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Communication Module BAC-06 for DGC-06 System

The module is designed for transmitting values from gas measuring systems or gas sensors to BMS or PLC systems that can be connected via Ethernet to a BACnet/IP-network.

APPLICATION

The DGC BAC-06 Communication Module is used in the DGC-06 system as interface module.

The connection to each local DGC-06 system must be within specified limits.

If all electrical wires for bus and power are connected correctly, communication from DGC-06 to BACnet side will start working.

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

These modules have been developed as per ANSI /ASRAE Standard 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 the 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) of this module to implement it on BMS side.

The communication is realized by **Modbus** Interface of DGC-06 Controller **with option Modbus Interface**.



BAC-06 Module





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SPECIFICATIONS

Electrical

Power supply	24 V DC (16 V DC to 30 V DC)
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-06 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 V DC, 4.5 A max. overload and short-circuit proof

Guidelines

Guidelines	EMC – Directive 2014/30/EU EN 61010-1:2010 ANSI/UL 61010-1 CAN/CSA-C22.2 No. 61010-1
Warranty	1 year on material





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ORDER INFORMATION

XX-BAC-XX - XXXX.X

C6-BAC-B1

C6-BAC-B2

OPTIONS

- BXXX.X Housing B
- BPS1.5 Housing incl. 24 V AC to VDC 1.5 A Power supply
- BPS230 Housing incl. 230 V AC to 24 V DC Power supply

SOFTWARE VERSIONS

- represents 1-96 DP + 1-32 AP + no SR + 1-16 AO + 1-32 AR + 1 Failure Relay P
- represents 1-75 DP + no AP + 1-75 SR + 1-16 AO + 1-32 AR + 1 Failure Relay Q



Ordering No. in DGC-06 Data sheet: DGC-06-X-X-X-XXXXXXX**X**

EXAMPLE

Module for field installation to a DGC-06 Controller for representation of 96 digital measuring points, 32 analog measuring points, 16 analog outputs, 32 alarm relays and 1 failure relay, without housing

Ordering number: C6-BAC-B1-0000.0

WIRING CONNECTION

The connection is made at the X-Bus Terminal 1 (Bus A) and 2 (BUS B) of the DGC-06 Controller. If all electrical wires for bus and power are connected correctly, communication from DGC-06 to BACnet side will start working. There is no additional work to do, because the BACnet host automatically finds the connected parts, such as sensors and relay modules with digital and analog outputs.

The modules have been developed as per ANSI /ASRAE Standard 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.





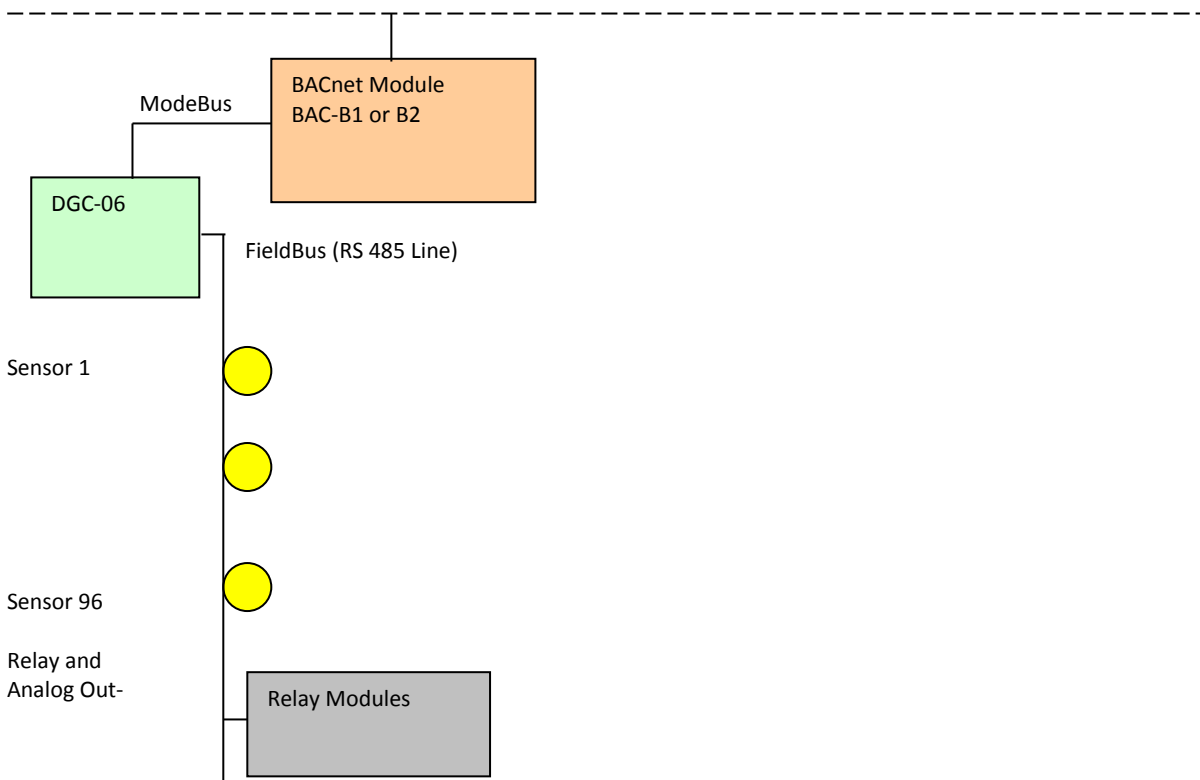
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DEVELOPMENT

Each DGC-06 unit is connected to the sensors and output module via its own bus system. The DGC-06 provides these values at the X-Bus terminal via Modbus Interface.

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



SOFTWARE INTERFACE DESCRIPTION

BACnet Profile

DGC-06-BACnet-Interface supports functions that fit the BACnet profile called an "Application Specific Controller" (B-ASC).

BACnet Services

DGC-06-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)** DGC-06-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





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ReadProperty (Execute)

All properties present in the Object Database are readable.

Upon receipt of a Read Property request, **DGC-06-BACnet-Interface** performs request validation and sends back an acknowledgement, as defined by the BACnet standard.

In case of a success **DGC-06-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, **DGC-06-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-06-BACnet-side
- DGC-06 Controller
- Another BACnet device (set by means of a WriteProperty BACnet service request)

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 **DGC-06-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)





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Reliability property handling

DGC-06-BACnet-Interface checks all possible DGC-06 Bus Nodes for their correct functionality. If a sensor or relay module is not available, damaged or not activated:

Input property with property ID set to Reliability **DGC-06-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
- Analog Input 1 to 96 - reflecting actual gas sensor value – DP 1 to 96
- Analog Input 101 to 132 - reflecting actual gas sensor value – AP 1 to 32
- Analog Value 1 to 16 - reflecting actual Min/Max/Av signal of the Controller
- Binary Input 101 to 132 - reflecting actual alarm relay status of the Controller – AR 1 to 32
- Binary Input 133 - reflecting actual failure relay status of the Controller

The version B2.2 will support these objects:

- Device Object
- Analog Input 1 to 75 - reflecting actual gas sensor value – DP 1 to 75
- Analog Value 1 to 16 - reflecting actual Min/Max/Av signal of the Controller
- Binary Input 1 to 75 - reflecting actual signal relay status of the Controller – SR 1 to 75
- Binary Input 101 to 132 - reflecting actual alarm relay status of the Controller – AR 1 to 32
- Binary Input 133 - reflecting actual failure relay status signal of the Controller

Every object has a set of "Properties". They describe the parameters within an object and their current status.

Here is an example of the properties of a gas sensor:

Object Name	DP 1
Description	Gas Sensor
Object Type	ANALOG_INPUT
Device Type	SC2
Present Value	20.3
Units	PERCENT(96)
Max Present Value	100
Reliability	no fault detected(0)





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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.

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 already loaded by DGC-06-BACnet-Interface manufacturer.

Device	
Property	Value
Vendor Name	MSR-Electronic
Vendor ID	532
Model Name	PG2 Bacnet
Firmware Revision	Bac1-1
Application Software Version	1-001
Database Revision	1





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Analogue Input Object

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 already loaded by DGC-06-BACnet-Interface manufacturer.

Property	Value
Instance Number	2
Object Name	DP 2
Units	percent
Description	Gas Sensor
Device Type	SC2
Min Present Value	0
Max Present Value	100
Resolution	0,1

Dynamic Properties:

This Analog Input Object reflects the Current Value Information from the Digital Bus Gas Sensors DP 1 to 96 in the field and the Current Value Information from Analog Inputs of EP Modules AP 1 to 32. All values of Analog Inputs are scaled 0 to 100 % → 0 to Measuring Range.

During normal operation the Properties

- Present value and
- Status Flags

are updated by DGC-06 Controller.

Present Value	89.9599990844727
Reliability	no_fault_detected (0)
Resolution	0.100000001490116
Status Flags	





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Analog Value Object 1 to 16

Available Properties

Property	Value	Is Writable
Object_Identifier	download (unique device-wide)	-
Object_Name	download (unique device-wide)	-
Units	download	-
Relinquish_Default 1)	download	Yes
Description	download	-
Object_Type	ANALOG-VALUE	-
Present_Value	variable	Optionally2)
Priority_Array 1)	variable (initial value is all NULLs)	-
Status_Flags	{ 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	Value
Instance Number	1
Object Name	Analog Output 1
Units	milliamperes
Description	Sensor Value per Area

Dynamic Properties:

This Analog Value object reflects the actual value Information from Relay- and analog Out Module 1 to 7 in the field or in the Controller.

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

So a maximum number of 16 signals are available.

Each analog output can be the signal of Minimum-Value or Maximum-Value or Average-Value depending on the settings in the DGC-06 Controller.

During normal operation the Properties

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

are updated by DGC-06 Controller.

Present Value	4
Reliability	no_fault_detected (0)
Status Flags	
Units	MILLIAMPERES (2)





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Binary Input Object

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

Property	Value
Instance Number	101
Object Name	AR 1
Polarity	NORMAL
Description	OUTPUT STAGE
Device Type	Alarm Relay
Inactive Text	AR 1 OFF
Active Text	AR 1 ON

Dynamic Properties

This Binary Input Object reflects the Relay Status Information from the Signal Relays (SR 1- 96) in the field and from Relay and Analog Out Module 1 to 7 in the field or in the Controller.

Alarm Relays: Each module has 1 to 4 relay outputs.

So a maximum number of 32 Alarm Relay Information bits are available as input on the BACnet side.

During normal operation the Properties

- Present Value and
- Status Flags

are updated by DGC-06 Controller.

Present Value	ACTIVE (1)
Reliability	no_fault_detected (0)
Status Flags	





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INTEGRATION - WHAT'S TO DO FROM THE USERS SIDE

The following screens are available at all times but the **DGC-06-BACnet-Interface** is not a completely "stand-alone" product until the Virtual Objects file has been downloaded by DGC-06-Manufacturer according to the version of DGC-06 Controller.

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

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

The current IP Address is noted as sticker onto the module (Currently: 192.168.1.123).

The address is changeable in the internet browser window under current TCP/IP Address or via Default Address:

Connect your computer DIRECTLY (over Switch or HUB) to the **DGC-06-BACnet-Interface** TCP/IP Connector on top of the Interface Module - with no other network devices attached (an isolated network). Either set your computer's network connections to Automatic IP Address (**DHCP**), or set your computer's 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 Default TCP/IP Address of the **DGC-06-BACnet-Interface** Module:

192.168.88.89

The default user name / password are "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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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 the network doesn't use fixed addresses, this unit can also be configured to DHCP addressing.

In this case automatic addresses will be generated by DHCP server.





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Please save this page after having changed it, and go to the 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															
BACnet/IP Settings	This page allows you to view current BACnet Device settings, to change them or to restore them to factory defaults.															
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NOTE: The Device ID must be unique on the entire BACnet internetwork.

If you want to use more than one DGC-06- BACnet interface, you must use a unique number on each node. The Restore Defaults and Change Password screens are very simplistic. When you select Activate Configuration, you will be asked if you want to SAVE your settings. It then stores your new settings and reboots automatically.





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General Information

Links to BACnet Resources

[ASHRAE BACnet Standard 135-2004](#)

[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.
- BACtix - Active X 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.

