

TOSVERT VF-PS1 series

BACnet[®] Option unit Function Manual

BCN001Z-2

NOTICE

1. Make sure that this instruction manual is delivered to the end user of BACnet[®] Option unit.
2. Read this manual before installing or operating the BACnet[®] Option unit. Keep it in a safe place for reference.
3. All information contained in this manual are subject to change without notice. Please confirm the latest information on our web site "www.inverter.co.jp".



E6581440REV001

Introduction

Thank you for purchasing the BACnet® Option unit (BCN001Z) for VF-PS1 series inverter.

Before using BACnet® Option unit, carefully read this function manual in order to completely and correctly utilize its excellent performance.

After reading this function manual, please keep it handy for future reference.




For details of its general handling, see an instruction manual attached with the option unit.

- TOSVERT VF-PS1 Instruction ManualE6581386
- BCN001Z Instruction ManualE6581438






* BACnet® is a registered trademark of ASHRAE.

(ASHRAE : American Society of Heating, Refrigerating and Air-Conditioning Engineers)

■ Handling in general

 Warning	
 Prohibited	▼ Do not connect or disconnect a network cable while the Inverter power is on. It may lead to electric shocks or fire.
 Mandatory	▼ See the instruction manual attached with the option unit for cautions the handling. Otherwise, it may lead to electric shocks, fire, injuries or damage to product.

■ Network control

 Warning	
 Prohibited	▼ Do not send the value out of the valid range to network variables. Otherwise, the motor may suddenly start/stop and that may result in injuries.
 Mandatory	▼ Use an additional safety device with your system to prevent a serious accident due to the network malfunctions. Usage without an additional safety device may cause an accident.
 Caution	
 Mandatory	▼ Set up “Communication error trip function (see below)” to stop the Inverter when the option unit is deactivated by an unusual event such as tripping, an operating error, power outage, failure, etc. - Network Time-Out, Inverter operation at disconnection, Preset speed operation selection (<i>F832</i> , <i>F851</i> and <i>F852</i> , see the Inverter instruction manual for details) Deactivated option unit may cause an accident, if the “Communication error trip function” is not properly set up. ▼ Make sure that the operation signals are STOP before resetting Inverter’s fault. The motor may suddenly start and that may result in injuries.

■ Notes on operation

Notes	
	▼ When the control power is shut off by the instantaneous power failure, communication will be unavailable for a while. ▼ The Life of EEPROM is approximately 100,000 times. Avoid writing a command more than 100,000 times to the same parameter of the Inverter and the communication board.

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1. Overview

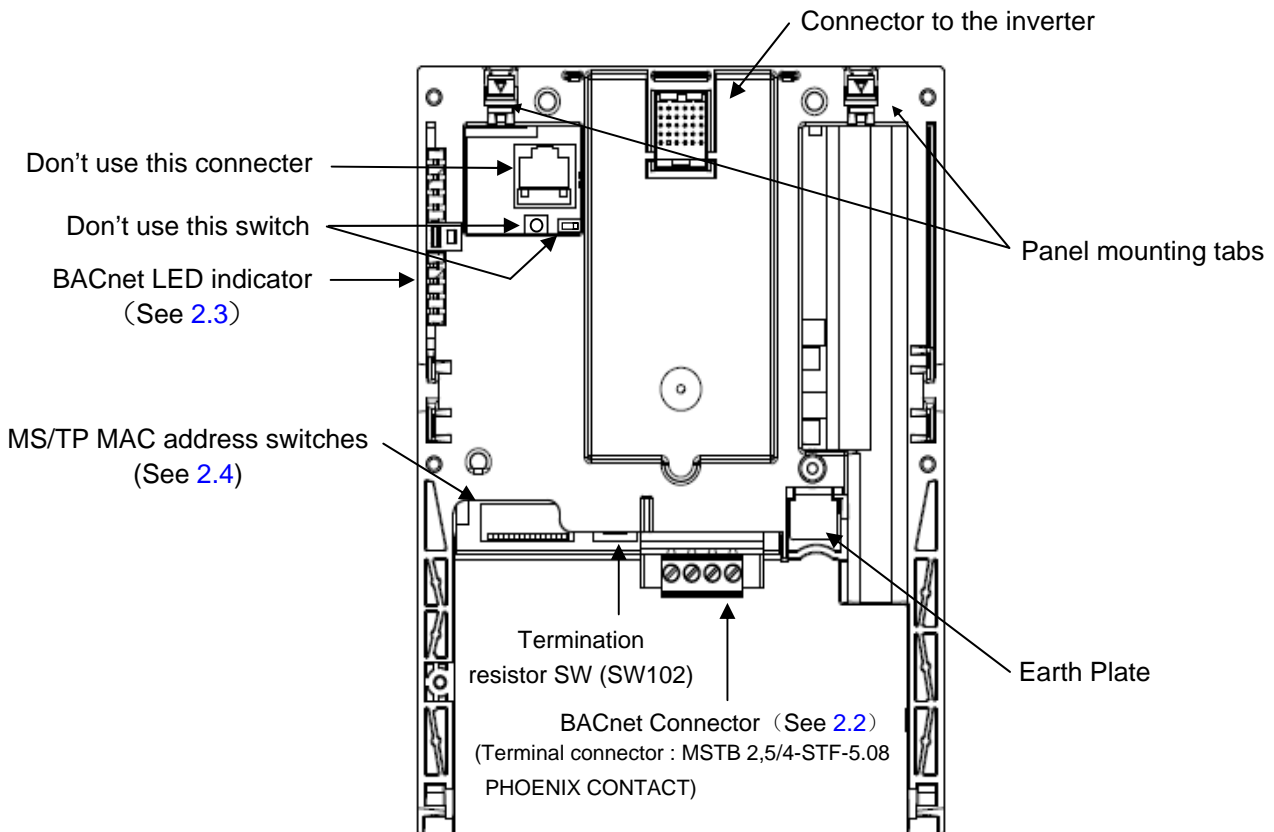
The BACnet® option unit(BCN001Z) allows the VF-PS1 inverter to be connected into a BACnet® network.

* BCN001Z is applicable for VF-PS1 software version V620 or later.

2. Names and functions

The drawing below shows names and functions of main parts.

2.1. Outline



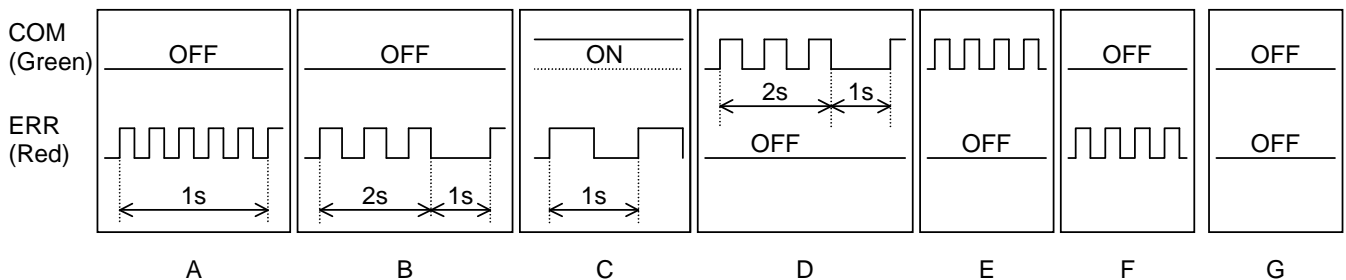
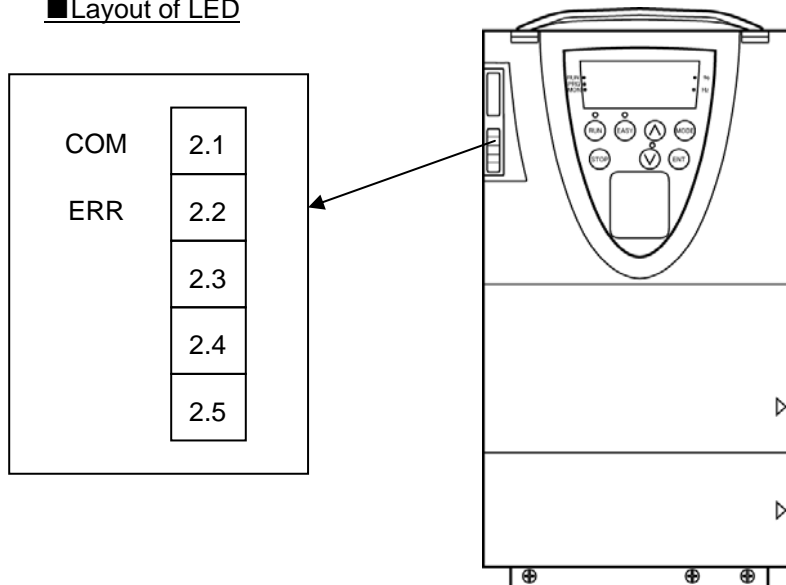
2.2. BACnet® Connector

Terminal symbol	Function	Electrical specifications	Internal circuits
B	BACnet® communication signal EIA-485	Communication signal (+)	
A		Communication signal (-)	
GND		Signal common	
SCR	Shield terminal.		

2.3. LED indicator

The LED shows the present status of the network and error.

■ Layout of LED

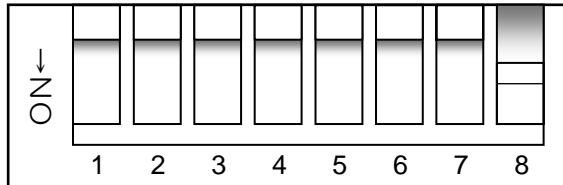


State	LEDs	Comment
A	COM LED: OFF ERR LED: Flashing 5 times in 1 second	BCN001Z board failure.
B	COM LED: OFF ERR LED: 3 times in 2 seconds, OFF for 1 second	Communication loss was detected. Confirm the network condition and connection of the cable.
C	COM LED: ON ERR LED: OFF 0.5s, ON 0.5s	Invalid configuration was detected. (MAC address > max master) (Note) When inverter occurred in E-23 or E-24, the LED becomes this state.
D	COM LED: 3 times in 2 seconds, OFF for 1 second ERR LED: OFF	Waiting for Auto baudrate detection
E	COM LED: Flashing ERR LED: OFF	Valid message was received for this node
F	COM LED: OFF ERR LED: Flashing	Invalid message was received (any node)
G	COM LED: OFF ERR LED: OFF	No communication Check the network condition and connection of the cable.

2.4. MAC address setting

The DIP switch on the circuit board of the option is used to set a MS/TP MAC address. Each DIP switch is ON when it is flipped to the lower position.

The MAC address must be unique and not match any other device on a network segment.



SW ID	1	2	3	4	5	6	7	8
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
4	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON
6	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF
7	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
8	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
9	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON
10	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF
11	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
12	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF
13	OFF	OFF	OFF	OFF	ON	ON	OFF	ON
14	OFF	OFF	OFF	OFF	ON	ON	ON	OFF
15	OFF	OFF	OFF	OFF	ON	ON	ON	ON
16	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
17	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
18	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
19	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
20	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
21	OFF	OFF	OFF	ON	OFF	ON	OFF	ON
22	OFF	OFF	OFF	ON	OFF	ON	ON	OFF
23	OFF	OFF	OFF	ON	OFF	ON	ON	ON
24	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
25	OFF	OFF	OFF	ON	ON	OFF	OFF	ON
26	OFF	OFF	OFF	ON	ON	OFF	ON	OFF
27	OFF	OFF	OFF	ON	ON	OFF	ON	ON
28	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
29	OFF	OFF	OFF	ON	ON	ON	OFF	ON
30	OFF	OFF	OFF	ON	ON	ON	ON	OFF
31	OFF	OFF	OFF	ON	ON	ON	ON	ON

SW ID	1	2	3	4	5	6	7	8
32	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
33	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
34	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
35	OFF	OFF	ON	OFF	OFF	OFF	ON	ON
36	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
37	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
38	OFF	OFF	ON	OFF	OFF	ON	ON	OFF
39	OFF	OFF	ON	OFF	OFF	ON	ON	ON
40	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF
41	OFF	OFF	ON	OFF	ON	OFF	OFF	ON
42	OFF	OFF	ON	OFF	ON	OFF	ON	OFF
43	OFF	OFF	ON	OFF	ON	OFF	ON	ON
44	OFF	OFF	ON	OFF	ON	ON	OFF	OFF
45	OFF	OFF	ON	OFF	ON	ON	OFF	ON
46	OFF	OFF	ON	OFF	ON	ON	ON	OFF
47	OFF	OFF	ON	OFF	ON	ON	ON	ON
48	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
49	OFF	OFF	ON	ON	OFF	OFF	OFF	ON
50	OFF	OFF	ON	ON	OFF	OFF	ON	OFF
51	OFF	OFF	ON	ON	OFF	OFF	ON	ON
52	OFF	OFF	ON	ON	OFF	ON	OFF	OFF
53	OFF	OFF	ON	ON	OFF	ON	OFF	ON
54	OFF	OFF	ON	ON	OFF	ON	ON	OFF
55	OFF	OFF	ON	ON	OFF	ON	ON	ON
56	OFF	OFF	ON	ON	ON	OFF	OFF	OFF
57	OFF	OFF	ON	ON	ON	OFF	OFF	ON
58	OFF	OFF	ON	ON	ON	OFF	ON	OFF
59	OFF	OFF	ON	ON	ON	OFF	ON	ON
60	OFF	OFF	ON	ON	ON	ON	OFF	OFF
61	OFF	OFF	ON	ON	ON	ON	OFF	ON
62	OFF	OFF	ON	ON	ON	ON	ON	OFF
63	OFF	OFF	ON	ON	ON	ON	ON	ON

ID	SW							
	1	2	3	4	5	6	7	8
64	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
65	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
66	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF
67	OFF	ON	OFF	OFF	OFF	OFF	ON	ON
68	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
69	OFF	ON	OFF	OFF	OFF	ON	OFF	ON
70	OFF	ON	OFF	OFF	OFF	ON	ON	OFF
71	OFF	ON	OFF	OFF	OFF	ON	ON	ON
72	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF
73	OFF	ON	OFF	OFF	ON	OFF	OFF	ON
74	OFF	ON	OFF	OFF	ON	OFF	ON	OFF
75	OFF	ON	OFF	OFF	ON	OFF	ON	ON
76	OFF	ON	OFF	OFF	ON	ON	OFF	OFF
77	OFF	ON	OFF	OFF	ON	ON	OFF	ON
78	OFF	ON	OFF	OFF	ON	ON	ON	OFF
79	OFF	ON	OFF	OFF	ON	ON	ON	ON
80	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
81	OFF	ON	OFF	ON	OFF	OFF	OFF	ON
82	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
83	OFF	ON	OFF	ON	OFF	OFF	ON	ON
84	OFF	ON	OFF	ON	OFF	ON	OFF	OFF
85	OFF	ON	OFF	ON	OFF	ON	OFF	ON
86	OFF	ON	OFF	ON	OFF	ON	ON	OFF
87	OFF	ON	OFF	ON	OFF	ON	ON	ON
88	OFF	ON	OFF	ON	ON	OFF	OFF	OFF
89	OFF	ON	OFF	ON	ON	OFF	OFF	ON
90	OFF	ON	OFF	ON	ON	OFF	ON	OFF
91	OFF	ON	OFF	ON	ON	OFF	ON	ON
92	OFF	ON	OFF	ON	ON	ON	OFF	OFF
93	OFF	ON	OFF	ON	ON	ON	OFF	ON
94	OFF	ON	OFF	ON	ON	ON	ON	OFF
95	OFF	ON	OFF	ON	ON	ON	ON	ON

ID	SW							
	1	2	3	4	5	6	7	8
96	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
97	OFF	ON	ON	OFF	OFF	OFF	OFF	ON
98	OFF	ON	ON	OFF	OFF	OFF	ON	OFF
99	OFF	ON	ON	OFF	OFF	OFF	ON	ON
100	OFF	ON	ON	OFF	OFF	ON	OFF	OFF
101	OFF	ON	ON	OFF	OFF	ON	OFF	ON
102	OFF	ON	ON	OFF	OFF	ON	ON	OFF
103	OFF	ON	ON	OFF	OFF	ON	ON	ON
104	OFF	ON	ON	OFF	ON	OFF	OFF	OFF
105	OFF	ON	ON	OFF	ON	OFF	OFF	ON
106	OFF	ON	ON	OFF	ON	OFF	ON	OFF
107	OFF	ON	ON	OFF	ON	OFF	ON	ON
108	OFF	ON	ON	OFF	ON	ON	OFF	OFF
109	OFF	ON	ON	OFF	ON	ON	OFF	ON
110	OFF	ON	ON	OFF	ON	ON	ON	OFF
111	OFF	ON	ON	OFF	ON	ON	ON	ON
112	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
113	OFF	ON	ON	ON	OFF	OFF	OFF	ON
114	OFF	ON	ON	ON	OFF	OFF	ON	OFF
115	OFF	ON	ON	ON	OFF	OFF	ON	ON
116	OFF	ON	ON	ON	OFF	ON	OFF	OFF
117	OFF	ON	ON	ON	OFF	ON	OFF	ON
118	OFF	ON	ON	ON	OFF	ON	ON	OFF
119	OFF	ON	ON	ON	OFF	ON	ON	ON
120	OFF	ON	ON	ON	ON	OFF	OFF	OFF
121	OFF	ON	ON	ON	ON	OFF	OFF	ON
122	OFF	ON	ON	ON	ON	OFF	ON	OFF
123	OFF	ON	ON	ON	ON	OFF	ON	ON
124	OFF	ON	ON	ON	ON	ON	OFF	OFF
125	OFF	ON	ON	ON	ON	ON	OFF	ON
126	OFF	ON	ON	ON	ON	ON	ON	OFF
127	OFF	ON	ON	ON	ON	ON	ON	ON

3. VF-PS1 Parameters

3.1. Communication parameters

Set up the inverter parameters as follows. To update, reset of inverter. If these parameters are not set to correct value, this unit can not work normally.

Title	Function	Description	Factory setting
<i>F831</i>	Network Baudrate *1 *2	0: AUTO adaptive, 1: 9600bps, 2: 19200bps, 3: 38400bps, 4: 76800bps, Over 5 is AUTO adaptive.	0000
<i>F832</i>	Network Time-Out *1 *2	0: No action Unit 0.1 sec, Setting range: 1 - 65535	0000
<i>F833</i>	Instance number *1 *2	Instance No.= <i>F833</i> x 1000 + <i>F834</i> <i>F834</i> < 1000	0000
<i>F834</i>		Instance No. < 4194304	0000
<i>F835</i>	MaxMaster *1 *2	Setting range : 0 to 127 Over 127 is limited 127.	0000
<i>F836</i>	Maxinfoframe *1 *2	Setting range : 0 to 100 0 same as 1. Over 100 is limited 100 internally.	0000
<i>F851</i>	Inverter operation at the communications loss action (Network wire breaks)	0: Inverter stop, communication command, frequency mode open (by <i>CNOd</i> , <i>FNOd</i>) 1: None (continued operation) 2: Deceleration stop 3: Coast stop 4: Network error (<i>ErrB</i> trip) *2 5: Preset speed operation by <i>F852</i> setting	0
<i>F852</i>	Preset speed operation selection	0:None 1-15:Preset speed operation (by parameter setting)	0
<i>F853</i>	MAC address *2 (Read Only)	BCN001Z MS/TP MAC address monitor. (Set DIP switches on the board)	-
<i>F856</i>	Number of motor poles for communication *2	1-8:Number of motor pole pairs (It is used to monitor the rotational speed of the motor)	2 (4 poles)
<i>F899</i>	Network option reset setting	0:None 1:Reset option unit and inverter	0
<i>FE66</i>	Add-on option 1 CPU version(Under side option)	Option unit software version number. If this monitor value is '123',that means version '1.23'.	-
<i>FE67</i>	Add-on option 2 CPU version(Panel side)		-

*1: In case of Setting a data via panel, use a hexadecimal number.

ex.) In case of Setting 5.0sec at Timeout parameter, considered unit is 0.1sec,It is need to set a internal value as '50'. Therefore ,set '0032' at the panel.

*2 After change the parameters or to reset *ErrB*, the power needs to be turned off and then turned back on (or set *F899* to *!*). After reset, the parameter changes become effective. *F899* might not be able to be set to *!* by the BACnet communication, and please set *F899* to *!* by Panel.



Please note that inverter keeps driving when the communication is lost if *!* (None) is set to the parameter *F851* (Inverter operation at the communications loss action).

3.2. Network Baudrate (*F831*)

Set the network baudrate to *F831*. Set the same baudrate in the network. If set AUTO baudrate, the option unit detects network baudrate automatically.

3.3. Network error detection (*F832, F851, F852*)

Set the network communication loss action time to *F832*. The network loss detection starts from the first receiving of the proper frame message. The action of the network communication loss is set by *F851*.

If *F851* is set other than 4, "E" alarm appear at the inverter panel display when communication loss was detected.

In addition, in the case of *F851*=5, the inverter output designated frequency in "Preset speed operation selection (*F852*)".

3.4. Instance Number (*F833, F834*)

Set BACnet[®] Object Instance number. The instance number should not be duplicate in the network. The instance number is 22bit data length, and set the number of the option board as below.

$$\text{Instance number} = F833 \times 1000 + F834$$

$$F834 < 1000$$

$$\text{Instance number} < 4194304$$

3.5. MaxMaster (*F835*)

Set the maximum master number of the segment. The BACnet[®] option unit polls master station node from 0 to MaxMaster, so set MaxMaster to be small number to be a fast response time.

3.6. MaxInfoframe (*F836*)

Set the max information frame number to send from this node. Not need to change.

3.7. MAC address monitor(*F853*)

Set the station MAC address to a switch (SW102) on the option board. This station MAC address should be a unique number on the MS/TP network segment.

F853 is the monitor parameter of MAC address that is set to the address switch on the option board.

3.8. Number of motor poles for communication(*F856*)

Set the number of motor pole pairs to calculate the motor rotational speed.

This parameter is used only when the motor rotational speed is monitored with a communication.

4. Functions

This option board is based on BACnet® “Application Specific Controller” (B-ASC).

4.1. Object / Property support Matrix

This option board supports below table objects and properties.

Property	Object Type						
	Device	Binary Input	Binary Output	Binary Value	Analog Input	Analog Output	Analog Value
Object Identifier	✓	✓	✓	✓	✓	✓	✓
Object Name	✓	✓	✓	✓	✓	✓	✓
Object Type	✓	✓	✓	✓	✓	✓	✓
System Status	✓						
Vendor Name	✓						
Vendor Identifier	✓						
Model Name	✓						
Firmware Revision	✓						
Appl Software Revision	✓						
Protocol Version	✓						
Protocol Revision	✓						
Services Supported	✓						
Object Types Supported	✓						
Object List	✓						
Max APDU Length	✓						
Segmentation Support	✓						
APDU Timeout	✓						
Number APDU Retries	✓						
Max Master	✓						
Max Info Frames	✓						
Device Address Binding	✓						
Database Revision	✓						
Present Value		✓	✓	✓	✓	✓	✓
Status Flags		✓	✓	✓	✓	✓	✓
Event State		✓	✓	✓	✓	✓	✓
Out-of-Service		✓	✓	✓	✓	✓	✓
Units					✓	✓	✓
Priority Array			✓*2	✓ *1 *2		✓	✓ *1
Relinquish Default			✓	✓ *1		✓	✓ *1
Polarity		✓	✓				
Active Text		✓	✓	✓			
Inactive Text		✓	✓	✓			

*1: For commandable object only.

*2: Priority Array 6 are not supported.

4.2. Drive I/O Objects

4.2.1. Binary Input Object Instance

Binary input objects allow to monitor the inverter actual terminal ON/OFF status. These objects are read only. If it is necessary to read inverter terminal output status via BACnet® network, Binary input object can be used to. Binary input #0 is FL labeled terminal monitor. Whatever function is set to the FL terminal by parameter *F 132*, it indicate a terminal level that inverter would try to output.

Instance ID	Object Name	Description	Active / Inactive	Access
Binary input #0	RO 1 ACT	Inverter FL terminal monitor (<i>F 132</i> **)	ON/OFF	R
Binary input #1	RO 2 ACT	Inverter OUT1 terminal monitor (<i>F 130</i> **)	ON/OFF	R
Binary input #2	RO 3 ACT	Inverter OUT2 terminal monitor (<i>F 131</i> **)	ON/OFF	R
Binary input #3 *	RO 4 ACT	Inverter R2 terminal monitor (<i>F 138</i> **)	ON/OFF	R
Binary input #4 *	RO 5 ACT	Inverter OUT5 terminal monitor (<i>F 136</i> **)	ON/OFF	R
Binary input #5 *	RO 6 ACT	Inverter OUT6 terminal monitor (<i>F 137</i> **)	ON/OFF	R
Binary input #6	DI 1 ACT	Inverter F terminal monitor	ON/OFF	R
Binary input #7	DI 2 ACT	Inverter R terminal monitor	ON/OFF	R
Binary input #9	DI 4 ACT	Inverter RES terminal monitor	ON/OFF	R
Binary input #10	DI 5 ACT	Inverter S1 terminal monitor	ON/OFF	R
Binary input #11	DI 6 ACT	Inverter S2 terminal monitor	ON/OFF	R
Binary input #12	DI 7 ACT	Inverter S3 terminal monitor	ON/OFF	R
Binary input #13	DI 8 ACT	Inverter RR/S4 terminal monitor	ON/OFF	R
Binary input #14 *	DI 9 ACT	Inverter LI5 terminal monitor	ON/OFF	R
Binary input #15 *	DI 10 ACT	Inverter LI6 terminal monitor	ON/OFF	R
Binary input #16 *	DI 11 ACT	Inverter LI7 terminal monitor	ON/OFF	R
Binary input #17 *	DI 12 ACT	Inverter LI8 terminal monitor	ON/OFF	R

* These are enabled with ETB004Z (Expansion IO card option).

** These parameters affect the function of terminals.

R=Read-only, W=Writable, C=Commandable.

4.2.2. Binary Output Object Instance

Binary output objects allow to control output terminals via BACnet® network.
 Set the terminal function parameter (see below table) before control output terminals.
 These commandable objects can be used for priority-array and relinquish-default property.

Instance ID	Object Name	Description	Active / Inactive	Access
Binary Output #0	RO 1 CMD	FL terminal control. (<i>F 132</i> = 92)	ON/OFF	C
Binary Output #1	RO 2 CMD	OUT1 terminal control. (<i>F 130</i> = 94)	ON/OFF	C
Binary Output #2	RO 3 CMD	OUT2 terminal control. (<i>F 131</i> = 96)	ON/OFF	C
Binary Output #3 *	RO 4 CMD	R2 terminal control. (<i>F 138</i> = 98)	ON/OFF	C
Binary Output #4 *	RO 5 CMD	OUT3 terminal control. (<i>F 135</i> = 100)	ON/OFF	C
Binary Output #5 *	RO 6 CMD	OUT4 terminal control. (<i>F 137</i> = 102)	ON/OFF	C

* These are enabled with ETB004Z (Expansion IO card option).

R=Read-only, W=Writable, C=Commandable.

4.2.3. Binary Value Objects Instance

Binary value objects allow to monitor inverter status and send command such as RUN/STOP command.

Commandable objects can be used for priority-array and relinquish-default property.

Binary Value ID	Object Name	Description	Active/ Inactive Text	Access
#0	RUN/STOP ACT	Indicates the drive run status (This object access to parameter <i>Fd0</i> ! bit10)	RUNS/READY	R
#1	FWD/REV ACT	Indicates the motor rotation's direction (This object access to parameter <i>Fd0</i> ! bit9)	REV/FWD	R
#2	FAULT ACT	Indicates the drive's fault status	FAULTED/NONE	R
#4	HAND/AUTO ACT	Indicates if the drive is locally controlled or not	HAND/AUTO	R
#6	MAINT REQ	Commutative operation time alarm status (This object access to parameter <i>FL9</i> ! bit10)	YES/NO	R
#7	DRIVE READY	The VSD is ready and waits a start command (This object access to parameter <i>Fd0</i> ! bit14)	READY/NOT READY	R
#8	AT SETPOINT	The VSD has reached the target speed	REACHED/NO	R
#10	RUN/STOP CMD	Commands a drive start	START/STOP	C
#11	FWD/REV CMD	Commands a motor direction's change	REV/FWD	C
#14	FAULT RESET	Command to reset faults	RESET/NO	C
#15	MBOX READ	Command to read parameter	READ/RESET	W
#16	MBOX WRITE	Command to write parameter	WRITE/RESET	W
#18	SP1PRESET	Preset speed operation frequency 1	SP1/NONE	C
#19	SP2PRESET	Preset speed operation frequency 2	SP2/NONE	C
#20	SP3PRESET	Preset speed operation frequency 3	SP2/NONE	C
#21	SPTSEL	Frequency priority selection (This object access to parameter <i>FRO6</i> bit14)	ENABLED/OFF	C
#22	CMDSEL	Command priority selection (This object access to parameter <i>FRO6</i> bit15)	ENABLED/OFF	C

R=Read-only, W=Writable, C=Commandable.

4.2.4. Analog Input Object Instance

The analog input objects allow to monitor inverter analog input terminal level.

These objects only read inverter parameters those are prepared as read only monitor parameters (from *F E 35* to *F E 39*).

These objects present-value unit is “%” unit, and present-value=100.0% mean analog input terminals are a full range input level.

Instance ID	Object Name	Description	Access
Analog Input #0	ANALOG INPUT 1	RR/S4 analog input level. (<i>F E 35</i>)	R
Analog Input #1	ANALOG INPUT 2	VI/II analog input level. (<i>F E 36</i>)	R
Analog Input #2	ANALOG INPUT 3	RX analog input level. (<i>F E 37</i>)	R
Analog Input #3 *	ANALOG INPUT 4	AI1 analog input level. (<i>F E 38</i>)	R
Analog Input #4 *	ANALOG INPUT 5	AI2 analog input level. (<i>F E 39</i>)	R

* These are enabled with ETB004Z (Expansion IO card option).

R=Read-only, W=Writable, C=Commandable.

4.2.5. Analog Output Object Instance

The analog output objects allow to control inverter analog (AM,FM,...) output levels, and also can be used priority-array and relinquish-default property.

These objects only write to inverter parameters (*F A 5 1-F A 5 4*). It is necessary to set meter function selection parameters (see below table) to 31.

Instance ID	Object Name	Description	Access
Analog output #0	AO1 COMMAND	Set <i>F A 5 1</i> to 31, in order to use inverter FM terminal.	W
Analog output #1	AO2 COMMAND	Set <i>F A 5 2</i> to 31, in order to use inverter AM terminal.	W
Analog output #2	AO3 COMMAND	Set <i>F 5 7 2</i> to 31, in order to use MON1 terminal on the expansion IO card option.	W
Analog output #3	AO4 COMMAND	Set <i>F 5 7 4</i> to 31, in order to use MON2 terminal or pulse output terminal on the expansion IO card option.	W

* These are enabled with ETB004Z(Expansion IO card option).

R=Read-only, W=Writable, C=Commandable.

4.2.6. Analog Value Object Instance

The analog value objects allow to monitor drive status such as output frequency, current and voltage. Additionally, drive speed reference can be set as Analog Value #16.

Binary Value ID	Object Name	Description	UNIT	Access
#0	OUTPUT SPEED	Output speed[min^{-1}] (Calculate from $Fd00$)	min^{-1}	R
#1	OUTPUT FREQ	Output frequency[Hz] ($Fd00$)	Hz	R
#2	DC BUS VOLT	DC bus voltage (Calculate from $FE04$)	V	R
#3	OUTPUT VOLT	Motor voltage (Calculate from $FE05$)	V	R
#4	CURRENT	Motor current (Calculate from $FE03$)	A	R
#5	TORQUE	Motor Torque ($FE18$)	%	R
#6	POWER	Motor Power (Calculate from $FE30$) $100\% = \sqrt{3} \times \text{VSD rate voltage} \times \text{Motor rate current}$	%	R
#7	DRIVE TEMP	Drive Thermal State ($Fd24$) OL1 will be caused, if this value reaches 100%,	%	R
#8	KWH (R)	Energy counter (Calculate from $Fd76, Fd77$)	KWH	R
#10	PRC PID FBCK	PID regulator feedback ($FE22 / UL * 100.00$)	%	R
#14	RUN TIME	Cumulate operation time ($FE14$)	hour	R
#16	INPUT REF 1	Speed reference ($Fd07 / UL * 100$)	%	C
#18	LAST FLT	Current fault code ($FL90$)	-	R
#19	PREV FLT 1	Past fault code (most recent fault)($FE10$)	-	R
#20	PREV FLT 2	Past fault code (fault before most recent)($FE11$)	-	R
#23	ACCEL1 TIME *	Acceleration time (ACC)	SEC	W
#24	DECEL1 TIME *	Deceleration time (dEL)	SEC	W
#25	MBOX PARAM	Parameter number	-	W
#26	MBOX DATA	Parameter value	-	W

* Avoid frequently writing to these objects, because the Life of EEPROM is approximately 100,000 times.

R=Read-only, W=Writable, C=Commandable.

4.3. Device Objects

Device object properties are below.

Property Name	Property Value
Object Name	"VF-PS1"
Object Type	8 (device)
Vendor Name	"TOSHIBA"
Vendor Identifier	203
Model Name	"VFPS1-2007P" (depend on the VSD model)
Firmware Revision	"V1.03" (depend on the option software version)
Application Software Version	"V6.20" (depend on the VSD software version)
Protocol Version	1
Protocol Revision	2

- * The Object Name can be set up to 100 characters.
Please use 0x20 - 0x7E of ASCII for Object Name
- * When no string is set to the Object Name, it is set to factory setting ("VF-PS1").
- * The Object Name is memorized in EEPROM.
- * Please manage the Object Name of slave station.

Note: The Life of EEPROM is approximately 100,000 times.

If EEPROM is broken, it's not possible to set the Object Name and drive shows
 E - 2 3 (COM LED: ON, ERR LED: OFF/ON 0.5s).

Table. 1 ASCII code table

High Low	0	1	2	3	4	5	6	7
0	NUL	TC7(DLE)	(SP)	0	@	P	.	p
1	TC1(SOH)	DC1	!	1	A	Q	a	q
2	TC2(STX)	DC2	"	2	B	R	b	r
3	TC3(ETX)	DC3	#	3	C	S	c	s
4	TC4(EOT)	DC4	\$	4	D	T	d	t
5	TC5(ENQ)	TC8(NAK)	%	5	E	U	e	u
6	TC6(ACK)	TC9(SYN)	&	6	F	V	f	v
7	BEL	TC10(ETB)	'	7	G	W	g	w
8	FE ₀ (BS)	CAN	(	8	H	X	h	x
9	FE ₁ (HT)	EM	)	9	I	Y	i	y
A	FE ₂ (LF)	SUB	*	:	J	Z	j	z
B	FE ₃ (VT)	ESC	+	;	K	[	k	{
C	FE ₄ (FF)	IS ₄ (FS)	,	<	L	¥	l	|
D	FE ₅ (CR)	IS ₃ (GS)	-	=	M	]	m	}
E	SO	IS ₂ (RS)	.	>	N	^	n	~
F	SI	IS ₁ (US)	/	?	O	_	o	DEL

5. Mailbox Function Points

Mail box object allow to read/write inverter parameters via BACnet® network.

Object ID		Object Name	Description
Analog value	#25	MBOX PARAM	Set parameter individual communication number. Communication address is normally consist of characters from 0 to 9, but Interpreted hexadecimal code internally. Set the real float number converted hexadecimal code to decimal code. Type of present-value is a BACnet® real number.
Analog value	#26	MBOX DATA	Set parameter value to read/write. The data unit is depend on the parameter specification. Refer to the inverter instruction manual and the communication function manual (E6581413). Type of present-value is a BACnet® real number.
Binary value	#15	MBOX READ	Read command If MBOX READ command value is set to "1", the parameter specified by MBOX PARAM is read from the inverter to MBOX DATA, and MBOX READ value is cleared to "0" automatically. If parameter reading is denied or specified communication number is illegal, MBOX READ value remains "1". It allow to check read failure.
Binary value	#16	MBOX WRITE	Write Command If MBOX WRITE command value is set to "1", the inverter parameter specified by MBOX PARAM is written the data specified by MBOX DATA, and MBOX WRITE set to "0" automatically. If parameter writing is denied or specified communication number is illegal, MBOX WRITE value remains "1". It allow to check write failure.

Example Read:

Read acceleration time.(\overline{R} \overline{E} \overline{E} Communication number is 0010)

- In order to set MBOX PARAM=0010H, Set "16.0" to Analog value #25.
- Set "1" to Binary value #15(MBOX READ).
- Wait until Binary value #15 is cleared to "0".
- Read the data from Analog value #26 (MBOX DATA).
If read value is "100.0", it means 10.0[sec].

Example Write:

Write deceleration time.(\overline{d} \overline{E} \overline{E} Communication number is 0011)

- In order to set MBOX PARAM=0011H, Set "17.0" to Analog value #25.
- In order to set MBOX DATA =12.3[sec], Set "123.0" to Analog value #26.
- Set "1" to Binary value #16(MBOX WRITE).
- Wait until Binary value #16 is cleared to "0".

Note: Do not write the same parameter to the EEPROM more than 100,000 times. The life time of EEPROM is approximately 100,000 times.

5.1. VF-PS1 Fault code

VF-PS1 Fault Code Table

Code (Dec)	Code (Hex)	Description	Display
0	0	No error	<i>nErr</i>
1	1	Over-current during acceleration	<i>OC1</i>
2	2	Over-current during deceleration	<i>OC2</i>
3	3	Over-current during constant speed operation	<i>OC3</i>
4	4	Over-current in load at startup	<i>OC4</i>
5	5	U-phase arm overcurrent	<i>OCRA1</i>
6	6	V-phase arm overcurrent	<i>OCRA2</i>
7	7	W-phase arm overcurrent	<i>OCRA3</i>
8	8	Input phase failure	<i>EPH1</i>
9	9	Output phase failure	<i>EPHO</i>
10	A	Overvoltage during acceleration	<i>OP1</i>
11	B	Overvoltage during deceleration	<i>OP2</i>
12	C	Overvoltage during constant speed operation	<i>OP3</i>
13	D	Over-LOAD in inverter	<i>OL1</i>
14	E	Over-LOAD in motor	<i>OL2</i>
15	F	Dynamic braking resistor overload	<i>OLr</i>
16	10	Overheat	<i>OH</i>
17	11	Emergency stop	<i>E</i>
18	12	EEPROM fault	<i>EEP1</i>
19	13	Initial read error	<i>EEP2</i>
20	14	Initial read error	<i>EEP3</i>
21	15	Inverter RAM fault	<i>Err2</i>
22	16	Inverter ROM fault	<i>Err3</i>
23	17	CPU fault	<i>Err4</i>
24	18	Communication time-out error	<i>Err5</i>
25	19	Gate array fault	<i>Err6</i>
26	1A	Output current detector error	<i>Err7</i>
27	1B	Option error	<i>Err8</i>
29	1D	Low current operation status	<i>UC</i>
30	1E	Undervoltage (main circuit)	<i>UP1</i>
32	20	Over-torque trip	<i>Ot</i>
33	21	Ground fault trip	<i>EF1</i>
34	22	Ground fault trip	<i>EF2</i>
36	24	Dynamic braking abnormal element	<i>OCr</i>
37	25	Overcurrent during acceleration (element overheat)	<i>OC1P</i>
38	26	Overcurrent during deceleration (element overheat)	<i>OC2P</i>
39	27	Overcurrent during fixed speed operation (element overheat)	<i>OC3P</i>
40	28	Tuning error	<i>Et_n</i>
41	29	Inverter type error	<i>EtYP</i>
42	2A	Analog input terminal overvoltage	<i>E-10</i>
43	2B	Abnormal brake sequence	<i>E-11</i>
44	2C	Disconnection of encoder	<i>E-12</i>
45	2D	Speed error	<i>E-13</i>
46	2E	External thermal	<i>OH2</i>
47	2F	Step-out (for PM motors only)	<i>SOUt</i>
50	32	Terminal input error	<i>E-18</i>
51	33	Abnormal CPU2 communication	<i>E-19</i>
52	34	V/f control error	<i>E-20</i>
53	35	CPU1 fault	<i>E-21</i>
54	36	Abnormal logic input voltage	<i>E-22</i>
55	37	Option 1 error	<i>E-23</i>
56	38	Option 2 error	<i>E-24</i>
57	39	Stop position retaining error	<i>E-25</i>
58	3A	CPU2 fault	<i>E-26</i>
61	3D	Control circuit option error	<i>E-29</i>
84	54	<i>F410</i> tuning error	<i>Et_{n1}</i>
85	55	<i>F412</i> tuning error	<i>Et_{n2}</i>
86	56	Motor constant setting error	<i>Et_{n3}</i>

6. Specifications

< Environmental specification >

Item	Specification
Model number	BCN001Z
Service environment	Conforms to VF-PS1
Ambient temperature	Conforms to VF-PS1
Storage temperature	-25 to +65°C
Relative humidity	20 to 93%(free from condensation and vapor)
Vibration	less than 5.9m/s ² ,10 to 55Hz
Power supply	24VDC supplied from the inverter.

<Network specification >

Item	Specification
Data link /physical layer	Master-Slave/Token Passing(MS/TP)
Node type	Master node
Maximum connection units	Maximum 32 units within one segment
Communication baudrate	9600bps, 19200bps, 38400bps, 76800bps Auto adaptive is supported.
Bias resistor and termination	Local bias resistors are mounted. Termination resistor (120 ohm) can be select by SW.
Terminal block	Detachable terminal block 4-pole (5.08mm pitch) Manufacturer: PHOENIX CONTACT Type-Form : MSTB 2,5/4-STF-5.08

7. BACnet Protocol Specification

Vendor Name	TOSHIBA
Product Name	Low Voltage AC Motor Drive
Product Model Number	VF-PS1
Firmware Revision	V1.03
BACnet Protocol Revision	2
Product Description	BACnet Option board is designed for VF-PS1 series. All standard MS/TP baud rates are supported, as well as master mode functionality. Over BACnet, the drive can be fully controlled as a standard adjustable frequency drive.
BACnet Standardized Device Profile (Annex L)	<input type="checkbox"/> BACnet Operator Workstation (B-OWS) <input type="checkbox"/> BACnet Building Controller (B-BC) <input type="checkbox"/> BACnet Advanced Application Controller (B-AAC) <input checked="" type="checkbox"/> BACnet Application Specific Controller (B-ASC) <input type="checkbox"/> BACnet Smart Sensor (B-SS) <input type="checkbox"/> BACnet Smart Actuator (B-SA)
List all BACnet Interoperability Building Blocks Supported (Annex K)	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B
Segmentation Capability	<input type="checkbox"/> Segmented requests supported. Window Size ____ <input type="checkbox"/> Segmented responses supported. Window Size ____
Standard Object Types Supported: An object type is supported if it may be present in the device. For each standard Object Type supported provide the following <ol style="list-style-type: none"> Whether objects of this type are dynamically creatable using the CreateObject service Whether objects of this type are dynamically detectable using the DeleteObject service List of the optional properties supported List of all properties that are writable where not otherwise required by this standard List of proprietary properties and for each its property identifier, datatype, and meaning List of any property range restrictions 	
Data Link Layer Options:	<input type="checkbox"/> BACnet IP, (Annex J) <input type="checkbox"/> BACnet IP, (Annex J), Foreign Device <input type="checkbox"/> ISO 8802-3, Ethernet (Clause 7) <input type="checkbox"/> ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8) <input type="checkbox"/> ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) ____ <input checked="" type="checkbox"/> MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800 <input type="checkbox"/> MS/TP slave (Clause 9), baud rate(s): ____ <input type="checkbox"/> Point-To-Point, EIA 232 (Clause 10), baud rate(s): ____ <input type="checkbox"/> Point-To-Point, modem, (Clause 10), baud rate(s): ____ <input type="checkbox"/> LonTalk, (Clause 11), medium: ____ <input type="checkbox"/> 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.)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Networking Options:	<input type="checkbox"/> Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc. <input type="checkbox"/> Annex H, BACnet Tunneling Router over IP <input type="checkbox"/> BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Character Sets Supported: Indicating support for multiple character sets does not imply that they can all be supported simultaneously.	<input checked="" type="checkbox"/> ANSI X3.4 <input type="checkbox"/> ISO 8859-1 <input type="checkbox"/> ISO 10646 (UCS-4) <input type="checkbox"/> IBM™/Microsoft™ DBCS <input type="checkbox"/> ISO 10646 (UCS-2) <input type="checkbox"/> JIS C 6226
If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:	