

The following procedure is a supplement to other documentation supplied with the SI-B3 option card. This document will cover option card information, installation, diagnostics, addressing, related drive parameters, accessing drive parameters and error codes.

Drives can be monitored and controlled by a controller on a Building Automation and Control network (BACnet) using RS-485 technology and MS/TP (Master-Slave/Token-Passing) protocol. The drives conform to the BACnet application specific controller (B-ASC) device profile. Up to 127 drives can communicate on a single BACnet MS/TP network.

Please read this cheat sheet and other documentation provided with the SI-B3 option card thoroughly before attempting any installation.

Step 1 Option Card Information

Applicable Models

The option can be used with the following drive models:

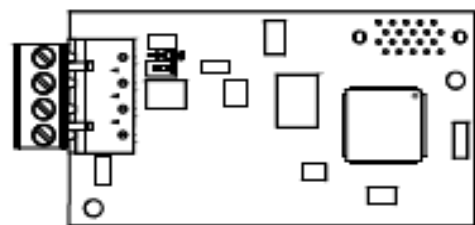
Drive Series	Drive Model	Software Version
A1000	CIMR-A*2A****	1017 or later
	CIMR-A*4A0002* to 4A0675*	1017 or later
	CIMR-A*5A****	1017 or later 5045 or later
P1000	CIMR-P*2A****	8500 or later
	CIMR-P*4A0002* to 4A0675*	8500 or later
	CIMR-P*5A****	8500 or later
iQpump1000	CIMR-PW2A****	8550 or later
	CIMR-PW4A0002* to 4A0675*	8550 or later
	CIMR-PW5A***	8550 or later

Receiving

Please perform the following tasks upon receipt of the option:

- Inspect the option for damage. Contact the shipper immediately if the option appears damaged upon receipt.
- Verify receipt of the correct model by checking the model number printed on the name plate of the option package.
- Contact your supplier if you have received the wrong model or the option does not function properly.

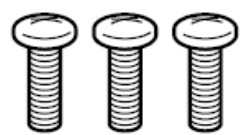
Option Package Contents



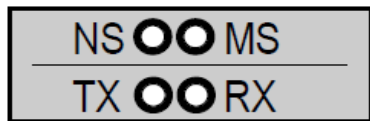
Option PCB – 1x
PN: UTC00043□



Ground Wire – 1x



Screws (M3) – 3x



LED Label – 1x

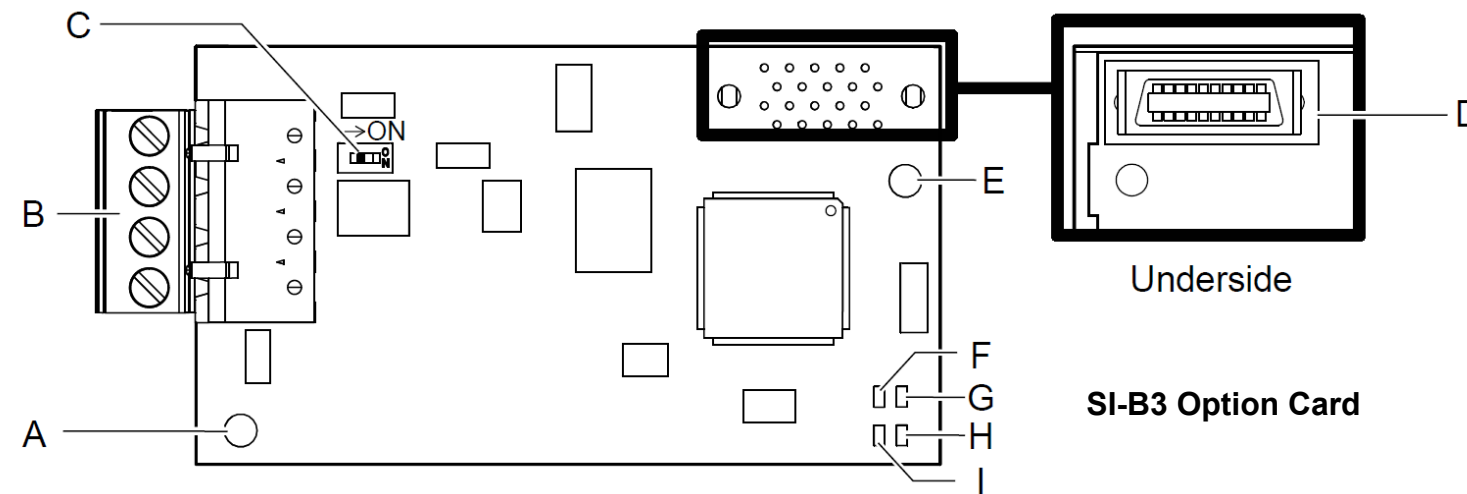
Tools required for installation

- A Phillips screwdriver (M3 metric/#1, #2 U.S. standard size) is required to install the option and remove drive front covers. Screw sizes vary by drive capacity. Select a screwdriver appropriate for the drive capacity.
- Diagonal cutting pliers. (required for some drive models)
- A small file or medium grit sandpaper. (required for some drive models)
- A straight-edge screwdriver (blade depth: 0.4 mm, width: 2.5 mm) is required to wire the option terminal block.

Step 2 Installing the SI-B3 Option Card

In this step the SI-B3 option card is installed. **WITH POWER OFF** install the SI-B3 card as shown below. **Make sure to follow good wiring practices and all applicable codes. Ensure that the option card is grounded properly as shown in item ④ below.**

This option card can be inserted into the CN5-A connector located on the drive's control board.



Terminal Block TB1

1	IG5	Isolated supply ground reference
2	+	RX/TX (+) signal
3	-	RX/TX (-) signal
4	SHLD	Shield Ground

A - Ground terminal and installation hole <1>

B - Terminal block TB1

C - Terminating resistor switch S1

D - Connector (CN5)

E - Installation hole

F - LED (NS)<2>

G - LED (MS)<2>

H - LED (RX)<2>

I - LED (TX)<2>

<1> Connect the ground wire provided in the option shipping package during installation.

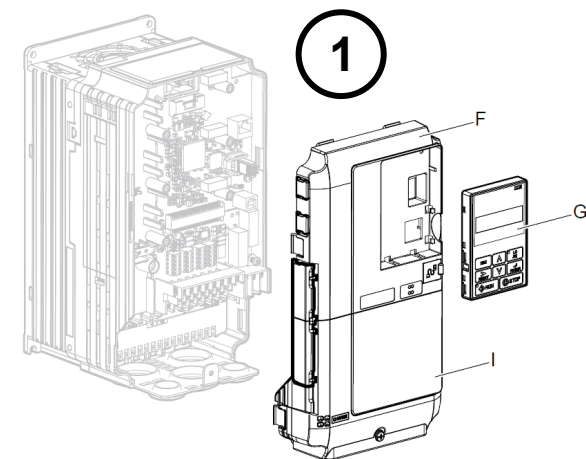
<2> Refer to Option LED section Step 3 for details on the LEDs.

Option Card Installation

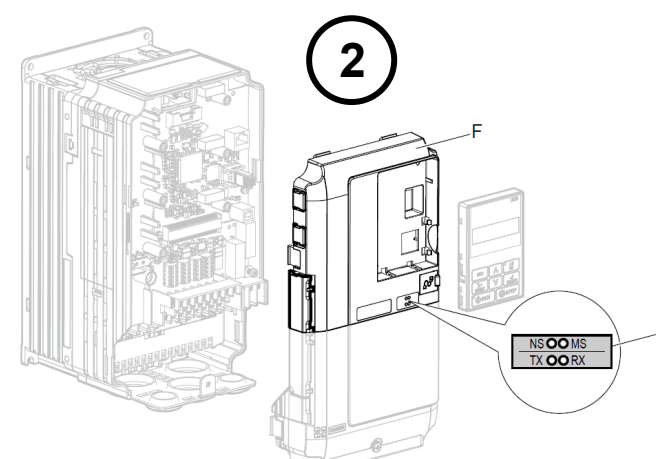
Prior to installing the option, wire the drive, make necessary connections to the drive terminals, and verify that the drive functions normally without the option installed. Refer to the Quick Start Guide packaged with the drive for information on wiring and connecting the drive. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the digital operator (G) and front covers (F, I). Front cover removal varies by model.

DANGER! Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply will result in death or serious injury. Before installing the option, disconnect all power to the drive. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

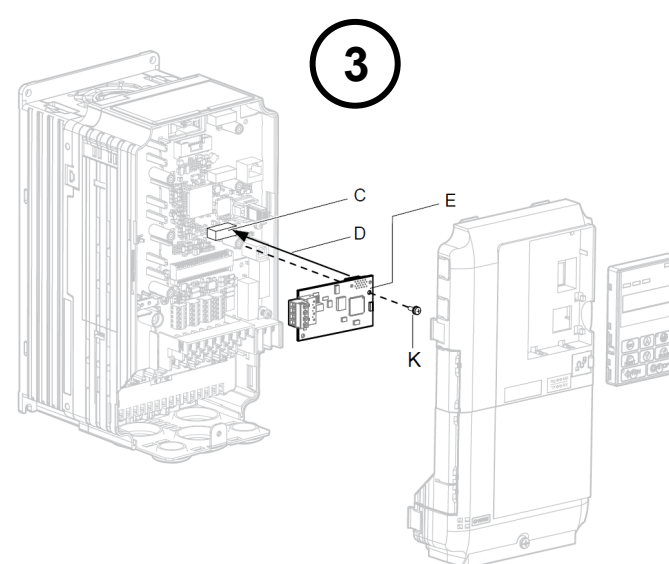
NOTICE: Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the option, drive, and circuit boards. Failure to comply may result in ESD damage to circuitry.



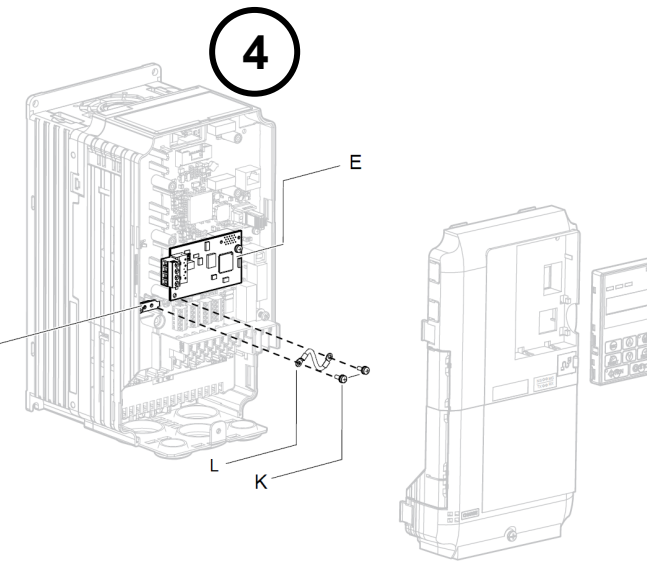
Remove the Front Covers and Digital Operator



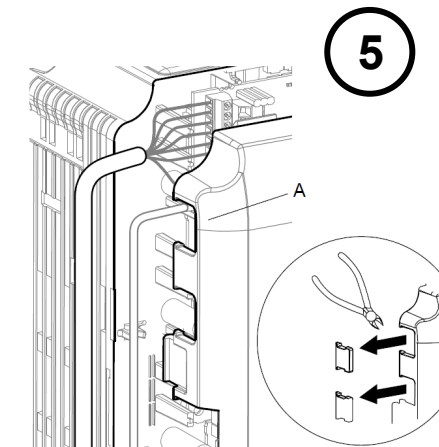
Apply the LED Label



Insert the Option



Connect the Ground Wire



Wire routing

Note: 'A' indicates wire routing.

Wiring the Option

Depending on the drive model, some drives may require routing the wiring through the side of the front cover to the outside to provide adequate space for the wiring. In these cases, using diagonal cutting pliers, cut out the perforated openings on the left side of the drive front cover. Sharp edges along the cut out should be smoothed down with a file or sand paper to prevent any damage to the wires. Route the communication wiring inside the enclosure for drives that do not require routing through the front cover.

Step 3 Option LED Display and Power-Up Diagnostics

Option LED Display

The BACnet option has four LEDs.

- Two bi-color Status LEDs:
 - Module status (MS) and Network status (NS) (red/green)
- Two BACnet LEDs:
 - Transmit (TX) and Receive (RX) (green)

The operational states of the option LEDs after completion of the BACnet power-up diagnostic LED sequence are described in the table below. Wait at least 2 seconds for the power-up diagnostic process to complete before verifying LED states.

Name	Display		Operating Status	Remarks
	Color	Status		
MS	-	OFF	Power supply OFF	Power is not being supplied to the drive.
	Green	ON	Normal operation	The option is operating normally and initialization is complete.
	Green	Flashing	Standby/Initializing	The option is in process of configuring or waiting for configuration information.
	Red	Flashing	Minor fault	The option has detected a recoverable minor fault such as incomplete configuration.
	Red	ON	Major fault	The option has detected an unrecoverable major fault.
	Green/Red	Flashing	Option self-test	The option is in self-test mode.
NS	-	OFF	Power supply OFF	-
	Green	ON	Connected	The device is currently communicating on the network.
	Green	Flashing	Not connected	The device currently is not communicating, but is correctly configured. The state is "waiting" for communication to resume.
	Red	Flashing	Minor fault	A minor recoverable fault has occurred.
	Red	ON	Major fault	A non-recoverable major network fault has occurred.
	Green/Red	Flashing	Network test	Power-up sequence and testing.
TX	-	OFF	No data being sent to the network	This node is not sending any data.
	Green	Flashing	Data being sent to the network	This node is sending network data.
RX	-	OFF	No data seen on the network	The option is not physically connected to the network or there is no network activity.
	Green	Flashing	Data is seen on the network	The option is connected to a network.

Power-Up Diagnostics

An LED test is performed each time the drive is powered up. The initial boot sequence may take several seconds. After the LEDs have completed the diagnostic LED sequence, the option is successfully initialized. The LEDs then assume operational conditions as shown in the table below.

Sequence	Module Status (MS)	Network Status (NS)	Time (ms)
1	Green	OFF	250
2	Red	OFF	250
3	Green	OFF	-
4	Green	Green	250
5	Green	Red	250
6	Green	OFF	-

Step 4 BACnet Node Addressing and Related Drive Parameters

BACnet Node Addressing

The BACnet node address is configurable by parameter F6-45 in the drive. This defines the physical address of the drive on the MS/TP network. In addition, both the Device Object Instance Identifier (parameters F6-48 and F6-49) and the Device Object Name are configurable. These allow the drive to have a virtual address and simplify the controller configuration.

After setting the addressing, a controller can initiate communication to the drive. The drive will perform the specified function and then send a response back to the controller. The drive will usually respond immediately, but may delay its response until it gets the token for commands that may take extra local processing time.

Related Drive Parameters

The following parameters are used to set up the drive for operation with the option. Parameter setting instructions can be found in the drive Quick Start Guide or Technical Manual. Confirm proper setting of the all parameters in the table below, before starting network communications. After changing parameter settings, cycle power to the drive for the new settings to take effect.

No.	Name	Description	Values
b1-01 <1>	Frequency Reference Selection	0: Operator 1: Terminals - A1 or A2 2: MEMOBUS/Modbus 3: Option PCB 4: Pulse Input	Default: 1 Range: 0 to 4 (Set to 3 for BACnet)
b1-02	Run Command Selection	0: Digital Operator 1: MEMOBUS/Modbus 2: MEMOBUS/Modbus 3: Option PCB	Default: 1 Range: 0 to 3 (Set to 3 for BACnet)
F6-45	Drive Node Address	Sets the BACnet MS/TP MAC address (physical node address).	Default: 1 Range: 0 to 127
F6-46	Comm. Speed Selection	Sets the comm. speed. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	Default: 3 Range: 0 to 8
F6-47	Drive Transmit Wait Time	Sets the time the drive waits after receiving data from a master before transmitting response data.	Default: 5 ms Range: 5 to 65
F6-48 <2>	BACnet Device Object Identifier 0	Set the Instance Identifier of the BACnet Device Object, where the F6-48 value is the least significant word.	Default: 1 Range: 0 to FFFFH
F6-49 <2>	BACnet Device Object Identifier 1	Set the Instance Identifier of the BACnet Device Object, where the F6-49 value is the most significant word.	Default: 0 Range: 0 to 3FH

<1> To start and stop the drive with the option master device using serial communications, set b1-02 to 3. To control the drive frequency reference via the master device, set b1-01 to 3.

<2> These parameters set the Instance Identifier of the BACnet Device Object, where the F6-48 value is the least significant word and the F6-49 value is the most significant word.

Example 1: Set the Device Object Instance Identifier of "1234". 1234 decimal is equal to 4D2H (hexadecimal). Set F6-48 to 4D2H and F6-49 to 0.

Example 2: Set Device Object Instance Identifier to "1234567". 1234567 decimal is equal to 12D687H. Set F6-48 to D687H and set F6-49 to 12H.

Step 5 BACnet Objects and Accessing Drive Parameters

Present Value Access

The Present Value (PV) of BACnet objects can be read. In addition, some PVs can be written or commanded. A commandable PV is similar to writing the value, but the value is actually written into a priority array. The value occupying the highest priority in the array will be used by the drive. The convention for showing how the PV is accessed is C = Commandable, Value written to a priority array. R = Readable, Value is read-only, W = Writable, Value written to the drive.

Binary Value Objects

Object ID	Object Name	Modbus Address	Active Text	Inactive Text	PV Access
BV1	Run FWD Cmd	0001H:bit 0	RUN	OFF	C
BV2	Run REV Cmd	0001H:bit 1	REV	OFF	C
BV3	Ext Fault Cmd	0001H:bit 2	FAULT	OFF	C
BV4	Fault Reset Cmd	0001H:bit 3	RESET	OFF	C
BV5	Com Net Cmd	0001H:bit 4	COM	LOCAL	C
BV6	Com Cntrl Cmd	0001H:bit 5	COM	LOCAL	C
BV7	MF Input 3 Cmd	0001H:bit 6	ON	OFF	C
BV8	MF Input 4 Cmd	0001H:bit 7	ON	OFF	C
BV9	MF Input 5 Cmd	0001H:bit 8	ON	OFF	C
BV10	MF Input 6 Cmd	0001H:bit 9	ON	OFF	C
BV11	MF Input 7 Cmd	0001H:bit 10	ON	OFF	C
BV12	Set Fault Contact Cmd	0009H:bit 6	ENABLE	OFF	C
BV13	RUN-STOP	0020H:bit 0	RUN	OFF	R
BV14	REV-FWD	0020H:bit 1	REV	FWD	R
BV15	READY	0020H:bit 2	READY	OFF	R
BV16	FAULT	0020H:bit 3	FAULTED	OFF	R
BV17	Data Set Error	0020H:bit 4	ERROR	OFF	R
BV18	Overcurrent - Gnd Fault	0021H:bit 0	OC-GF	OFF	R
BV19	Main Ckt Overvoltage	0021H:bit 1	OV	OFF	R
BV20	Drive Overload	0021H:bit 2	OL2	OFF	R
BV21	Drive Overheat	0021H:bit 3	OH1-OH2	OFF	R
BV22	Fuse Blown	0021H:bit 5	PUF	OFF	R
BV23	PI Feedback Loss	0021H:bit 6	FBL	OFF	R
BV24	External Fault	0021H:bit 7	EF0-EF	OFF	R
BV25	Hardware Error	0021H:bit 8	CPF	OFF	R
BV26	Mtr Ovrld-OvrTorque	0021H:bit 9	OL1-OL3	OFF	R
BV27	Overspeed	0021H:bit 10	OS-DEV	OFF	R
BV28	Main Ckt Undervoltage	0021H:bit 11	UV	OFF	R
BV29	MCU, Cntrl Pwr Sy Err	0021H:bit 12	UV1-2-3	OFF	R
BV30	Output Phase Loss	0021H:bit 13	LF	OFF	R
BV31	Communication Error	0021H:bit 14	CE	OFF	R
BV32	Operator Disconnect	0021H:bit 15	OPR	OFF	R
BV33	Operating	002CH:bit 0	OPERATING	OFF	R
BV34	Zero Speed	002CH:bit 1	ON	OFF	R
BV35	Frequency Agree	002CH:bit 2	ON	OFF	R
BV36	Desired Freq Agree	002CH:bit 3	ON	OFF	R
BV37	Frequency Detect 1	002CH:bit 4	ON	OFF	R
BV38	Frequency Detect 2	002CH:bit 5	ON	OFF	R
BV39	Drv Startup Complete	002CH:bit 6	ON	OFF	R
BV40	Low Voltage Detect	002CH:bit 7	ON	OFF	R
BV41	Base Block	002CH:bit 8	ON	OFF	R
BV42	Frequency Ref Mode	002CH:bit 9	COM	LOCAL	R
BV43	Run Command Mode	002CH:bit 10	COM	LOCAL	R
BV44	Overtorque Detect	002CH:bit 11	ON	OFF	R
BV45	Frequency Refer Lost	002CH:bit 12	ON	OFF	R
BV46	Retry Error	002CH:bit 13	ON	OFF	R
BV47	Modbus Comms Error	002CH:bit 14	ON	OFF	R
BV48	Modbus Timeout Error	002CH:bit 15	ON	OFF	R
BV49	CRC Error	003DH:bit 0	ON	OFF	R
BV50	Invalid Data Length	003DH:bit 1	ON	OFF	R
BV51	Parity Error	003DH:bit 3	ON	OFF	R
BV52	Overrun Error	003DH:bit 4	ON	OFF	R
BV53	Framing Error	003DH:bit 5	ON	OFF	R
BV54	Timeout Error	003DH:bit 6	ON	OFF	R
BV55	Parameter Accept	0910H:bit 0	ON	OFF	W
BV56	Parameter Enter	0900H:bit 0	ON	OFF	W
BV57	Drive Comms Error	-	ON	OFF	R

Binary Input Objects

Object ID	Object Name	Modbus Address	Active Text	Inactive Text	PV Access
BI1	Input Terminal 1	002BH:bit 0	ON	OFF	R
BI2	Input Terminal 2	002BH:bit 1	ON	OFF	R
BI3	Input Terminal 3	002BH:bit 2	ON	OFF	R
BI4	Input Terminal 4	002BH:bit 3	ON	OFF	R
BI5	Input Terminal 5	002BH:bit 4	ON	OFF	R
BI6	Input Terminal 6	002BH:bit 5	ON	OFF	R
BI7	Input Terminal 7	002BH:bit 6	ON	OFF	R
BI8	Multi-Function Out 1	0020H:bit 5	ON	OFF	R
BI9	Multi-Function Out 2	0020H:bit 6	ON	OFF	R

Binary Output Objects

Object ID	Object Name	Modbus Address	Active Text	Inactive Text	PV Access
BO1	MF Output M1-M2	0009H:bit 0	ON	OFF	C
BO2	MF Output M3-M4	0009H:bit 1	ON	OFF	C
BO3	MF Output M5-M6	0009H:bit 2	ON	OFF	C
BO4	Ref Sel:PI Setpoint	000FH:bit 1	ON	OFF	C
BO5	Ref Sel:Term S5 IN	0001H:bit 8	ON	OFF	C
BO6	Ref Sel:Term S6 IN	0001H:bit 9	ON	OFF	C
BO7	Ref Sel:Term S7 IN	0001H:bit 10	ON	OFF	C

Analog Outputs Objects

Object ID	Object Name	Modbus Address	Precision	Range	Units	PV Access
AO1	Analog Output 1 Level	0007H	XXXX.X	0 to 100.0	%	C
AO2	Analog Output 2 Level	0008H	XXXX.X	0 to 100.0	%	C

Analog Inputs Objects

Object ID	Object Name	Modbus Address	Precision	Range	Units	PV Access
AI1	Analog Input 1 Level	004EH	XXXX.X	-	%	R
AI2	Analog Input 2 Level	004FH	XXXX.X	-	%	R
AI3	Not Used AI3	-	-	-	-	-
AI4	Not Used AI4	-	-	-	-	-
AI5	Not Used AI5	-	-	-	-	-
AI6	Display Format o1-03	0502H	XXXXX	-	-	R
AI7	Scale Format b5-20	01E2H	XXXXX	-	-	R
AI8	Inverter Model o2-04	0508F	XXXXX	-	-	R
AI9	Rated Current n9-01	05D0H	XXXX.X	-	Amps	R

Analog Value Objects

Object ID	Object Name	Modbus Address	Precision	Range	Units	PV Access
AV1	Operation Cmd	0001H	XXXXX	0 to 65535	-	C
AV2	Frequency Cmd	0002H	XXX.XX Dep. on o1-03	0.00 to 600.00	Hz (o1-03)	C
AV3	PI Setpoint Cmd	0006H	XXX.XX	0.00 to 100.00	%	C
AV4	MF Output 1 Cmd	0009H	XXXXX	0 to 65535	-	C
AV5	Reference Select Cmd	000FH	XXXXX	-	-	C
AV6	Drive Status	0020H	XXXXX	-	-	R
AV7	Fault Details	0021H	XXXXX	-	-	R
AV8	Data Link Status	0022H	XXXXX	-	-	R
AV9	Frequency Reference	0040H	XXX.XX Dep. on o1-03	-	Hz (o1-03)	R
AV10	Output Frequency	0041H	XXX.XX Dep. on o1-03	-	Hz (o1-03)	R
AV11	Output Voltage	0045H	XXXX.X	-	Volts	R
AV12	Output Current	0042H	XXXX.X (>11 kVA) XXX.XX (<=11 kVA)	-	Amps	R
AV13	Output Power	0047H	XXXX.X (>11 kVA) XXX.XX (<=11 kVA)	-	Watts	R
AV14	Torque Reference	0048H	XXXX.X	-	%	R
AV15	MF Input Status	002BH	XXXXX	-	-	R
AV16	Drive Status 2	002CH	XXXXX	-	-	R
AV17	MF Output Status	002DH	XXXXX	-	-	R
AV18	DC Bus Voltage	0031H	XXXX.X	-	Volts	R
AV19	PI Feedback Level	0038H	XXXX.X	-	%	R
AV20	PI Input Level	0039H	XXXX.X	-	%	R
AV21	PI Output Level	003AH	XXXX.X	-	%	R
AV22	CPU Software	005BH	XXXXX	-	-	R
AV23	Flash Number	004DH	XXXXX	-	-	R
AV24	Comm Error Detail	003DH	XXXXX	-	-	R
AV25	kVA Setting	0508H	XXXXX	-	-	R
AV26	Control Method	0102H	XXXXX	-	-	R
AV27	Accel Time	0200H	XXXX.X (C1-10 = 1) XXX.XX (C1-10 = 0)	0.0 to 6000.0 (C1-10=1) 0.00 to 600.00 (C1-10 = 0)	Sec	W
AV28	Decel Time	0201H	XXXX.X (C1-10 = 1) XXX.XX (C1-10 = 0)	0.0 to 6000.0 (C1-10=1) 0.00 to 600.00 (C1-10 = 0)	Sec	W
AV29	Parameter Number	-	XXXXX	0 to FFFFH	-	W
AV30	Parameter Data	-	XXXXX	0 to FFFFH	-	W

Accessing Drive Parameters

Reading Drive Parameters

Reading drive parameters not listed in the analog or digital objects is accomplished using AV29 and AV30 as shown below:
1. In decimal, write the desired Modbus register to AV29.
2. In decimal, read the value at the given register from AV30.
For example, to read the Frequency Reference Upper Limit, read from parameter d2-01. Parameter d2-01 is located at Modbus register 0289H, which is decimal 649.
Set AV29 to "649"
Read AV30 to get the value.

Enter Command

Enter Commands are only required when using AV29 and AV30 to write drive parameters. An Enter command is not required when reading or writing to the other BACnet objects.
When writing parameters to the drive from a controller using BACnet communications, an Enter command must be issued to enable these parameters. This section describes the types and functions of the Enter commands.

Writing Drive Parameters

Writing drive parameters not listed in the analog or digital objects is accomplished using AV29, AV30, and BV55 or BV56 as shown below:
1. In decimal, write the desired Modbus register to AV29.
2. In decimal, write the value to be written into AV30.
3. At this point the value is pending. One of two actions must be taken to complete the writing process:
Set BV55 to "ON" to move data to active memory.
Set BV56 to "ON" to move data into active memory and save to non-volatile memory.
For example, to reset the KWH Monitor, write a value of "1" to parameter o1-12. Parameter o1-12 is located at Modbus register 0512H, which is decimal 1298.
Set AV29 to "1298"
Set AV30 to "1"
Set BV55 to "ON".

Enter Command Types

The drive supports two types of Enter commands as shown in the table below.

BACnet Object	Modbus Address	Description
BV55 (Write "ON")	0910H (bit 0)	Writes data in the active RAM only. Parameter changes are lost when the drive is shut off.
BV56 (Write "ON")	0900H (bit 0)	Simultaneously writes data into the EEPROM (non-volatile memory) of the drive and enables the data in active RAM. Parameter changes remain after cycling power.

Step 6 Error Codes

Display	Description
BUS	Option Communication Error.
	The connection was lost after establishing initial communication. Only detected when the run command frequency reference is assigned to an option card.
EFO	Option Card External Fault.
	An external fault condition is present.
oFA00	Option Card Connection Error at Option Port CN5-A.
	Option compatibility error.
oFA01	Option Card Fault at Option Port CN5-A.
	Option not properly connected.
oFA03 to oFA06, oFA10, oFA11	Option Card Error Occurred at Option Port CN5-A.
oFA12 to oFA17	Option Card Connection Error (CN5-A).
oFA30 to oFA43	Communication Option Card Connection Error (CN5-A).
CALL	Serial Communication Transmission Error.
	Communication has not yet been established.