

BACnet T5 Upwards Communication Coupler Module for DGC5, DGC3 Systems & DT5 Transmitters

– Preliminary December 10, 2013 –

DESCRIPTION

This Module is used to transport values from Gas measuring systems or gas Sensors to BMS or PLC systems, which are able to be connected via Ethernet to a BACnet/IP-network.

APPLICATION

The DGC BAC-05 Communication Module is used in the DGC-05 system as Interface module.

The connection to each local DGC-05 System must be within specified limits.

If all electrical wires for bus and power are connected correctly, communication from DGC-05 to BACnet Side will start working.

There is no additional work to do, because the BACnet Host automatically detect the connected parts, such as sensors and relay modules with digital and analogue outputs do.

These modules have been developed per ANSI /ASRAE Norm 135-2001_BACnet-A- Data Communication protocol for Building Automation and Control Networks.

The used data link layer is the same as specified in Annex J- named BACnet /IP.

On BACnet side user has to do:

- use correct static IP address on IP Side or use DHCP
- use Correct BACnet ID Number
- take the EPICS (Electronic Protocol Implementation Conformance Statement) from this module to implement it on BMS side



T5-BACnet-X-A



C5 Module

T5 BACnet Upwards Communication Modules

TECHNICAL DATA

Electrical

Power supply	24 VDC (16 VDC to 30 VDC)
Power consumption	0.7 W, 50 mA
Fieldbus current	Max. 1.0 A
Over-voltage protection	Max. 35 V
Reverse polarity protection	Max. 30 V

DGC-05 side

Signal repeater bi-directional	Max. 900 m / 2700 ft. segment length
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BACnet side

Ethernet requirements	Max. 100 m /300 ft. per segment length
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Environmental conditions

Humidity	15 – 95 % RH non condensing
Working temperature	-10 °C to + 70 °C (14 °F to 158 °F)
Storage temperature	0 °C to + 50 °C (32 °F to 122 °F)

Physical

Enclosure	Plastic housing ABS
Colour	RAL 7035
Protection class	IP 40
Weight	0.1 kg (0.2 lbs.)
Installation	Top hat rail installation
Connection	Spring type: 0.5 to 1.5 mm ² (AWG 22 to 16)
Dimensions (W x H x D)	36 x 86 x 56 mm (1.4 x 3.4 x 2.2 in.)

Physical (housing incl. power supply unit / field installation)

Enclosure	Plastic housing ABS
Colour	RAL 7035
Protection class	IP 55
Weight	1.5 kg (3.2 lbs.)
Installation	Wall / ceiling installation
Dimensions (W x H x D)	200 x 250 x 100 mm (7.9 x 9.8 x 3.9 in.)

Power supply unit for field installation

Power supply	110/230 VAC 50/60Hz
Alternate	24 VAC 50/60 Hz
Secondary	24 VDC, 4,5 A max. overload and short-circuit proof

Guidelines

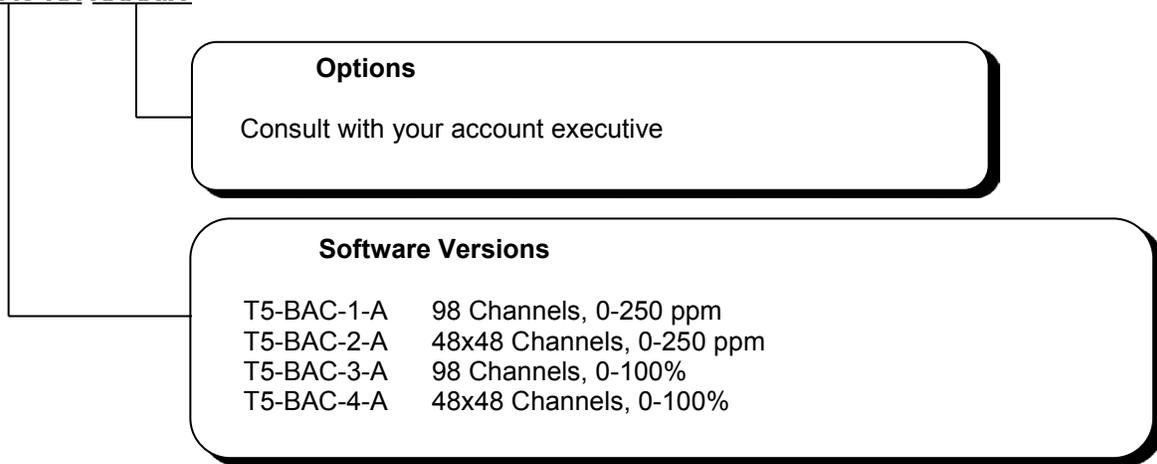
EMC Directives 2004 / 108 / EC
EN 61010-1:2010
ANSI/UL 61010-1
CAN/CSA-C22.2 No. 61010-1

Warranty

Two years material and workmanship

ORDERING INFORMATION

XX-BAC-XX-XXXX.X



Example: Module for field installation to a DGC-05 Controller with only 98 Bus Sensors (300 ppm)
Order number: C5-BAC-B1-XXXX.X

WIRING CONNECTION

If all electrical wires for bus and power are connected correctly, communication from DGC-05 to BACnet Side will start working. There is no additional work to do, because the BACnet Host automatically find the connected parts, such as sensors and relay modules with digital and analogue outputs.

The modules have been developed as per ANSI /ASRAE Norm 135-2001_BACnet-A- Data Communication protocol for Building Automation and Control Networks.

The used data link layer is the same as specified in Annex J- named BACnet /IP.

TYPE DESCRIPTION

Available Properties

Property	Value	Is Writable
Object_Identifier	configured at install-time (unique internetwork-wide)	-
Object_Name	configured at install-time (unique internetwork-wide)	-
Location	configured at install-time (optional)	-
Description	configured at install-time (optional)	-
Vendor_Name	download	-
Vendor_Identifier	download	-
Model_Name	download	-
Firmware_Revision	download	-
Application_Software_Version	download	-
Object_Type	DEVICE	-
System_Status	OPERATIONAL	-
APDU_Timeout	3 sec (download?)	-
Number_Of_APDU_Retries	3 (download?)	-
Protocol_Version	1	-
Protocol_Revision	1	-
Protocol_Services_Supported	{ READ-PROPERTY, WRITE-PROPERTY, WHO-IS, I-AM }	-
Protocol_Object_Types_Supported	{ DEVICE, AI, AO, AV, BI, BO, BV, MSI, MSO, MSV }	-
Object_List	based on downloaded configuration	-
Max_APDU_Length_Accepted	1024	-
Segmentation_Supported	FALSE	-
Device_Address_Binding	empty	-
Database_Revision	download	-

Not Available Properties

The following optional properties are not present: Max_Segments_Accepted, VT_Classes_Supported, Active_VT_Sessions, Local_Time, Local_Date, UTC_Offset, Daylight_Savings_Status, APDU_Segment_Timeout, List_Of_Session_Keys, Time_Synchronization_Recipients, Max_Master, Max_Info_Frames, Configuration_Files, Last_Restore_Time, Backup_Failure_Timeout, Active_COV_Subscriptions, Slave_Proxy_Enable, Manual_Slave_Address_Binding, Auto_Slave_Discovery, Slave_Address_Binding, Profile_Name.

Static Properties

The Parameters were downloaded by DGC-05-BACnet-Interface-Manufacturer

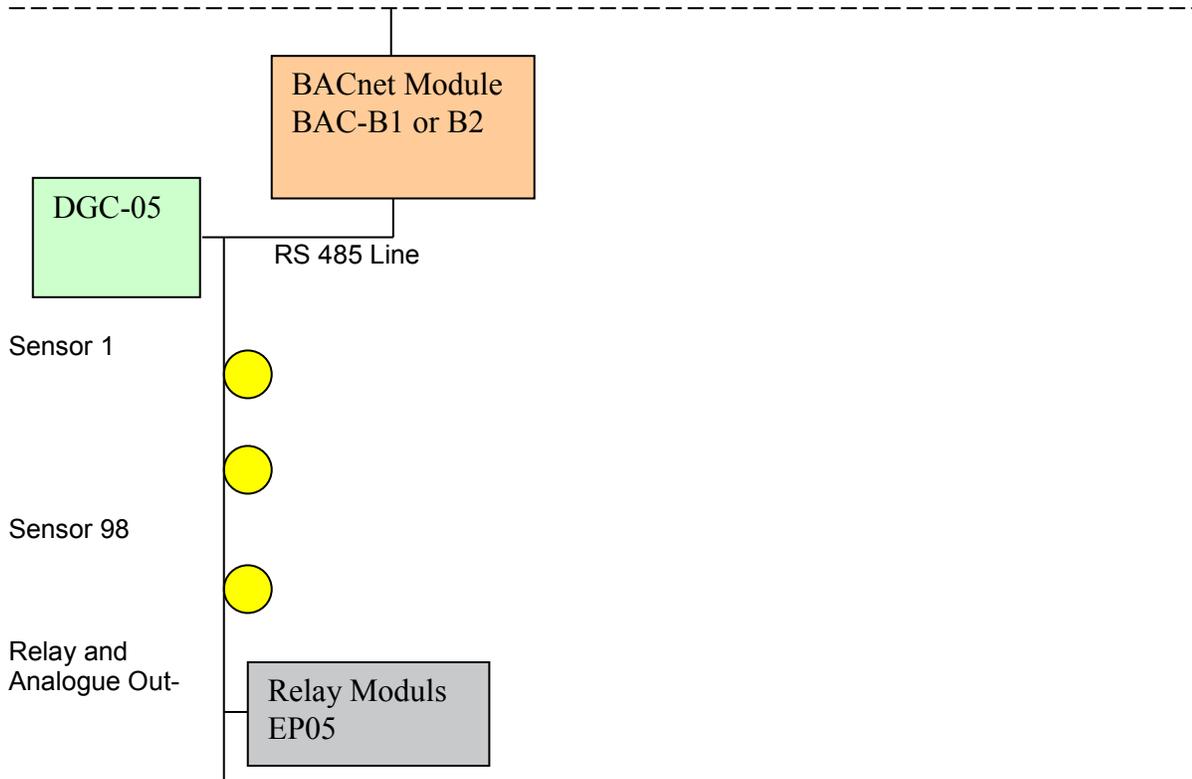
Device	
Property	Value
Vendor Name	MSR-Electronic
Vendor ID	60368
Model Name	DT5-Bacnet
Firmware Revision	Bac1-1
Application Software Version	1-001
Database Revision	1

DEVELOPMENT

Each DGC-05 unit is connected to the sensors and output module via its own bus system. At this local bus structure the converter to BACnet picks all Information from the system.

Each gas-Controller DGC-05 is connected to its bus sensors and output Modules over separate bus-system (RS485 bases with power supply within the same cable). At this point, BACnet-station will also be connected to this LAN (Local Area Network), to get all information about the connected DGC-05 stations.

TCP/IP Line to BMS with Protocol BACnet - ISO 16484-5



SOFTWARE INTERFACE DESCRIPTION

BACnet Profile

DGC05-BACnet-Interface supports functions that fit the BACnet profile called an "Application Specific Controller" (B-ASC).

BACnet Services

DGC05-BACnet-Interface supports the following BACnet protocol services:

- 1. Who-Is (Execute)** Upon receipt of a Who-Is request, EasyBAC initiates an I-Am request, as appropriate, using Device object's properties values for service request parameters.
- 2. I-Am (Initiate)** **DGC05-BACnet-Interface** initiates I-Am requests filled with Device object's properties values in the following situations:
 - at start-up
 - upon receipt of a Who-Is request

ReadProperty (Execute) all properties present in the Object Database are readable.

Upon receipt of a Read Property request, **DGC05-BACnet-Interface** performs request validation and sends back an acknowledgement, as defined by the BACnet standard. In case of a success.

DGC05-BACnet-Interface

sends back to the BACnet network positive acknowledgement (ReadProperty-ACK) containing current value of the requested property from the BACnet Object Database. In case of a failure, **DGC05-BACnet-Interface** sends negative acknowledgement (BACnet-Error) with appropriate BACnet error class and error code.

Current value of a property in the Database may originate from:

- DGC-05-BACnet-side
- DGC-05-Controller
- Another BACnet device (set by means of a WriteProperty BACnet service request)

WriteProperty (Execute)

Most of the properties in the BACnet Object Database are not writeable and cannot be changed by means of a WriteProperty service request. See Object Types Supported for complete list of writeable properties in each supported object type.

Upon receipt of a valid WriteProperty request, **DGC05-BACnet-Interface** writes to the Virtual Object Database specified value of the specified property of the specified object and sends back to the BACnet network positive acknowledgement, as defined by the BACnet standard. In case of a failure

DGC05-BACnet-Interface sends negative acknowledgement.

If the property being written is Present value or Relinquish default, and the object in question is not out of service (see Handling out Of Service Property), new property value is sent to the **DGC05 Controller**. FB: Output Property serial message is sent a synchronously and may be sent to the microprocessor either after or before BACnet acknowledgement is actually sent over the BACnet network.

DGC05-BACnet-Interface

WriteProperty handler performs basic request validity checks, such as existence of the object specified, existence and write ability of the property specified. Standard-mandated BACnet logic is also implemented: see handling Command Priorities and Out_Of_Service handling.

However, application-level checks, such as checking Present_Value against device-specific bounds, are not performed.

BACnet BIBBs supported

The BACnet standard defines a concept called **BIBBs** (BACnet Interoperability Building Blocks). A BIBB is a simple definition of a specific set of BACnet features that must be implemented by a device to support that BIBB.

The **DGC05-BACnet-Interface** is capable of performing the functionality of the following BIBBs:

- **DS-RP-B** that means **DS** (data sharing), **RP** (read property), **B** (Server device)
 - **DS-WP-B** that means **DS** (data sharing), **WP** (write property), **B** (Server device)
 - **DM-DDB-B** that means **DM** (device management), **DDB** (Dynamic Device Binding), **B** (Server device)
- The "DDB" description means that this device can find another device on the network.

This set of BIBBs matches the **BACnet B-ASC profile** (without support for Who-Has/I-Have and DCC - Device Communications Control)

Reliability property handling

DGC05-BACnet-Interface checks all possible DGC-05 –Bus-Nodes for his correct functionality. If a Sensor- or Relay Module is not available, damaged or not activated:

Input property with property ID set to Reliability **DGC-05-BACnet-Interface** automatically updates FAULT flag in the Status Flags property in the BACnet Object Database: sets it if new Reliability value is not equal to NO_FAULT_DETECTED, and clears it otherwise.

Object Types supported

The Version B1.2 will support this objects:

- Device Object
- Analogue Input 1 to 98 - reflecting actual CO Gas Sensor Value –Adr.1 to 98
- Analogue Value 1 to 12 - reflecting actual Min/Max/Av Signal of the Controller
- Binary Input 1 to 30 - reflecting actual Relay Status Signal of the Controller

The Version B2.2 will support this objects:

- Device Object
- Analogue input 1, 3, 5..95 - reflecting act. internal CO Gas Sensor Value Bus-Adr1 to 48
- Analogue input 2, 4, 6..96 - reflecting act. external CO Gas Sensor Value Bus-Adr1 to 48
- Analogue Value 1 to 12 - reflecting actual Min/Max/Av Signal of the Controller
- Binary Input 1 to 30 - reflecting actual Relay Status Signal of the Controller

Every object has a set of "Properties". These describe the parameters within an object and their current status. Here is an example of the properties of a temperature sensor:

Every product that communicates over BACnet must have a "Device Object" which includes identification information and a summary of the capabilities that are available to other devices on the network.

Object_Name	SPACE TEMP
Object_Typ	ANALOG INPUT
Present_Value	72.3
Status_Flags	Normal, Out-of-Service
High_Limit	78.0
Low_Limit	68.0

The Object_Identifier property must be unique across the entire BACnet network connection.

Device Object

Device Object reflects Information about Manufacturer and Version.

Available Properties

Property	Value	Is Writable
Object_Identifier	configured at install-time (unique internetwork-wide)	-
Object_Name	configured at install-time (unique internetwork-wide)	-
Location	configured at install-time (optional)	-
Description	configured at install-time (optional)	-
Vendor_Name	download	-
Vendor_Identifier	download	-
Model_Name	download	-
Firmware_Revision	download	-
Application_Software_Version	download	-
Object_Type	DEVICE	-
System_Status	OPERATIONAL	-
APDU_Timeout	3 sec (download?)	-
Number_Of_APDU_Retries	3 (download?)	-
Protocol_Version	1	-
Protocol_Revision	1	-
Protocol_Services_Supported	{ READ-PROPERTY, WRITE-PROPERTY, WHO-IS, I-AM }	-
Protocol_Object_Types_Supported	{ DEVICE, AI, AO, AV, BI, BO, BV, MSI, MSO, MSV }	-
Object_List	based on downloaded configuration	-
Max_APDU_Length_Accepted	1024	-
Segmentation_Supported	FALSE	-
Device_Address_Binding	empty	-
Database_Revision	download	-

Not Available Properties

The following optional properties are not present: Max_Segments_Accepted, VT_Classes_Supported, Active_VT_Sessions, Local_Time, Local_Date, UTC_Offset, Daylight_Savings_Status, APDU_Segment_Timeout, List_Of_Session_Keys, Time_Synchronization_Recipients, Max_Master, Max_Info_Frames, Configuration_Files, Last_Restore_Time, Backup_Failure_Timeout, Active_COV_Subscriptions, Slave_Proxy_Enable, Manual_Slave_Address_Binding, Auto_Slave_Discovery, Slave_Address_Binding, Profile_Name.

Static Properties

These Parameters are downloaded by DGC5-BACnet-Interface-Manufacturer

Device	
Property	Value
Vendor Name	MSR-Electronic
Vendor ID	60368
Model Name	DT5-Bacnet
Firmware Revision	Bac1-1
Application Software Version	1-001
Database Revision	1

Analogue Input Object 1 to 98

Available Properties:

Property	Value	Is Writable
Object_Identifier	download (unique device-wide)	-
Object_Name	download (unique device-wide)	-
Units	download	-
Description	download	-
Device_Type	download	-
Min_Pres_Value	download	-
Max_Pres_Value	download	-
Resolution	download	-
Object_Type	ANALOG-INPUT	-
Present_Value	variable (initial value is 0.0)	-
Status_Flags	{ 0, 0, 0, 0 }	-
Event_State	NORMAL	-
Out_Of_Service	FALSE	Yes
Reliability	No_Fault_Detected	-

Not Available Properties:

The following optional properties are not present:

Update_Interval, COV_Increment, Time_Delay, Notification_Class, High_Limit, Low_Limit, Deadband, Limit_Enable, Event_Enable, Acked_Transitions, Notify_Type, Event_Time_Stamps, Profile_Name.

Static Properties:

These Parameters are downloaded by DGC5-BACnet-Interface-Manufacturer

Property Name	Property Value
description	Carbon Monoxide Sensor
device-type	DT05-v2
event-state	normal (0)
max-pres-value	250
min-pres-value	0
object-identifier	(analog-input,3)
object-name	Gas Concentration
object-type	analog-input (0)
out-of-service	F
present-value	128.825
reliability	no-fault-detected (0)
resolution	0.1
status-flags	(F,F,F,F) ()
units	parts-per-million (96)

Dynamic Properties:

This Analogue Input Object reflects the Current Value Information from Digital Bus Gas Sensors 1 to 98 in the Field.

During Normal Operation Properties

- **Present value** and
- **Status Flags**

updated by DDC-05 Controller.

present-value	128.825
reliability	no-fault-detected (0)
resolution	0.1
status-flags	(F,F,F,F) ()

Analogue Value Object 1 to 12

Available Properties

Property	Value	Is Writable
Object_Identifier	download (unique device-wide)	-
Object_Name	download (unique device-wide)	-
Units	download	-
<i>Relinquish_Default</i> 1)	download	Yes
Description	download	-
Object_Type	ANALOG-VALUE	-
Present_Value	variable	<i>Optionally</i> 2)
<i>Priority_Array</i> 1)	variable (initial value is all NULLs)	-
Status_Flags	{ 0, 0, 0, 0 }	-
Event_State	NORMAL	-
Out_Of_Service	FALSE	Yes
Reliability	Nn_Fault_Detected	-

Not Available Properties

The following optional properties are not present:

COV_Increment, Time_Delay,
 Notification_Class, High_Limit, Low_Limit, Deadband, Limit_Enable, Event_Enable,
 Acked_Transitions, Notify_Type, Event_Time_Stamps, Profile_Name.

Static Properties:

Property Name	Property Value
description	CO Gas Concentration per Zone
event-state	normal (0)
object-identifier	(analog-value,1)
object-name	DT05 Analog -MIN/MAX/AV
object-type	analog-value (2)
units	parts-per-million (96)

Dynamic Properties:

This Analogue Value object reflects the actual value Information from Relay- and analogue Out Module 1 to 6 in the Field or in the Controller.

Each Module 1 to 2 analogue- Outputs with 4-20 mA signal.

So a maximum Number of 12 signals are available.

Per Software Select in the DGC-05 Controller-menu each analogue- Output can be the Signal of Minimum-Value or Maximum-Value or Average-Value of a individual set of sensor signals- also selectable per software.

During Normal operation Properties

- **Present value** and
- **Status flags**

are updated by DGC-05 Controller.

out-of-service	F
present-value	126.2
reliability	no-fault-detected (0)
status-flags	(F,F,F,F) ()

Binary Input Object 1 to 30

Available Properties

Property	Value	Is Writable
Object_Identifier	download (unique device-wide)	-
Object_Name	download (unique device-wide)	-
Polarity	download	-
Description	download	-
Device_Type	download	-
Inactive_Text	download	-
Active_Text	download	-
Object_Type	BINARY-INPUT	-
Present_Value	variable (initial value is INACTIVE)	-
Status_Flags	{ 0, 0, 0, 0 }	-
Event_State	NORMAL	-
Out_Of_Service	FALSE	Yes
Reliability	No_Fault_Detected	-

Not Available Properties

The following optional properties are not present:

Change Of State Time, Change of State Count, Time Of State Count Reset, Elapsed Active Time, Time of Active Time Reset, Time Delay, Notification Class, Alarm Value, Event Enable, Acked Transitions, Notify Type, Event Time Stamps, Profile Name.

Static Properties

Binary Input, 1 (Read-only)	
Property	Value
Instance Number	1
Object Name	Relais 1
Polarity	NORMAL
Description	OUTPUT STAGE
Device Type	DT05-v2
Inactive Text	RELAIS 1 OFF
Active Text	RELAIS 1 ON

Dynamic Properties

This Binary Input object reflects the Relay Status Information from Relay- and analogue Out Module 1 to 6 in the Field or in the Controller.

Each Module 1 to 5 Relay- Outputs.

So a maximum Number of 30 Relay Information bits are available as Input on the BACnet side.

Per Software Select in the DGC-05 Controller-Menu each Relay is software addressable from each sensor-alarm output.

During Normal operation Properties

- **Present Value** and
- **Status Flags**

present-value	active (1)
reliability	no-fault-detected (0)
status-flags	(F,F,F,F) (0)

are updated by DGC-05 Controller.

INTEGRATION - WHAT'S TO DO FROM THE USERS SIDE

The following screens are available at all times but the **DGC05-BACnet-Interface** is not a completely "stand-alone" product until the Virtual Objects file has been downloaded by DGC-05-Manufacturer according to the version of DGC-05 Controller.

IMPORTANT: This is what an end-user (or installation) person does.

Installing TCP/IP Network Node into End-User-Network.

Connect your computer DIRECTLY (over Switch or HUB) to the **DGC05-BACnet-Interface** TCP/IP Connector in Top of the Interface Module - with no other network devices attached (an isolated network). Either set your computers network connections to Automatic IP Address (**DHCP**), or set your computers IP address to 192.168.88.90 (subnet mask of 255.255.255.0)

Restart the EasyBAC interface (or module) by cycling the power off and then on again.

Open a browser window and insert the correct url: <http://192.168.1.123/admin>

- other TCP/IP Adresses are noted as stricker onto the modul

The default user name / password "**admin**" and "**admin**" (without the quotes).

BACnet Device																
Home	BACnet/IP Settings															
BACnet/IP Settings	This page allows you to view current BACnet/IP settings, to change them or to restore them to factory defaults.															
BACnet Device Settings	<table border="1"> <thead> <tr> <th>Parameter</th> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>IP</td> <td>192.168.xx.xx</td> <td>IP address of the BACnet device.</td> </tr> <tr> <td>Network Mask</td> <td>255.255.255.0</td> <td>IP subnet mask.</td> </tr> <tr> <td>Default Gateway</td> <td>192.168.xx.xx</td> <td>IP address of the default gateway.</td> </tr> <tr> <td>UDP Port</td> <td>47808</td> <td>BACnet/IP UDP port number.</td> </tr> </tbody> </table>	Parameter	Value	Description	IP	192.168.xx.xx	IP address of the BACnet device.	Network Mask	255.255.255.0	IP subnet mask.	Default Gateway	192.168.xx.xx	IP address of the default gateway.	UDP Port	47808	BACnet/IP UDP port number.
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IP	192.168.xx.xx	IP address of the BACnet device.														
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UDP Port	47808	BACnet/IP UDP port number.														
Restore Defaults																
Change Password																
Activate Configuration																
<input type="button" value="Save"/> <input type="button" value="Reset"/> <input type="button" value="Defaults"/>																

Now Change IP address to your address, it should be in your network.
 Now Change Default Gateway to your address, it should be in your network.

IMPORTANT: Make sure that you remember any changes made here.

If network will not use fixed addresses, this unit can also be configured to DHCP addressing.
 In this case automatic addresses will generated from DHCP server.



Please save this page after changing, and go to next menus or activate configuration

You can now reconfigure these settings according to your network requirements. Make sure that you press SAVE on every screen where you make changes. The BACnet Device Settings screen looks like this:

BACnet Device																
Home	BACnet Device Settings															
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NOTE: The **Device ID** must be unique on the entire BACnet internetwork.

If you will use more than one DGC-05- BACnet -Interfaces- you must use a unique Number on each Node.

The Restore Defaults and Change Password screens are very simplistic. When you select Activate

Configuration, it will ask you if you want to SAVE your settings. This will then store your new settings and reboot automatically.

General Information

Links to BACnet Resources

Here is where you can purchase a copy of the BACnet standard:

[ASHRAE BACnet Standard 135-2004](http://resourcecenter.ashrae.org/store/ashrae/newstore.cgi?itemid=22170&view=item&page=1&loginid=5193944&priority=category&words=135-2004&method=and) - or the crazy long URL is this:
<http://resourcecenter.ashrae.org/store/ashrae/newstore.cgi?itemid=22170&view=item&page=1&loginid=5193944&priority=category&words=135-2004&method=and>

This is available in as a hard-copy , CD-ROM, or download.

[BACnet.org](http://www.bacnet.org) - The official ASHRAE BACnet web site.

[BACnet International](#) - A group of manufacturers who promote the use of BACnet.

[BACnet Testing Lab](#) - The organization that tests BACnet devices for conformance to the standard.

[BACnet - European Interest Group](#) - The European group which promotes the use of BACnet and holds regular training conferences in Europe.

[BACnet FAQ](#) - A good frequently asked questions page on the www.bacnet.org web site.

Available additional Automation Tools for BACnet Side

- BACnet OPC Server - Control BACnet devices with any OPC workstation.
- BACnet Explorer - Auto discovery of devices and status on existing BACnet networks.
- BACTIVEX - ActiveX software for writing custom BACnet control programs.
- BACstac series - BACnet Windows and embedded protocol stacks for manufacturers.
- BAS-o-matic - A powerful protocol analyzer for **building automation** protocols.
- Indy/A - A powerful protocol analyzer for **industrial automation** protocols.

Authorized Distributor:
GasDetectorsUSA.com
Houston, TX USA
832-615-3588
sales@GasDetectorsUSA.com