

User Guide BACnet MS/TP Communication with MBS UBR-01 Router

VLT[®] HVAC Drive FC 102 • VACON[®] 100 HVAC



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User Guide

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1 Introduction

1.1 Purpose of the Manual

This user guide provides information on the configuration and use of the universal BACnet Router UBR-01 from MBS with Danfoss VLT[®] HVAC Drive FC 102 and VACON[®] 100 HVAC, using the embedded BACnet MS/TP communication.

The user guide details:

- The electrical connection of the RS485.
- The IP settings of the PC.
- The settings of the UBR-01 router.
- The relevant communication parameters of the frequency converter.

For further settings of the UBR-01, refer to www.mbsugw.de/ubr-01bacnet-router/.

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1.2 Additional Resources

Resources available for the frequency converters and optional equipment:

- The VLT[®] HVAC Drive FC 102 Operating Guide provides the necessary information for getting the frequency converter up and running.
- The VLT[®] HVAC Drive FC 102 Design Guide provides detailed information about capabilities and functionality to design motor control systems.
- The VLT[®] HVAC Drive FC 102 Programming Guide provides greater detail on working with parameters and many application examples.
- The VACON[®] 100 BACnet Installation Manual describes how to commission and parameterize the BACnet protocol.
- The VACON[®] 100 HVAC Application Manual provides greater detail on the parameters and application examples.

Supplementary publications and manuals are available from Danfoss. See *drives.danfoss.com/knowledge-center/ technical-documentation/* for listings.

1.3 Product Overview

Use the BACnet MS/TP UBR-01 router to enable communication in a BACnet network. The router is the device sending messages through the network. The messages can be from master to slave or slave to master, and the router can trigger alarms and/or warnings if the communication is lost.

1.4 Symbols, Abbreviations, and Conventions

Abbreviation	Definition
BMS	Building management system
EMC	Electromagnetic compatibility
IP	Internet protocol
PC	Personal computer
ТСР	Transmission control protocol

Table 1.1 Symbols and Abbreviations

Conventions

- Numbered lists indicate procedures.
- Bullet lists indicate other information and description of illustrations.
- Italicized text indicates the following:
 - Cross-reference.
 - Link.
 - Parameter name.
 - Parameter option.
 - Parameter group name.
- All dimensions are in metric values (imperial values in brackets).
- An asterisk (*) indicates the default setting of a parameter.

2 Network

2.1 Network Set-up

The system consists of 2 networks:

- Ethernet network (shown as Network number 1-NW#1)
- BACnet MS/TP network (shown as Network number 2-NW#2)

For the correct function of this network system, it is mandatory to follow the instructions on installation of the communication cables given in this user guide.



A	PC with web browser
В	Ethernet switch
С	BMS controller
D	UBR-01 BACnet Ethernet to MS/TP router
E	VLT® HVAC Drive FC 102
F	VACON [®] 100 HVAC
NW #1	Ethernet network, network number 1
NW #2	BACnet MS/TP network, network number 2

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Illustration 2.1 Router Running BACnet Ethernet





2.2 Cabling of the Networks

2.2.1 BACnet MS/TP Cabling (NW #2)

To ensure correct functionality of the BACnet MS/TP network, be sure to do the cabling correctly. Pay special attention to mounting of the cable shield and to termination of the network.

NOTICE

Never connect the shield to terminal 61 on the frequency converter.



Illustration 2.2 Grounding Shielded Cables

Shielding of frequency converters connected to the same ground potential

- 1. Use an adequate equalizing cable to eliminate the risk of equalizing current running into the shield of the BACnet cables.
- 2. Mount the shield at the terminal marked *Shld* on the router.
- 3. On the frequency converters, connect the shield to the ground shield brackets.

Shielding of frequency converters without the same ground potential

If the frequency converters do not have the same ground potential, only connect the shield to ground in 1 location. Expect a lower EMC performance.

2.2.2 Ethernet Cabling (NW #1)

NOTICE

EMC INTERFERENCE

Use shielded cables for motor and control wiring, and separate cables for fieldbus communication, motor wiring, and brake resistor. Failure to isolate fieldbus communication, motor, and brake resistor cables can result in unintended behavior or reduced performance. Minimum 200 mm (7.9 in) clearance between power, motor, and control cables is required. For power sizes above 315 kW (450 hp), increase the minimum distance to 500 mm (20 in).

NOTICE

When the fieldbus cable crosses a motor cable or a brake resistor cable, ensure that the cables cross at an angle of 90°.



Illustration 2.3 Cable Routing

For the Ethernet, use standard shielded Cat5e patch cables. Maximum cable length is 100 m (328 ft).

An Ethernet switch distributes the packets to the participants on the Ethernet network. For industrial installation, only use industrial graded products as other products may cause faults and sporadic loss of communication. User Guide

3 Addressing and Setting up the Devices on the Networks

For proper function of the network, configure each device correctly.

Device	Product	Device	MAC address	Network number	Baud rate	IP address	Subnet mask
		instance					
A	PC	10000	N/A	N/A	N/A	192.168.0.xxx	255.255.255.000
В	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C	N/A	1	N/A	1	N/A	N/A	N/A
D	UBR-01 router, RS485	100	0	1 & 2	38400	192.168.0.1	255.255.255.0
E	VLT [®] HVAC Drive FC 102, 1 st	1001	1	N/A	38400	N/A	N/A
	frequency converter						
F	VACON [®] 100 HVAC, 2 nd frequency	1002	2	N/A	38400	N/A	N/A
	converter						

Table 3.1 BACnet and Ethernet Settings

3.1 Setting up the IP Address and Subnet Mask of the PC

On the PC, set up the IP address in the *Internet Protocol Version 4 (TCP/IP) Properties* configuration menu.

- 1. Open the *Control panel* window.
- 2. Select View network status and tasks.
- 3. Select Local Area Connection.
- 4. Select Properties.
- 5. Select Internet Protocol Version 4 (TCP/IPv 4).
- 6. Select Properties.
- 7. Select Use the following IP address.
- 8. Set the IP address to 192.168.0.xx, where xx must be a number not currently used on the network.
- 9. Set the subnet mask to 255.255.255.000.
- 10. Exit the windows to activate the new IP addresses.

3.2 Setting up the UBR-01

To route to and from the MS/TP network, configure the UBR-01 router via the router web page.

As factory setting, the UBR-01 has the IP address 192.168.0.1.

- 1. Enter the IP address *192.168.0.1* in the web browser address bar.
- 2. Press Enter.
 - 2a The main page of the router web page opens.



Illustration 3.1 Entering the IP Address in the Web Browser

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- Consult the manual for the UBR-01 for login and password. Danfoss recommends to change the default login and password, since keeping the default is a security vulnerability.
- 4. Open the *Device* menu.
- 5. Enter the settings shown in *Illustration 3.2*.



Illustration 3.2 Settings in the Device Menu

- 6. Click Save.
- 7. Open the *Ethernet* menu.
- 8. Enter the settings shown in *Illustration 3.3*.

Ethernet	2	gogmærker	Funktioner Hj	aelp			
Ethernet			+				_
•) 🕲 192.1	.68.0.1/cgi-bin/ethe	er.cgi?sessid=8	AzKkN6NcW50s	54GY2: ☆ ♥ C	Soogle	P	â
							^
~							
Imas	1				0	BR-01	
i making below by	and .					rivadet	
ogin/Logo	out				Logged in	as: admin	
ssistant	Diagnostics	Backup	Passwords	Maintenance	Activate	Help	
tart Dev	vice Network	BACnet,	/IP BBMD	FD MS/TR	Ethernet		
	Net	work Num	ber 1]			
Save							

Illustration 3.3 Settings in the Ethernet Menu

- 9. Click Save.
- 10. Open the MS/TP menu.
- 11. Enter the settings shown in *Illustration 3.4*.

iler A	Kealder	ΨIS	Misconik	Bogmærker	Punkao	ner ma	eip			
M	5/TP				+					
(+)	@ 192.16	58.0.1	/cgi-bin/ms	tp.cgi?sessid=	EAzKkN6	VcW50s54	IGY2z ☆	⊽ C	- Google	P ·
_		_								
1	Impe								0	BR-01
1	· main particular	~								Produce
Loc	in/Logo	ut							Logged in	as: admin
As	sistant	Dia	gnostics	5 Backup	Passv	vords	Maint	enance	Activate	Help
Sta	rt Dev	ice	Network	k BACne	t/IP	BBMD	FD	MS/TP	Ethernet	
	En	able	Ne Ma sole ma	MAC Add etwork Nur Token Time Reply Time Max Ma ax Info Fra ster opera	ress 0 nber 2 sout 2 ster 1 mes 2 ition	0 50 27	ms ms			
Г	Slave F	rox	y Opera	ation	_					
		Slav	e autod	iscovery d	elay 6	0 :	5			
	En	able nable	slave p auto s	roxy opera lave disco	ition very	}				
	En	Slav able nable	e autod slave p auto s	iscovery d roxy opera lave disco	elay 6 ition very	0 :	5			

Illustration 3.4 Settings in the MS/TP Menu

- 12. Click Save.
- 13. Open the *Activate* menu.
- 14. Click Activate and restart to activate the settings, see *Illustration 3.5*.
 - 14a The router restarts and the new settings become active, see *Illustration 3.6.*



Illustration 3.5 Settings in the MS/TP Menu

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🕞) 🐨 192.:	68.0.1/cgi-bin/activate.cgi?sessid=pu8/MLxKE2cKQA3pXobxwcpv201/eG.	☆ ♥ C	P
			^
	Imes'	UBR-01	
	Login/Logout Assistant Diagnostics Backup Passwords Ma	Logged in as: admin intenance Activate Help	
	Wait while the router restarts.		
	Click here if you are not redirected automatically	after 25 seconds.	

Illustration 3.6 Router Restarting

3.3 Configuring the Frequency Converters

To enable the frequency converters to communicate over the embedded BACnet MS/TP network, set the parameters listed in *Table 3.2* and *Table 3.3*.

For correct programming of the frequency converter, see the VLT[®] HVAC Drive FC 102 Programming Guide for details on setting up motor size, motor voltage, ramp times, and more.

Parameter	Setting
	First frequency converter (E)
Parameter 8-01 Control Site	[2] Control word only
Parameter 8-02 Control Source	[1] FC Port
Parameter 8-03 Control Timeout Time	10.0 s ¹⁾
Parameter 8-04 Control Timeout Function	[2] Stop ¹⁾
Parameter 8-10 Control Profile	[0] FC Profile
Parameter 8-30 Protocol	[5] BACnet
Parameter 8-31 Address	1
Parameter 8-32 Baud Rate	[4] 38400 Baud
Parameter 8-70 BACnet Device Instance	1001

Table 3.2 Required Communication Parameters and their Correct Settings, VLT® HVAC Drive FC 102

Parameter	Setting
	Second frequency converter (F)
Parameter 3.2.1 Control Place	FieldbusCTRL
Parameter 3.2.2 Local/Remote Control	Remote
Parameter 5.8.3.1.5 Communication Timeout	10.0 s ¹⁾
Parameter 3.9.1.6 (ID 733) Fieldbus Fault	Stop
Parameter 5.8.1.1 Protocol	BACnet MSTP
Parameter 5.8.3.1.2 MAC Address	2
Parameter 5.8.3.1.1 Baud Rate	38400
Parameter 5.8.3.1.3 Instance Number	1002

Table 3.3 Required Communication Parameters and their Correct Settings, VACON® 100 HVAC

1) To achieve a stable system, it is recommended that 3 write commands are sent within the timeout set in parameter 8-03 Control Timeout Time.

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4 Testing the BACnet Settings in a Delta BMS System

For testing the settings in the UBR-01 router and in the frequency converters, a BMS tool is used for:

- Scanning the network.
- Find the BACnet devices.
- Showing the device objects.

O Delta Network Name Object Description Image: Second	
Active Adams	1308F51

Illustration 4.1 BMS Tool Scanning the Network

By selecting the frequency converter with device instance 1001, the BMS starts the discovery of the frequency converter objects and shows their present value. This proves the correct function of the UBR-01 and the frequency converters connected via BACnet.

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Delta Network	Name	Value	Units	Object	Description	^
😑 🚽 🖉 BACnet Protocol	Terminal 42 Output Bus	0	%	1001.AO0	Analog Output	
	Pulse out #27 Bus Control	0	%	1001.AO1	Analog Output	
	Pulse out #29 Bus Control	0	%	1001.AO2	Analog Output	
BACnet router (100)	Digital Output Term 27	OFF		1001.BO0	Binary Output	
	Digital Output Term 29	OFF		1001.BO1	Binary Output	
	Relay 1	OFF		1001.BO4	Binary Output	
	Relay 2	OFF		1001.BO5	Binary Output	
Active Alarms	Analog Input 53	-0.6	%	1001.AI0	Analog Input	
- B Reports	Realog Input 54	-0.6	%	1001.AI1	Analog Input	
Graphics	Digital input Term 33	OFF		1001.BI0	Binary Input	
	Digital input Term 32	OFF		1001.BI1	Binary Input	
	🕬 Digital input Term 29	OFF		1001.BI2	Binary Input	
	🕬 Digital input Term 27	OFF		1001.BI3	Binary Input	
	🖏 Digital input Term 19	OFF		1001.BI4	Binary Input	
	Digital input Term 18	OFF		1001.BI5	Binary Input	
	🖏 Digital input Term 37	ON		1001.BI6	Binary Input	_
	Disput Reference 1	0	%	1001.AV1	Analog Variable	
	Disput Reference 2	0	%	1001.AV2	Analog Variable	
	Output Speed	0	%	1001.AV3	Analog Variable	
	PID Feedback	0	%	1001.AV4	Analog Variable	
	C Motor Current	0	Α	1001.AV5	Analog Variable	
	O Power	0	k₩	1001.AV6	Analog Variable	
	C Motor Thermal	0	%	1001.AV15	Analog Variable	
	Operating Hours	249	hr	1001.AV21	Analog Variable	
	C Running Hours	4	hr	1001.AV22	Analog Variable	
	KWh Counter	0	kWh	1001.AV23	Analog Variable	
	C Motor Voltage	0	V.	1001.AV24	Analog Variable	
	C Frequency	0	Hz	1001.AV25	Analog Variable	
	C Torque	0	%	1001.AV26	Analog Variable	
	C Link Voltage	312	¥.	1001.AV27	Analog Variable	
	CHeatsink Temp.	28	°C	1001.AV28	Analog Variable	
	Inverter Thermal	0	%	1001.AV29	Analog Variable	
	Setpoint 1	0	%	1001.AV30	Analog Variable	
	Bus Feedback 1	n	%	1001.AV31	Analon Variable	\sim

Illustration 4.2 List of $\mathsf{VLT}^{\textcircled{0}}$ HVAC Drive FC 102 Objects and their Values

						-
Delta Network	Name	Value	Units	Object	Description	^
😑 🚽 BACnet Protocol	C Frequency Setpoint	0	Hz	10002.AV0	Analog Variable	
- 🕅 <panel 13=""> (13)</panel>	Output Frequency	0	Hz	10002.AV1	Analog Variable	
🔊 <panel 14=""> (14)</panel>	Motor Speed	0	r/min	10002.AV2	Analog Variable	
BACnet router (100)	Coad (power)	0	%	10002.AV3	Analog Variable	
- 🔲 Router 200 (200)	Kilowatt Hours total	0.9	kWh	10002.AV4	Analog Variable	
FC-102 (1001)	Motor Current	0	A	10002.AV5	Analog Variable	
VACON 100 BACnet cont	C Ink Voltage	334.7	v	10002.AV6	Analog Variable	
Compag Evo 610c (1)	Motor Voltage	0	v	10002.AV7	Analog Variable	
Active Alarms	Unit Temperature	28	°C	10002.AV8	Analog Variable	
Craphics	Motor Torque	0	%	10002.AV9	Analog Variable	
Californics	Operating Days	4	day	10002.AV10	Analog Variable	
	Operating Hours	12	hr	10002.AV11	Analog Variable	
	Kilowatt Hours	0.9	kWh	10002.AV12	Analog Variable	
	Torque Reference	0	%	10002.AV13	Analog Variable	
	Temperature Rise	0	%	10002.AV14	Analog Variable	
	G fb ProcessdataOut 01	0		10002.AV15	Analog Variable	
	G fb ProcessdataOut 02	0		10002.AV16	Analog Variable	
	G fb ProcessdataOut 03	0		10002.AV17	Analog Variable	
	G fb ProcessdataOut 04	0		10002.AV18	Analog Variable	
	G fb ProcessdataOut 05	0		10002.AV19	Analog Variable	
	G fb ProcessdataOut 06	0		10002.AV20	Analog Variable	
	G fb ProcessdataOut 07	335		10002.AV21	Analco Variable	
	G fb ProcessdataOut 08	0		10002.AV22	Analog Variable	
	Active Fault Code	0		10002.AV23	Analog Variable	
	Speed Reference	0	%	10002.AV24	Analog Variable	
	Current Limit	3.7	A	10002.AV25	Analog Variable	
	Min Frequency	0	Hz	10002.AV26	Analog Variable	
	Maximum Frequency	100	Hz	10002.AV27	Analog Variable	
	C Accel Time	1.5	sec	10002.AV28	Analog Variable	
	Decel Time	1.5	sec	10002.AV29	Analog Variable	
	G fb ProcessdataIn 01	0		10002.AV30	Analog Variable	
	O fb_ProcessdataIn_02	0		10002.AV31	Analog Variable	
	G fb ProcessdataIn 03	0		10002.AV32	Analog Variable	
	G fb ProcessdataIn 04	0		10002.AV33	Analog Variable	
	AnyParam ID	1		10002.AV34	Analog Variable	
	AnyParam Value	0		10002.AV35	Analog Variable	
	Fb_Control_Word Lo16	0		10002.AV36	Analog Variable	
	Pb Control Word Hi16	0		10002.AV37	Analog Variable	~
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Illustration 4.3 List of VACON® 100 Objects and their Values

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