YASKAWA

VARISPEED SERIES OPTION CARD
CC-Link COMMUNICATION INTERFACE CARD
INSTRUCTIONS

MODEL: SI-C
CONFORMS TO CC-Link VER.1.10

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

YASKAWA

MANUAL NO. TOBZ-C736-70.6

INTRODUCTION

This Instruction Manual describes operations and specifications of the General-purpose Inverter VARISPEED Series and the CC-Link Communication Interface Card SI-C that is connected to the MITSUBISHI FA Field Network CC-Link for data communications. Read this manual and the SI-C User's Manual (SIEZ-C736-70.7) carefully and be sure you understand the infrormation provided before attempting any operations.

For handling of the inverter unit, refer to the VS-616G5 Series Instruction Manual (TOE-S616-10.30) and Varispeed F7 Series Instruction Manual (TOE-S616-55.1).

YASKAWA ELECTRIC CORPORATION

General Precautions

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe the details with more clarity. Make sure all covers and shields are replaced before operating this product, and operate it in accordance with the instructions in this manual.
- This manual may be modified when necessary because of improvements of the product, modification, or changes in specifications.
- A new version of the manual will be released under a revised manual number when any changes are made.
- Contact your Yaskawa representative or a Yaskawa office listed on the back of this manual to order a new manual if this manual is damaged or lost. Please provide the document number listed on the front cover of this manual when ordering.
- Yaskawa cannot guarantee the quality of any product which have been modified by the user. Yaskawa assumes no responsibility for any injury or damage caused by such a modified product.

Safety Information

Read this instruction manual and the related documents thoroughly before installation, operation, maintenance or inspection of this product. Make sure you understand product information, all precautions and safety information before using the product. Also, keep this manual in a convenient location so that it can be referred to whenever necessary.

The following symbols are used to indicate precautions in this manual.

⚠ WARNING	Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.
⚠ CAUTION	Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

Even items described in ⚠CAUTION may result in a serious acccident in some situations.
In either case, follow these important notes.

NOTE

Items to be observed by users are described in the relevant sections.

■ Receiving

⚠ CAUTION
● Do not use any option unit which is damaged or has missing parts. Failure to observe this caution may result in injury.

■ Installation and Wiring

⚠ WARNING
● Never touch the inside of the Inverter. Failure to observe this warning may result in electric shock. ● Disconnect all power before mounting or removing the option unit or wiring. Then wait for at least the specified time (specified on the front cover) after the power supply is disconnected and all LEDs and CHARGE LED are extinguished. Failure to observe this warning may result in electric shock. ● Do not damage or apply excessive stress to the cables. Do not place heavy objects on the cables or place the cables between other objects. Failure to observe this warning may result in electric shock, malfunction, or damage to the equipment.

⚠ CAUTION
● Do not touch the elements of the option card with bare hands. Failure to observe this caution may result in equipment damage caused by static electricity. ● Insert the connector firmly. Failure to observe this caution may result in malfunction or damage to the equipment.

■ Setting

⚠ CAUTION
● Be careful when changing Inverter settings. The Inverter is set to suitable settings. Failure to observe this caution may result in damage to the equipment.

Contents

1 OUTLINE

The CC-Link Communication Interface Card SI-C is an interface card to achieve data communication with the CC-Link Master by connecting the VARISPEED Series to MITSUBISHI FA Network CC-Link, and is conforming to the CC-Link version 1.10.

This SI-C supports to run or stop the inverter, monitor the operation status, to specify or change various constants in the inverter from the CC-Link master.

The following is the inverter series on which the SI-C option card can be installed.

VS-616G5: Standard series (inverter software No. S1042 and later)

Varispeed F7: Standard series

2 RECEIVING

Products are rigorously inspected before delivery. Confirm the following points before installation.

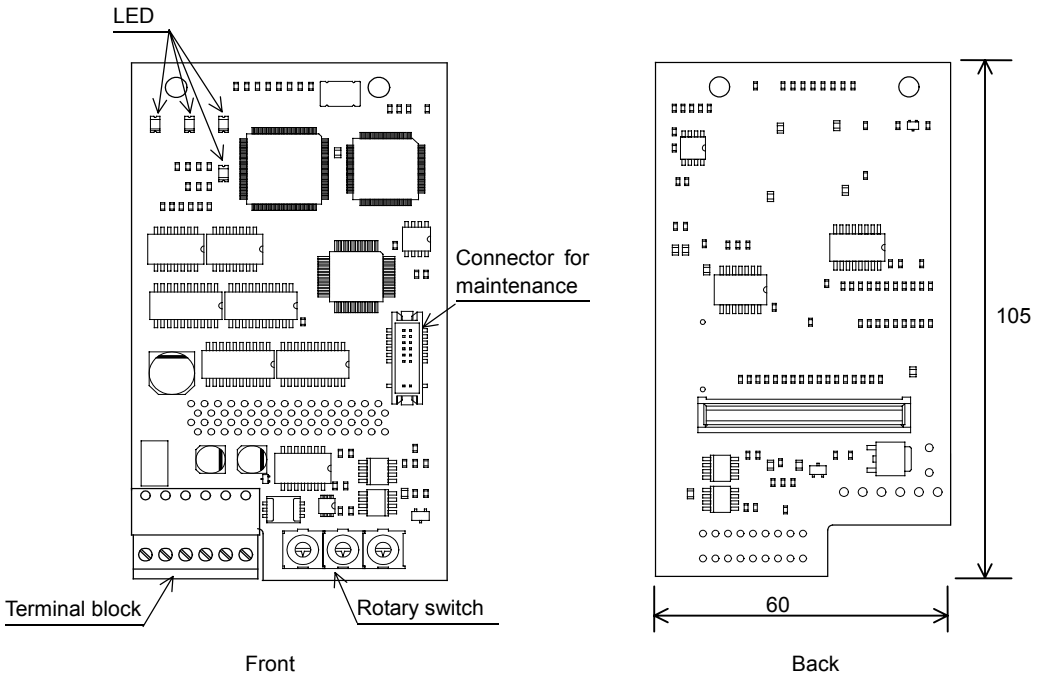
Item	Inspection Method
Is the product what you have ordered?	Check it with the the number printed in the lower right cornerof the SI-C card.
Is the inverter damaged?	Check the SI-C card visually for any damage that may have occurred during transport.

Contact your Yaskawa representative immediately if any problem should be found concerning the shipment.

3 NOMENCLATURE AND SETTINGS

3.1 Components

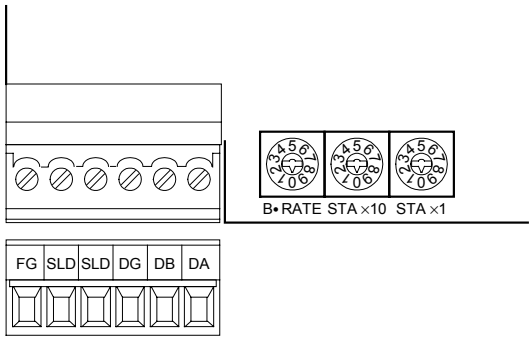
The appearance of the SI-C option card and the name of its components are shown below.



3.2 Terminal Block

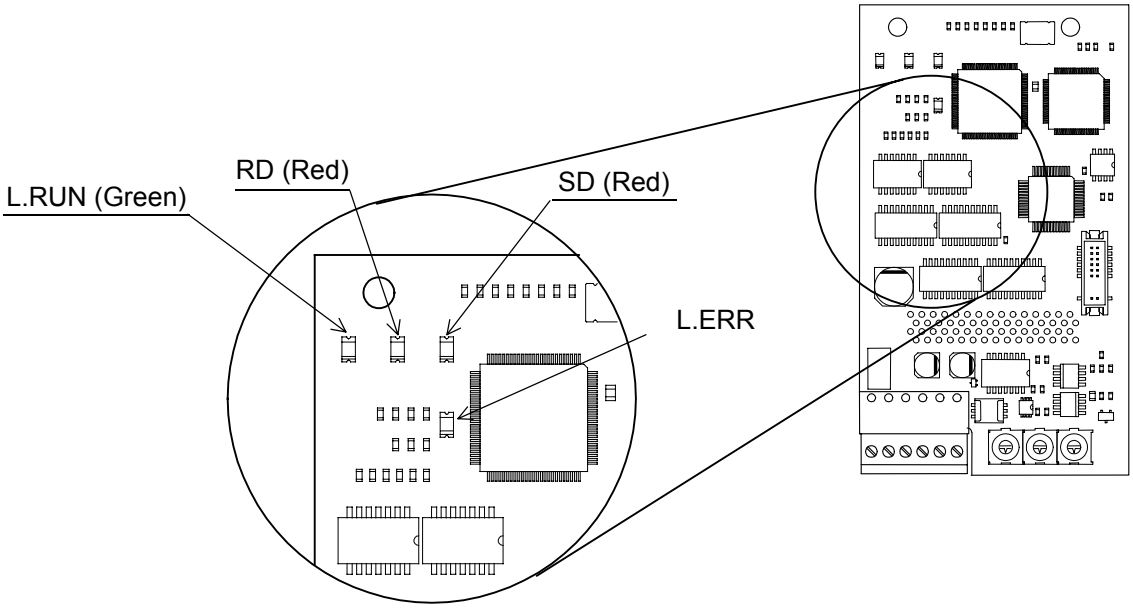
The table below shows CC-Link bus connection terminals.

Terminal No.	Name	Contents
1	DA	Communication data +
2	DB	Communication data -
3	DG	Signal grounding
4	SLD	Shield
5	SLD	Shield
6	FG	Grounding



3.3 LED

These LED indicator lamps indicate the status of the CC-Link or the SI-C.

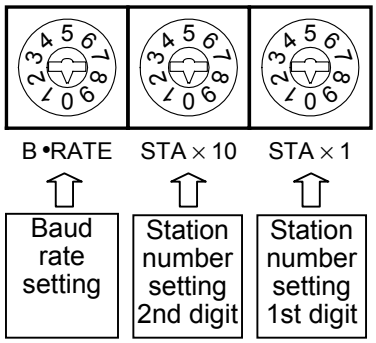


LED display				Meaning	Operator display	Corrective action
L.RUN (Green)	SD (Red)	RD (Red)	L.ERR (Red)			
☼	☼	☼	☼	Normal but an error occurring.	Normal	Remove the influence of noise.
☼	☼	☼	●	Normal	Normal	
☼	☼	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
☼	☼	●	●	H/W error	CAL or BUS	Turn ON the power supply again.
☼	●	☼	☼	A CRC error occurred and the SI-C cannot replay.	Normal	Remove the influence of noise.
☼	●	☼	●	A local data cannot be received.	CAL or BUS	Confirm the PLC program.
☼	●	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
☼	●	●	●	H/W error	CAL or BUS	Turn ON the power supply again.
●	☼	☼	☼	Polling response is made but an CRC error occurred in refresh receiving.	Normal	Remove the influence of noise.
●	☼	☼	●	H/W error	CAL or BUS	Turn ON the power supply again.
●	☼	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
●	☼	●	●	H/W error	CAL or BUS	Turn ON the power supply again.
●	●	☼	☼	A CRC data occurred in a local data.	Normal	Remove the influence of noise.
●	●	☼	●	A local data is not provided or cannot be received because of noise.	CAL or BUS	Remove the influence of noise.
●	●	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
●	●	●	●	Data cannot be received because of disconnection, etc.	CAL or BUS	Check the wiring.
●	●	*	☼	Baud rate or station number is not correct.	Normal	Correct the setting and turn the power supply OFF and then ON again.
☼	☼	☼	☼	Baud rate or station number is changed after the power supply is turned ON.	Normal	Return the setting to the former setting. Turn ON the power supply again.

☼ : Lit ☼ :Blinking ● :Not lit *: Either blinking or not lit

3.4 Rotary Switch

These switches set the baud rate and station number of the CC-Link.



NOTE

Set these three setting switches before turning ON the inverter power supply. Do not change the settings after turning ON the power supply. Be sure to change the settings after turning ON the inverter power supply.

■Baud Rate Setting Switch

Switch	0	1	2	3	4
Communication Speed	156 kbps	625 kbps	2.5 Mbps	5 Mbps	10 Mbps

Note: If setting this switch to 5 or above, the LED lamp "L.ERR" lights, resulting in a communication error.

■Station No. setting switches

1.Set the station number in the range from 1 to 64.

"STA×10" sets the 2nd order of the station number.

"STA×1" sets the 1st order of the station number.

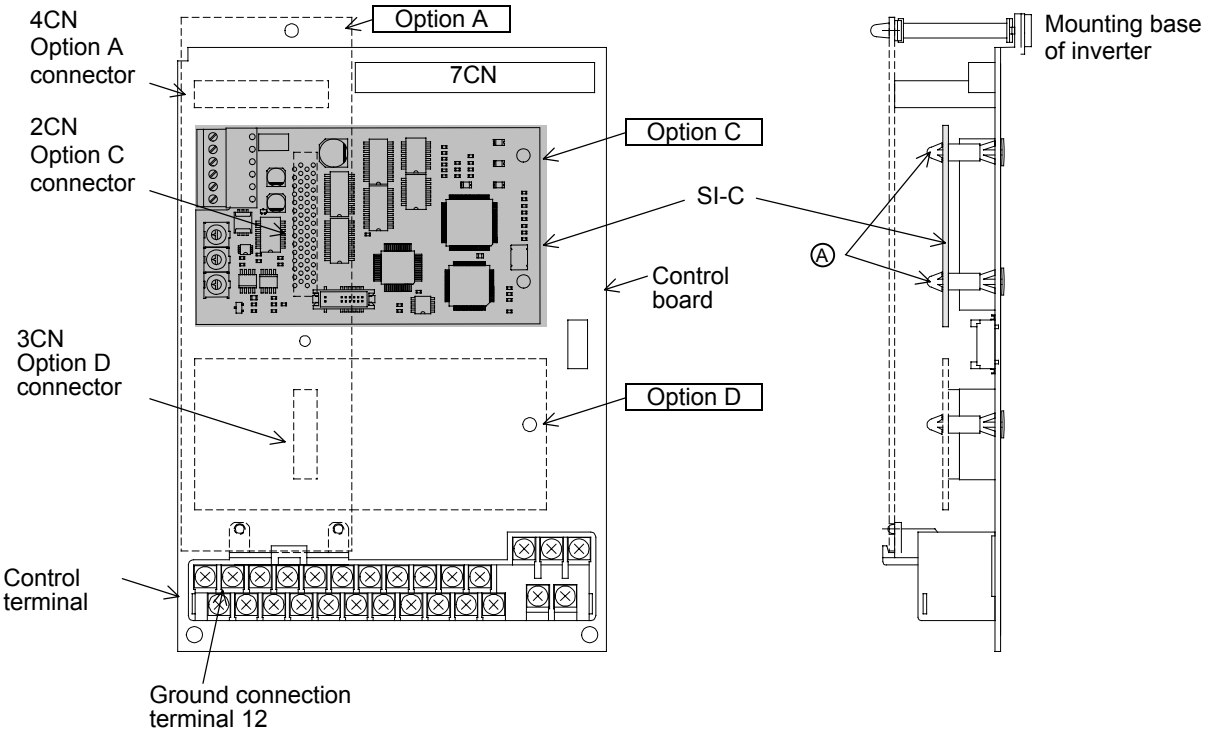
2.The station number cannot be overlapped. Confirm that the station number to be set has not been set for any other stations.

4 INSTALLATION AND WIRING

4.1 Installation

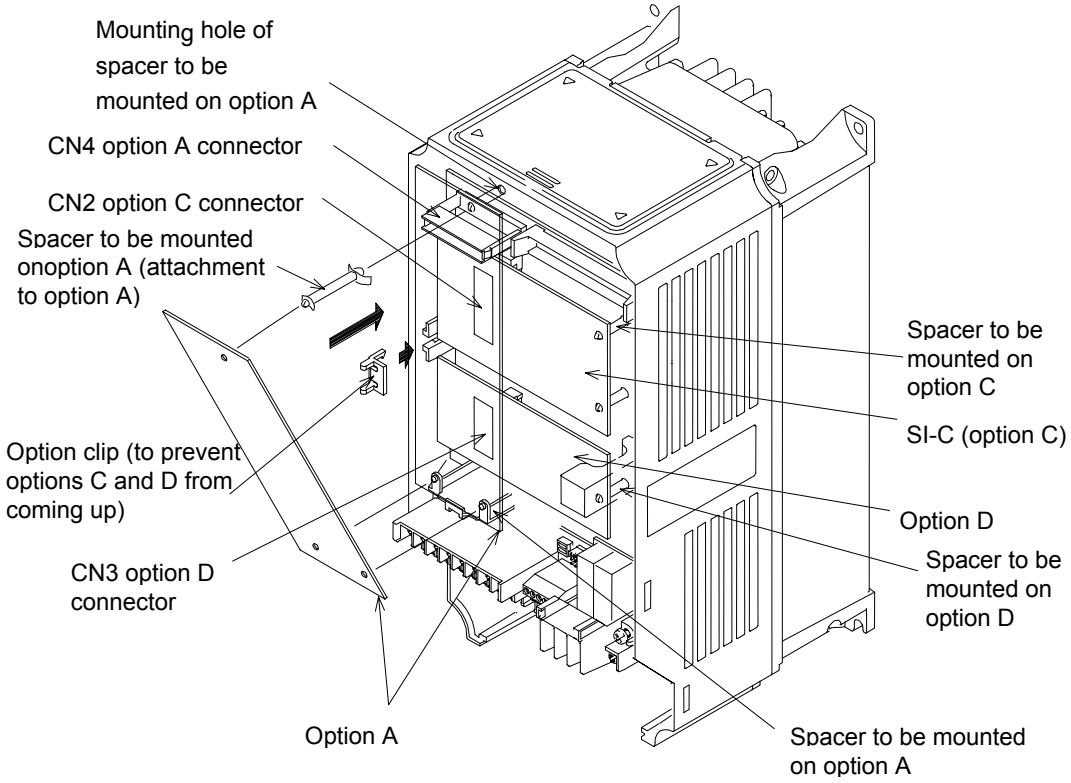
The SI-C Communication Interface Card is mounted on the control board with the front cover of the inverter removed. Mount the card in accordance with the following procedure.

1. Remove the digital operator and the front cover and then wait at least one minute (three minutes for the inverter of 30 kW or more) after turning OFF the inverter power supply. Confirm that the CHARGE indicator lamp has been extinguished.
2. Mount this option card on option C connector 2CN (60-pin) on the inverter control board. At this time, insert the two option card spacer mounting holes into the spacer for the option card on the control board until a click is heard. (See section Ⓐ in the Side View of the following diagrams.)
3. After mounting the option card, connecting the communication cables and setting the rotary switches, re-install the front cover and the operator.



Front View (G5 Series)

Side View (G5 Series)



F7 Series

NOTE

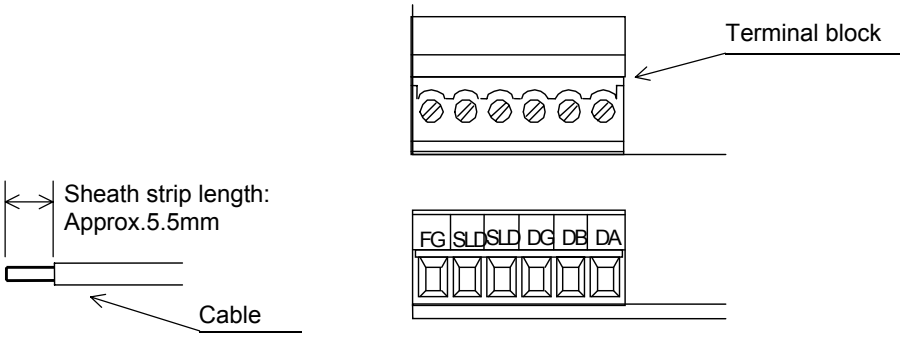
When installing the SI-C card, handle it by the edges to prevent damaging the card.

4.2 Wiring of CC-Link Cable

■Wiring

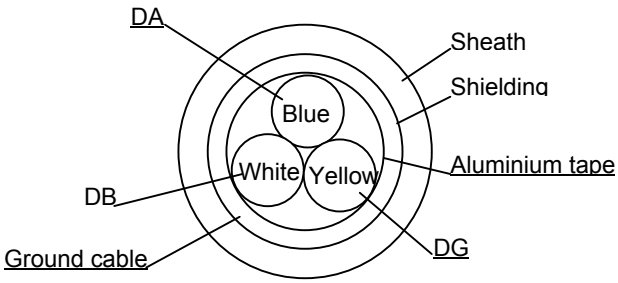
Follow the steps below to wire the CC-Link communication cable on the terminal block.

1. Use a thin flat screwdriver to loosen the screws.
2. Insert the cable from the bottom of the terminal block.
3. Tighten the terminal screws so firmly that the cable will not be removed.
   (Tightening torque: 0.22 to 0.25 [N • m])



■Cable Specifications

Be sure to use a cable of the following specifications as the communication cable. Any cable other than the recommended cable shown below cannot assure the performance of the CC-Link.

Item	Specifications
Model	FANC-SB 0.5 mm^2×3 [Manufactured by Kuramo Electric Co., Ltd]
Conductor cross-sectional area	0.5mm^2
Conductor resistance (at 20°C)	37.8Ω/km or less
Insulation resistance	10000MΩ/km or more
Withstand voltage	500 VDC for one minute
Static electricity (1 kHz)	60nF/km or less
Impedance	100±15Ω
Cross-section	
External dimensions	7mm
Approx. mass	65kg/km

Note: 1. Separete the CC-Link communication cable from the main circuit wiring or other power cables.

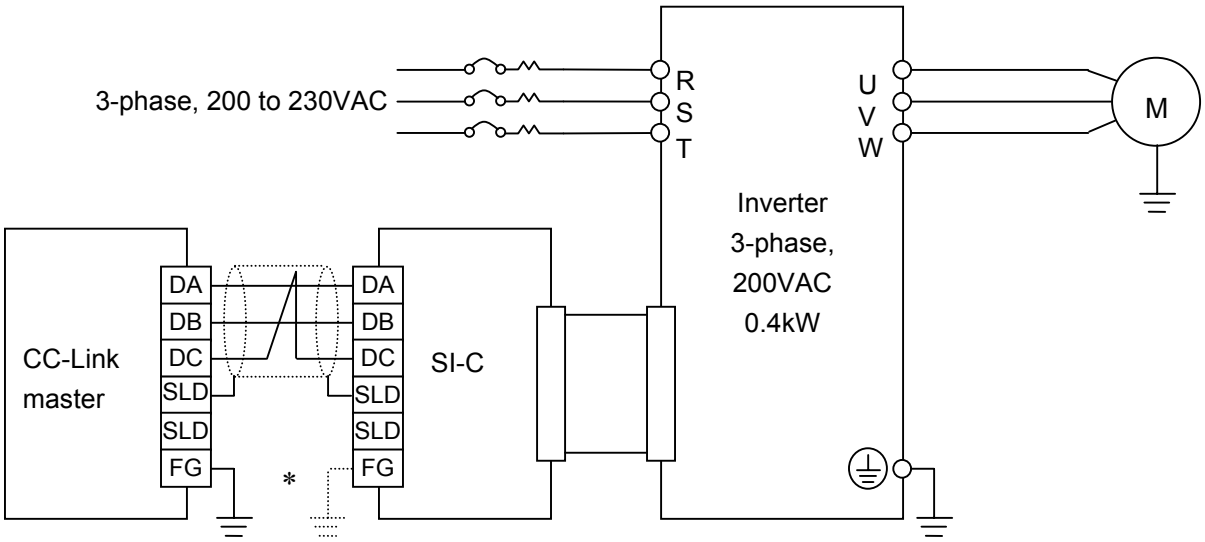
2. There is a scale indiation of 5.5 mm on the top of the terminal block in the front face of the SI-C.
Use this scale to confirm the strip length.

■Connection of Termination Resistor

When the SI-C is connected to the communication line as the end unit, connect an termination resistor between terminals DA and DB. Use the termination resistor attached to the master unit or any one of 110Ω, 1/2W on the market.

4.3 Interconnection

The figure below shows the interconnection between the inverter, the SI-C card and the CC-Link master.



* Ground the terminal only when a communication error occurs.

5 FUNCTIONS

SI-C is a communication interface card to execute operation, adjustment and monitoring using the PLC program with the VS-616G5 as a remote device station of the CC-Link. Both the bit data and the word data cyclic transmission are enabled, and high-speed communications up to 10 Mbps is available.

5.1 Initial Setting

■G5 Series

Execute the following constant setting, whenever necessary, before starting communications between the inverter and the PLC.

Constant No.	Name Operator Display	Description	Factory Setting
b1-01	Reference selection *1 Reference Source	0: Digital Operator 1: Control circuit terminals (analog inputs) 2: MEMOBUS communication (using SI-K2) 3: Option Card 4: MEMOBUS communication (for CP-717)	1
b1-02	Run command selection *1 Run Source	0: Digital Operator 1: Control circuit terminals (sequence inputs) 2: MEMOBUS communication (using SI-K2) 3: Option Card 4: MEMOBUS communication (for CP-717)	1
F9-01	External Fault Input Level from Optical option E-15 Selection	0:NO contact (external fault at "1") 1:NC contact (external fault at "0")	0
F9-02	External Fault from Optical Option EF0 Detection	0: Always detect 1: Detect during run	0
F9-03	Action for external fault from Optical option EF0 ERROR SELECT	0: Deceleration to stop/fault detection at C1-02 set time 1: Coast to stop/fault detection 2: Deceleration to stop/fault detection at CI-09 set time 3: Continue operation/warning *2	1
F9-04	Optical option trace sampling time Trace Sample Time	Do not set this constant since it is not used for SI-P card.	0
F9-05	Torque reference/torque limit selection from communication cards other than SI-K2 *3 Torq/Ref/Lmt Sel	0: Torque reference/torque limit from communication disabled 1: Torque reference/torque limit from communication enabled *4	1
F9-06	Operation selection when transmission error detected for communication cards other than SI-K2 BUS Fault Sel	0: Deceleration to stop/fault detection at C1-02 set time 1: Coast to stop/fault detection 2: Deceleration to stop/fault detection at CI-09 set time 3: Continue operation/warning *2	1
H5-04	Operation selection when transmission error detected Transmission Error Sel	Select the stopping method when a transmission error is detected. 0: Deceleration to stop 1: Coast to stop 2: Emergency stop 3: Continue operation	3

*1. To run/stop through the CC-Link communications from the PLC, set "3" to b1-02. To set frequency, set "3" to b1-01.

*2. Selecting "Continuous operation" continues the operation with the inverter single-unit at fault occurrence. Therefore, provide some other measures (emergency stop switch, etc.) to assure safe operation.

*3. Enabled when "3: flux vector control" is selected at A1-02 (control mode selection). In this case, d5-01 (torque control selection) setting alternates torque reference and torque limit.
d5-01 = 0 (speed control mode) : Torque limit value
d5-01 = 1 (torque control mode) : Torque reference value

*4. When "1: Enabled" is selected for F9-05 (factory setting), the motor may not rotate unless torque reference/torque limit is set from the PLC.

■F7 Series

Constant No.	Name	Description	Factory Setting
b1-01	Reference selection *1	Set the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input) 2: MEMOBUS communication 3: Option Card 4: Pluse train input	1
b1-02	Run command selection *1	Set the run command input method 0: Digital Operator 1: Control circuit terminal (sequence input) 2: MEMOBUS transmission 3: Option Card	1
F6-01	Stopping method after communications error	Set the stopping method for communications errors. 0: Deceleration stop using deceleration time in C1-02. 1: Coast to stop 2: Emergency stop using deceleration time in C1-09 3: Continue operation *2	1
F6-02	Input level of external error from Communications Option Card	0: Always detect. 1: Detect during run.	0
F6-03	Stopping method for external error from Communications Option Card	0: Deceleration stop using deceleration time in C1-02 1: Coast to stop 2: Emergency stop using deceleration time in C1-09 3: Continue operation *2	1

5.2 Basic Functions

The following describes the basic functions that can be operated from the PLC using the CC-Link communication function.

■Run Command and Frequency Reference

Running or stopping the inverter, or setting or changning the operation frequency can be performed from the PLC. To perform these operations from the PLC, the inverter run command right and frquency commanding right must be set to the PLC side.

Switching by inverter constant setting

Run command right selection

b1-02 = 3: "Option card" (0: "External terminal" at factory setting)

Frequency commanding right selection

b1-01 = 3: "Option card" (0: "External terminal" at factory setting)

For the details, refer to the VS-616G5 Inverter Instruction Manual and the SI-C User's Manual.

■Monitor

The inverter status information can be monitored.

Set the monitor code to RW_{W0} and turn ON the RYC signal, and the data corresponding to the monitor code is stored in the PLC buffer memory.

For the monitor codes and the units, refer to the SI-C User's Manual.

■Constant Setting/Reading

Write-in/read-out of the inverter constants and status information, and inverter reset can be performed from the PLC.

Set the command code to RW_{W2} (also set the write-in data to RW_{W3} when necessary) and turn ON the RYF (command code execution request flag) signal, the inverter performs the processing corresponding to the command code and returns the data.

For the command codes and write-in data units and ranges, refer to the SI-C User's Manual.

5.3 List of CC-Link Data

■List of Remote Inputs and Outputs

The inverter uses the PLC buffer memory for one station. The following lists the inverter inputs and output viewed from the PLC. Refer to the MITSUBISHI PLC Programming Manual for details on the PLC buffer memory.

List of Remote Inputs and Outputs

Remote Input (from PLC to Inverter)			Remote Output (from Inverter to PLC)		
Device No.	Signal Name	Remarks	Device No.	Signal Name	Remarks
RY0	Forward run command		RX0	During forward run	
RY1	Reverse run command		RX1	During reverse run	
RY2	Terminal 3 multi-function input terminal function	Running (H1-01:24)	RX2	Terminals 9-10 multi-function output	Running (H2-01:0)
RY3	Terminal 4 multi-function input terminal function	Fault reset (H1-02:14)	RX3	Speed agree	
RY4	Terminal 5 multi-function input terminal function	Multi-step speed reference 1 (H1-03:3)	RX4	Reserved	
RY5	Terminal 6 multi-function input terminal function	Multi-speed rererence 2 (H1-04:4)	RX5	Reserved	
RY6	Terminal 7 multi-function input terminal function	Jog command (H1-05:6)	RX6	Terminal 25 multi-function output	Zero speed (H2-02:1)
RY7	Terminal 8 multi-function input terminal function	External baseblock	RX7	Terminal 26 multi-function output	Frequency agree (H2-03:2)
RY8	Not used		RX8	Not used	
RY9	Inverter output shutoff		RX9	Not used	
RYA	Not used		RXA	Not used	
RYB	Motor actual rotation speed /output frequency changeover *1	RW_{R1} data contents changeover	RXB	Monitoring actual rotation speed	
RYC	Monitor command		RXC	Monitoring	
RYD	Frequency setting command 1	RAM write-in	RXD	Completion of frequency setting 1	RAM write-in
RYE	Frequency setting command 2	Writing frequency reference 1	RXE	Completion of frequency setting 2	Writing frequency reference 1
RYF	Command code execution request		RXF	Completion of command code execution	
RY10 to RY18	Not used		RX10 to RX18	Not used	
RY19	Multi-function I/O allocation change request		RX19	Completion of multi-function I/O allocation change	
RY1A	Error reset		RX1A	Error	
RY1B	Not used		RX1B	Remote station ready	

Remote Input (from PLC to Inverter)			Remote Output (from Inverter to PLC)		
Device No.	Signal Name	Remarks	Device No.	Signal Name	Remarks
RY1C	Not used		RX1C	Not used	
RY1D	Not used		RX1D	Not used	
RY1E	Not used		RX1E	Not used	
RY1F	Not used		RX1F	Not used	

*1. Enabled when the control mode is set to the V/f control with PG and flux vector control.

*2. Never change the function of multi-function input 8.

List of Remote Registers

From PLC to Inverter			From Inverter to PLC		
Device No.	Name	Check Flag	Device No.	Name	Execution Request Flag
RW_{W0}	Monitor code	RYC	RW_{R0}	Monitor data	RXC
RW_{W1}	Setting frequency	RYA, RXB	RW_{R1}	Output frequency	RXA
RW_{W2}	Command code	RYF	RW_{R2}	Response code	RXF
RW_{W3}	Write-in data		RW_{R3}	Read-out data	

For the details, refer to the VS-616G5 Inverter Instruction Manual and the SI-C User's Manual (SIEZ-C736-70.7).

6 SPECIFICATIONS

Item	Specifications
Model	SI-C
Station type	Rmote device station
Number of Exclusive Stations	1 station
Communication speed	156kbps to 10Mbps
Communication Power Supply	4.75 to 5.25 VDC (supplied from inverter, insulated from operating power supply.)
Operating power supply	4.75 VAC to 5.25 VAC (supplied from inverter)
Ambient Temperature	-10°C to +50°C
Humidity	95%Rh max. (non-condensing)
Storage Temperature	-20°C to +60°C
Location	Indoor (free from corrosive gases, dust, etc.)
Altitude	1000 m max.

7 TROUBLESHOOTING

7.1 Inverter Faults

The following describes the faults, causes and corrective actions displayed on the VS-616G5 operator.

For any faults displayed on the operator other than described below, refer to the inverter instruction manual.

Fault Display	Contents	Cause	Corrective Action
OPE05 Sequence Select	Option card selection error	Although b1-01 (frequency commanding right) is set to "3", the option card (option C card) is not connected.	Connect the SI-C to the connector 2CN on the inverter control board.
BUS Option Com Err	Option card communication error	Disconnection of ommunication line. Power supply is not turned	Confrim that the communication line is connected. Check the PLC.
EF0 OPT External Flt	External fault from option card	An external error is input from the PLC.	Turn OFF the external fault input.
CPF06 Option Error	Option card connection error	The inverter is not connected properly to the transmission option.	Turn OFF the inverter power supply and check the connection of the SI-C and the inverter before turning ON the power supply again. If the fault lasts, replace the SI-C.
CPF20 Option A/D Error	Option card A/D converter error	The inverter and the option card are not connected properly. The option card A/D converter is defective.	Turn OFF the inverter power supply and check the connection of the SI-C and the inverter before turning ON the power supply again. If the fault lasts, replace the SI-C.
CPF21 Option CPU Down	Transmission Option card self diagnostic error	The transmission option is defective.	Turn ON the inverter power supply again. If the fault lasts, replace the option SI-C.
CPF22 Option Type Err	Transmission Option card model code error		
CPF23 Option DPRAM Err	Transmission Option card DPRAM error		

Note: For the details, refer to the VS-616G5 Inverter Instruction Manual and the SI-C User's Manual (SIEZ-C736-70.7).

7.2 CC-Link Interface Card LED Display

This section describes the failures, causes and corrective actions displayed in the LEDs on the SI-C.

Confirm the following points when communication is halted during run.

The SI-C and the twisted pair cable are mounted correctly.

(Check that there is no imperfect contact or disconnection.)

The PLC program has been executed without fail. The PLC CPU has not been stopped.

Data communication is not interrupted because of a momentary power failure, etc. The following describes how to check an error with the LED indicator lamps.

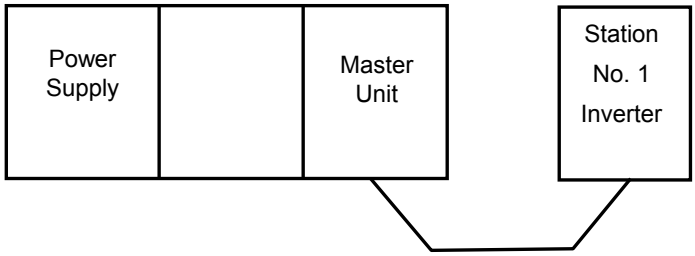
L.RUN: Lit when refresh data is received normally.
Extinguished when data is interrupted for a certain period.

SD :Lit when send data is "1".

RD :Lit at detection of receiving data carrier.

LERR :Lit when local data is CRC abort error.

The following outlines the causes and corrective actions of the failures that can be determined according to the LED status of the SI-C in a system configuration where one master is connected to one inverter.



LED display				Meaning	Operator display	Corrective action
L.RUN (Green)	SD (Red)	RD (Red)	L.ERR (Red)			
☼	☼	☼	☼	Normal but an error occurring.	Normal	Remove the influence of noise.
☼	☼	☼	●	Normal	Normal	
☼	☼	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
☼	☼	●	●	H/W error	CAL or BUS	Turn ON the power supply again.
☼	●	☼	☼	A CRC error occurred and the SI-C cannot replay.	Normal	Remove the influence of noise.
☼	●	☼	●	A local data cannot be received.	CAL or BUS	Confirm the PLC program.
☼	●	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
☼	●	●	●	H/W error	CAL or BUS	Turn ON the power supply again.
●	☼	☼	☼	Polling response is made but an CRC error occurred in refresh receiving.	Normal	Remove the influence of noise.
●	☼	☼	●	H/W error	CAL or BUS	Turn ON the power supply again.
●	☼	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
●	☼	●	●	H/W error	CAL or BUS	Turn ON the power supply again.
●	●	☼	☼	A CRC data occurred in a local data.	Normal	Remove the influence of noise.
●	●	☼	●	A local data is not provided or cannot be received because of noise.	CAL or BUS	Remove the influence of noise.
●	●	●	☼	H/W error	CAL or BUS	Turn ON the power supply again.
●	●	●	●	Data cannot be received because of disconnection, etc.	CAL or BUS	Check the wiring.
●	●	*	☼	Baud rate or station number is not correct.	Normal	Correct the setting and turn the power supply OFF and then ON again.
☼	☼	☼	☼	Baud rate or station number is changed after the power supply is turned ON.	Normal	Return the setting to the former setting. Turn ON the power supply again.

☼ : Lit ☼ :Blinking ● :Not lit * : Either blinking or not lit

Note: For the details, refer to the VS-616G5 Inverter Instruction Manual and the SI-C User's Manual (SIEZ-C736-70.7).

VARISPEED SERIES OPTION CARD
CC-Link COMMUNICATION INTERFACE CARD
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YASKAWA ELECTRIC CORPORATION

YASKAWA

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.

Specifications are subject to change without notice for ongoing product modifications and improvements.

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