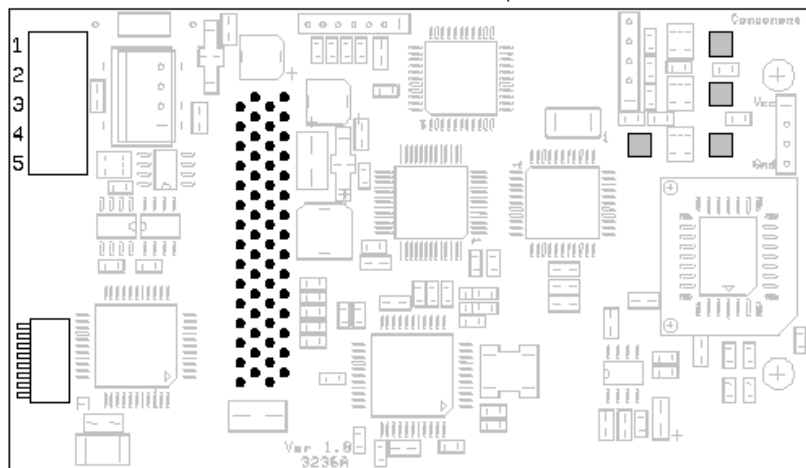


VS-616G5 SI-N Option Card for DeviceNet Instructions



TENTATIVE

1 Introduction

This instructions is intended to provide information necessary to start-up and use the VS-616G5 SI-N DeviceNet Option Card.

1.1 Background

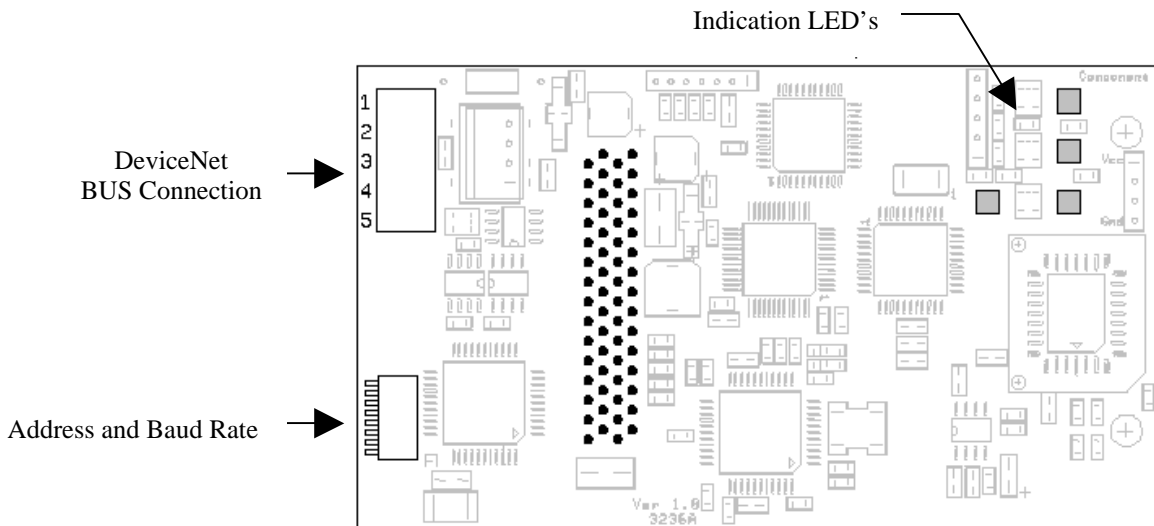
The option card adopted to 2CN option connector on the VS-616G5 control card. The option board supports 4 different Input Assemblies and 4 different Output Assemblies, two of the input and two off the output are YASKAWA specific. All DeviceNet objects required to meet the AC Drive type are supported. The VS-616G5 communicates in DeviceNet as a Group 2 only server.

Supported Message Type

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.

2 Board Installation and set-up

2.1 Option board overview



2.2 DeviceNet BUS connectors and cabling

Cable for DeviceNet networks can be found in the product catalogues from ODVA.

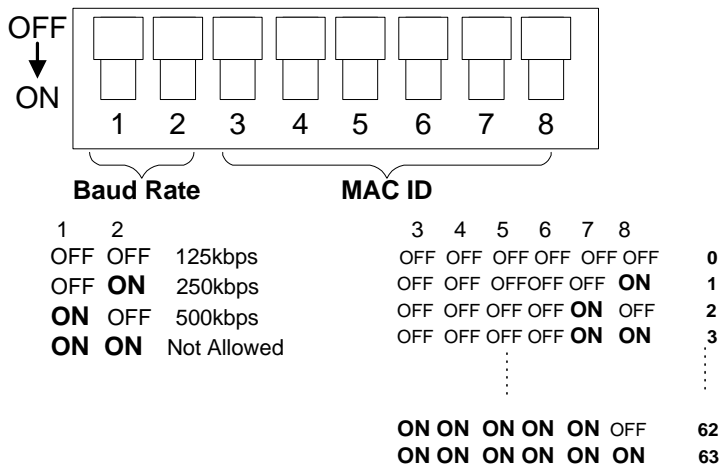
Pin No	Name	Function
1 black	V-	Power supply from the bus.
2 blue	Can Lo	CAN signals
3 -	Shield	Shield from bus cable
4 white	Can Hi	CAN signals
5 red	V+	Power supply from the bus.

2.3 Termination resistors.

Terminating resistors must be mounted on the first and last node in a DeviceNet network. The value of this resistor is specified by ODVA to 121 Ohm. Terminating resistors can be found in the product catalogue from ODVA.

2.4 Address and Baudrate configuration

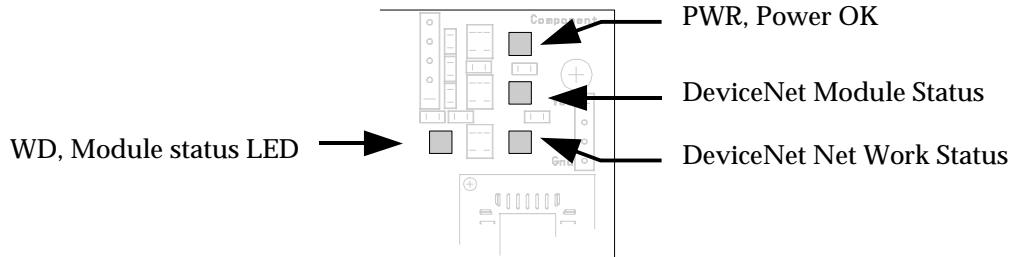
There is one 8-bit DIP-Switch for configuration on the DeviceNet option card.



If setting the Not Allowed baud rate configuration, “BUS” is indicated on the digital operator.

2.5 Board LED indications

The board is equipped with four indications LED's for module and DeviceNet status indication. The LED's are located on the board according to the figure below.



2.5.1 DeviceNet indications

The table below describes the function of DeviceNet specific LED's

LED	Colour	Indication / Function
DeviceNet Module Status (MS)	Off	No power.
	Green	Device Operational.
	Flashing Green	Device in standby.
	Flashing Red	Minor fault.
	Red	Unrecoverable Fault
	Off	Not powered/Not on line
DeviceNet Net Work Status (NS)	Flashing Green	On-line, Not connected
	Green	Link OK, On-line, connected
	Flashing Red	Connection Time-out
	Red	Critical link failure

2.5.2 Option board Module status indications

The following LED's indicates the module (option board) status.

LED	Colour	Indication/Function
PWR	Green	Lit when the +5V power to the electronics is OK. Turned off if the +5V is below +4.5V (min)
WD	bicolour Red/Green	Indicates the module status. Turned off: Option board CPU not running. Lit green: Initialisation. Flashing green: Normal operation. Lit red: Internal option board error. Flashing red: G5 error detected. Other indication: Unspecified, option board error Note The LED will flash red once (100 ms) after initialisation. This is used during our internal testing to verify that the red LED is working.

3 DeviceNet

The SI-N follows the specification for the AC/DC-profile from ODVA .

- * Identity Object (Class 01 hex)
- * Message Router Object (Class 02 hex)
- * DeviceNet Object (Class 03 hex)
- * Assembly Object (Class 04 hex)
- * Connection Object (Class 05 hex)
- * Motor Data Object (Class 28 hex)
- * Control Supervisor Object (Class 29 hex)
- * AC/DC Drive Object (Class 2A hex)

Identity Object (Class 01hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
05	Reset

Attribute Supported

Instance ID	Attribute	Description	Get	Set	Size
0	1	Object Software Revision	X	-	UINT
1	1	Vendor ID	X	-	UINT
	2	Device Type	X	-	UINT
	3	Product Code	X	-	UINT
	4	Revision	X	-	Array of 2 SINT
	5	Status	X	-	WORD
	6	Serial Number	X	-	UDINT
	7	Product Name	X	-	SHORT STRING
	8	State	X	-	USINT

Message Router Object (Class 02hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single

Attribute Supported

Instance ID	Attribute	Description	Get	Set	Size
0	1	Object Software Revision	X	-	UINT

DeviceNet Object (Class 03hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
05	Reset

Attribute Supported

Instance ID	Attribute	Description	Get	Set	Size
0	1	Object Software Revision	X	-	UINT
	1	MAC ID	X	-	USINT
	2	Baud Rate	X	-	USINT
	5	Allocation Information	X	-	WORD

The MAC ID and Baud Rate are set by DIP-switch on the SI-N card.

Supported Objects (Cont.)

Assembly Object (Class 04hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single

Attribute Supported

Instance ID	Attribute	Description	Get	Set	Size	Default Value
0	1	Object Software Revision	X	-	Word	1
20	3	Data	X	X	Array 4 bytes	00 00 00 00
21	3	Data	X	X	Array 4 bytes	00 00 00 00
70	3	Data	X	-	Array 4 bytes	00 00 00 00
71	3	Data	X	-	Array 4 bytes	00 00 00 00
100	3	Data	X	X	Array 5 bytes	00 00 00 00 00
101	3	Data	X	X	Array 8 bytes	00 00 00 00 00 00 00 00
150	3	Data	X	-	Array 5 bytes	00 00 00 00 00
151	3	Data	X	-	Array 8 bytes	00 00 00 00 00 00 00 00

See the I/O Assembly Description

DeviceNet Connection Object (Class 05hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single

Attribute Supported

Instance ID	Attribute	Description	Get	Set	Size	Default Value
0	1	Object Software Revision	X	-	Word	1
1 (Explicit Message)	1	State	X	-	USINT	3
	2	Instance type	X	-	USINT	0
	3	Transport class trigger	X	-	Byte	83hex
	4	Produced connection ID	X	-	UINT	Depends on master ID
	5	Consumed connection ID	X	-	UINT	Depends on node ID
	6	Initial comm characteristics	X	-	Byte	21hex
	7	Produced connection size	X	-	UINT	32
	8	Consumed connection size	X	-	UINT	32
	9	Expected packet rate	X	X	UINT	2500
	12	Watchdog time-out action	X	-	USINT	1
	13	Produced connection path length	X	-	UINT	0
	14	Produced connection path	X	-	Array of USINT	0
	15	Consumed connection path length	X	-	UINT	0
	16	Consumed connection path	X	-	Array of USINT	0
2 (Remote I/O)	1	State	X	-	USINT	1
	2	Instance type	X	-	USINT	1
	3	Transport class trigger	X	-	Byte	82hex
	4	Produced connection ID	X	-	UINT	Depends on master ID
	5	Consumed connection ID	X	-	UINT	Depends on node ID
	6	Initial comm characteristics	X	-	Byte	1
	7	Produced connection size	X	-	UINT	4
	8	Consumed connection size	X	-	UINT	4
	9	Expected packet rate	X	X	UINT	0
	12	Watchdog time-out action	X	X	USINT	0
	13	Produced connection path length	X	-	UINT	3
	14	Produced connection path	X	X	Array of USINT	62 34 36
	15	Consumed connection path length	X	-	UINT	3
	16	Consumed connection path	X	X	Array of USINT	62 31 34

Produced connection path instance 2 can be set to following values:

- 62 34 36 (Instance 70)
- 62 34 37 (Instance 71)
- 62 39 36 (Instance 150)
- 62 39 37 (Instance 151)

Consumed connection path instance 2 can be set to following values:

- 62 31 34 (Instance 20)
- 62 31 35 (Instance 21)
- 62 36 34 (Instance 100)
- 62 36 35 (Instance 101)

Motor Data Object (Class 28hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single

Attribute Supported

Instance ID	Attribute	Description	Get	Set	Size	Default Value
0	1	Object Software Revision	X	-	UINT	1
1	3	Motor type	X	-	BYTE	7 Fixed (Squirrel Cage Induction Motor)
	6	Rated Current [0.1A/2 ^{CS}]	X	X	INT	Parameter E2-01
	7	Rated Voltage [1V/2 ^{VS}]	X	X	INT	Parameter E1-13 *1

^{CS}; Current Scale (AC/DC Drive Object Attr. 23)

^{VS}; Voltage Scale (AC/DC Drive Object Attr. 27)

*1; When E1-13 setting is "0", parameter E1-05 is used for this attribute instead of E1-13.

Control Supervisor Object (Class 29hex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single
05	RESET

Attribute Supported

Instance ID	Attribute	Name	Get	Set	Type	Description
0	1	Object Software Revision	X	-	UINT	-
1	3	Run 1	X	X	BOOL	1= Forward Run Command
	4	Run 2	X	X	BOOL	1= Reverse Run Command
	5	Net Control	X	X	BOOL	1= Operation Command from DeviceNet
	6	State	X	-	BYTE	3= Inverter Ready 7= Inverter Faulted
	7	Running 1	X	-	BOOL	1= Forward Running
	8	Running 2	X	-	BOOL	1= Reverse Running
	9	Ready	X	-	BOOL	1= Inverter Ready
	10	Faulted	X	-	BOOL	1= Inverter Fault
	11	Warning	X	-	BOOL	1= Inverter Minor Fault
	12	Fault Reset	X	X	BOOL	1= Fault Reset Command
	13	Fault Code	X	-	UINT	Current Fault See the Fault code table below.
	15	Control from Net	X	-	BOOL	1= DeviceNet Operation Command is valid
	16	DeviceNet Fault Mode	X	-	BYTE	Action on loss of DeviceNet 2(Fixed); depends on parameter F9-06
	17	Force Fault	X	X	BOOL	1= External Fault Command (EF0)
18	Force Status	X	-	BOOL	1= External Fault Status (EF0)	

Table for Control Supervisor Object fault code:

DeviceNet Fault Code [hex]	Description
0000	None
5120	DC Bus Fuse Open (PUF)
3220	DC Bus Under volt (UV1)
5110	CTL PS Under volt (UV2)
3222	MC Answer back (UV3)
2130	Short Circuit (SC)
2120	Ground Fault (GF)
2300	Over Current (OC)
3210	DC Bus Over volt (OV)
4200	Heatsnk Over temp (OH)
4210	Heatsnk Max Temp (OH1)
2220	Motor Overload (OL1)
2200	Inv Overload (OL2)
2221	Over torque Det 1 (OL3)
2222	Over torque Det 2 (OL4)
7110	Dyn Brk Transistor (RR)
7112	Dyn Brk Resistor (RH)
9000	External Fault 0 (EF0)
9000	External Fault 3 (EF3)
9000	External Fault 4 (EF4)
9000	External Fault 5 (EF5)
9000	External Fault 6 (EF6)
9000	External Fault 7 (EF7)
9000	External Fault 8 (EF8)
4140	Heat sink Fan (FAN)
7310	Over speed Det (OS)
7310	Speed Deviation (DEV)
7310	PG Open (PGO)
3130	Input Phase Loss (PF)
3130	Output Phase Loss (LF)
5210	DCCT fault
5300	Operator Disconnected (OPE)
6320	EEPROM R/W Error (ERR)
0000	None
7500	Memo bus Com Fault (CE)
7500	SI-B Com Error (BUS)
7500	SI-F/G Com Error (E-15)
7500	SI-F/G CPU Down (E-10)
8321	Out of Control (CF)
8313	Zero Servo Fault (SVE)

AC/DC Drive Object (Class 2Ahex)

Services supported

Service Code No. (hex)	Service Name
0E	Get Attribute Single
10	Set Attribute Single

Attribute Supported

Instance ID	Attribute	Name	Get	Set	Type	Description
0	1	Object Software Revision	X	-	Word	
1	3	At Reference	X	-	BOOL	1= Speed Agree
	4	Net Reference	X	X	BOOL	1= Speed Reference from DeviceNet
	6	Drive Mode	X	X	USINT	0= Open Loop Vector (A1-02= 2) 1= V/f (A1-02= 0) 2= V/f with PG (A1-02= 1) 3= Closed Loop Vector (A1-02= 3)
	7	Speed Actual [RPM/2 ^{SS}]	X	-	INT	Output Frequency (Speed Feedback when FVC mode)
	8	Speed Reference [RPM/2 ^{SS}]	X	X	BOOL	Frequency Reference
	9	Current actual [0.1A/2 ^{CS}]	X	-	INT	Inverter Output Current
	15	Power Actual [W/2 ^{PS}]	X	-	INT	Inverter Output Power
	16	Input Voltage [V/2 ^{VS}]	X	-	INT	Inverter Input Voltage [E1-01]
	17	Output Voltage [V/2 ^{VS}]	X	-	INT	Inverter Output Voltage
	18	Accel Time [ms/2 ^{TS}]	X	X	UNIT	Acceleration Time [C1-01]
	19	Decel Time [ms/2 ^{TS}]	X	X	UINT	Deceleration Time [C1-02]
	20	Low Speed Limit [RPM/2 ^{SS}]	X	X	UINT	[D2-02]
	21	High Speed Limit [RPM/2 ^{SS}]	X	X	UINT	[D2-01]
	22	Speed scale	X	X	SINT	Data scale for Speed data (-15 to 15)
	23	Current scale	X	X	SINT	Data scale for Current data (-15 to 15)
	26	Power scale	X	X	SINT	Data scale for Power data (-15 to 15)
	27	Voltage scale	X	X	SINT	Data scale for Voltage data-15 to 15
	28	Time scale	X	X	SINT	Data scale for Time data (-15 to 15)
29	Reference from the Net	X	-	BOOL	1= DeviceNet Frequency Reference is valid	

^{SS}; Speed Scale (AC/DC Drive Object Attr. 22)

^{CS}; Current Scale (AC/DC Drive Object Attr. 23)

^{PS}; Power Scale (AC/DC Drive Object Attr. 26)

^{VS}; Voltage Scale (AC/DC Drive Object Attr. 27)

^{TS}; Time Scale (AC/DC Drive Object Attr. 28)

I/O Assembly Description (Inputs)

DeviceNet Basic Speed Control

Input 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) [RPM/2 ^{SS}]							

^{SS}; Speed Scale (AC/DC Drive Object Attr. 22)

Data	Name	Description
Byte 0 - bit 0	Run Fwd	1= Forward Run command
Byte 0 - Bit 2	Fault Reset	1= Fault Reset
Byte 2,3	Speed Reference	Speed Reference for Inverter [RPM/2 ^{SS}]

DeviceNet Extended Speed Control

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
21	0	-	Net Ref	Net Ctrl	-	-	Fault Reset	Run Rev	Run Fwd
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte) [RPM/2 ^{SS}]							

^{SS}; Speed Scale (AC/DC Drive Object Attr. 22)

Data	Name	Description
Byte 0 - bit 0	Run Fwd	1= Forward Run command
Byte 0 - bit 1	Run Rev	1= Reverse Run command
Byte 0 - bit 2	Fault Reset	1= Fault Reset
Byte 0 - bit 5	Net Ctrl	1= Operation command from DeviceNet
Byte 0 - bit 6	Net Ref	1= Frequency Reference from DeviceNet
Byte 2,3	Speed Reference	Speed Reference for Inverter [RPM/2 ^{SS}]

G5 Memobus Message (Vendor-Specific YASKAWA Assembly)

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100	0	Function Code							
	1	Resister Number (High Byte)							
	2	Resister Number (Low Byte)							
	3	Resister Data (High Byte)							
	4	Resister Data (Low Byte)							

Data	Name	Description
Byte 0	Function Code	03hex= Read command, 10hex = Write command
Byte 1,2	Register Number	Register Number (Address)
Byte 3,4	Register Data	Writing-in data

G5 Standard Control (Vendor Specific YASKAWA Assembly)

Input Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
101	0	Terminal 8	Terminal 7	Terminal 6	Terminal 5	Terminal 4	Terminal 3	Run Rev	Run Fwd
	1	Terminal 26	Terminal 25	Terminal 9	-	-	-	Fault Rest	External Fault
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte) [RPM]							
	4	Torque Reference (Low Byte)							
	5	Torque Reference (High Byte) [0.1%]							
	6	Torque Compensation (Low Byte)							
	7	Torque Compensation (High Byte) [0.1%]							

Data	Name	Description
Byte 0 - bit 0	Run Fwd	1= Forward Run command
Byte 0 - bit 1	Run Rev	1= Reverse Run command
Byte 0 - bit 2	Terminal 3	1= Terminal 3 function ON (depends on H1-01)
Byte 0 - bit 3	Terminal 4	1= Terminal 4 function ON (depends on H1-02)
Byte 0 - bit 4	Terminal 5	1= Terminal 5 function ON (depends on H1-03)
Byte 0 - bit 5	Terminal 6	1= Terminal 6 function ON (depends on H1-04)
Byte 0 - bit 6	Terminal 7	1= Terminal 7 function ON (depends on H1-05)
Byte 0 - bit 7	Terminal 8	1= Terminal 8 function ON (depends on H1-06)
Byte 1 - bit 0	External Fault	1= Eternal Fault command (EF0)
Byte 1 - bit 1	Fault Reset	1= Fault Reset
Byte 1 - bit 5	Terminal 9	1= Terminal 9-10 ON (vaid at H2-01= Fhex)
Byte 1 - bit 6	Terminal 25	1= Terminal 25 ON (vaid at H2-02= Fhex)
Byte 1 - bit 7	Terminal 26	1= Terminal 26 ON (vaid at H2-03= Fhex)
Byte 2,3	Speed Reference	Speed Reference [RPM fixed]
Byte 4,5	Torque Reference	Torque Reference [0.1%] When Flux Vector Control mode is selected, this data works as follows; In case of Speed Control (D5-01=0); Torque Limit Value In case of Torque Control (D5-01=1); Torque Reference Value
Byte 6,7	Torque Compensation	Torque Compensation [0.1%] Valid at only Flux Vector Control Mode

I/O Assembly Description (Outputs)

DeviceNet Basic Speed Control

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0	-	-	-	-	-	Running 1	-	Faulted
	1	-							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte) [RPM/2 ^{SS}]							

^{SS}; Speed Scale (AC/DC Drive Object Attr. 22)

Data	Name	Description
Byte 0 - bit 0	Faulted	1= Inverter Fault
Byte 0 - Bit 2	Running 1	1= Inverter Forward Running
Byte 2,3	Speed Actual	Output Frequency [RPM/2 ^{SS}]

DeviceNet Extended Speed Control

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
71	0	At Speed	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) [RPM/2 ^{SS}]							

^{SS}; Speed Scale (AC/DC Drive Object Attr. 22)

Data	Name	Description
Byte 0 - bit 0	Faulted	1= Inverter Faulted
Byte 0 - bit 1	Warning	1= Minor Fault
Byte 0 - bit 2	Running 1	1= Forward Running
Byte 0 - bit 3	Running 2	1= Reverse Running
Byte 0 - bit 4	Ready	1= Inverter Ready
Byte 0 - bit 5	Control from Net	1= Operation command from DeviceNet
Byte 0 - bit 6	Reference from Net	1= Frequency Reference from DeviceNet
Byte 0 - bit 7	At Speed	1= Speed Agree
Byte 2,3	Speed Actual	Output Frequency [RPM/2 ^{SS}]

G5 Memobus Message (Vendor Specific YASKAWA Assembly)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
150	0	Function Code							
	1	Resister Number (High Byte)							
	2	Resister Number (Low Byte)							
	3	Resister Data (High Byte)							
	4	Resister Data (Low Byte)							

Data	Name	Description
Byte 0	Function Code	Response code
Byte 1,2	Register Number	Register Number (Address)
Byte 3,4	Register Data	Read-out data, Error Code

G5 Standard Control (Vendor Specific YASKAWA Assembly)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
151	0	FAULT	ALARM	READY	Speed Agree	Reset	REV Running	ZSP	Running
	1	ZSV	-	Terminal 26	Terminal 25	Terminal 9	Local/Remote	UV	OPE
	2	Output Frequency (Low Byte)							
	3	Output Frequency (High Byte) [RPM]							
	4	Torque Reference (Low Byte)							
	5	Torque Reference (High Byte) [0.1%]							
	6	Output Current (Low Byte)							
	7	Output Current (High Byte) [0.01A] *1							

*1; When Inverter capacity is 11kW or bigger, [0.1A] is used for the unit of Output Current.

Data	Name	Description
Byte 0 - bit 0	Running	1= Running
Byte 0 - bit 1	ZSP	1= Zero Speed
Byte 0 - bit 2	REV Running	1= Reverse Running
Byte 0 - bit 3	Reset	1= Reset Command Receiving
Byte 0 - bit 4	Speed Agree	1= Speed Agree
Byte 0 - bit 5	READY	1= Inverter Ready
Byte 0 - bit 6	ALARM	1= Minor Fault
Byte 0 - bit 7	FAULT	1= inverter Fault
Byte 1 - bit 0	OPE	1= OPE (parameter) error
Byte 1 - bit 1	UV	1= Inverter had Under Voltage
Byte 1 - bit 2	Local/Remote	1= Remote Operation
Byte 1 - bit 3	Terminal 9	1= Terminal 9-10 ON
Byte 1 - bit 4	Terminal 25	1= Terminal 25 ON
Byte 1 - bit 5	Terminal 26	1= Terminal 26 ON
Byte 1 - bit 7	ZSP	1= Zero Servo Completion
Byte 2,3	Output Frequency	Output Frequency [RPM fixed]
Byte 4,5	Torque Reference	Torque Reference monitor [0.1%]
Byte 6,7	Output Current	Inverter Output Current [0.01A] *1

*1; When Inverter capacity is 11kW or bigger, [0.1A] is used for the unit of Output Current.

4 DeviceNet data types

Data Type Name	Data Type Description
BOOL	Logical Boolean whit values TRUE and FALSE
SINT	Signed 8-bit integer value
INT	Signed 16-bit integer value
DINT	Signed 32-bit integer value
USINT	Unsigned 8-bit integer value
UINT	Unsigned 16-bit integer value
SHORT STRING	character string
WORD	bit string 16-bits

5 Attention

5.1

Before setting up the DeviceNet with SI-N card, sets the number of motor poles into parameter [o1-03] and inverter **MUST** be recycled power.

5.2

When modifying the following parameters, inverter **MUST** be recycled power.

- o1-03; Frequency unit of reference setting and monitor
- b1-01; Reference selection
- b1-02; Operation method selection
- o2-09; Initialise mode selection