

BACnet Protocol Implementation Conformance Statement

Date: March 31, 2008-03-31

Vendor Name: Danfoss Drives A/S

Product Name: AC Motor Drive

Product Model Number: FC-102/ MCA-109 and Optional MCO-104 Bypass Control

Applications Software Version: 1.15 **Firmware Revision:** 1.15 **BACnet Protocol Revision:** 4

Product Description:

Danfoss Drives VLT[®] HVAC Drive is the first Variable Frequency Drive to offer a single BACnet solution in either a stand-alone VFD or fully integrated Variable Frequency Drive and Electronically or Electro-Mechanically controlled bypass option package. With one BACnet interface you can communicate with and control both the VFD and/or the bypass option. The VLT HVAC Drive BACnet solution eliminates the challenge and confusion of having separate BACnet solutions for the VFD and bypass option panel.

The standard VLT HVAC Drive connection is MS/TP, RS485-based; and it supports all BIBBs defined by the BACnet standard profile for an Application Specific Controller (B-ASC). VLT HVAC BACnet provides the capability to control and monitor the VFD and/or bypass panel, including all analog and digital inputs and outputs and extendable I/O (multiple PI Loops) options and dedicated HVAC functionality available. Thereby making it the first truly integrated and broadest application oriented, seamless solution for variable speed fan, pump and compressor HVAC applications.

VLT HVAC BACnet also lets you easy synchronise the VFD's internal real-time clock with the BMS clock, eliminating the need to change time due to daylight saving, or exchanging batteries in battery backed up real-time clocks. To maximize BACnet performance VLT HVAC BACnet utilizes alarm- and notification objects which lets the VLT HVAC Drive monitor analog values and only sends messages when an alarm occurs significantly reducing network traffic.

BACnet Standardized Device Profile (Annex L):

- BACnet Operator Workstation (B-OWS)
- BACnet Building Controller (B-BC)
- BACnet Advanced Application Controller (B-AAC)
- BACnet Application Specific Controller (B-ASC)
- BACnet Smart Sensor (B-SS)
- BACnet Smart Actuator (B-SA)

List all BACnet Interoperability Building Blocks Supported (Annex K):

Data Sharing-ReadProperty-B	(DS-RP-B)
Data Sharing-ReadPropertyMultiple-B	(DS-RPM-B)
Data Sharing-WriteProperty-B	(DS-WP-B)
Data Sharing-WritePropertyMultiple-B	(DS-WPM-B)
Alarm and Event-ACK-B	(AE-ACK-B)
Alarm and Event-Notification Internal-B	(AE-N-I-B)
Alarm and Event-Information-B	(AE-INFO-B)
Device Management-Dynamic Device Binding-A	(DM-DDB-A)
Device Management-Dynamic Device Binding-B	(DM-DDB-B)
Device Management-Dynamic Object Binding-B	(DM-DOB-B)
Device Management-DeviceCommunicationControl-B	(DM-DCC-B)
Device Management-TimeSynchronization-B	(DM-TS-B)
Device Management-ReinitializeDevice-B	(DM-RD-B)

Segmentation Capability:

- Segmented requests supported Window Size _____
- Segmented responses supported Window Size _____

Standard Object Types Supported:

Analog Input
Analog Output
Analog Value
Binary Input
Binary Output
Binary Value
Device
File
Multi-state Output
Notification Class

Object instantiation is static. Refer to tables at end of this document for object details.

Data Link Layer Options:

- BACnet IP, (Annex J)
- BACnet IP, (Annex J), Foreign Device
- ISO 8802-3, Ethernet (Clause 7)
- ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)
- ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) _____
- MS/TP master (Clause 9), baud rate(s): 9.600; 19.200; 38.400; 76.800
- MS/TP slave (Clause 9), baud rate(s): _____
- Point-To-Point, EIA 232 (Clause 10), baud rate(s): _____
- Point-To-Point, modem, (Clause 10), baud rate(s): _____
- LonTalk, (Clause 11), medium: _____
- Other: _____

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) Yes No

Networking Options:

- Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.
- Annex H, BACnet Tunneling Router over IP
- BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices? Yes No

Character Sets Supported:

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

- ANSI X3.4
- IBM™/Microsoft™ DBCS
- ISO 8859-1
- ISO 10646 (UCS-2)
- ISO 10646 (UCS-4)
- JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:

Property	Object Type									
	Device	Binary Input	Binary Output	Binary Value	Analog Input	Analog Output	Analog Value	Multistage Output	File	Event notification Class
Object Identifier	X	X	X	X	X	x	X	X	X	X
Object Name	X	X	X	X	X	x	X	X	X	X
Object Type	X	X	X	X	x	x	X	X	X	X
System Status	X									
Vendor Name	X									
Vendor Identifier	X									
Model Name	X									
Firmware Revision	X									
Appl Software Revision	X									
Location	X									
Description	X	X	X	X	X	X	X	X	X	X
Protocol Version	X									
Protocol Revision	X									
Services Supported	X									
Object Types Supported	X									
Object List	X									
Max APDU Length	X									
Segmentation Support	X									
Local Time	X									
Local Date	X									
APDU Timeout	X									
Number APDU Retries	X									
Max Master	X									
Max Info Frames	X									
Device Address Binding	X									
Database Revision	X									
Present Value		X	X	X	X	X	X	X		
Status Flags		X	X	X	X	X	X	X		
Event State		X	X	X	X	X	X	X		
Reliability		X	X	X	X	X	X	X		
Out-of-Service		X	X	X	X	X	X	X		
Number of States								X		
State text								X		
Units					X	X	X			
Time delay					X		X			
Notification Class					X		X			X
High Limit					X		X			
Low Limit					X		X			
Deadband					X		X			
Limit enable					X		X			
Event Enable					X		X			
Acked Transitions					X		X			

Notify Type					X		X			
Event time stamp					X		X			
Priority Array			X	x*		X		X		
Priority										X
Ack Required										X
Recipient list										X
# of Notification Class										X
Relinquish Default			X	x*		X		X		
Polarity		X	X							
Active Text		X	X	X						
Inactive Text		X	X	X						
File Type										X
File Size										X
Modification Date										X
Archive										X
Read Only										X
File Access Method										X

* For Commandable values only.

Analogue Inputs

Instance ID	Object Name	Present value access	Alarm notification	Remark
AI:0	Analog Input 53	R	Yes	
AI:1	Analog Input 54	R	Yes	
AI:2	Analog In X30/11	R	Yes	MCB 101 General Purpose I/O
AI:3	Analog In X30/12	R	Yes	MCB 101 General Purpose I/O
AI:4	Analog Input X42/1	R	Yes	MCB 109 Analog I/O w. RTC
AI:5	Analog Input X42/3	R	Yes	MCB 109 Analog I/O w. RTC
AI:6	Analog Input X42/5	R	Yes	MCB 109 Analog I/O w. RTC

Analogue Outputs

Instance ID	Object Name	Present value access	Alarm notification	Remark
AO:0	Terminal 42 Output Bus Control	W/R	No	
AO:1	Pulse out #27 Bus Control	W/R	No	
AO:2	Pulse out #29 Bus Control	W/R	No	
AO:3	Analogue Out X30/8 [mA]	W/R	No	MCB 101 General Purpose I/O
AO:4	Analogue output X42/7[V]	W/R	No	MCB 109 Analog I/O w. RTC
AO:5	Analogue output X42/9[V]	W/R	No	MCB 109 Analog I/O w. RTC
AO:6	Analogue output X42/11[V]	W/R	No	MCB 109 Analog I/O w. RTC

Analogue Values

Instance ID	Object Name	Present value access	Alarm notification	Remark
AV:0	Reference	W/R	No	Commandable
AV:1	Speed Act. Value	W/R	Yes	
AV:2	Bus Feedback1	W/R	No	
AV:3	Bus Feedback2	W/R	No	
AV:4	Bus Feedback3	W/R	No	
AV:5	Motor Voltage	Read	Yes	
AV:6	Motor Current	Read	Yes	
AV:7	Motor Torque %	Read	Yes	
AV:8	DC Link Voltage	Read	Yes	
AV:9	Motor thermal	Read	Yes	
AV:10	Heat sink Temperature	Read	Yes	
AV:11	Inverter Thermal	Read	Yes	
AV:12	Operating Hours	Read	No	
AV:13	Running Hours	Read	No	
AV:14	KWh Counter	Read	No	
AV:15	Power [KW]	Read	No	
AV:16	PID Start Speed [Hz]	W/R	No	
AV:17	PID Proportional Gain	W/R	No	
AV:18	PID Integral Time	W/R	No	
AV:19	PID Differential Time	W/R	No	
AV:20	PID Dif. Gain Limit	W/R	No	
AV:21	On Reference Bandwith	W/R	No	
AV:22	Ext. 1 Setpoint	W/R	No	Commandable
AV:23	Ext. 1 Reference [Unit]	W/R	No	Commandable
AV:24	Ext. 1 Feedback [Unit]	W/R	No	
AV:25	Ext. 1 Propotional Gain	W/R	No	
AV:26	Reserved	W/R		
AV:27	Ext. 1 Integral Time	W/R	No	
AV:28	Ext. 1 Differential Time	W/R	No	
AV:29	Ext. 1 Dif. Gain Limit	W/R	No	
AV:30	Reserved	W/R		
AV:31	Ext. 2 Setpoint	W/R	No	Commandable
AV:32	Ext. 2 reference [Unit]	W/R	No	Commandable
AV:33	Ext. 2 Feedback [Unit]	W/R	No	
AV:34	Ext. 2 Proportional Gain	W/R	No	
AV:35	Ext. 2 Integral Time	W/R	No	
AV:36	Ext. 2 Differential Time	W/R	No	
AV:37	Ext. 2 Dif. Gain	W/R	No	
AV:38	Ext. 3 Setpoint	W/R	No	Commandable
AV:39	Ext. 3 Reference [Unit]	W/R	No	Commandable
AV:40	Ext. 3 Feedback [Unit]	W/R	No	
AV:41	Ext. 3 Proportional Gain	W/R	No	

Instance ID	Object Name	Present value access	Alarm notification	Remark
AV:42	Ext. 3 Integral Time	W/R	No	
AV:43	Ext. 3 Differential Time	W/R	No	
AV:44	Ext. 3 Dif. Gain Limit	W/R	No	
AV:45	Running Bypass	Read	No	MCO 104 Electronic Bypass

Binary Inputs

Instance ID	Object Name	Present value access	Alarm notification	Remark
BI:0	Digital input 33	Read	No	
BI:1	Digital input 32	Read	No	
BI:2	Digital input 29	Read	No	
BI:3	Digital input 27	Read	No	
BI:4	Digital input 19	Read	No	
BI:5	Digital input 18	Read	No	
BI:6	Digital input 37	Read	No	
BI:7	Digital input X30/2	Read	No	MCB 101 General Purpose I/O
BI:8	Digital input X30/3	Read	No	MCB 101 General Purpose I/O
BI:9	Digital input X30/4	Read	No	MCB 101 General Purpose I/O
BI:10	Digital input P1660/10	Read	No	
BI:11	Digital input P1660/11	Read	No	
BI:12	Digital input P1660/12	Read	No	
BI:13	Digital input P1660/13	Read	No	
BI:14	Digital input P1660/14	Read	No	
BI:15	Digital input P1660/15	Read	No	

Binary Outputs

Instance ID	Object Name	Present value access	Alarm notification	Remark
BO:0	Digital output 27	W/R	No	
BO:1	Digital output 29	W/R	No	
BO:2	GPIO Output Term X30/6	W/R	No	MCB 101 General Purpose I/O
BO:3	GPIO Output Term X30/7	W/R	No	MCB 101 General Purpose I/O
BO:4	Relay 1 output	W/R	No	
BO:5	Relay 2 output	W/R	No	
BO:6	Option B Relay 1 output	W/R	No	MCB 105 Relay card
BO:7	Option B Relay 2 output	W/R	No	MCB 105 Relay card
BO:8	Option B Relay 3 output	W/R	No	MCB 105 Relay card
BO:9	Reserved output P590/9	W/R	No	
BO:10	Reserved output P590/10	W/R	No	
BO:11	Reserved output P590/11	W/R	No	
BO:12	Reserved output P590/12	W/R	No	
BO:13	Reserved output P590/13	W/R	No	
BO:14	Reserved output P590/14	W/R	No	
BO:15	Reserved output P590/15	W/R	No	
BO:16	Option C Relay 1 output	W/R	No	
BO:17	Option C Relay 2 output	W/R	No	
BO:18	Option C Relay 3 output	W/R	No	
BO:19	Option C Relay 4 output	W/R	No	
BO:20	Option C Relay 5 output	W/R	No	
BO:21	Option C Relay 6 output	W/R	No	
BO:22	Option C Relay 7 output	W/R	No	
BO:23	Option C Relay 8 output	W/R	No	
BO:24	Reserved output P590/24	W/R	No	
BO:25	Reserved output P590/25	W/R	No	
BO:36	Reserved output P590/26	W/R	No	
BO:37	Reserved output P590/27	W/R	No	
BO:38	Reserved output P590/28	W/R	No	
BO:39	Reserved output P590/29	W/R	No	
BO:30	Reserved output P590/30	W/R	No	
BO:31	Reserved output P590/31	W/R	No	

Binary Values

Instance ID	Object Name	Present value access	Alarm notification	Remark
BV:0	Com. Fault	R	Yes	
BV:1	Start	W/R	No	Commandable
BV:2	Coasting	W/R	No	Commandable
BV:3	CW/CCW	W/R	No	Commandable
BV:4	Jog	W/R	No	Commandable
BV:5	Reset	W	No	Commandable
BV:6	Reset Kwh Counter	W	No	
BV:7	Reset Running Hours Counter	W	No	
BV:10	Drive Ready	R	No	
BV:11	Reverse	R	No	
BV:12	Speed = reference	R	No	
BV:13	Bus control	R	No	
BV:14	Tripped	R	Yes	
BV:15	Triplock	R	Yes	
16-21	Reserved	R		
BV:21	ECB test mode	R	No	MCO 104 Electronic Bypass
BV:22	ECB Drivemode	R	No	MCO 104 Electronic Bypass
BV:23	ECB aut. bypass enable	R	No	MCO 104 Electronic Bypass
BV:24	ECB bypass mode	R	No	MCO 104 Electronic Bypass
BV:xx	Reserved	R		
BV:25	ECB state	R	Yes	MCO 104 Electronic Bypass
BV:26	ECB overload trip	R	Yes	MCO 104 Electronic Bypass
BV:27	M2 fault	R	Yes	MCO 104 Electronic Bypass
BV:28	M3 fault	R	Yes	MCO 104 Electronic Bypass
BV:29	ECB external interlock	R	Yes	MCO 104 Electronic Bypass
BV:30	ECB manual override	R	No	MCO 104 Electronic Bypass
BV:31-	Reserved	R		
BV:40	Brake check	R	Yes	
BV:41	Pwr. Card Temp	R	Yes	
BV:42	Earth Fault	R	Yes	
BV:43	Ctrl.Card Temp	R	Yes	
BV:44	Ctrl. Word TO	R	Yes	
BV:45	Over Current	R	Yes	
BV:46	Torque Limit	R	Yes	
BV:47	Motor TH Over	R	Yes	
BV:48	Motor TH Over	R	Yes	
BV:49	Inverter Overld.	R	Yes	
BV:50	DC under Volt	R	Yes	
BV:51	DC over Volt	R	Yes	
BV:52	Short Circuit	R	Yes	
BV:53	Inrush Fault	R	Yes	

Instance ID	Object Name	Present value access	Alarm notification	Remark
BV:54	Mains Fault	R	Yes	
BV:55	AMA Not OK	R	Yes	
BV:56	Live Zero Error	R	Yes	
BV:57	Internal Fault	R	Yes	
BV:58	Brake Overload	R	Yes	
BV:59	U Phase Loss	R	Yes	
BV:60	V Phase Loss	R	Yes	
BV:61	W Phase Loss	R	Yes	
BV:62	Fieldbus Fault	R	Yes	
BV:63	24 V Supply Low	R	Yes	
BV:64	Mains fault	R	Yes	
BV:65	1.8V supply low	R	Yes	
BV:66	Brake Failure	R	Yes	
BV:67	Brake IGBT	R	Yes	
BV:68	Option Changed	R	Yes	
BV:69	Drive Initialized	R	Yes	
BV:70	Safe Stop	R	Yes	
BV:71	Brake low	R	Yes	
BV:72	Service trip 1691/0	R	Yes	
BV:73	Service trip 1691/1	R	Yes	
BV:74	Service trip 1691/2	R	Yes	
BV:75	Service trip 1691/3	R	Yes	
BV:76	Service trip 1691/4	R	Yes	
BV:77	No flow	R	Yes	
BV:78	Dry Pump	R	Yes	
BV:79	Curve end	R	Yes	
BV:80	Broken Belt	R	Yes	
BV:81	Discharge High	R	Yes	
BV:82	Start fault	R	Yes	
BV:83	Speed limit	R	Yes	
BV:84	State fault 1691/12	R	Yes	
BV:85	State fault 1691/13	R	Yes	
BV:86	State fault 1691/14	R	Yes	
BV:87	State fault 1691/15	R	Yes	
BV:88	KTY Temperature error	R	Yes	
BV:89	Drive Fan error	R	Yes	
BV:90	ECB error	R	Yes	MCO 104 Electronic Bypass
BV:91	Alarm 1692/19	R	Yes	
BV:92	Alarm 1692/20	R	Yes	
BV:93	Alarm 1692/21	R	Yes	
BV:94	Alarm 1692/22	R	Yes	
BV:95	Alarm 1692/23	R	Yes	
BV:96	Alarm 1692/24	R	Yes	

Instance ID	Object Name	Present value access	Alarm notification	Remark
BV:97	Alarm 1692/25	R	Yes	
BV:98	Alarm 1692/26	R	Yes	
BV:99	Alarm 1692/27	R	Yes	
BV:100	Alarm 1692/28	R	Yes	
BV:101	Alarm 1692/29	R	Yes	
BV:102	Alarm 1692/30	R	Yes	
BV:103	Alarm 1692/31	R	Yes	
BV:104	Brake Check	R	Yes	
BV:105	Pwr. Card Temp	R	Yes	
BV:106	Earth Fault	R	Yes	
BV:107	Ctrl. Card Temp	R	Yes	
BV:108	Ctrl. Word TO	R	Yes	
BV:109	Over Current	R	Yes	
BV:110	Torque Limit	R	Yes	
BV:111	Motor Th Over	R	Yes	
BV:112	Motor ETR Over	R	Yes	
BV:113	Inverter overld.	R	Yes	
BV:114	DC under Volt	R	Yes	
BV:115	DC over Volt	R	Yes	
BV:116	DC Voltage Low	R	Yes	
BV:117	DC Voltage high	R	Yes	
BV:118	Mains Ph. Loss	R	Yes	
BV:119	No Motor	R	Yes	
BV:120	Live Zero Error	R	Yes	
BV:121	10V low	R	Yes	
BV:122	Brake Overload	R	Yes	
BV:123	Brake Resistor	R	Yes	
BV:124	Brake IGBT	R	Yes	
BV:125	Speed Limit	R	Yes	
BV:126	Fieldbus Fault	R	Yes	
BV:127	24V Supply Low	R	Yes	
BV:128	Mains Failure	R	Yes	
BV:129	Current Limit	R	Yes	
BV:130	Low Temp	R	Yes	
BV:131	Voltage Limit	R	Yes	
BV:132	Encoder loss	R	Yes	
BV:133	Output Freq. limit	R	Yes	
BV:134	Safe stop	R	Yes	
BV:135	Ext. Status	R	Yes	
BV:136	Start delayed	R	Yes	
BV:137	Stop delayed	R	Yes	
BV:138	Clock failure	R	Yes	
BV:139	Fire mode was active	R	Yes	

Instance ID	Object Name	Present value access	Alarm notification	Remark
BV:140	Reserved, P1693/04	R	Yes	
BV:141	No Flow	R	Yes	
BV:142	Dry Pump	R	Yes	
BV:143	End of Curve	R	Yes	
BV:144	Belt Broken	R	Yes	
BV:145	Discharge High	R	Yes	
BV:146	Reserved, P1693/10	R	Yes	
BV:147	Reserved, P1693/11	R	Yes	
BV:148	Reserved, P1693/12	R	Yes	
BV:149	Reserved, P1693/13	R	Yes	
BV:150	Reserved, P1693/14	R	Yes	
BV:151	Reserved, P1693/15	R	Yes	
BV:152	Reserved, P1693/16	R	Yes	
BV:153	KTY Temperature	R	Yes	
BV:154	Drive Fan failure	R	Yes	
BV:155	ECB failure	R	Yes	MCO 104 Electronic Bypass
BV:156	Reserved, P1693/20	R	Yes	
BV:157	Reserved, P1693/21	R	Yes	
BV:158	Reserved, P1693/22	R	Yes	
BV:159	Reserved, P1693/23	R	Yes	
BV:160	Reserved, P1693/24	R	Yes	
BV:161	Reserved, P1693/25	R	Yes	
BV:162	Reserved, P1693/26	R	Yes	
BV:163	Reserved, P1693/27	R	Yes	
BV:164	Reserved, P1693/28	R	Yes	
BV:165	Reserved, P1693/29	R	Yes	
BV:166	PTC Temperature	R	Yes	
BV:167	Reserved, P1693/31	R	Yes	
BV:168	Ramping active	R	No	
BV:169	AMA Running	R	No	
BV:170	Start CW/CCW	R	No	
BV:171	Slowdown	R	No	
BV:172	Catch up	R	No	
BV:173	Feedback High	R	No	
BV:174	Feedback Low	R	No	
BV:175	Output Current High	R	No	
BV:176	Output Current Low	R	No	
BV:177	Output Freq High	R	No	
BV:178	Output Freq low	R	No	
BV:178	Brake Check OK	R	No	
BV:180	Brake Max	R	No	
BV:181	Braking	R	No	
BV:182	Out of Speed range	R	No	

Instance ID	Object Name	Present value access	Alarm notification	Remark
BV:183	OVC Active	R	No	
BV:184	AC Brake	R	No	
BV:185	Password Timelock	R	No	
BV:186	Password status	R	No	
BV:187	Reference high	R	No	
BV:188	Reference low	R	No	
BV:189	Reference site	R	No	
BV:190	Reserved, P1694/22	R	No	
BV:191	Reserved, P1694/23	R	No	
BV:192	Reserved, P1694/24	R	No	
BV:193	Reserved, P1694/25	R	No	
BV:194	Reserved, P1694/26	R	No	
BV:195	Reserved, P1694/27	R	No	
BV:196	Reserved, P1694/28	R	No	
BV:197	Reserved, P1694/29	R	No	
BV:198	Reserved, P1694/30	R	No	
BV:199	Reserved, P1694/31	R	No	

Multistate Output

Object Id	Object Name	Read/Write	Alarm notification	Remark
MS0:0	Setup command	W/R	No	Commandable

File

Object Id	Object Name	Read/Write	Alarm notification	Remark
MBV:0	Mailbox Read	R	No	
MBV:1	Mailbox Write	W/R	No	

Notification class

Object Id	Object Name	Read/Write	Alarm notification	Remark
NC:1	Warning notification	W/R		
NC:2	Alarm notification	W/R		