



VS-616G5

Option Instruction Manual

DeviceNet™ Communication Interface Card SI-M2

⚠ WARNING

PRECAUTIONS

1. Read this instruction manual in its entirety before installing the *DeviceNet™* Communication Interface Card SI-M2 or operating the inverter with this card installed.
2. DO NOT connect or disconnect wiring, or perform signal checks while the electrical power is turned ON. *Failure to observe these and other precautions indicated in this manual will expose the user to high voltages, resulting in serious injury or death. Damage to equipment may also occur.*

⚠ CAUTION

NOTE

The Option Card uses CMOS IC chips. Therefore, the card could become damaged when physically handled if static electricity is present. The person handling the card should wear a discharge strap to eliminate the possibility of static charge (if present) affecting the card.

Failure to observe this precaution may result in equipment damage.

NOTICE

Printed August, 1997. The information contained within this document is the proprietary property of Yaskawa Electric America, Inc., and may not be copied, reproduced or transmitted to other parties without the expressed written authorization of Yaskawa Electric America, Inc.

No patent liability is assumed with respect to the uses of the information contained herein. Moreover, because Yaskawa is constantly improving its high quality product, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this document. Nevertheless, Yaskawa assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

~~This document assumes that the reader possesses and completely understands the *DeviceNet™*~~

specification. For more information and training on the use of *DeviceNet™*, or to obtain a copy of the specification, contact the Open *DeviceNet™* Vendors Association (ODVA-Coral Gables, FL).

~~This manual also assumes that the reader is familiar with writing to the VS-616G5 Flash memory with the appropriate hardware and software tools.~~

INTRODUCTION

The *DeviceNet™* Communication Interface Card SI-M2 is mounted on the control board (2CN connector) of a VS-616G5 inverter, and is used to connect to and communicate with a *DeviceNet™* communication network. When purchasing an option card, please specify the inverter model and code number.

SI-M2 Option Card Description

Name	Code Number	Functions
<i>DeviceNet™</i> Communication Interface Option Card SI-M2 (YEA Order P/N UTC000018)	73600-C0200	<ul style="list-style-type: none"> • Connects inverter to a <i>DeviceNet™</i> communication network. • Custom software required to use option card. Software number VSG11005X (where X: minor revision number, 0-9 are valid). • All <i>DeviceNet™</i> objects required to meet the standard AC Drive type are supported. • The VS-616G5 inverter communicates on <i>DeviceNet™</i> as a Group 2 only server. • The pre-defined Master/Slave set must be used. • Option card plugs into 2CN connector on the control board.

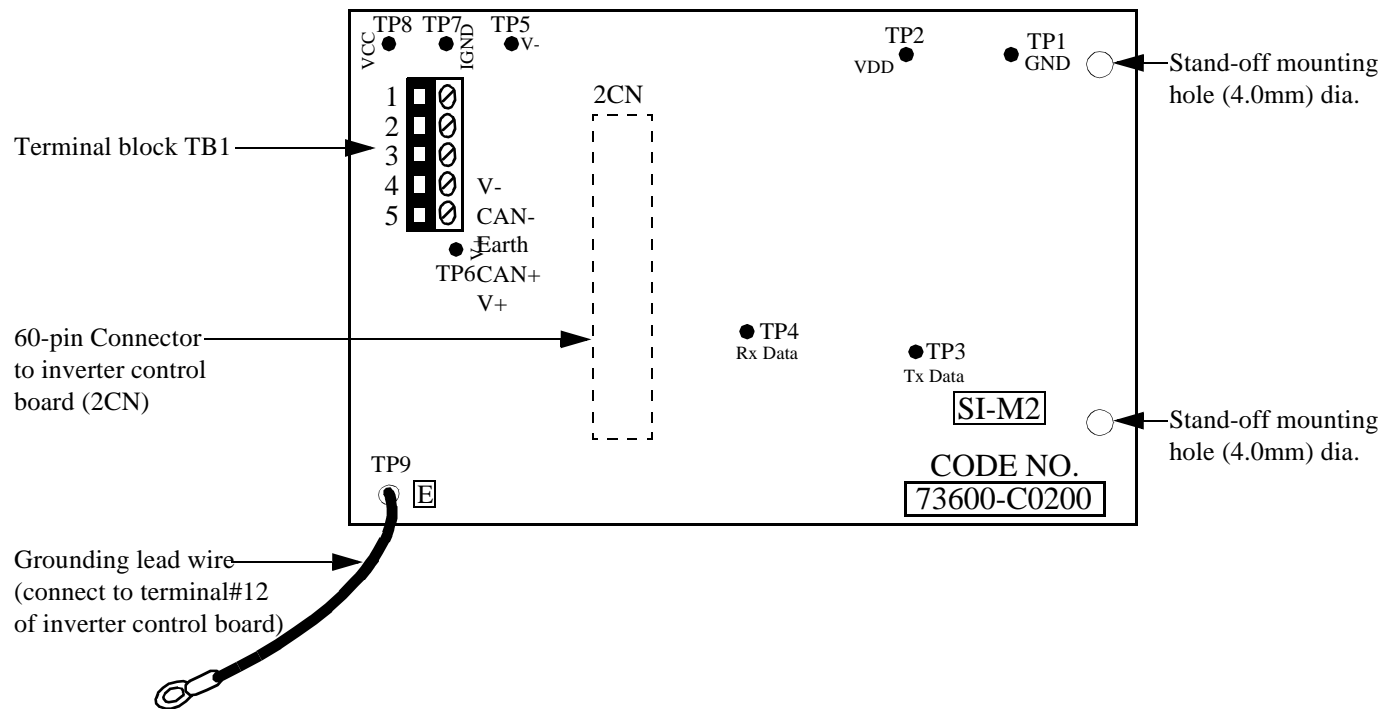


Fig. 1 *DeviceNet™* Communication Interface Option Card SI-M2

INSTALLATION

1. Before attempting to install or use the *DeviceNet*TM Communication Interface Card SI-M2, read these instructions.
2. After unpacking the card, verify that the code number is correct and that no damage occurred during shipping. Contact your YASKAWA representative if you should require any assistance.
3. Turn OFF the main electrical power to the inverter.
4. Remove the inverter's cover by first removing the digital operator. Then push inward (on the cover) at the indented area located on each side of the cover, and lift the cover upward pivoting from the rear of the cover. (Refer to the VS-616G5 User's Manual, if necessary).
5. Check that the indicator CHARGE lamp is OFF (power OFF indication).
6. Plug the 2CN connector of *DeviceNet*TM Communication Interface Card SI-M2 into the 2CN connector (60 pins) on the control board of the inverter. Gently push the SI-M2 card until the stand-off posts engage the two holes on the option card. Secure the SI-M2 card. (See part A of the side view).
7. Attach the green ground wire to terminal 12 of the VS-616G5 control board.
8. Connect an appropriate Flash ROM writing cable to the 1CN connector on the inverter's control board. If so equipped, set the cable's switch to Flash writing mode.
9. Apply power to the VS-616G5 unit.
10. Write the VS-616G5's Flash ROM using the required *DeviceNet*TM Flash software.
11. Set the VS-616G5's MAC ID, Baud Rate, Output Assy Inst, and Input Assy Inst. These settings are in the "Group P *DeviceNet*TM menus".
12. Cycle the power to the VS-616G5. This must be done so that the inverter will recognize the new MAC ID and Baud Rate settings. In a multiple unit installation, this can be done after the last unit is setup.
13. Replace the inverter's cover. Refer to Fig. 3 for correct wiring of the *DeviceNet*TM Communication Interface Card SI-M2 and the control board.
14. The hardware and software installation is now complete.

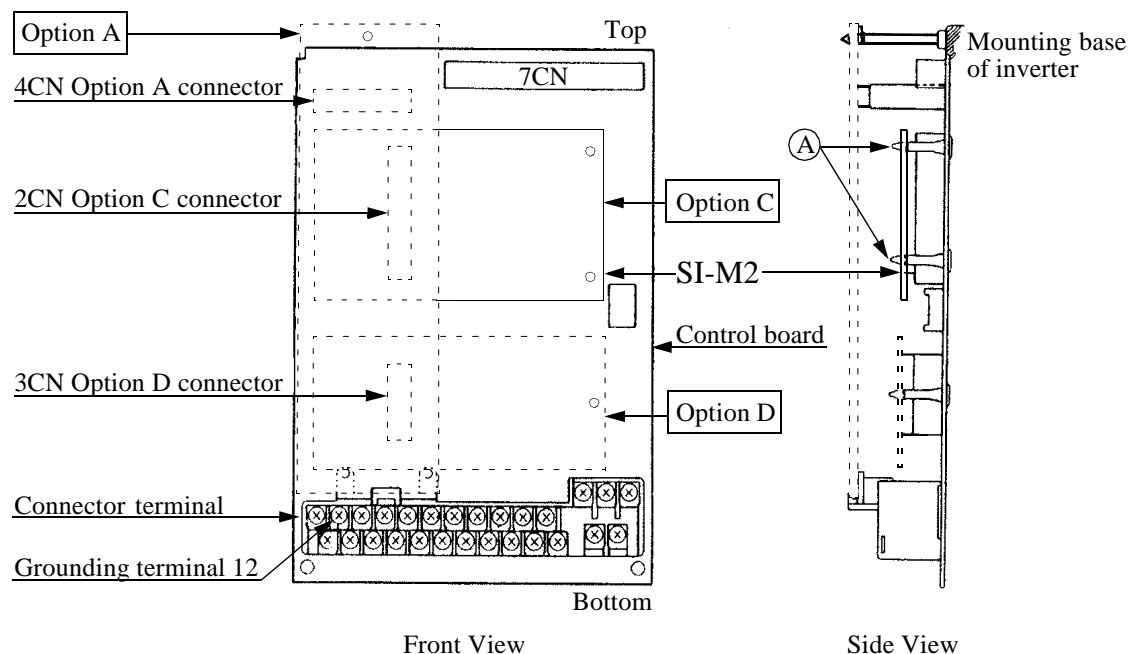


Fig. 2 Installation of the *DeviceNet*TM Communication Interface Card SI-M2

INTERCONNECTION DIAGRAM

Fig. 4 shows the interconnection between the inverter, the *DeviceNet™* Communication Interface Card SI-M2, and peripheral equipment:

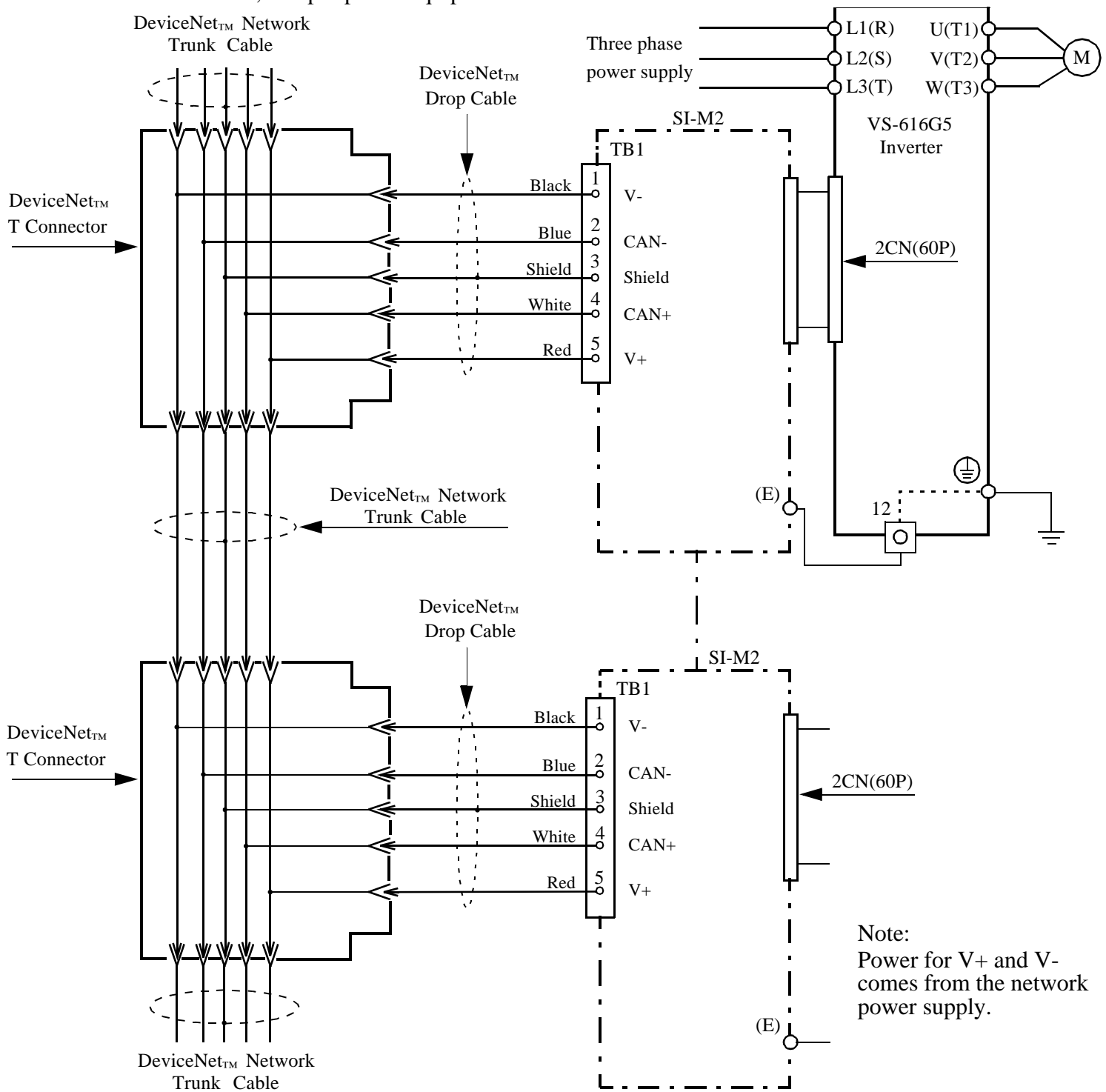


Fig. 3 SI-M2 Interconnection Diagram

Connecting to *DeviceNet*_{TM}

The *DeviceNet*_{TM} specification states that nodes on the network must be able to be connected and disconnected without breaking the network. This means that the SI-M2 option card **must** be connected to the *DeviceNet*_{TM} main (trunk) cable through a “drop cable” and “T” connector arrangement (see Fig. 3).

It is important to ensure that the SI-M2 card is connected to the *DeviceNet*_{TM} network and that the network power is energized before applying power to the G5 inverter.

*DeviceNet*_{TM} Configuration Menus in VS-616G5

Function P1 Parameter List, *DeviceNet*_{TM} Configuration

Digital Operator Display	Parameter No.	Parameter Name	Setting Range	Factory Default	Data Selection
MAC ID	P1-01	MAC ID Address No.	0 - 63	63	0 - 63
Baud Rate	P1-02	Communication Speed Set	0 - 2	0	0 = 125 kBaud 1 = 250 kBaud 2 = 500 kBaud
Output Assy Inst *	P1-03	I/O Instruction to Inverter	20, 21, 100	21	20 = Basic Spd Cntrl 21 = Extend Spd Cntrl 100 = G5 Standard Comm
Input Assy Inst *	P1-04	I/O Instruction From Inverter	70, 71, 100	71	70 = Basic Spd Cntrl 71 = Extend Spd Cntrl 110 = G5 Standard Comm
DNet Loss Action	P1-05	Inverter Action on Loss of Communication	0 - 1	0	0 = Fault and Stop 1 = Continue Operation

* Note: Input Assembly Instructions and Output Assembly Instructions 100 and 110 must be set to the same type.
Note: After changing parameters, the power to the VS-616G5 must be cycled for the changes to take effect.

*DeviceNet*_{TM} Functions in SI-M2

Supported Message Types

Explicit Messages: Fragmentation is supported. Up to 32 bytes can be input and output.
Polled I/O Messages: Fragmentation is not supported. Up to 8 bytes can be input and output.

Supported I/O Assemblies

Static output # 20, 21, and 100
Static input # 70, 71, and 110

Dynamic assemblies are not supported.

Supported Connection path type

Symbolic: Connection path length must be 3 bytes long.

Supported Objects

Identity Object (Class 01h)

Services supported:

Get Attribute Single (0Eh)

Reset (05h)

Number of instances = 1

Class Level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Vendor ID	Word	44
2	X	—	Device Type	Word	2
3	X	—	Product Code	Word	18
4	X	—	Revision	Word	1.0
5	X	—	Status	Word	0
6	X	—	Serial Number	Long	(Each unit is unique)
7	X	—	Product Name	String (16 Bytes)	VS-616G5 SI-M2
8	X	—	State	Byte	0

Message Router Object (Class 02h)

Services supported:

Get Attribute Single (0Eh)

Number of instances = 1

Class Level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
—	—	—	No instance level attributes are supported	—	—

Note: The Message Router object is included as a “stub” only to provide data for the *DeviceNet™* Conformance Test.

Supported Objects (cont.)

DeviceNet™ Object (Class 03h)

Services supported:

Get Attribute Single (0Eh)

Set Attribute Single (10h)

Reset (05h)

Number of instances = 1

Class Level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
1	X	—	MAC ID	Byte	63
2	X	—	Baud Rate	Byte	0 (125 kBaud)
3	X	X	Bus-Off Interrupt	Byte	0
4	X	X	Bus-Off Counter	Byte	0
5	X	X	Allocation Information	Word	0

Note: The MAC ID and Baud Rate settings are configured through the digital operator at menus P1-01 and P1-02.

Assembly Object (Class 04h)

Services supported:

Get Attribute Single (0Eh)

Set Attribute Single (10h)

Number of instances = 2

Class Level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Number of members in list	Word	4
2	X	—	Member List	Struct	—
3	X	X	Data	Array	—

Supported Objects (cont.)

Instance 2: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Number of members in list	Word	4
2	X	—	Member List	Struct	—
3	X	X	Data	Array	—

Note: The Assembly object is included as a “stub” only to provide data for the DeviceNet Conformance Test.

Connection Object (Class 05h)

Services supported:

Get Attribute Single (0Eh)

Set Attribute Single (10h)

Number of instances = 2

Class level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
1	X	—	State	Byte	3
2	X	—	Instance type	Byte	0
3	X	—	Transport class trigger	Byte	83h
4	X	—	Produced connection ID	Word	—
5	X	—	Consumed connection ID	Word	—
6	X	—	Initial comm characteristics	Byte	21h
7	X	—	Produced connection size	Byte	—
8	X	—	Consumed connection size	Byte	—
9	X	X	Expected packet rate	Word	09C4h
12	X	—	Watchdog time-out action	Byte	1
13	X	—	Produced connection path length	Word	0
14	X	—	Produced connection path	Array	—
15	X	—	Consumed connection path length	Word	0
16	X	—	Consumed connection path	Array	—

Supported Objects (cont.)

Instance 2: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
1	X	—	State	Byte	1
2	X	—	Instance type	Byte	1
3	X	—	Transport class trigger	Byte	83h
4	X	—	Produced connection ID	Word	—
5	X	—	Consumed connection ID	Word	—
6	X	—	Initial comm characteristics	Byte	1
7	X	X	Produced connection size	Byte	4
8	X	X	Consumed connection size	Byte	4
9	X	X	Expected packet rate	Word	0
12	X	X	Watchdog time-out action	Byte	1
13	X	—	Produced connection path length	Word	3
14	X	X	Produced connection path	Array	62 34 37
15	X	—	Consumed connection path length	Word	3
16	X	X	Consumed connection path	Array	62 31 35

Motor Data Object (Class 28h)

Services supported:

Get Attribute Single (0Eh)

Set Attribute Single (10h)

Number of instances = 1

Class level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
3	X	—	Motor Type	Byte	7
6	X	X	Rated Current	Word	—
7	X	X	Rated Voltage	Word	—

Supported Objects (cont.)

Control Supervisor Object (Class 29h)

Services supported:

Get Attribute Single (0Eh)

Set Attribute Single (10h)

Number of instances = 1

Class level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
3	X	X	Run 1	Byte	0
4	X	X	Run 2	Byte	0
5	X	—	Net Control	Byte	0
6	X	—	State	Byte	0
7	X	—	Running 1	Byte	0
8	X	—	Running 2	Byte	0
9	X	—	Ready	Byte	0
10	X	—	Faulted	Byte	0
11	X	—	Warning	Byte	0
12	X	X	Fault Reset	Byte	0
13	X	—	Fault Code	Word	0
15	X	—	Warning Code	Word	0
16	X	X	DeviceNet fault mode	Byte	0
17	X	X	Force fault	Byte	0
18	X	—	Force status	Byte	0

AC/DC Drive Object (Class 2Ah)

Services supported:

Get Attribute Single (0Eh)

Set Attribute Single (10h)

Number of instances = 1

Class level: Attributes Supported (Instance 0)

Attribute	Get	Set	Description	Size	Default Value
1	X	—	Object Software Revision	Word	1

Supported Objects (cont.)

Instance 1: Attributes Supported

Attribute	Get	Set	Description	Size	Default Value
3	X	—	At reference	Byte	0
4	X	X	Net reference	Byte	0
6	X	X	Drive mode	Byte	0
7	X	—	Speed actual	Byte	0
8	X	X	Speed reference	Byte	0
9	X	—	Current actual	Byte	0
15	X	—	Power actual	Byte	0
16	X	—	Input voltage	Byte	0
17	X	—	Output voltage	Byte	0
18	X	X	Accel time	Byte	10.0
19	X	X	Decel time	Word	10.0
20	X	X	Low speed limit	Word	0
21	X	X	High speed limit	Byte	100
22	X	X	Speed scale	Byte	0
23	X	X	Current scale	Byte	0
24	X	X	Torque scale	Byte	0
25	X	X	Process scale	Word	0
26	X	X	Power scale	Word	0
27	X	X	Voltage scale	Byte	0
28	X	X	Time scale	Byte	0
29	X	X	Reference from the net	Byte	0

I/O Assembly Description

Note: All bytes in these I/O Assembly Instructions are in hexadecimal format.

DeviceNet™ Basic Speed Control

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0	—	—	—	—	—	Fault Reset	—	Run Fwd
	1	—							
	2	Speed Reference (Low byte)							
	3	Speed Reference (High byte)							

DeviceNet™ Extended Speed Control

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
21	0	—	NetRef	NetCtrl	—	—	Fault Reset	Run Rev	Run Fwd
	1	—							
	2	Speed Reference (Low byte)							
	3	Speed Reference (High byte)							

G5 Standard Communications

Output Instance	Byte	G5 standard command message format
	0	Function Code
100	1	Register Number (High Byte)
	2	Register Number (Low byte)
	3	Register Data (High byte)
	4	Register Data (Low byte)

DeviceNet™ Basic Speed Control

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit	Bit 0
70	0	—	—	—	—	—	Running 1	—	Faulted
	1	—							
	2	Speed Actual (Low byte)							
	3	Speed Actual (High byte)							

DeviceNet™ Extended Speed Control

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit	Bit 0
71	0	At Spd	Ref From Net	Ctrl From Net	Ready	Running 2 (Rev)	Running 1 (Fwd)	Warning	Faulted
	1	—							
	2	Speed Actual (Low byte)							
	3	Speed Actual (High byte)							

G5 Standard Communications

Input Instance	Byte	G5 standard response message format
	0	Function Code
110	1	Register Number (High Byte)
	2	Register Number (Low byte)
	3	Register Data (High byte)
	4	Register Data (Low byte)

I/O assembly instance settings are configured through the digital operator at menus P1-03 and P1-04. Assemblies 100 and 110 are “vendor-specific” Yaskawa assemblies. They are designed to act much like the standard network communications already active in the G5. Individual registers can be addressed in a read or write manner allowing access to every configurable parameter. Assembly numbers 100 and 110 must be used together otherwise an OPE02 error will occur. Please note that these assemblies use the Motorola High-byte Low-byte addressing versus the normal *DeviceNet*™ Low-byte High-byte addressing.

I/O Assembly Usage Example

1. *DeviceNet™* pre-defined static assemblies

Inverter Programming

- Output Assembly #20, Input Assembly #70
- MAC ID = 63

Using a Group 2 Polled I/O connection (Message ID = 5)

Assume a 10 second accel/decel rate and ramp to stop.

Set RUN at 1800 RPM

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	01 00 08 07
G5 inverter inputs to the network	03FF	00 00 00 00
Master device outputs to the network	05FD	[empty]
G5 inverter inputs to the network	03FF	20 00 23 00
Master device outputs to the network	05FD	[empty]
G5 inverter inputs to the network	03FF	20 00 DF 02

(10 seconds pass)

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	[empty]
G5 inverter inputs to the network	03FF	20 00 08 07

Set STOP at 0 RPM

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	00 00 00 00
G5 inverter inputs to the network	03FF	20 00 08 07
Master device outputs to the network	05FD	[empty]
G5 inverter inputs to the network	03FF	20 00 3B 06
Master device outputs to the network	05FD	[empty]
G5 inverter inputs to the network	03FF	20 00 F1 05

(10 seconds pass)

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	[empty]
G5 inverter inputs to the network	03FF	00 00 00 00

I/O Assembly Example Usage (cont.)

2. Yaskawa vendor specific assemblies

Inverter Programming

- Output Assembly #100, Input Assembly #110
- MAC ID = 63

Using a Group 2 Polled I/O connection

Assume a 10 second accel/decel rate and ramp to stop.

Set RUN at 60.00Hz (1800 RPM, 4 Pole Motor)

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	10 00 02 17 70
G5 inverter inputs to the network	03FF	10 00 02 17 70
Master device outputs to the network	05FD	10 00 01 00 01
G5 inverter inputs to the network	03FF	10 00 01 00 01
Master device outputs to the network	05FD	03 00 21 00 00
G5 inverter inputs to the network	03FF	03 00 21 00 D3
Master device outputs to the network	05FD	03 00 21 00 00
G5 inverter inputs to the network	03FF	03 00 21 02 45

(10 seconds pass)

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	03 00 21 00 00
G5 inverter inputs to the network	03FF	03 00 21 17 70

Set STOP at 00.00Hz (0 RPM)

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	10 00 01 00 00
G5 inverter inputs to the network	03FF	10 00 01 00 00
Master device outputs to the network	05FD	10 00 02 00 00
G5 inverter inputs to the network	03FF	10 00 02 00 00
Master device outputs to the network	05FD	03 00 21 00 00
G5 inverter inputs to the network	03FF	03 00 21 17 01
Master device outputs to the network	05FD	03 00 21 00 00
G5 inverter inputs to the network	03FF	03 00 21 16 C2

(10 seconds pass)

I/O Activity	MSGID Value	Data Value
Master device outputs to the network	05FD	03 00 21 00 00
G5 inverter inputs to the network	03FF	03 00 21 00 00
Master device outputs to the network	05FD	03 00 10 00 00
G5 inverter inputs to the network	03FF	03 00 10 00 22



YASKAWA ELECTRIC AMERICA, INC.

Chicago-Corporate Headquarters 2942 MacArthur Blvd. Northbrook, IL 60062-2028, U.S.A.

Phone: (847) 291-2340 Fax: (847) 291-4203 Internet: <http://www.yaskawa.com>

Chicago-Technical Center 3160 MacArthur Blvd. Northbrook, IL 60062-1917, U.S.A.

Phone: (847) 291-0411 Fax: (847) 291-1018

MOTOMAN INC.

805 Liberty Lane West Carrollton, OH 45449, U.S.A.

Phone: (513) 847-6200 Fax: (513) 847-6277

YASKAWA ELETRICO DO BRASIL COMERCIO LTDA.

Avenida Brigadeiro Faria Lima, 1664-5º Andar, CJS 504/511 CEP 01452-001 - Sao Paulo-SP, Brasil

Phone: (011) 815-7723 Fax: (011) 210-9781 Internet: yaskawabrasil@originet.com.br

YASKAWA ELECTRIC EUROPE GmbH

Am Kronberger Hang 2, 65824 Schwalbach, Germany

Phone: (49) 6196-569-300 Fax: (49) 6196-888-301 Internet: marketing@yeg.yaskawa.de

Motoman Robotics AB

Box 130 S-38500. Torsas, Sweden

Phone: 0486-10575 Fax: 0486-11410

Motoman Robotec GmbH

Kammerfeldstraße 1, 85391 Allershausen, Germany

Phone: 08166-900 Fax: 08166-9039

YASKAWA ELECTRIC UK LTD.

3 Drum Mains Park Orchardton Woods Cumbernauld, Scotland, G68 9LD, U.K.

Phone: (1236) 735000 Fax: (1236) 458182

YASKAWA ELECTRIC KOREA CORPORATION

Paik Nam Bldg. 901 188-3, 1-Ga Euljiro, Joong-Gu, Seoul, Korea

Phone: (02) 776-7844 Fax: (02) 753-2639

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.

Head Office: CPF Bldg. 79 Robinson Road #13-05, Singapore 0106, SINGAPORE

Phone: 221-7530 Telex: (87) 24890 YASKAWA RS Fax: 224-5854

Service Center: 221 Henderson Road, #07-20 Henderson Building Singapore 0315, SINGAPORE

Phone: 276-7407 Fax: 276-7406

YATEC ENGINEERING CORPORATION

Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan

Phone: (02) 563-0010 Fax: (02) 567-4677

SHANGHAI OFFICE Room No. 8B Wan Zhong Building 1303 Yan An Road (West), Shanghai 200050, CHINA

Phone: (86) 212-1015 Fax: (86) 212-1015

TAIPEI OFFICE Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan

Phone: (02) 563-0010 Fax: (02) 567-4677

YASKAWA ELECTRIC CORPORATION

Tokyo Office 8th Floor, New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minato-ku, Tokyo, 105, Japan

Phone: (03) 5402-4542 Fax: (03) 5402-4588 Internet: <http://www.yaskawa.co.jp>