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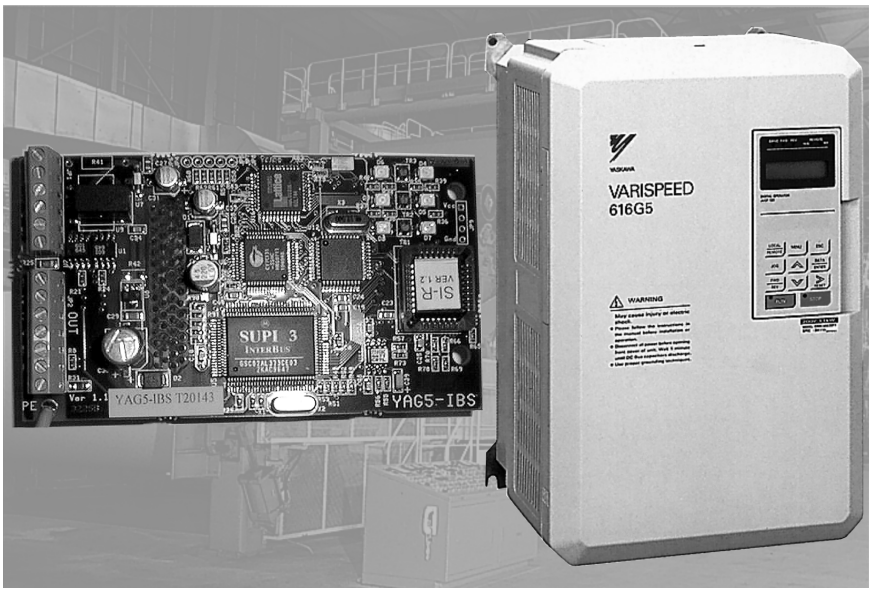

VS-616G5
Option Instruction Manual

InterBus-S Control Card SI-R

⚠WARNING

PRECAUTIONS

1. Read this instruction manual in its entirety before installing the InterBus-S Control Card SI-R or before 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

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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.

INTRODUCTION

The InterBus-S Control Card SI-R is used to connect the VS-616G5 inverter to an InterBus-S network. It can communicate with either 4-word fast cycle data or 3 objects in PCP (Peripheral Communications Protocol). These objects are: Accel Time 1, Decel Time 1, and Modbus commands. The communication rate is fixed at 500 kbps with RS-422 electrical interface.

Table 1: InterBus-S Control Card SI-R Overview

Name	YEA Code Number	Functions
InterBus-S Control Card SI-R	YAG5-IBS	• Connects inverter to, and communicates with, an InterBus-S communication network. • Option card plugs into 2CN connector on the control board. • Option card is a 4-word InterBus-S remote bus slave unit. PCP is supported. • The card requires VS-616G5 Flash # VSG101042 or higher.

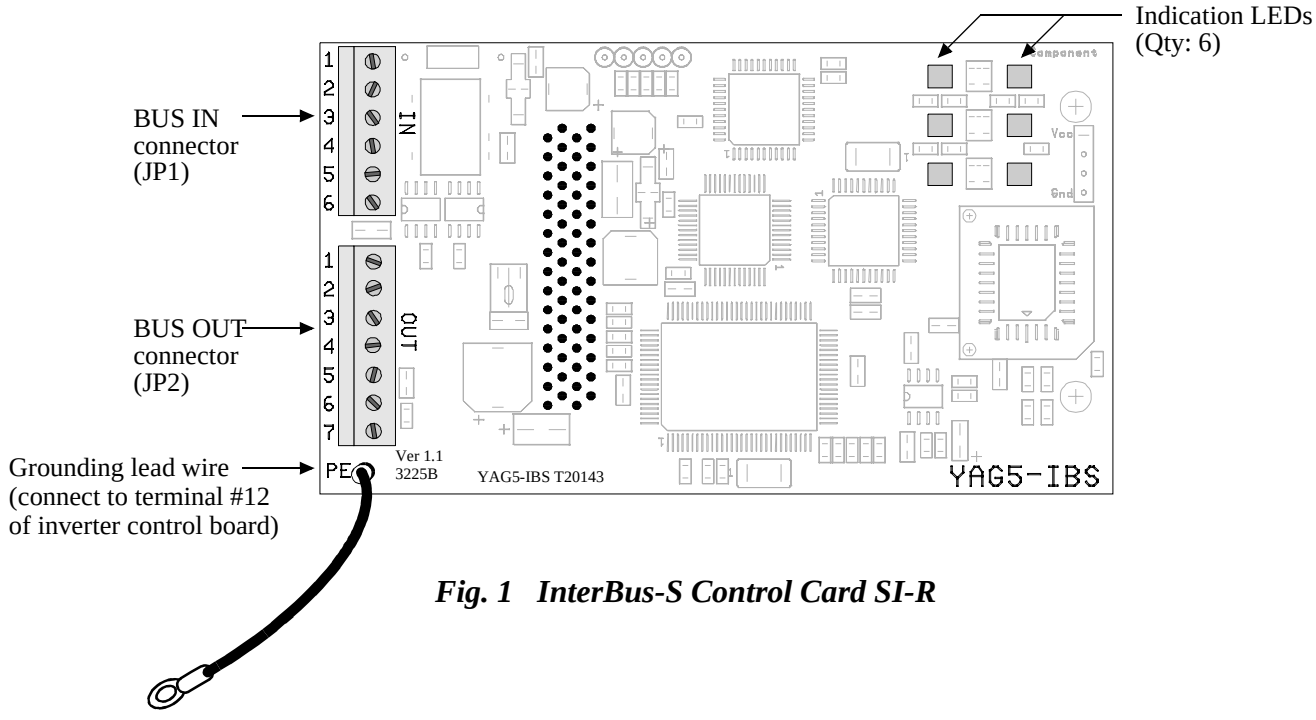

Fig. 1 InterBus-S Control Card SI-R

INSTALLATION

1. Before attempting to install or use the InterBus-S Control Card SI-R, please read these instructions.
2. After unpacking the card, verify that the code number is correct and that no damage has occurred during shipping. Contact your YASKAWA representative if you require any assistance.
3. Turn OFF the main electrical power to the inverter.
4. Remove the inverter's digital operator. Then remove the inverter's front cover. Refer to the VS-616G5 User's Manual for specific removal instructions for your particular inverter size.
5. Verify that the indicator CHARGE lamp is OFF (power OFF indication).
6. Plug the 2CN connector of the InterBus-S Control Card SI-R into the 2CN connector (60 pins) on the control board of the inverter as illustrated in Fig. 2 below. Gently push the SI-R card until the stand-off posts engage the two holes on the option card. Secure the SI-R card. (See part Ⓐ of the side view below).
7. Attach the green grounding load wire (PE-Protected Earth) cable to terminal 12 of the VS-616G5 control board.
8. Replace the inverter cover. Refer to Figs. 3 and 4 for correct wiring of the InterBus-S Control Card and the Control Board. Note: The cable colors indicated meet the InterBus-S standard.

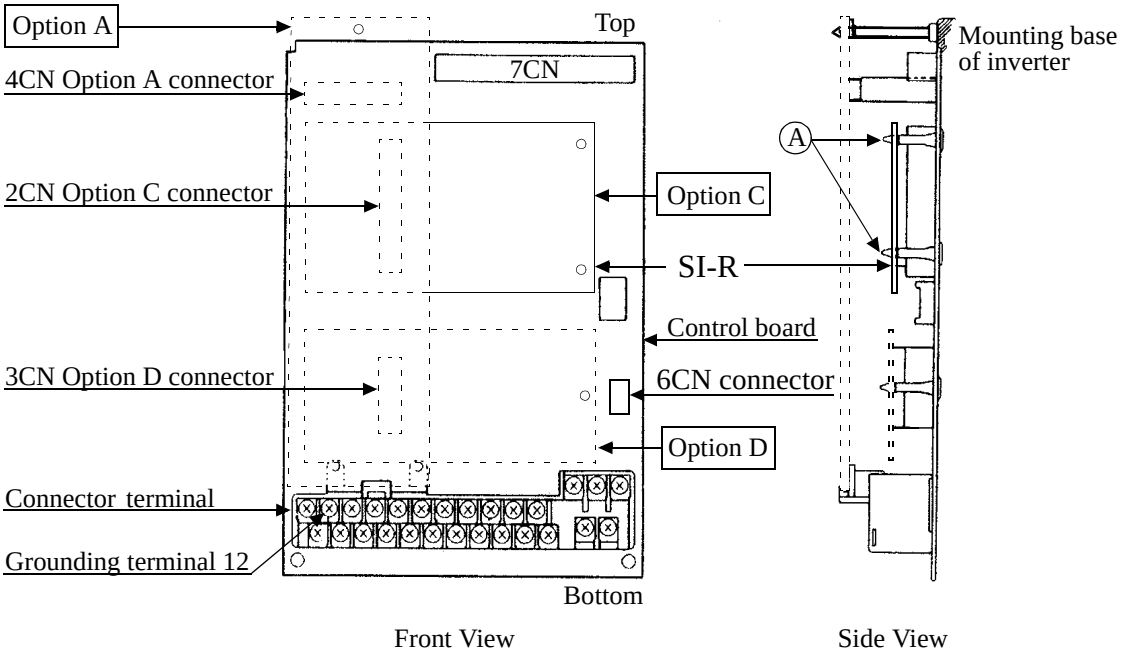

Fig. 2 Installation of the InterBus-S Control Card SI-R

⚠CAUTION

WIRING NOTES

1. Separate the control signal wires (on the option card terminal block) from the main circuit wires and other power cables.
2. Use twisted shielded wire. Prepare the wire as shown in Fig. 3 to prevent noise interference.

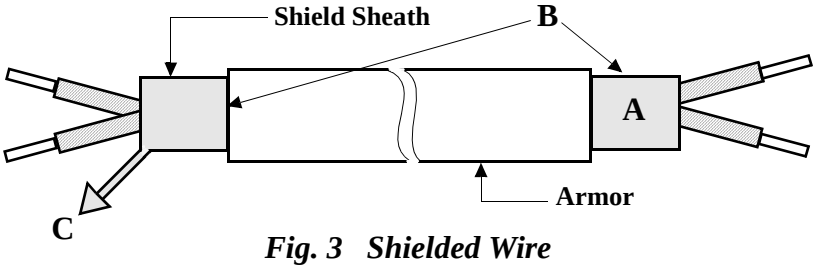

Fig. 3 Shielded Wire

A. **NEVER** connect the shield to ground.

B. **WRAP** insulating tape around shielded areas and wires where termination occurs.

C. **CONNECT** the shielded wire end to the Grounding Terminal on the inverter control board.

3. Care must be taken when selecting twisted shielded wire in lengths exceeding 50 feet. The impedance of the wire should be low enough to ensure sufficient signal amplitude for proper operation of all communication equipment connected to the InterBus-S Control Card SI-R. In general, as the length of wire is increased, the cross section or gauge must also increase.
4. Please observe National Electrical Code (NEC) and any other governing regional or local codes when wiring electrical devices.

Wiring Connection Notes:

1. To prevent noise, use shielded wire as specified in Fig. 3. Separate from the power circuits (100VAC or greater).
2. Terminate shielded wire correctly. (Refer to Fig. 3.)
3. Applicable wire sizes for the terminal block are listed in Table 2 below.

Table 2: Applicable Wire Sizes for Terminal Blocks JP1 and JP2

Wire / Installation Type	Cross-sectional Area [mm^2]	AWG	I [A]	VAC [V]
Thin twisted wire	1	16	12	125
Solid wire	1.5	16	12	125
UL	—	22-16	10	300
CSA	—	26-16	10	300
CSA	—	26-16	10	150

WIRING

InterBus-S Terminal Blocks

The InterBus-S network cables are connected to the option board on the left side of the module, using the two terminal blocks (Phoenix contact MKDS1-6 and MKDS1-7). There is one terminal block (JP1) for the remote bus IN (i.e., from the previous InterBus-S unit), and one terminal block (JP2) for the remote bus OUT (i.e., to the next InterBus-S unit). The pin layout of the connectors follows the InterBus-S standard. (Refer to Table 3 below.)

Table 3: InterBus-S Pin Layout

Bus IN (JP1)	
Pin	Function
1	DO1
2	/DO1
3	DI1
4	/DI1
5	GND BUS
6	SHIELD
—	—

Bus OUT (JP2)	
Pin	Function
1	DO2
2	/DO2
3	DI2
4	/DI2
5	GND
6	RBST
7	PE

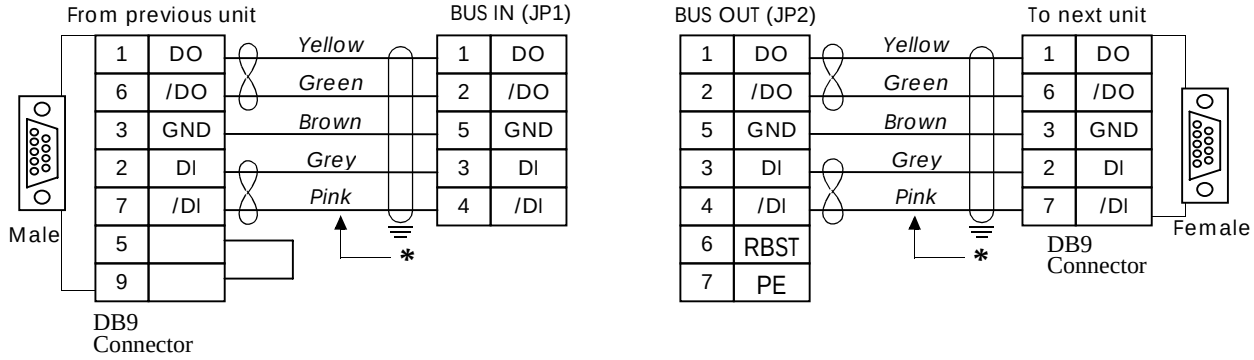

Fig. 4 Wiring of the InterBus-S Control Card SI-R

Note: If the InterBus-S option card is the last unit on the bus, the RBST signal must be connected to GND as illustrated below.

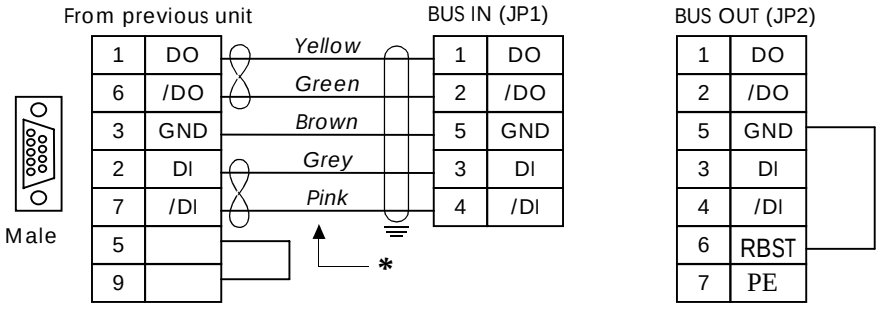

Fig. 5 Installation of the RBST signal

* Standard color coding of InterBus-S communications cable

Option Card LEDs

The option card is equipped with six LED indicators, as illustrated in Fig. 6 below.

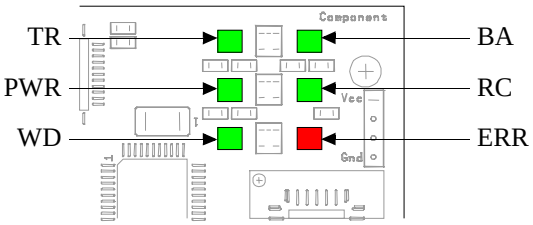

Fig. 6 LED Indicators

Table 4: InterBus-S Module Status - LED Indicators

LED	Color	Indication/Function
PWR	Green	Lit when the +5V supply is OK on the board
WD	Bi-color Red/Green	Indicates module status as follows: Turned off: Option board CPU not running Lit Green: Option board initialization Flashing green: Normal operation Lit red: Internal option board error Flashing red: G5 error detected Other unspecified: Option board error
TR	Green	TR Flashes when a new PCP frame has been received. (The flash rate is high; consequently the user may not be able to see this.)
BA	Green	Bus Active Lit only when the InterBus-S is running.
RC	Green	Remote bus check Lit only when the input cable is connected.
ERR	Red	ERROR indication Lit when an InterBus-S error has been detected. When the InterBus-S is restarted, the LED is turned off.

INTERBUS-S FUNCTION

InterBus-S System Description

The following contains a brief technical and functional description of the InterBus-S standard. For a more detailed description, please consult the InterBus-S specification.

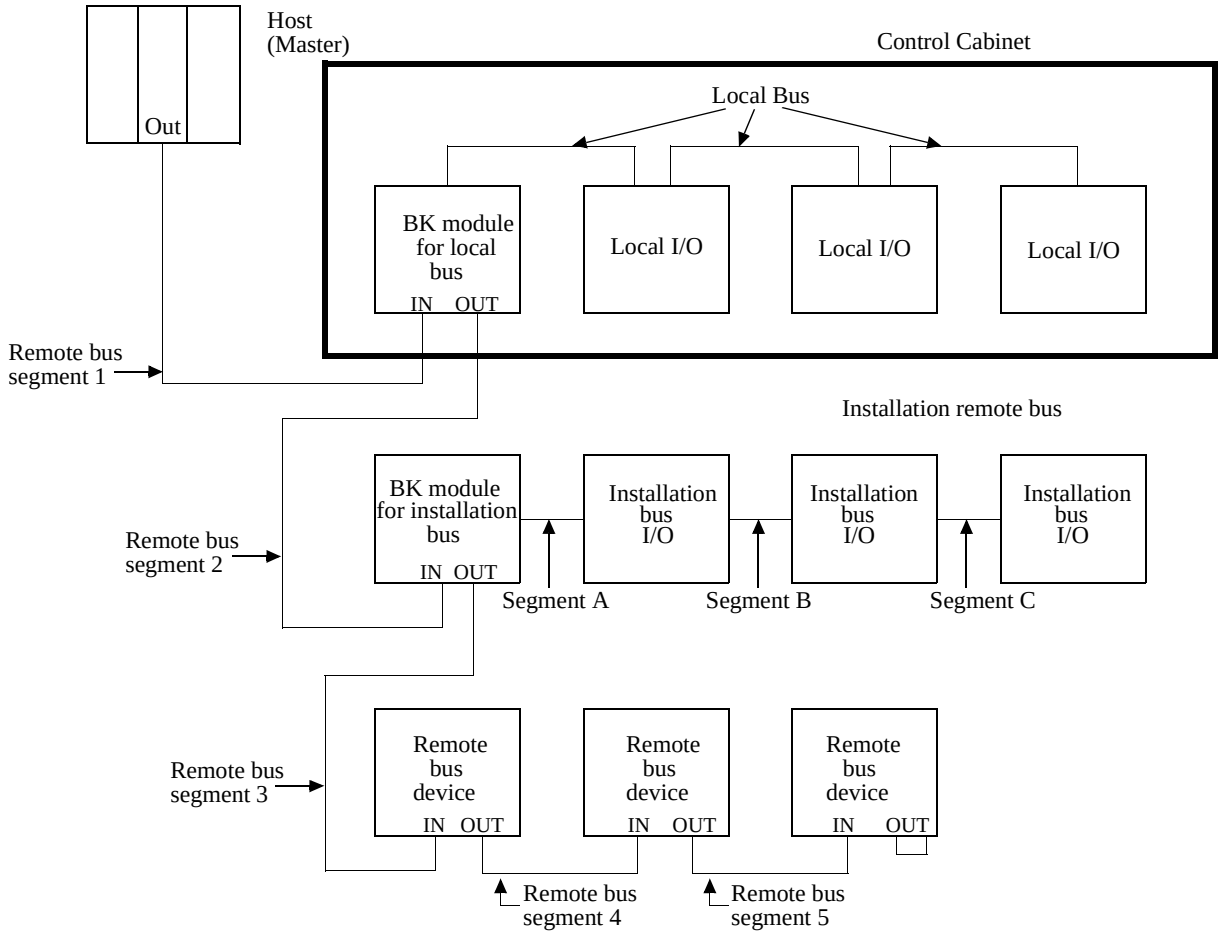

Fig. 7 InterBus-S Topology

Notes:

Each segment (1, 2, 3, 4, or 5) length ≤ 400m
Total segment (1 + 2 + 3 + 4 + 5) ≤ 2Km
Maximum 256 segments with total length < 12.8Km

InterBus-S Remote Bus Data

The remote bus bridges large distances within the system. The entire remote bus can be up to 12.8 km in length (from the host to the last connected remote bus module). This is achieved by dividing the entire remote bus into individual segments.

A remote bus segment consists of the transmission line (remote bus cable), and the bus module connected to it; a remote bus segment can bridge up to 400 m. The complete remote bus can thus be subdivided into 256 remote bus segments.

The local bus is for use inside the control cabinets. The local bus carries signals, power, and control to the local bus I/O modules.

The installation remote bus is used mainly in IP65 or IP67 environments and is a remote bus with 24VDC power for remote installation I/O modules.

Table 5: Basic Remote Bus Specifications

Maximum length of remote bus segment	400m
Maximum bus cable length between:	—
Host and first remote bus module	400m
Two remote bus modules	400m
Host and last remote bus module	12.8 km
Transmission rate	500kbits/s
Transmission medium	RS-422

The scan time of the InterBus-S system depends on the various factors and increases linearly with an increasing number of I/O points. However, due to the efficiency of the InterBus-S protocol, the scan time is predominantly determined by the number of I/O points.

The SI-R option card for the VS-616G5 is a remote bus device only.

Controlling the Inverter Via InterBus-S

The option board is a 4 word InterBus-S remote bus slave unit with a 1 word PCP channel. This means that the board can exchange data in two ways:

1. Through the InterBus-S fast cyclic data (3 words) of 16 bit data
2. Through PCP (Peripheral Communication Protocol)

Cyclic data

The board supports 3 words of fast cyclic data. The data exchanged supports the following functions and parameters:

Input data

(IBS master ⇒ VS-616G5)

Word 0	*Word 1*	*Word 2*	*Word 3*
Fast data w0	Fast data w1	Fast data w2	PCP
Not used	Run Operation Signals (See Table 6)	Speed command (1hex = 0.01Hz)*	Used by PCP protocol

* 1770 hex = 60.00Hz

Table 6: Input Data: Run Operation Signals

Bit No	Description	Remarks
0	Forward run	Effective when the setting is B1-02 = 3
1	Reverse run	Effective when the setting is B1-02 = 3
2	Terminal 3 function	Dependent on H1-01 setting
3	Terminal 4 function	Dependent on H1-02 setting
4	Terminal 5 function	Dependent on H1-03 setting
5	Terminal 6 function	Dependent on H1-04 setting
6	Terminal 7 function	Dependent on H1-05 setting
7	Terminal 8 function	Dependent on H1-06 setting
8	External fault	—
9	Fault Reset	—
A	Not used	—
B	Not used	—
C	Not used	—
D	Not used	—
E	Not used	—
F	Not used	—

Output data

(VS-616G5 ⇒ IBS master)

Word 0	*Word 1*	*Word 2*	*Word 3*
Fast data w0 Not used	Fast data w1 Inverter status (See Table 7)	Fast data w2 Output frequency (1 hex = 0.01Hz)*	PCP Used by PCP protocol

* 1770 hex = 60.00Hz

Table 7: Output Data: Inverter Status

Bit No.	Description
0	Running
1	Zero speed
2	Reverse running
3	Reset command receiving
4	Speed agree
5	Inverter ready
6	Minor fault
7	Major fault
8	OPE error
9	During momentary power ridethrough
A	Local/Remote
B	Terminal 9-10 output
C	Terminal 25 output
D	Terminal 26 output
E	Motor selection
F	Zero servo completion (FV control mode only)

Peripheral Communications Protocol (PCP)

The PCP channel supports three objects:

ID	Name	Data type	Access
6800 (HEX)	ACCELERATION	16 bit integer	R/W
6801 (HEX)	DECELERATION	16 bit integer	R/W
6802 (HEX)	MODBUS COMMAND	ARRAY (3 x 16 bit integer)	R/W

The SI-R board uses one-word PCP channel communications. The board supports only up to four cycles per PCP communication. In other words, the PCP communication message can only be up to four words long.

Object 6800 (Acceleration Time 1)

Using this parameter the IBS master can read and write ACCELERATION TIME 1 in the inverter. The object is accessed with PCP service read or write parameter.

Object 6801 (Deceleration Time 1)

Using this parameter the IBS master can read and write DECELERATION TIME 1 in the inverter. The object is accessed with PCP service read or write parameter.

Object 6802 (MODBUS Commands)

Using this parameter the IBS master can access the inverter parameters by sending MODBUS commands. A MODBUS command is sent to the G5 option card with PCP service write parameter and the result is accessed with PCP service read parameter.

The MODBUS command is entered in an array of integers. The command has the following structure:

Word	*Name*	*Description*
1	MODBUS command	Word1 = 0003 (HEX) = Read command 0010 (HEX) = Write command Other commands will result in an error response.
2	Address	Word2 = Inverter internal address (HEX)
3	Data	Word3 = Command data

The MODBUS response has the following structure:

Word	*Name*	*Description*
1	MODBUS response	Word1 = 0000 (HEX) = Waiting for response from inverter 0003 (HEX) = Data contains read response 0010 (HEX) = Write complete 0083 (HEX) = Read command error 0090 (HEX) = Write command error
2	Address	Word2 = Inverter address
3	Data	Word3 = Response data or ERROR code

If a fault occurs, the option card indicates an ERROR response by setting the MSB bit in the MODBUS Response code to one (1). The data word then contains the ERROR code.

Error	Error Code	Description
Function error	01H	Unregistered MODBUS function code.
Address fault	02H	Parameter address (Starting address) is greater than 600H. Designate unused parameter address.
No. of data faults	03H	Read more than 4 words. Write more than 4 words.
Data content fault	21H	Parameter contents exceed the upper or lower limit.

Write fault	22H	Parameters are changed during running or undervoltage condition.
	23H	Write parameter during undervoltage.
	24H	Write parameter during calculating parameter.

Examples of using Modbus PCP on SI-R

A. Read value of inverter torque reference:

Parameter U1-09, address 28 hex

Send message: Word1 = 0003 (read)
Word2 = 0028 (U1-09 address 28h)
Word3 = 0000 (no data)

Receive message: Word1 = 0003 (read resp)
Word2 = 0028 (U1-09 data)
Word3 = 03E8 (100.0% value)

B. Actual fast cycle data of example above:

Inverter is running forward at 30.00Hz

		Word0	Word1	Word2	Word3
Sending	1st message	0000	0001	0bb8	6802
	2nd message	0000	0001	0bb8	0003
	3rd message	0000	0001	0bb8	0028
	4th message	0000	0001	0bb8	0000
Receiving	1st message	0000	2C31	0bb8	6802
	2nd message	0000	2C31	0bb8	0003
	3rd message	0000	2C31	0bb8	0028
	4th message	0000	2C31	0bb8	03E8

For complete details on Modbus communication with the VS-616G5, please contact your nearest Yaskawa representative and ask for Document # PI95029, Modbus Communication.

Using the Phoenix Contact PCPM Software

A printed example of how to use the SI-R InterBus-S communication card with the Phoenix Contact PCPM software program is available from Yaskawa Electric America, Inc. If you require this document, please contact your local Yaskawa representative and ask for Document # SI98001, PCPM Software for the SI-R.

Related-Parameters

Parameter Number	Name	Description	Factory Setting
b1-01	Frequency Reference Selection	0: Digital Operator 1: Terminal 2: Serial Communication 3: Option (Frequency Reference comes from SI-R option card.	1
b1-02	Operation Method Selection	0: Digital Operator 1: Terminal 2: Serial Communication 3: Option (Run Command comes from SI-R option card)	1
F9-01	EF0* Contact Mode Selection	0: Fault at “1” 1: Fault at “0”	0
F9-02	EF0 Detection Mode Selection	0: Always detected 1: Only detected while in operation	0
F9-03	EF0 Stop Method Selection	0: Ramp to stop according to C1-02 setting 1: Coast to stop 2: Ramp to stop according to C1-09 setting (fast-stop) 3: Operation continues, alarm only	1
F9-04	Trace Sample Time	This parameter has no effect on SI-R card	0
F9-05 ***	Torque Reference/Limit Selection	***Flux Vector Control Mode Only:*** 0: Torque Reference/Limit from option disabled 1: Torque Reference/Limit from option enabled	1
F9-06	BUS** Stop Method Selection	0: Ramp to stop according to C1-02 setting 1: Coast to stop 2: Ramp to stop according to C1-09 setting (fast-stop) 3: Operation continues, alarm only	1

Notes:

***** EF0: External Fault Signal from Serial Communication Option Card (SI-R). Operation Signal Bit 8.

****** BUS: Serial Communication Error between Serial Communication Option Card (SI-R) and PLC.

***F9-05: Torque Reference/Limit Selection:
Due to Torque Reference/Limit, cannot be set via SI-R option parameter F9-05. **MUST** be set to “0” (Torque Reference/Limit from option disabled) when control method is set to “Flux Vector Control” (A1-02 = 3).

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YASKAWA
Energy In Motion™

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: (937) 847-6200 Fax: (937) 847-6277

YASKAWA ELECTRIC CORPORATION
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo, 105-0022, Japan
Phone: 81-3-5402-4511 Fax: 81-3-5402-4580 Internet: http://www.yaskawa.co.jp

YASKAWA ELETRICO DO BRASIL COMERCIO LTDA.
Avenida Fagundes Filho, 620 Bairro Saude Sao Paolo-SP, Brasil CEP: 04304-000
Phone: 55-11-5071-2552 Fax: 55-11-5581-8795 E-mail: 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

MOTOMAN ROBOTICS AB
Box 504 S38525, Torsas, Sweden
Phone: 46-486-48800 Fax: 46-486-41410

MOTOMAN ROBOTEC GmbH
Kammerfeldstraβe 1, 85391 Allershausen, Germany
Phone: 49-8166-900 Fax: 49-8166-9039

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, Scotland, United Kingdom
Phone: 44-12-3673-5000 Fax: 44-12-3645-8182

YASKAWA ELECTRIC KOREA CORPORATION
Paik Nam Bldg. 901 188-3, 1-Ga Euljiro, Joong-Gu, Seoul, Korea
Phone: 82-2-776-7844 Fax: 82-2-753-2639

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
Head Office: 151 Lorong Chuan, #04-01, New Tech Park Singapore 556741, SINGAPORE
Phone: 65-282-3003 Fax: 65-289-3003

TAIPEI OFFICE (AND YATEC ENGINEERING CORPORATION)
10F 146 Sung Chiang Road, Taipei, Taiwan
Phone: 886-2-2563-0010 Fax: 886-2-2567-4677

YASKAWA JASON (HK) COMPANY LIMITED
Rm. 2909-10, Hong Kong Plaza, 186-191 Connaught Road West, Hong Kong
Phone: 852-2803-2385 Fax: 852-2547-5773

BEIJING OFFICE
Room No. 301 Office Building of Beijing International Club,
21 Jianguomanwai Avenue, Beijing 100020, China
Phone: 86-10-6532-1850 Fax: 86-10-6532-1851

SHANGHAI OFFICE
27 Hui He Road Shanghai 200437 China
Phone: 86-21-6553-6600 Fax: 86-21-6531-4242

SHANGHAI YASKAWA-TONJI M & E CO., LTD.
27 Hui He Road Shanghai 200437 China
Phone: 86-21-6533-2828 Fax: 86-21-6553-6677

BEIJING YASKAWA BEIKE AUTOMATION ENGINEERING CO., LTD.
30 Xue Yuan Road,Haidian, Beijing 100083 China
Phone: 86-10-6232-9943 Fax: 86-10-6234-5002

SHOUGANG MOTOMAN ROBOT CO., LTD.
7, Yongchang-North Street, Beijing Economic & Technological Development Area,
Beijing 100076 China
Phone: 86-10-6788-0551 Fax: 86-10-6788-2878

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