BACnet Interface

FLUXUS ADM 5x07
(Special Version)

FLUXUS ADM 7x07
FLUXUS G70x

FLUXUS ADM 8x27
FLUXUS G80x

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Supplement to User Manual FLUXUS
SUFLUXUS_BACnetV1-0EN, 2012-08-01

BACnet Defaults

MAC address: 3
Device Instance: 457000
Max Master: 127
Max info frames: 9
RS485 Defaults: 38400, N, 1

BACnet Interface (optional)

The BACnet interface is optional for the transmitters FLUXUS ADM 5x07 (special version), ADM 7x07, G70x, ADM 8x27, G800, G801 (except for ADM 8x27C24, G80xC24, ADM 8027LC24, ADM 8127B) with firmware version V5.98 and higher.

The BACnet interface supports two modes:

- **BACnet mode**: the transmitter is operated as BACnet device
- **RS485 (sender) mode**: the transmitter sends human readable information of the current measurement and does not react to BACnet requests

A HotCode has to be entered to select the BACnet mode.

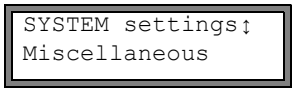
Settings in the Transmitter

Input of HotCode

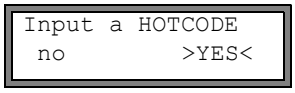
FLUXUS ADM 7x07, G70x

Press key C. Enter HotCode **485000**.

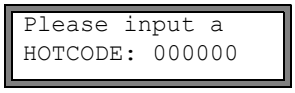
FLUXUS ADM 5x07, ADM 8x27, G80x



Select `Special Funct.\SYSTEM settings\Miscellaneous`.

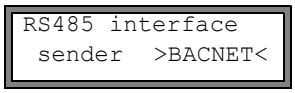


Select `yes` to enter a HotCode.



Enter HotCode **485000**. Press ENTER.

Selection of Mode

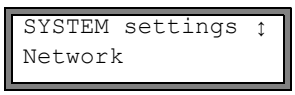


Select the mode.

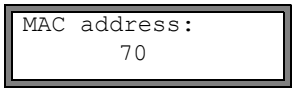
- `sender`: The transmitter is operated as sender via the RS485 interface.
- `BACnet`: The transmitter is operated as BACnet device.

Press ENTER.

Setting the Transmission Parameters



Select `Special Funct.\SYSTEM settings\ Network` to change the settings of the transmission parameters. Press ENTER.



Enter the MAC address. Press ENTER.

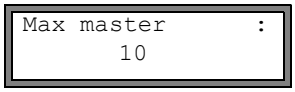
range: 1...127

Every device network has to have a unique MAC address within the MS/TP.

Enter the device instance. Press ENTER.

range: 0...4 194 302

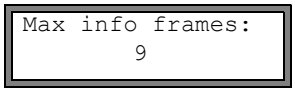
Every device has to have a unique device instance system wide.



Enter Max master. Press ENTER.

range: 1...10

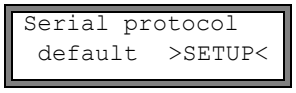
The highest possible MAC address that exists on the MS/TP network has to be entered.



Enter Max info frames. Press ENTER.

range: 1...9

The max. number of frames that the transmitter may send before it has to pass the token has to be entered.



Select `default` to display the default settings of the transmission parameters.

Select `setup` to change the transmission parameters.

Press ENTER.

Set the transmission parameters: Select one of the list items in the upper line. Change the setting in the lower line. Press ENTER.

- `baud`: baud rate (BACnet standard: 9 600, 38 400, optional: 19 200, 57 600, 76 800, 115 200)
- `parity`: (BACnet standard: `NONE`, optional: `EVEN`, `ODD`)
- `st`: number of stop bits (BACnet standard: 1, optional: 2)

The number of data bits (8) cannot be changed.

The transmission parameters can only be changed if `setup` is selected.

BACnet - Basics

BACnet is a network protocol standard for building automation (**B**uilding **A**utomation and **C**ontrol **Net**works). It is described in ANSI/ASHRAE/ISO Standard 135-2004. The protocol defines the interaction between different systems and devices. Data and commands are structured with an object oriented approach.

Networks

The BACnet standard supports 6 networks, each describing the physical and data link layer.

Tab. 1.1: Supported networks

BACnet MS/TP (RS485)
BACnet ARCnet
BACnet PointToPoint (RS232)
BACnet Ethernet
BACnet IP
BACnet Lontalk

The BACnet messages used to exchange data between the BACnet devices are independent of the physical and data link layers allowing BACnet routers to be used to interconnect different types of networks, e.g. Ethernet for management level and MS/TP for sensor/actuator level.

BACnet MS/TP over RS485

MS/TP (Master Slave/Token Passing) is a network type using the EIA-485 (RS485) standard as physical layer.

Each master device represents a node. A segment can have max. 32 nodes that communicate over the half duplex connection (transmission of data in one direction at a time).

The token is passed consecutively from master to master starting e.g. with the lowest address. Only the master device holding the token can start communication. The slave devices communicate only when responding to the request of a master device. The max. number of frames a master device is allowed to send can be configured in parameter "Max Info Frames". Thereafter the token has to be passed to the next master if existing or otherwise to the starting master. The selection of the next master is supported by parameter "Max Master" where the max. number of nodes within the segment is set.

MS/TP uses octets (bytes) to transfer data over the bus. One octet contains 8 data bits and has 1 start bit, 1 stop bit and no parity bit.

RS485 uses twisted pair cables with a length of max. 1 200 m. Stub lines are allowed but have to be as short as possible. Both ends of a RS485 network/segment have to be terminated with a resistor of typically 120 Ω to prevent data signals from being reflected at the open ends of the cable.

Tab. 1.2: BACnet frame

	octet	field	explanation
header	2	preamble 0x55 0xFF	start of a BACnet frame
	1	frame type	standard frame types: 0 token 1 poll for master 2 reply to poll for master 3 test request 4 test response 5 BACnet data expecting reply 6 BACnet data not expecting reply 7 reply postponed
			8...127 idle
			128...255 supplier specific frame types
	1	destination address	address of the destination device
	1	source address	address of the source device
	2	length (data)	number of data bytes in the frame
	1	header CRC	cyclic redundancy check of the header
data	0...501	data	
	2	data CRC	cyclic redundancy check of the data

Objects, Properties, Services

The data/information in the device is represented by objects. Each object has properties that can be readable and/or writeable. Each device has to have the device object which contains properties as device name, firmware version, number of objects provided by the device and their object identifier. For accessing the properties of the objects, the devices communicate by means of BACnet services. Confirmed services expect a response, while unconfirmed services do not.

Tab. 1.3: Examples for objects, properties, services

object types	properties	service categories and services
binary input	object identifier	object access:
binary output	object name	- ReadProperty
binary value	present value	- WriteProperty
analog input	description	alarm and event:
analog output	unit of measurement	- SubscribeCOV
analog value		- UnsubscribeCOV
device		remote device management:
file		- Who-Has
		- I-Have
		- Who-Is
		- I-Am

BIBBs, Device Profile

To ensure interoperability, all devices have to use the same BIBBs (BACnet Interoperability Building Block). A BIBB describes the services that have to be supported by master and slave to implement a requirement of the system.

For standard BACnet devices, device profiles with determined sets of BIBBs are defined.

Tab. 1.4: Classes of BiBBs

DS	data sharing
AE	alarm and event management
SCHED	scheduling
T	trending
DM	device management
NM	network management

Tab. 1.5: Examples of BIBBs (A - master, B - slave)

DS-RP-A	Data Sharing-ReadProperty-A/B	A reads property of B
DS-RP-B		B provides property for A
DS-RPM-A	Data Sharing-ReadPropertyMultiple-A/B	A reads multiple properties of B
DS-RPM-B		B provides multiple properties for A
DS-WP-A	Data Sharing-WriteProperty-A/B	A writes property of B
DS-WP-B		B allows writing by A
DS-COV-A	Data Sharing-COV-A/B (COV - change of value)	A subscribes for COV notification of a property of B
DS-COV-B		B allows A to subscribe for COV notification
AE-N-A	Alarm and Event-Notification-A	A processes notification of B

Tab. 1.6: Device profiles

B-OWS	BACnet operator workstation	building operation center, management system, workstation
B-BC	BACnet building controller	freely programmable automation station
B-AAC	BACnet advanced application controller	configurable automation device
B-ASC	BACnet application specific controller	parametrizable automation device
B-SA	BACnet smart actuator	
B-SS	BACnet smart sensor	

BACnet Specifics of the FLUXUS Transmitters

The transmitter is equipped with a BACnet module (optional).

Network, Device Profile, BIBBs

Tab. 1.7:

network type	MS/TP with a full master node state machine (see ANSI/ASHRAE/ISO Standard 135-2004)	
device profile	B-ASC	BACnet application specific controller
supported BIBBs	DS-RP-B	provides property for reading
	DS-RPM-B	provides multiple properties for reading
	DS-WP-B	allows writing of a property
	DS-COV-B	provides COV data
	DS-COVU-B	generates unsolicited COV data
	DM-DDB-B	gives I-Am in response to Who-Is
	DM-DOB-B	gives I-Have in response to Who-Has
	DM-DCC-B	device communication control

Objects and Properties

The transmitter includes the device object and a collection of measured values as standard BACnet object types. These objects are of type analog input (AI) and analog value (AV) whose property Units are writeable. The default units of measurements are listed in Tab. 1.8. Additional units of measurement with BACnetEngineeringUnits code are listed in annex A. There are some units of measurement that are not defined for BACnet, but are nonetheless available as non-standard enumeration values

All objects of type AV are totalizers. They can be reset by writing 0 to their property Present_Value. No other values may be written.

Change of Value (COV)

The transmitter provides support for Change Of Value subscription and notification for some objects (see Tab. 1.8). They may be subscribed for notification of changes of the property Present_Value. Max. 8 simultaneous subscriptions are supported that may be used by any combination of subscriber devices and COV supporting objects. COV is only supported by the confirmed BACnet service SubscribeCOV.

The COV increment of the subscribed object is initially set to 0. It should be changed to a reasonable value. Otherwise, a COV notification will be transmitted every time a new measuring value is available. This could result in a high bus traffic load. The COV parameter Lifetime, which holds the lifetime of the subscription in seconds have to be in the range $1...2^{32}$. A loss of power of the transmitter will reset the COV configurations.

There are no commandable objects.

Tab. 1.8: Objects of the transmitter

object identifier	description	channel	COV support	default unit of measurement	Units table in annex A
Device-457000	xxxxxxx-457000			-	-
AI - 101	medium temperature Tfluid (where the flow is measured, supply or return)	A	x	°C	Temperature
AI - 102	medium temperature Taux (the other temperature, return or supply)	A	x	°C	Temperature
AI - 103	medium pressure pfluid (where the flow is measured, supply or return)	A	x	bar	Pressure

Tab. 1.8: Objects of the transmitter

object identifier	description	channel	COV support	default unit of measurement	Units table in annex A
AI - 104	medium pressure paux (the other pressure, return or supply)	A	x	bar	Pressure
AI - 105	signal amplitude	A	x	no unit	Miscellaneous
AI - 106	sound speed	A	x	m/s	Flow Velocity, Sound Speed
AI - 107	flow velocity	A	x	m/s	Flow Velocity, Sound Speed
AI - 108	volumetric flow rate	A	x	m^3/h	Volumetric Flow Rate
AV - 109	volumetric flow rate, + totalizer	A		m^3	Volume
AV - 110	volumetric flow rate, - totalizer	A		m^3	Volume
AI - 111	standard volumetric flow rate	A	x	m^3/h	Volumetric Flow Rate
AV - 112	standard volumetric flow rate, + totalizer	A		m^3	Volume
AV - 113	standard volumetric flow rate, - totalizer	A		m^3	Volume
AI - 114	mass flow rate	A	x	kg/s	Mass Flow Rate
AV - 115	mass flow rate, + totalizer	A		kg	Mass
AV - 116	mass flow rate, - totalizer	A		kg	Mass
AI - 117	heat flow	A	x	W	Heat Flow
AV - 118	heat flow, + totalizer	A		MWh	Heat Quantity
AV - 119	heat flow, - totalizer	A		MWh	Heat Quantity
AI - 120	concentration	A		no unit	Miscellaneous
AI - 121	SNR	A		dB	Miscellaneous
AI - 122	SCNR	A		dB	Miscellaneous
AI - 123	VariAmp	A		%	Miscellaneous
AI - 124	VariTime	A		%	Miscellaneous
AI - 125	detection rate	A		%	Miscellaneous
AI - 126	diagnostic error bits	A		bit	Miscellaneous
AI - 201	medium temperature Tfluid (where the flow is measured, supply or return)	B	x	°C	Temperature
AI - 202	medium temperature Taux (the other temperature, return or supply)	B	x	°C	Temperature
AI - 203	medium pressure pfluid (where the flow is measured, supply or return)	B	x	bar	Pressure
AI - 204	medium pressure paux (the other pressure, return or supply)	B	x	bar	Pressure
AI - 205	signal amplitude	B	x	no unit	Miscellaneous
AI - 206	sound speed	B	x	m/s	Flow Velocity, Sound Speed
AI - 207	flow velocity	B	x	m/s	Flow Velocity, Sound Speed

Tab. 1.8: Objects of the transmitter

object identifier	description	channel	COV support	default unit of measurement	Units table in annex A
AI - 208	volumetric flow rate	B	x	m^3/h	Volumetric Flow Rate
AV - 209	volumetric flow rate, + totalizer	B		m^3	Volume
AV - 210	volumetric flow rate, - totalizer	B		m^3	Volume
AI - 211	standard volumetric flow rate	B	x	m^3/h	Volumetric Flow Rate
AV - 212	standard volumetric flow rate, + totalizer	B		m^3	Volume
AV - 213	standard volumetric flow rate, - totalizer	B		m^3	Volume
AI - 214	mass flow rate	B	x	kg/s	Mass Flow Rate
AV - 215	mass flow rate, + totalizer	B		kg	Mass
AV - 216	mass flow rate, - totalizer	B		kg	Mass
AI - 217	heat flow	B	x	W	Heat Flow
AV - 218	heat flow, + totalizer	B		MWh	Heat Quantity
AV - 219	heat flow, - totalizer	B		MWh	Heat Quantity
AI - 220	concentration	B		no unit	Miscellaneous
AI - 221	SNR	B		dB	Miscellaneous
AI - 222	SCNR	B		dB	Miscellaneous
AI - 223	VariAmp	B		%	Miscellaneous
AI - 224	VariTime	B		%	Miscellaneous
AI - 225	detection rate	B		%	Miscellaneous
AI - 226	diagnostic error bits	B		bit	Miscellaneous
AI - 1008	volumetric flow rate	Y		m^3/h	Volumetric Flow Rate
AV - 1009	volumetric flow rate, + totalizer	Y		m^3	Volume
AV - 1010	volumetric flow rate, - totalizer	Y		m^3	Volume
AI - 1011	standard volumetric flow rate	Y		m^3/h	Volumetric Flow Rate
AV - 1012	standard volumetric flow rate, + totalizer	Y		m^3	Volume
AV - 1013	standard volumetric flow rate, - totalizer	Y		m^3	Volume
AI - 1014	mass flow rate	Y		kg/s	Mass Flow Rate
AV - 1015	mass flow rate, + totalizer	Y		kg	Mass
AV - 1016	mass flow rate, - totalizer	Y		kg	Mass
AI - 1017	heat flow	Y		W	Heat Flow
AV - 1018	heat flow, + totalizer	Y		MWh	Heat Quantity
AV - 1019	heat flow, - totalizer	Y		MWh	Heat Quantity

Tab. 1.9: Properties of the device object

property	value	access	data type
Object_Identifier	contains the device instance range: lower 22 bit: 0...4 194 302 and upper 10 bit (object type): 0x02000000 default: 34011432 (0x0206F928)	R	BACnet object identifier
Object_Name	have to be unique system wide The device instance number is appended to the string "FLEXIM FLUXUS" automatically. default: FLEXIM FLUXUS 457000	R	character string
Object_Type	8 (device)	R	BACnet object type (bit string)
System_Status	0 (always operational)	R	BACnet device status (enumerated)
Vendor_Name	FLEXIM Americas Corporation	R	character string
Vendor_Identifier	457	R	unsigned16
Model_Name	e.g. ADM07402965	R	character string
Application_ Software_Version	e.g. 1.1 BACnet-00000001	R	character string
Description	-	R/W	character string
Protocol_Version	1	R	unsigned8
Protocol_Revision	4	R	unsigned8
Protocol_Services_ Supported	0x04 0x0B 0x40 0x28 0x60 (subscribeCOV, readProperty, readPropertyMultiple, writeProperty, deviceCommunicationControl, I-Am, unconfirmedCOVNotifiacation, Who-Is, Who-Has)	R	BACnet services supported (bit string)
Protocol_Object_ Types_Supported	0xA0 0x80 0x00 0x00 (Analog Input, Analog Value, Device)	R	BACnet object types supported (bit string)
Object_List	contains all available object identifiers	R	BACnet array of BACnet object identifier
Max_APDU_ Length_Accepted	480	R	unsigned8
Segmentation_ Supported	3 (no segmentation)	R	BACnet segmentation (enumerated)
APDU_Timeout	3 000 ms	R	unsigned8
Number_Of_ APDU_Retries	0	R	unsigned8
Device_Address_ Binding	-	R	list of BACnet address binding
Database_Revision	0	R	unsigned8

A Units of Measurement (Property Units)

Temperature

code	unit of measurement
62	°C

code	unit of measurement
64	°F

Pressure

code	unit of measurement
55	bar
134	mbar
45700	MPa
56	psi

code	unit of measurement
45701	mW
59	mmHg
45702	bar(g)
45703	psi(g)

Flow Velocity, Sound Speed

code	unit of measurement
74	m/s
45704	cm/s

code	unit of measurement
45705	in/s
76	ft/s

Volumetric Flow Rate

code	unit of measurement
135	m^3/h
45706	m^3/d
165	m^3/min
85	m^3/s
45707	hl/h
45708	hl/min
136	l/h
88	l/min
87	l/s
45709	MGD
45710	USgpd
192	USgph
89	USgpm
45711	USgps

code	unit of measurement
45712	bbl/d
45713	bbl/h
45714	bbl/m
45715	bbl/s
45716	Ml/d
45717	ml/min
45718	CFD
191	CFH
84	CFM
142	CFS
45719	MCFD
45720	MCFH
45721	USkgpm
45722	hl/s

Volume

code	unit of measurement
80	m^3
45723	Ml
45724	hl
82	l
83	USgal
45725	bbl

code	unit of measurement
45726	USMgal
45727	USkgal
197	ml
79	CF
45728	MCF

Mass Flow Rate

code	unit of measurement
42	kg/s
154	g/s
45729	t/d
156	t/h
44	kg/h
43	kg/min

code	unit of measurement
45730	lb/d
46	lb/h
45	lb/min
119	lb/s
45731	klb/h
45732	klb/min

Mass

code	unit of measurement
39	kg
195	g
41	t

code	unit of measurement
40	lb
45733	klb

Heat Flow

code	unit of measurement
47	W
48	kW
49	MW
45734	kBTU/m
157	kBTU/h
45735	MBTU/h

code	unit of measurement
45736	MBTU/d
52	TON
45737	kTON
45738	GW
45739	kBTU/d
45740	BTU/m

BTU: British thermal unit

TON: ton of refrigeration

Heat Quantity

code	unit of measurement
146	MWh
18	Wh
19	kWh
16	J
17	kJ
126	MJ
147	kBTU

code	unit of measurement
148	MBTU
22	TONhrs
45741	kTONd
45742	TONd
45743	kTONh
45744	GWd
20	BTU

BTU: British thermal unit

TON: ton of refrigeration

Miscellaneous

code	unit of measurement
199	dB
98	%

code	unit of measurement
45745	bit
95	no unit