------|
| Class 1 <input checked="" type="checkbox"/> | Class 4 <input type="checkbox"/> |
| Class 2 <input checked="" type="checkbox"/> | Class 5 <input type="checkbox"/> |
| Class 3 <input type="checkbox"/> | Class 6 <input type="checkbox"/> |

BACNET FUNCTIONAL GROUPS SUPPORTED

| | |
|----------------------------------------------------------|-----------------------------------------------------|
| Clock <input type="checkbox"/> | Files <input type="checkbox"/> |
| HHWS <input type="checkbox"/> | Reinitialize <input type="checkbox"/> |
| PCWS <input type="checkbox"/> | Virtual Operator Interface <input type="checkbox"/> |
| Event Initiation <input type="checkbox"/> | Virtual Terminal <input type="checkbox"/> |
| Event Response <input type="checkbox"/> | Device Communications <input type="checkbox"/> |
| COV Event Initiation <input checked="" type="checkbox"/> | Time Master <input type="checkbox"/> |
| COV Event Response <input checked="" type="checkbox"/> | |

BACNET FUNCTIONAL GROUPS SUPPORTED

| Application Service | Initiates Requests | Executes Requests |
|--------------------------------|-------------------------------------|-------------------------------------|
| Acknowledge Alarm | <input type="checkbox"/> | <input type="checkbox"/> |
| Confirmed COV Notification | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Confirmed Event Notification | <input type="checkbox"/> | <input type="checkbox"/> |
| Get Alarm Summary | <input type="checkbox"/> | <input type="checkbox"/> |
| Get Enrollment Summary | <input type="checkbox"/> | <input type="checkbox"/> |
| Subscribe COV | <input type="checkbox"/> | <input type="checkbox"/> |
| Unconfirmed COV Notification | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Unconfirmed Event Notification | <input type="checkbox"/> | <input type="checkbox"/> |
| Atomic Read File | <input type="checkbox"/> | <input type="checkbox"/> |
| Atomic Write File | <input type="checkbox"/> | <input type="checkbox"/> |
| Add List Element | <input type="checkbox"/> | <input type="checkbox"/> |
| Remove List Element | <input type="checkbox"/> | <input type="checkbox"/> |
| Create Object | <input type="checkbox"/> | <input type="checkbox"/> |
| Delete Object | <input type="checkbox"/> | <input type="checkbox"/> |
| Read Property | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Read Property Conditional | <input type="checkbox"/> | <input type="checkbox"/> |
| Read Property Multiple | <input type="checkbox"/> | <input type="checkbox"/> |
| Write Property | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Read Range | <input type="checkbox"/> | <input type="checkbox"/> |
| Write Property Multiple | <input type="checkbox"/> | <input type="checkbox"/> |
| Device Communication Control | <input type="checkbox"/> | <input type="checkbox"/> |
| Confirmed Private Transfer | <input type="checkbox"/> | <input type="checkbox"/> |
| Unconfirmed Private Transfer | <input type="checkbox"/> | <input type="checkbox"/> |
| Reinitialize Device | <input type="checkbox"/> | <input type="checkbox"/> |
| Confirmed Text Message | <input type="checkbox"/> | <input type="checkbox"/> |

| | | |
|--------------------------|-------------------------------------|-------------------------------------|
| Unconfirmed Text Message | <input type="checkbox"/> | <input type="checkbox"/> |
| Time Synchronization | <input type="checkbox"/> | <input type="checkbox"/> |
| Who-Has | <input type="checkbox"/> | <input type="checkbox"/> |
| I-Have | <input type="checkbox"/> | <input type="checkbox"/> |
| Who-Is | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| I-AM | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| VT-Open | <input type="checkbox"/> | <input type="checkbox"/> |
| VT-Close | <input type="checkbox"/> | <input type="checkbox"/> |
| VT-Data | <input type="checkbox"/> | <input type="checkbox"/> |
| Authenticate | <input type="checkbox"/> | <input type="checkbox"/> |
| Request Key | <input type="checkbox"/> | <input type="checkbox"/> |

STANDARD OBJECT TYPES SUPPORTED

| Object-Type | Supported | Dynamically Creatable | Dynamically Deletable | Optional Properties Supported | Writeable Properties |
|--------------------|-------------------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------|
| Analog Input | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Analog Output | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Analog Value | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Binary Input | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Binary Output | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Binary Value | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Calendar | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Command | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Device | YES | N/A | N/A | | |
| Event Enrollment | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| File | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Group | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Loop | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Multi-state Input | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Multi-state Output | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Notification Class | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Program | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Schedule | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | |

DATA LINK LAYER OPTION

| | | |
|-----------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------|
| <input type="checkbox"/> ISO 8802-3 10BASE5 | <input type="checkbox"/> ARCNET, coax star | <input type="checkbox"/> MS/TP master, baud rate |
| <input type="checkbox"/> ISO 8802-3 10BASE2 | <input type="checkbox"/> ARCNET, coax bus | <input type="checkbox"/> MS/TP slave, baud rate |
| <input checked="" type="checkbox"/> ISO 8802-3 10BASET | <input type="checkbox"/> ARCNET, twisted pair star | <input type="checkbox"/> Point-to-Point, EIA 232, baud rate |
| <input type="checkbox"/> ISO 8802-3 Fiber | <input type="checkbox"/> ARCNET, twisted pair bus | <input type="checkbox"/> Point-to-Point, modem, baud rate |
| <input checked="" type="checkbox"/> other - BACnet/IP as defined in Annex J | <input type="checkbox"/> ARCNET, fiber star | <input type="checkbox"/> LonTalk |

CHARACTER SETS SUPPORTED

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

| | | |
|-----------------------------------------------|---------------------------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> ANSI X3.4 | <input type="checkbox"/> IBM/Microsoft DBCS | <input type="checkbox"/> JIS C 6226 |
| <input type="checkbox"/> ISO 10646 (ICS-4) | <input type="checkbox"/> ISO 10646 (UCS2) | <input type="checkbox"/> ISO 8859-1 |

SPECIAL FUNCTIONALITY

Segmented Requests Supported yes no Window Size:
 Segmented Responses Supported yes no Window Size: 1

ROUTER

No routing capability.

APPENDIX C: BACNET INTEROPERABILITY BUILDING BLOCKS (BIBB)

BIBBs define the available functionality of a particular BACnet device. They are broken down into several interoperability areas. The SAGE^{MAX} can handle data sharing and device management. In the following BIBB, specific to the SAGE^{MAX}, an A device acts as the client and the B device acts as the server.

DATA SHARING - READPROPERTY-A (DS-RP-A)

The A device is a user of data from device B.

| BACnet Service | Initiate | Execute |
|----------------|----------|---------|
| ReadProperty | x | |

DATA SHARING-READPROPERTY-B (DS-RP-B)

The B device is a provider of data to device A.

| BACnet Service | Initiate | Execute |
|----------------|----------|---------|
| ReadProperty | | x |

DATA SHARING-WRITEPROPERTY-A (DS-WP-A)

The A device sets a value in device B.

| BACnet Service | Initiate | Execute |
|----------------|----------|---------|
| WriteProperty | x | |

DATA SHARING-WRITEPROPERTY-B (DS-WP-B)

The B device allows a value to be changed by device A.

| BACnet Service | Initiate | Execute |
|----------------|----------|---------|
| WriteProperty | | x |

DATA SHARING-COV-A (DS-COV-A)

The A device is a user of COV data from device B.

| BACnet Service | Initiate | Execute |
|----------------------------|----------|---------|
| SubscribeCOV | x | |
| ConfirmedCOVNotification | | x |
| UnconfirmedCOVNotification | | x |

DATA SHARING-COV-B (DS-COV-B)

The B device is a provider of COV data to device A.

| BACnet Service | Initiate | Execute |
|----------------------------|----------|---------|
| SubscribeCOV | | x |
| ConfirmedCOVNotification | x | |
| UnconfirmedCOVNotification | x | |

Devices claiming conformance to DS-COV-B shall support a minimum of 5 concurrent subscriptions.

DEVICE MANAGEMENT-DYNAMIC DEVICE BINDING-A (DM-DDB-A)

The A device seeks information about device attributes of other devices and interprets device announcements.

| BACnet Service | Initiate | Execute |
|----------------|----------|---------|
| Who-Is | x | |
| I-Am | | x |

DEVICE MANAGEMENT-DYNAMIC DEVICE BINDING-B (DM-DDB-B)

The B device provides information about its device attributes and responds to requests to identify itself.

| BACnet Service | Initiate | Execute |
|----------------|----------|---------|
| Who-Is | | x |
| I-Am | x | |

