

YASKAWA AC Drive-V1000 Option **CANopen** **Technical Manual**

Type SI-S3/V

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.

PRELIMINARY

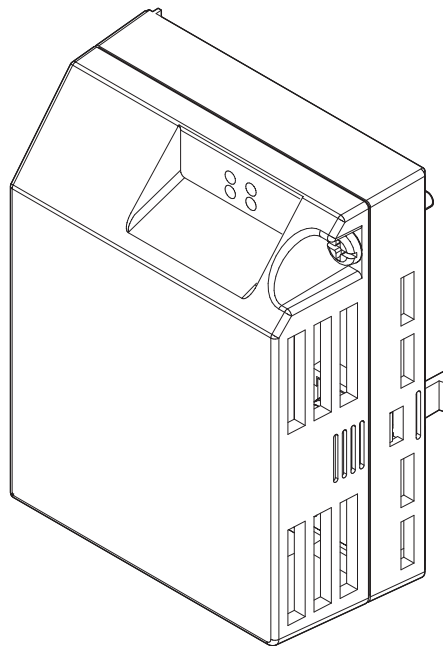




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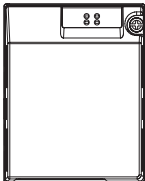
1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer or end user. Yaskawa accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any Yaskawa product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product manufactured by Yaskawa must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by Yaskawa must be promptly provided to the end user. Yaskawa offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the Yaskawa manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. Yaskawa assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

The following manuals are available for SI-S3/V CANOpen Option unit:

Option Unit

	V1000 Option CANOpen Installation Manual (this book) Manual No. : TOBP C730600 24
	Read this manual first. The installation manual is packaged with the CANOpen Option and contains a basic overview of wiring, settings, functions, and fault diagnoses.
	V1000 Option CANOpen Installation Manual (this book) Manual No. : SIEP C730600 24
	The technical manual contains detailed information and command registers. To obtain the technical manual access these sites: Europe: http://www.yaskawa.eu.com Japan: https://www.e-mechatronics.com Other areas: contact a Yaskawa representative.

For the drive setup, refer to one of the documentation listed below.

Yaskawa Drive

	V1000 Series AC Drive Technical Manual Manual No. : SIJP C710606 16
	This manual describes installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation. To obtain instruction manuals for Yaskawa products access these sites: Europe: http://www.yaskawa.eu.com Japan: https://www.e-mechatronics.com Other areas: contact a Yaskawa representative
	V1000 Series AC Drive Quick Start Guide Manual No. : TOJP C710606 12
	This guide is packaged together with the product. It contains basic information required to install and wire the drive. This guide provides basic programming and simple set-up and adjustment.

◆ Terms

Note: Indicates a supplement or precaution that does not cause drive damage.

Drive: Yaskawa AC Drive -V1000 Series

CANOpen Option: Yaskawa AC Drive -SI-S3/V CANOpen option unit for the Yaskawa V1000 drive

◆ Registered Trademarks

- CANOpen is a registered trademark of the CAN in Automation (CiA).
- Other company names and product names listed in this manual are registered trademarks of those companies.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option unit. The option unit must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

DANGER

Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates an equipment damage message.

1 Preface and Safety

■ General Safety

General Precautions

- The diagrams in this section may include option units and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option board should be used according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.

DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

NOTICE

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the option unit.

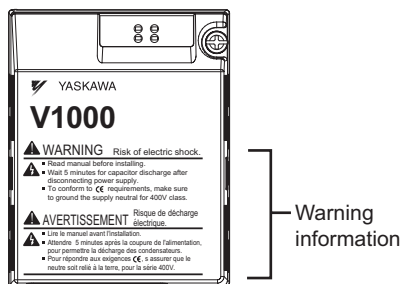
Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

■ Option Unit Label Warnings

Warning information is displayed on the option unit as shown in the figure below. Follow all warnings and safety instructions when using the product.

When using the drive in an area that may require displaying warning information in Japanese or Chinese, a sticker is provided with the CANopen Option. This sticker can be placed over the English and French warnings on the front of the CANopen Option.



■ Warning Contents

WARNING Risk of electric shock.

-  Read manual before installing.
- Wait 5 minutes for capacitor discharge after disconnecting power supply.
- To conform to **CE** requirements, make sure to ground the supply neutral for 400V class.

AVERTISSEMENT Risque de décharge électrique.

-  Lire le manuel avant l'installation.
- Attendre 5 minutes après la coupure de l'alimentation, pour permettre la décharge des condensateurs.
- Pour répondre aux exigences **CE**, s'assurer que le neutre soit relié à la terre, pour la série 400V.

2 Product Overview

◆ About This Product

The SI-S3/V is an option unit designed to connect the V1000 drive to a CANopen network. Using this option unit a CANopen master can

- Operate the drive
- Monitor the drive operation status
- Read or modify drive parameters

The SI-S3/V supports the following communication profiles

- DS 301 Ver. 4.02
- DSP 402 Ver. 1.1 Velocity Mode

◆ Applicable Models

The CANopen Option can be used with the drive models in [Table 1](#).

Table 1 Applicable Models

Drive	Software Version*
CIMR-V□□A□□□□BA□	1010 or later
CIMR-V□□A□□□□FA□	1010 or later
CIMR-V□□A□□□□JA□	1010 or later

* See "PRG" on the drive nameplate for the software version number.

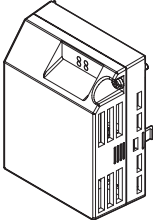
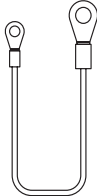
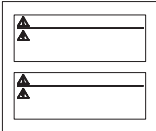
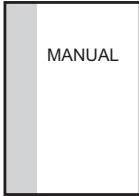
3 Receiving

Please perform the following tasks after receiving the CANopen Option:

- Inspect the CANopen Option for damage.
If the CANopen Option appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the PCB (see Figure 1).
- If you have received the wrong model or the CANopen Option does not function properly, contact your supplier.

◆ Contents and Packaging

Table 2 Contents of Package

Description:	Option Unit	Ground Cables	Warning Labels	Installation Manual
				
Quantity:	1	4	1	1

◆ Tool Requirements

A Phillips screwdriver (for screw size* #1 or #2, U.S. standard size) is required to install the CANopen Option.

* Screw sizes vary by drive capacity. Select a screwdriver that matches the drive capacity.
Note: Tools required to prepare CANopen cables for wiring are not listed in this manual.

4 CANopen Option Components

◆ CANopen Option

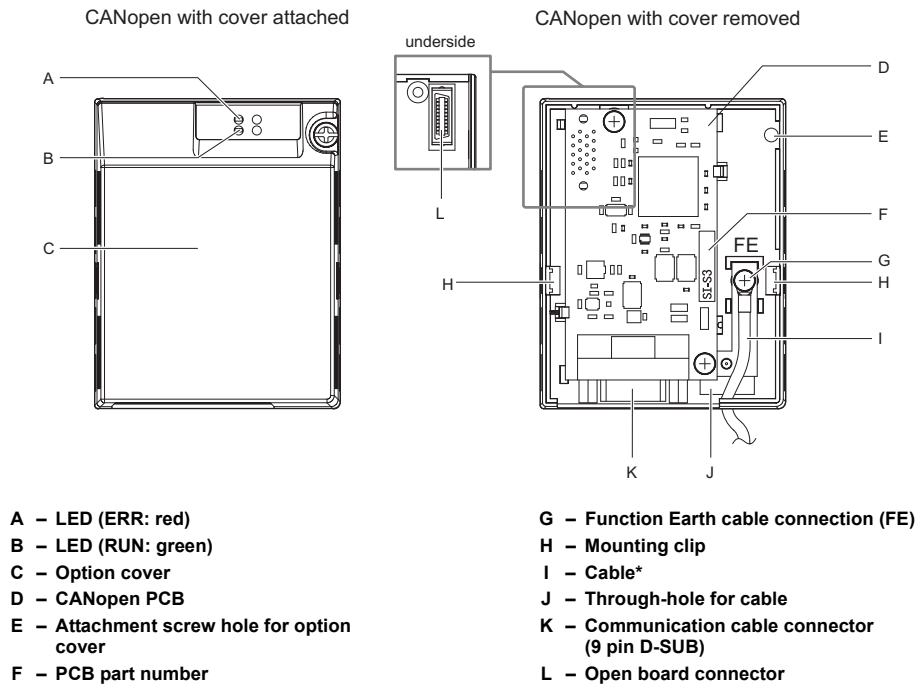


Figure 1 Option Unit

* Cables are not connected to the CANopen Option and are packaged separately in the box.

◆ Dimensions

The installed CANopen Option adds 27 mm (1.06 in.) to the total depth of the drive.

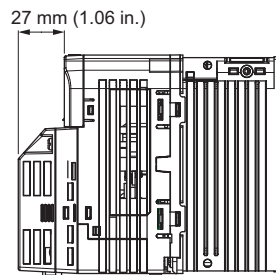


Figure 2 Dimensions

4 CANopen Option Components

◆ Communication connector

The SI-S3/V is connected to the network using a 9 pin D-SUB connector. The connector location is illustrated in [Figure 3](#), the pin assignment is explained in [Table 3](#).

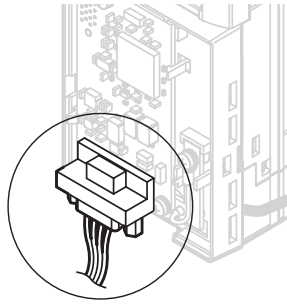
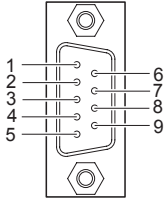


Figure 3 Communication connector location

Table 3 Communication connector (9 pin D-SUB)

CANopen Connector	Pin	Signal	Description
Bottom View 	1	–	–
	2	CAN_L	CAN_L bus line (dominant low)
	3	CAN_GND	CAN Ground
	4	–	–
	5	CAN_SHLD	CAN shield
	6	–	–
	7	CAN_H	CAN_H bus line (dominant high)
	8	–	–
	9	–	–
	–	CAN_SHLD	CAN shield

◆ CANopen Option LED Display

The SI-S3/V has two LEDs that indicate the Option unit or communication status. The indications are conform with the DS303, Part 3: Indicator Specification.

■ Checking LED Operation

Table 4 LED Display

LED	Color	Display	Meaning
RUN	Green	On	Operational State
		Blinking	Pre-operational State
		Single flash	Stopped
ERR	Red	On	Bus off
		Blinking	Bus initialization failed (parameter setting error)
		Single flash	Fault has occurred Receiving CAN error frame (too many error frames)
		Double flash	Guard / Heartbeat event has occurred
		Off	Online

[Figure 4](#) explains the indicator flash rates.

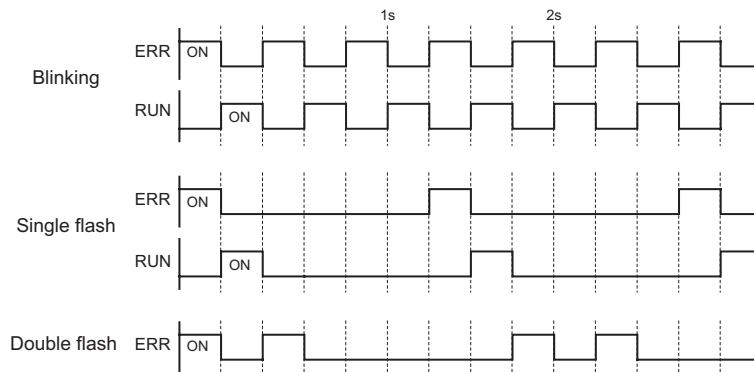


Figure 4 LED Flash Rates and Meaning

◆ Setting Node Address

Set the node address in the drive parameter F6-35. The node address can be set between 1 and 99 but has to be unique in the network. If the Node address is set to 0 the ERR LED will flash and communications will not be possible.

5 Installation Procedure

◆ Section Safety

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.

Disconnect all power to the drive, wait at least five minutes after all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. 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.

WARNING

Electrical Shock Hazard

Do not remove option board cover while the power is on.

Failure to comply could result in death or serious injury.

The diagrams in this section may include option units and drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. The option board should be used according to the instructions described in this manual.

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of this product.

Do not use damaged wires, place excessive stress on wiring, or damage the wire insulation.

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge procedures (ESD) when handling the option unit, drive, and circuit boards.

Failure to comply may result in ESD damage to circuitry.

Never shut the power off while the drive is outputting voltage.

Failure to comply may cause the application to operate incorrectly or damage the drive.

Do not operate damaged equipment.

Failure to comply may cause further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance.

Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Properly connect all pins and connectors.

Failure to comply may prevent proper operation and possibly damage equipment.

Check wiring to ensure that all connections are correct after installing the option unit and connecting any other devices.

Failure to comply may result in damage to the option unit.

◆ Wiring the CANopen Option

The CANopen option must be connected to the network using a 9 pin D-SUB connector like shown in [Figure 5](#).

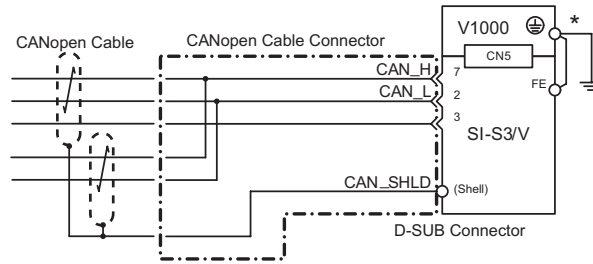


Figure 5 Wiring Diagram

* The FE terminal on the CANopen Option must be connected to the drive ground terminal using one of the 4 delivered ground wires.

◆ Termination

Both ends of a CANopen bus system have to be terminated with a 120 Ω resistor. As the SI-S3/V has no build in terminating resistor, make sure to apply a terminating resistor as shown in [Figure 6](#) if the SI-S3/V is the last node in the network.

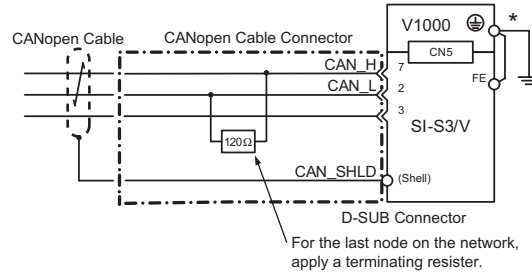


Figure 6 Terminating Diagram

* The FE terminal on the CANopen Option must be connected to the drive ground terminal using one of the 4 delivered ground wires.

◆ Prior to Installing the Option Unit

Prior to installing the CANopen Option, wire the drive and make necessary connections to the drive terminals. Refer to the V1000 Installation and Start-Up Manual for information on wiring and connecting the drive. Verify that the drive runs normally without the option installed.

◆ Installing the CANopen Option

Remove the front cover of the drive before installing the CANopen Option. Wire the drive terminals first, as they are obscured by the CANopen Option. Follow the directions below for proper installation.

Note: Run the drive before installing the CANopen Option to ensure that the drive or drive connections are not faulty.

1. Switch off the power supply to the drive.

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 CANopen 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.

2. Remove the front cover. The original drive front cover may be discarded because it will be replaced by the CANopen Option cover in step 7.

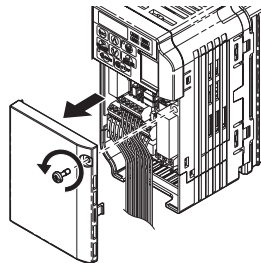


Figure 7 Remove Front Cover

3. Remove the bottom cover and connect the CANopen Option ground cable to the ground terminal.

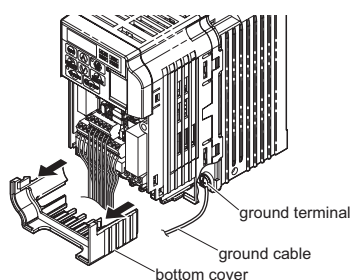
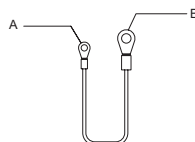


Figure 8 Connect Ground Cable

Note: The four different ground cables packaged with the CANopen Option connect the unit to different models. Select the proper ground cable from the CANopen Option kit depending on drive size.



- A** – Option unit connection: screw size = M3
B – Drive-side connection: screw size = M3.5 to M6

Figure 9 Ground Cable

Note: 1. The four different ground cables packaged with the CANopen Option connect to different models. Select the proper ground cable from the CANopen Option kit depending on drive size.

2. Cover removal for certain larger models with a Terminal Cover:

- Single-Phase 200 V Class: CIMR-V□BA0006 to BA0018
- Three-Phase 200 V Class: CIMR-V□2A0008 to 2A0069
- Three-Phase 400 V Class: All models

Remove the terminal cover before removing the bottom cover to install the CANopen Option. Replace the terminal cover after wiring the CANopen Option.

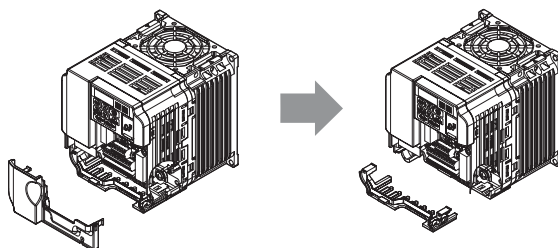


Figure 10 Models with Terminal Cover

4. Reattach the bottom cover.

5. Connect the CANopen Option to the drive. Properly secure the tabs on the left and right sides of the CANopen Option to the drive case.

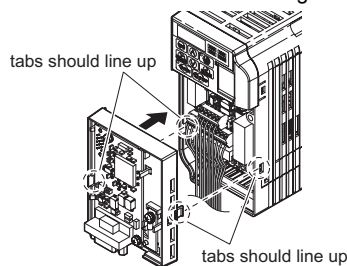


Figure 11 Attach CANopen Option

6. Connect the ground cable from the drive ground terminal to the CANopen Option ground. When wiring the CANopen Option, pass the ground cable through the inside of the drive bottom cover, then pass the ground cable into the through-hole at the front of the CANopen Option.

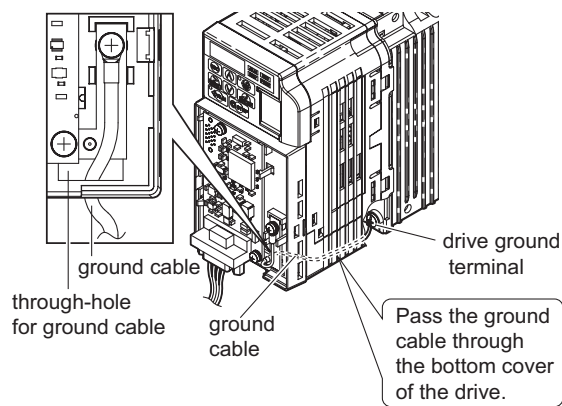


Figure 12 Ground Cable Connection

7. Attach the CANopen Option cover to the front of the CANopen Option.

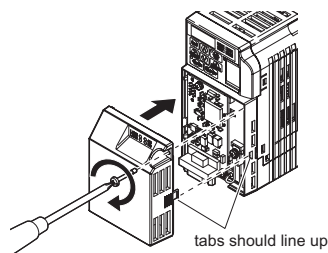


Figure 13 Attach Cover

Note: When using the drive in an area that may require displaying warning information in Japanese or Chinese, a sticker has been provided with the CANopen Option. This sticker can be placed over the English and French warnings on the front of the CANopen Option.

◆ Communication Cable Specifications

To ensure proper performance Yaskawa recommends using CANopen dedicated communication cables only.

◆ EDS Files

For easy network implementation of drives equipped with a SI-S3/V, an EDS file can be obtained from:

Europe: <http://www.yaskawa.eu.com>

Japan: <https://www.e-mechatronics.com>

Other areas: contact a Yaskawa representative

6 CANopen Option Drive Parameters

Confirm the proper setting of all parameters in [Table 5](#) before starting network communications.

Table 5 Parameter Settings

No.	Name	Description	Default
b1-01 <1><2>	Frequency Reference Selection	Selects the frequency reference input source 0: Operator - Digital preset speed d1-01 to d1-17 1: Terminals - Analog input terminal A1 or A2 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse Input (Terminal RP)	1
b1-02 <1><2>	Run Command Selection	Selects the run command input source 0: Digital Operator - RUN and STOP keys 1: Digital input terminals S1 to S7 2: MEMOBUS/Modbus communications 3: Option PCB	1
E2-04 <3>	Motor 1 Motor Poles	Set the number of motor poles described on the motor nameplate.	4 poles
E4-04 <3>	Motor 2 Motor Poles	Sets the number of poles of motor 2.	4 poles
E5-04 <3>	PM Motor Pole Number	Sets the number of motor poles for PM motors.	<4>
F6-01	Operation Selection after Communications Error	Determines drive response when a bUS error is detected during communications with the CANopen Option 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	1
F6-02	External Fault Detection Conditions (EF0)	Sets the condition for external fault detection (EF0) 0: Always detected 1: Detected only during operation	0
F6-03	Stopping Method for External Fault from Communication Option Board	Determines drive response for external fault input (EF0) detection during CANopen communication 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only<5>	1
F6-04	bUS Error Detection Delay Time	Set the maximum time the drive should wait for a communication error to occur (bUS) Range 0.00 to 5.00 s	0.05
F6-35 <6>	Node Address	0 to 99	99
F6-36	Communication Speed	0: Auto-adjust 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	6
o1-03 <7>	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: Hz 1: % (100% = E1-04) 2: r/min (enter the number of motor poles into E2-04/E4-04/E5-04) 3: User defined by parameters o1-10 and o1-11	0

- <1>To start and stop the drive from a CANopen master device using serial communications, set b1-02 to 3. To control the frequency reference of the drive via the master device, set b1-01 to "3".
- <2>When b1-01=3 and/or b1-02=3 are selected and the communication option is not installed, V1000 detects oPE07 instead of oPE05 with software version 1010.
- <3>E2-04, E4-04 and E5-04 are necessary to set up when the Drive Profile DSP402 objects are used.
- <4>Default setting value is dependent on parameter E5-01, Motor Code Selection.
- <5>If F6-03 is set to 3, then the drive will continue to operate when an EF0 fault is detected. Take proper safety measures, such as installing an emergency stop switch.
- <6>All node addresses must be unique. The ERR LED will illuminate when 0 or greater than 99 is entered.
- <7>The setting of o1-03 affects the data format in Object 2200 (Hex.) (Motor Speed)

7 Communication Objects Overview

The Object Dictionary is essentially a group of objects accessible via the network in an ordered pre-defined fashion. Each object uses a 16 bit index.

The Object Dictionary consists of three sections:

- Communications Profile (index numbers 1000 - 1FFF) contains objects related to the CANopen network, which are shared with each device.
- Manufacturer Profile (index numbers 2000 - 5FFF) concerns objects that have been set for manufacturer-specific functions. These objects are specific to Yaskawa products, and therefore are not compatible with other products that may be CANopen.
- Drive and Motion Profile (index numbers 6000 - 9FFF) includes data objects shared among all device classes that can read and write across the network. SI-S3/V is compatible with DSP 402 Drive and Motion Control Profile and Velocity Mode.

◆ Communication Profile Objects (DS 301)

Index (Hex.)	Object Name
1000	Device Type
1001	Error Register
1003	Pre-defined Error Field
1005	COB-ID SYNC Message
1008	Manufacturer Device Name
1009	Manufacturer Hardware Version
100A	Manufacturer Software Version
100C	Guard Time
100D	Life Time Factor
100E	Node Guarding Identifier
1010	Store Parameters
1011	Restore Default Parameters
1014	COB-ID Emergency Object
1016	Consumer Heartbeat Time
1017	Producer Heartbeat Time
1018	Identity Object

◆ Manufacturer Specific Objects (DS 301)

■ Input Objects

Index (Hex.)	Function
2000	Operation Command
2010	Speed Command
2020	Torque Reference
2030	Torque Compensation
2040	MEMOBUS Read Command
2050	MEMOBUS Write Command
2060	MEMOBUS Not Limited Enter Command
2070	MEMOBUS Limited Enter Command
2080	Optional Input 1
2090	Optional Input 2
3000	Optional Input 3
3100	Optional Input 4

■ Output Objects

Index (Hex.)	Function
2100	Drive Status
2110	Output Frequency
2120	Output Current
2130	Output Torque
2140	MEMOBUS Read Command Response
2150	MEMOBUS Write Command Response
2160	MEMOBUS Not Limited Enter Command Response
2180	Optional Output Object
2190	Analog Input Monitor
2200	Motor Speed<1>

<1>Unit depends on the setting of o1-03 (Digital Operator Display Scaling). The register content is zero if the drive is set for V/f control.

◆ Drives and Motion Profile (DSP 402)

The drive supports the Drive and Motion Profile DSP 402 Velocity Mode. Before using the Velocity Mode objects the following parameters have to be set up in the drive:

- The motor pole number must be set up in E2-04 for motor 1, E4-04 for motor 2 and E5-04 for PM motors.
- The frequency reference and output frequency display unit has to be set to min^{-1} by setting parameter o1-03 = 2.

If these settings are not done properly, the Velocity Mode objects can not be used or deliver wrong data.

■ Common Entries

Index (Hex.)	Object Name
60FD	Digital Input<1>
60FE	Digital Output<2>

<1>YASKAWA specifies this object as the drive digital output monitor. (Input of the network)

<2>YASKAWA specifies this object as additional digital inputs of the drive. (Output of the network)

■ Device Control

Index (Hex.)	Object Name
6040	Controlword
6041	Statusword
6060	Modes_of_operation
6061	Modes_of_operation_display

■ Velocity Mode

Index (Hex.)	Object Name
6042	vl_target_velocity
6043	vl_velocity_demand
6044	vl_control_effort
6046	vl_velocity_min_max_amount
6048	vl_velocity_acceleration
6049	vl_velocity_deceleration
604A	vl_velocity_quick_stop
604C	vl_dimension_factor
604D	vl_pole_number

8 Object Description

◆ Communication Objects (DSP 301)

Index (Hex.)	Object Name	Description		
1000	Device type	This object describes the type of the device and its functionality. It is composed of a 16 bit field which describes the device profile that is used and a second 16 bit field which gives additional information about optional functionality.		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1001	Error register	This bit shows the fault status of the device. If any errors occurs in the device bit 0 (generic error) is set to one.		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	Optional	--	Unsigned 8

Index (Hex.)	Object Name	Description		
1003	Pre-defined error field	The subindex of this object contain the errors that have occurred on the drive. Subindex 0 (Hex.): contains the number of errors. Subindex 1-FF (Hex.): standard error field		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read (Subindex 0) Read write (subindex 1 (Hex.))	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1005	COB-ID SYNC message	This object defines the COB-ID of the synchronization object (SYNC). Further it defines whether the device consumes or generates the SYNC.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1008	Manufacturer Device Name	This object contains the Manufacturer device name		
Class	Access	PDO Mapping	Units	Value range
Optional	Read only	No	--	Visible string

Index (Hex.)	Object Name	Description		
1009	Manufacturer Hardware Version	This object contains the Manufacturer hardware version		
Class	Access	PDO Mapping	Units	Value range
Optional	Read only	No	--	Visible string

Index (Hex.)	Object Name	Description		
100A	Manufacturer Software Version	This object contains the Manufacturer software version It indicates the version number of the EEPROM.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read only	No	--	Visible string

Index (Hex.)	Object Name	Description		
100C	Guard Time	This object contains the guard time. The unit is milliseconds.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	(ms)	Unsigned 16

Index (Hex.)	Object Name	Description		
100D	Life Time Factor	This object contains the life time factor. It defines how often the guard time cannot be kept until an error is created.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	--	Unsigned 8

Index (Hex.)	Object Name	Description		
100E	Node Guarding Identifier	This object contains the node guarding identifier. It defines the identifier for the node guarding.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1010 (subindex 1 only)	store parameters	This object supports the saving of parameters in non volatile memory Our device has to save the parameters on command only. This object supports subindex 1 only. To save the parameter SAVE has to set: (s = 73, a = 61, v = 76, e = 65)		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1011 (subindex 1 only)	Restore default parameters	This object supports to restore the default parameters. Our device has to restore parameters by command (bit 0 = 1) To restore the parameters LOAD has to written in subindex 1. (l = 6C, o = 6F, a = 61, d = 64)		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1014	COB-ID Emergency Object	This object defines the COB-ID of the emergency object.		
Class	Access	PDO Mapping	Units	Value range
Conditional	Read only	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1016 (subindex 1)	Consumer Heartbeat Time	This object defines the expected heartbeat cycle time and has to be bigger higher than the corresponding producer heartbeat time. Monitoring starts after receiving the first producer heartbeat. If 0 than it is not used. Setting in 1 ms.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1017	Producer Heartbeat Time	This object defines the cycle time of the heartbeat. The setting is in 1ms.		
Class	Access	PDO Mapping	Units	Value range
Conditional	Read write	No	--	Unsigned 32

Index (Hex.)	Object Name	Description		
1018	Identity Object	This object contains general information of the drive		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	No	--	Unsigned 32

◆ Drive Error List

Object No.	Object Name	Drive Display
2220	Over current	OC
2221	Drive over load	OL 2
2310	Motor over load	OL 1
2311	Motor over heat alarm	OL 3
2312	Motor over heat	OL 4
2330	Drive output Ground fault	GF
3130	Input phase loss	PF
3210	DC bus over voltage	OV
3220	DC bus under voltage	UV 1
3221	DC bus charging circuit fault	UV 3
3300	Output phase loss	LF
4210	Drive over heat	OH 1
4280	Drive over heat alarm	OH
4310	Motor over heat	OH 4
4410	Internal braking resistor over heat	RH
5200	Control power supply under voltage	UV 2
5300	Digital operator disconnected	OPR
5420	Braking transistor fault	RR
5441	External Fault 3	EF 3
5442	External Fault 4	EF 4
5443	External Fault 5	EF 5
5444	External Fault 6	EF 6
5445	External Fault 7	EF 7
5481	Fault input from option unit	EF 0
5530	EEPROM error	ERR
6000	Controller error	CPF
7180	Motor over speed (V/f with PG only)	OS
7305	PG fault	PGO
8321	Speed deviation (V/f with PG only)	DEV

The following error codes will be shown in object 1003 (subindex 01) if the correspondent error occurred on the drive.

8 Object Description

Object No.	Object Name	Drive Display
FF01	Motor overheating Alarm	OH 3
FF02	PID Feedback Lost	FBL
FF03	Undertorque Detected 1	UL 3
FF04	Undertorque Detected 2	UL 4
FF05	High Slip Braking OL	OL 7
FF06	Control Fault	CF
FF07	BUS Error	BUS
FF08	MEMOBUS Error	CE

◆ Manufacturer Specific Objects (DSP 301)

■ Input Parameters

Index (Hex.)	Subindex	Function	Data length
2000	0	Operation Command	2 byte
2010	0	Speed Command	2 byte
2020	0	Torque Limit	2 byte
2030	0	Torque Compensation	2 byte
2040	0	MEMOBUS Read Command - Number of Entries	1 byte
	1	MEMOBUS Read Command - Address + Data	4 byte
2050	0	MEMOBUS Write Command - Number of Entries	1 byte
	1	MEMOBUS Write Command - Address + Data	4 byte
2060	0	MEMOBUS Not Limited Enter Command	4 byte
2070	0	MEMOBUS Limited Enter Command	4 byte
2080	0	Optional Input 1	4 byte
2090	0	Optional Input 2	2 byte
3000	0	Optional Input 3	2 byte
3100	0	Optional Input 4	2 byte

Input data to Drive

Input data are updated and processed in the drive with a 2 ms cycle time.

Input data	Function
Operation Command	See the table
Speed Command	unit depends on parameter o1-03 [min ⁻¹ /Hz/%]
Torque Limit	0.1% (Vector control mode only)
Torque compensation	0.1% (Vector control mode only)

Operation Command

Bit No	Description	Function
0	Forward Run	Effective when Run command source is set to option unit (b1-02/16=3)
1	Reverse Run	Effective when Run command source is set to option unit (b1-02/16=3)
2	Terminas 3 enable/disable	Depends on H1-03 setting
3	Terminas 4 enable/disable	Depends on H1-04 setting
4	Terminas 5 enable/disable	Depends on H1-05 setting
5	Terminas 6 enable/disable	Depends on H1-06 setting
6	Terminal 7 enable/disable	Depends on H1-07 setting
7	Not used	
8	External Fault (EF0)	
9	Fault Reset	
A	Not used	
B	Not used	
C	Not used	
D	Not used	
E	Not used	
F	Not used	

Optional Input Object

Index	Subindex	Name	Data
2080	0	Optional Input Object 1	application dependent

Index	Subindex	Name	Data
2090	0	Optional Input Object 2	application dependent

Index	Subindex	Name	Data
3000	0	Optional Input Object 3	application dependent

Index	Subindex	Name	Data
3100	0	Optional Input Object 4	application dependent

MEMOBUS Data

MEMOBUS Read request

This register specifies the MEMOBUS register number that is read from if a MEMOBUS read command 2140(Hex.) is performed. For reading a MEMOBUS register from the drive first the MEMOBUS register address has to be written in object 2040(Hex.), subindex 1. After that the register content can be read out using object 2140(Hex.).

Index	Subindex	Name	Data (Hex.)
2040	0	Number of entries	
	1	MEMOBUS Read Request	MEMOBUS Address + 00 16 bit + 16 bit

MEMOBUS Write Request

Index	Subindex	Name	Data (Hex.)
2050	0	Number of entries	
	1	MEMOBUS Write Request	MEMOBUS Address + Data 16 bit + 16 bit

MEMOBUS Not Limited Enter Command

To enable drive parameter changes this enter command must be used.
It is enough to use it after the last changed drive parameter.
(If a block transfer is done please use this enter command only one time after the last parameter changed.)
The use of this command is not limited.

Index	Subindex	Name	Data (Hex.)
2060	0	Not Limited Enter Command	"SAVE" 73+61+76+65

Note: After power off the drive all changes are lost.

MEMOBUS Limited Enter Command

To enable drive parameter changes this enter command must be used.
It is enough to use it after the last changed drive parameter.
(If a block transfer is done please use this enter command only one time after the last parameter changed.)
The use of this command is limited up to 100000 times.

Index	Subindex	Name	Data (Hex.)
2070	0	Limited Enter Command	"SAVE" 73+61+76+65

Note: After power off the drive all changes will be kept.

Output Objects

Index (Hex.)	Subindex	Function	Data length
2100	0	Drive Status	2 byte
2110	0	Output Frequency	2 byte
2120	0	Output Current	2 byte
2130	0	Output Torque	2 byte
2140	0	MEMOBUS Read Command Response - Number of Entries	1 byte
	1	MEMOBUS Read Command Response - Address + Data	4 byte
2150	0	MEMOBUS Write Command Response - Number of Entries	1 byte
	1	MEMOBUS Write Command Response - Address + Data	4 byte
2160	0	MEMOBUS Not Limited Enter Command Response	4 byte
2180	0	Optional Output	2 byte
2190	0	Analog Input Monitor	4 byte
2200	0	Motor Speed	2 byte

8 Object Description

Output data from drive

Output data are updated in a cycle of 2 ms.

Output data	Content / Unit
Drive Status	See the table
Output Frequency	unit depends on parameter o1-03 [min ⁻¹ /Hz/%]
Output Current	0.1 A or 0.01 A (depend on drive setting of the drive)
Output Torque	0.1% (Vector control mode only)

■ Drive Status

Bit No	Description
0	Running
1	Zero Speed
2	Reverse Running
3	Reset Command Receiving
4	Speed Agree
5	Drive Ready
6	Minor Fault
7	Major Fault
8	OPE error
9	During Momentary Power Ride-through
A	Local/Remote
B	Terminal MA-MB-MC Output
C	Terminal P1-PC Output
D	Terminal P2-PC Output
E	Motor Selection
F	Reserved

MEMOBUS Read Response

This object contains the data of the drive MEMOBUS register specified in object 2040 (Hex.).

Index	Subindex	Name	Data (Hex.)
2140	0	Number of entries	
	1	MEMOBUS Read Response	MEMOBUS Address + Data 16 bit + 16 bit

MEMOBUS Write Response

Index	Subindex	Name	Data (Hex.)
2150	0	Number of entries	
	1	MEMOBUS Write Response	MEMOBUS Address + Data 16bit + 16 bit

MEMOBUS Not Limited Enter Command Response

Index	Subindex	Name	Data (Hex.)
2160	0	Not Limited Enter Response	“SAVE” 73+61+76+65

Optional Output Object

Index	Subindex	Name	Data (Hex.)
2180	0	Optional Output Object	16 bit free for future use

Analog Input Monitor

Index	Subindex	Name	Data (Hex.)
2190	0	Analog Input Monitor	16 bit Monitors the value of the Analog input of the drive

Motor Speed

Index	Subindex	Name	Data (Hex.)
2200	0	Motor Speed <1> (only available in close loop)	16 bit Monitors the value of the motor speed

<1>Unit depends on the setting of o1-03 (Digital Operator Display Scaling). The register content is zero if the drive is set for V/f control.

■ Drives and Motion Control (DSP 402)

Common Entries

Index (Hex.)	Object Name	Description		
60FD	Digital_input	Simple digital output of device <i>YASKAWA specifies this object as the drive digital output monitor.</i> (Input of the network)		
Class	Access	PDO Mapping	Units	Value range
Option	Read only	Possible	--	0 ... (2 ³² -1)

Index (Hex.)	Object Name	Description		
60FE	Digital_output	Simple digital input for devices <i>YASKAWA specifies this object as additional digital inputs of the drive.</i> (output of the network)		
Class	Access	PDO Mapping	Units	Value range
Option	Read write (used as write only)	Possible	--	0 ... (2 ³² -1)

Device Control

Index (Hex.)	Object Name	Description		
6040	Controlword	Set the device to different states		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read write	Possible	--	0 ... 65535

Index (Hex.)	Object Name	Description		
6041	Statusword	Shows different states of the device		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	Possible	--	0 ... 65535

Index (Hex.)	Object Name	Description		
6061	Modes_of_operation_display	Shows the mode of our device		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	Possible	--	-128...127

Velocity Mode

Index (Hex.)	Object Name	Description		
6042	vl_target_velocity	vl_target_velocity is the required speed of the system. It is interpreted in min ⁻¹ . Parameter o1-03 has to be set by customer before operation. Vl_target_velocity has to be multiplied with the Dimension factor. The Dimension factor can be used for setting the resolution also.		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read write	Possible	min ⁻¹	-32768...0...32767

Index (Hex.)	Object Name	Description		
6043	vl_velocity_demand	vl_target_velocity is the speed reference provided by the ramp function and limiting functions in units of min ⁻¹		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	Possible	min ⁻¹	-32768...0...32767

Index (Hex.)	Object Name	Description		
6044	vl_control_effort	vl_control_effort is the output frequency of our drive to the motor. The unit is min ⁻¹ . In case of close loop vector control mode the exact motor speed can be read out.		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read only	Possible	min ⁻¹	-32768...0...32767

Index (Hex.)	Object Name	Description		
6046	vl_velocity_min_max_amount	vl_velocity_min_max_amount consists of two subindex. One for max and one for the min amount. They do not have units. Yaskawa does interpret these values as min ⁻¹		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read write	Possible	min ⁻¹	0...(2 ³² -1)

8 Object Description

Index (Hex.)	Object Name	Description		
6048	vl_velocity_acceleration	Vl_velocity_acceleration specifies the acceleration time It consists of two subindex (delta_speed and delta_time). So it is generated as the quotient of the delta_speed and delta_time subindex. This object correspond to the acceleration time of the drive.		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read write	Possible	min ⁻¹ (subindex 1); Second (subindex 2)	0...(2 ²³ -1) (subindex 1); 0...65535 (subindex 2)

Index (Hex.)	Object Name	Description		
6049	vl_velocity_deceleration	Vl_velocity_deceleration specifies the deceleration time It consists of two subindex (delta_speed and delta_time). So it is generated as the quotient of the delta_speed and delta_time subindex. This object correspond to the acceleration time of the drive.		
Class	Access	PDO Mapping	Units	Value range
Mandatory	Read write	Possible	min ⁻¹ (subindex 1); Second (subindex 2)	0...(2 ²³ -1) (subindex 1); 0...65535 (subindex 2)

Index (Hex.)	Object Name	Description		
604A	vl_velocity_quick_stop	Vl_velocity_quick_stop specifies the quick stop ramp. It consists of two subindex (delta_speed and delta_time). So it is generated as the quotient of the delta_speed and delta_time subindex. This object correspond to the emergency stop time of the drive.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	Possible	min ⁻¹ (subindex 1); Second (subindex 2)	0...(2 ²³ -1) (subindex 1); 0...65535 (subindex 2)

Index (Hex.)	Object Name	Description		
604C	vl_dimension_factor	Vl_dimension_factor is to multiply the Target Velocity (reference speed) with a customer specific factor. It consists of two subindex (numerator and denominator). So it is generated as the quotient numerator and denominator		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	Possible	min ⁻¹ (subindex 1); Second (subindex 2)	0...(2 ²³ -1) (subindex 1); 0...65535 (subindex 2)

Index (Hex.)	Object Name	Description		
604D	vl_pole_number	Vl_pole_number sets the number of poles of the connected motor This data is necessary for us to calculate for min ⁻¹ (all velocity values) to Hz. It is mandatory for the customer to set the pole number. This is possible enter by digital operator or by object dictionary entry.		
Class	Access	PDO Mapping	Units	Value range
Optional	Read write	Possible	- (number of poles)	0...255

◆ PDO Mapping

The drive supports 15 Receive and 16 Transmit PDO's. The tables below show the default PDO Mapping.

■ Receive PDO

PDO number	Receive PDO Parameter		Receive PDO Mapping	
	COB-ID (Hex.)	Index (Hex.)	Mapped objects	Index (Hex.)
1	200 + Node ID	1400	Subindex 1: 6040	1600
2	300 + Node ID	1401	Subindex 1: 6040 Subindex 2: 6060	1601
6	240 + Node ID	1405	Subindex 1: 6040 Subindex 2: 6042	1605
7	340 + Node ID	1406	Subindex 1: 6040 Subindex 2: 60FE	1606
8	380 + Node ID	1407	Subindex 1: 6040 Subindex 2: 6060	1607
21	Not assigned	1414	Subindex 1: 6048 sub1 Subindex 2: 6048 sub2	1614
22	Not assigned	1415	Subindex 1: 6049 sub1 Subindex 2: 6049 sub2	1615
23	Not assigned	1416	Subindex 1: 604A sub1 Subindex 2: 604A sub2	1616
24	Not assigned	1417	Subindex 1: 604C sub1 Subindex 2: 604C sub2	1617
36	Not assigned	1423	Subindex 1: 2000	1623
37	Not assigned	1424	Subindex 1: 2010	1624
38	Not assigned	1425	Subindex 1: 2020	1625
39	Not assigned	1426	Subindex 1: 2030	1626
40	Not assigned	1427	Subindex 1: 2040 sub1	1627
41	Not assigned	1428	Subindex 1: 2050 sub1	1628

■ Transmit PDO

PDO number	Transmit PDO Parameter		Transmit PDO Mapping	
	COB-ID (Hex.)	Index (Hex.)	Mapped objects	Index (Hex.)
1	180 + Node ID	1800	Subindex 1: 6041	1A00
2	280 + Node ID	1801	Subindex 1: 6041 Subindex 2: 6061	1A01
6	1C0 + Node ID	1805	Subindex 1: 6041 Subindex 2: 6044	1A05
7	2C0 + Node ID	1806	Subindex 1: 6041 Subindex 2: 60FD	1A06
21	Not assigned	1814	Subindex 1: 6042	1A14
22	Not assigned	1815	Subindex 1: 6043	1A15
23	Not assigned	1816	Subindex 1: 6048 sub1 Subindex 2: 6048 sub2	1A16
24	Not assigned	1817	Subindex 1: 6049 sub1 Subindex 2: 6049 sub2	1A17
25	Not assigned	1818	Subindex 1: 604A sub1 Subindex 2: 604A sub2	1A18
26	Not assigned	1819	Subindex 1: 604C sub1 Subindex 2: 604C sub2	1A19
36	Not assigned	1823	Subindex 1: 2100	1A23
37	Not assigned	1824	Subindex 1: 2110	1A24
38	Not assigned	1825	Subindex 1: 2120	1A25
39	Not assigned	1826	Subindex 1: 2130	1A26
40	Not assigned	1827	Subindex 1: 2140 sub1	1A27
41	Not assigned	1828	Subindex 1: 2160	1A28

9 Fault Diagnosis and Possible Solutions

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive LED operator. Causes of the errors and corrective actions are listed in [Table 6](#). For additional error codes that may appear on the LED operator screen, refer to the instruction manual for the drive.

■ Faults

bUS (CANopen Option Communication Error) and EF0 (External Fault Input from the CANopen Option) may appear as an alarm or a fault. When a fault occurs, the digital operator LEDs remain lit. When an alarm occurs, the digital operator LEDs flash and the “ALM” light illuminates.

If communication stops while the drive is running, check the following items:

- Is the CANopen Option properly installed?
- Is the communication line properly connected to the CANopen Option? Is it loose?
- Is the controller program working? Has the controller CPU stopped?
- Did a momentary power loss interrupt communications?

Table 6 Fault Display and Possible Solutions

LED Operator Display		Fault Name
bUS	bUS	CANopen Option Communication Error
		After establishing initial communication, the connection was lost. Only detected when the run command frequency reference is assigned to the option.
Cause		Possible Solution
Master controller (PLC) has stopped communicating.		Check for faulty wiring. ⇒ Correct any wiring problems.
Communication cable is not connected properly.		
A data error occurred due to noise.		Check the various options available to minimize the effects of noise. ⇒ Take steps to counteract noise in the control circuit wiring, main circuit lines, and ground wiring. ⇒ If a magnetic contactor is identified as a source of noise, install a surge absorber to the contactor coil. ⇒ Make sure the cable used fulfills the CANopen requirements. Ground the shield on the controller side and on the CANopen Option side.
CANopen Option is damaged.		⇒ If there are no problems with the wiring and the error continues to occur, replace the CANopen Option.
CANopen Option is not properly connected to the drive.		The connector pins on the CANopen Option are not properly seated with the connector pins on the drive. ⇒ Reinstall the CANopen Option

LED Operator Display		Fault Name
	EF0	External Fault Input from CANopen Option
		The alarm function for an external device has been triggered.
Cause		Possible Solution
An external fault is being sent from the upper controller (PLC).		⇒ Remove the cause of the external fault. ⇒ Reset the external fault input from the upper controller (PLC) device.
Problem with the upper controller (PLC) program.		⇒ Check the program used by the upper controller (PLC) and make the appropriate corrections.

LED Operator Display		Fault Name
oF000	oFA00	CANopen Option Fault
		CANopen Option is not properly connected.
Cause		Possible Solution
Non-compatible option connected to the drive.		⇒ Connect an option that is compatible with the drive.

LED Operator Display		Fault Name
oF001	oFA01	CANopen Option Fault
		CANopen Option is not properly connected.
Cause		Possible Solution
Problem with the connectors between the drive and CANopen Option.		⇒ Turn the power off and check the connectors between the drive and CANopen Option.

LED Operator Display		Fault Name
	oFA03	CANopen Option Fault
		CANopen Option self-diagnostics error.
Cause		Possible Solution
CANopen Option hardware fault.		⇒ Replace the CANopen Option.

LED Operator Display		Fault Name
oFA04	oFA04	CANopen Option Fault
		CANopen Option Flash write mode
Cause		Possible Solution
CANopen Option hardware fault.		⇒ Replace the CANopen Option.

10 CANopen Code Numbers

◆ Command Data

Table 7 Command Data

Register	Command Name		Comments
	BIT		
0001H		Operation signal	
	0	Run/Stop1: Forward run	
	1	Reverse/Stop1: Reverse run	
	2	External fault1: Fault (EF0)	
	3	Fault reset1: Fault reset	
	4	Multi-function digital input command 1	ComRef when set for Forward/Stop
	5	Multi-function digital input command 2	ComCtrl when set for Reverse/Stop
	6	Multi-function digital input command 3	
	7	Multi-function digital input command 4	
	8	Multi-function digital input command 5	
	9	Multi-function digital input command 6	
	A	Multi-function digital input command 7	
0002H		Frequency reference	Determined by o1-03
0006H		PID setpoint	0.01% (signed)
0007H		Analog output 1	10 V / 4000 H
0009H		Multi-function digital output settings	
	0	Contact output (MA/MB-MC)	
	1	Photocoupler output 1 (P1)	
	2	Photocoupler output 2 (P2)	
000AH		Pulse output setting	1/1 Hz Setting range: 0 to 32000
000FH		Control Selection Setting	
	0	Reserved	
	1	PID Target Input	
	2 to B	Reserved	
	C	Broadcast Data Terminal S5 Input	
	D	Broadcast Data Terminal S6 Input	
	E	Broadcast Data Terminal S7 Input	
	F	Reserved	
0010H		Frequency reference	
0011H		Frequency reference	

◆ Monitor Data

Table 8 Monitor Data

Register	Command Name		Comments
	BIT		
0020H		Drive status 1	
	0	During forward run	
	1	During reverse run	
	2	Drive ready	
	3	Fault	
	4	Data setting error	
	5	Contact output (MA/MB-MC)	
	6	Photocoupler output 1 (P1)	
	7	Photocoupler output 2 (P2)	
	E	ComRef status, NetRef status	
	F	ComCtrl status, NetCtrl status	

1. See [Faults on page 24](#) for information on fault contents.
2. See [Alarms on page 28](#) for information on alarm contents.

Register	Command Name		Comments
	BIT		
0021H	Fault contents		
	0	Overcurrent (oC), Ground fault (GF), Load short-circuit (SC)	
	1	Overvoltage (ov)	
	2	Drive overload (oL2)	
	3	Overheat 1 (oH1), Drive overheat warning (oH2)	
	4	Dynamic braking transistor (rr), Braking resistor overheat (rH)	
	6	PID feedback loss (FbL), Excessive PID feedback (FbH)	
	7	External fault (EF□), CANopen Option external fault (EF0)	
	8	CANopen Option fault (CPF or oFA)	
	9	Motor overload (oL1), Overtorque detection 1 (oL3), Overtorque detection 2 (oL4), Undertorque detection 1 (UL3), Undertorque detection 2 (UL4)	
	A	PG disconnect (for Simple V/f with PG) (PGo), (PGoH), Overspeed (for Simple V/f with PG) (oS), Excessive speed deviation (for Simple V/f with PG) (dEv)	
	B	Main circuit undervoltage (Uv) detecting	
	C	Undervoltage (Uv1), Control power supply undervoltage (Uv2), Soft charge circuit fault (Uv3)	
	D	Output phase loss (LF), Input phase loss (PF)	
	E	MEMOBUS/Modbus communication error (CE), Option communication error (bUS)	
	F	Operator connection fault (oPr)	
0022H	Data link status		
	0	Writing data or switching motors	
	3	Upper or lower limit error	
	4	Data conformity error	
	5	Writing to EEPROM	
0023H	Frequency reference (U1-01)		
0024H	Output frequency (U1-02)		
0025H	Output voltage reference (U1-06)		MEMOBUS/Modbus: 1/0.1 V, OPT: 1/0.1 V MEMOBUS/Modbus switches setting units according to H5-10: 0 = 0.1 V units, 1 = 1 V units
0026H	Output current (U1-03)		10/1 A
0027H	Output power (U1-08)		
0028H	Torque reference (U1-09)		
0029H	Fault contents 2		
	0	Load short-circuit (SC)	
	1	Ground fault (GF)	
	2	Input phase loss (PF)	
	3	Output phase loss (LF)	
	4	Braking resistor overheat (rH)	
	6	Motor overheat 2 (PTC input) (oH4)	
	8	Reserved	
	9	Reserved	
002AH	Minor fault 1		
	2	Run command input error (EF)	
	3	Drive baseblock (bb)	
	4	Overtorque detection 1 (oL3)	
	5	Heatsink overheat (oH)	
	6	Overvoltage (ov)	
	7	Undervoltage (Uv)	
	8	Cooling fan error (FAN)	
	9	MEMOBUS/Modbus communication error (CE)	
	A	Option communication error (bUS)	
	B	Undertorque detection 1 (UL3), Undertorque detection 2 (UL4)	
	C	Motor Overheat (oH3)	
	D	PID feedback loss (FbL), Excessive PID feedback (FbH)	
	F	Serial communication transmission error (CALL)	
002BH	Input terminal status (U1-10)		
	0	1: Control circuit terminal S1 closed	
	1	1: Control circuit terminal S2 closed	
	2	1: Control circuit terminal S3 closed	
	3	1: Control circuit terminal S4 closed	
	4	1: Control circuit terminal S5 closed	
	5	1: Control circuit terminal S6 closed	
	6	1: Control circuit terminal S7 closed	

1. See [Faults on page 24](#) for information on fault contents.

2. See [Alarms on page 28](#) for information on alarm contents.

10 CANopen Code Numbers

Register	Command Name		Comments
	BIT		
002CH	Drive Status 2		
	0	During run	
	1	During zero speed	
	2	During Speed Agree	
	3	During user-set Speed Agree	
	4	Frequency detection 1	
	5	Frequency detection 2	
	6	Drive ready	
	7	During undervoltage	
	8	During baseblock	
	9	Frequency reference is not supplied by the CANopen Option	
	A	Run command is not supplied by the CANopen Option	
	B	Over/Under torque 1, 2	
	C	Frequency reference loss	
	D	During fault restart	
	E	During fault	
	F	MEMOBUS/Modbus timeout	
002DH	Output terminal status (U1-11)		
	0	Contact output (MA/MB-MC)	
	1	Photocoupler output 1 (P1)	
	2	Photocoupler 2 (P2)	
002FH	Frequency reference bias (Up 2, Down 2 function)		1000/100%
0030H	Reserved		
0031H	DC bus voltage (U1-07)		
0032H	Torque reference (U1-09)		1/1%
0034H	Product code 1 [ASCII]		V', '0'
0035H	Product code 2 [ASCII]		A', '0'
0038H	PID feedback		1/0.1%
0039H	PID input		1/0.1%
003AH	PID output		1/0.1%
003DH	Communication error contents		
	0	CRC error	
	1	Data length error	
	3	Parity error	
	4	Overrun error	
	5	Framing error	
	6	Timed out	
003EH	Output frequency		Units: min ⁻¹
003FH	Output frequency		Units: 0.01%
0040H	Frequency reference (U1-01)		Determined by o1-03.
0041H	Output frequency (U1-02)		Determined by o1-03.
0042H	Output current (U1-03)		8192 / drive rated current
0043H	Control mode (U1-04)		
0044H	Motor speed (U1-05)		Determined by o1-03.
0045H	Output voltage reference (U1-06)		Units: 0.1 V
0046H	DC bus voltage (U1-07)		Units: 1 V
0047H	Output power (U1-08)		
0048H	Torque reference (U1-09)		Units: 0.1%
0049H	Input terminal status (U1-10)		
	0	Control terminal S1 closed	
	1	Control terminal S2 closed	
	2	Control terminal S3 closed	
	3	Control terminal S4 closed	
	4	Control terminal S5 closed	
	5	Control terminal S6 closed	
	6	Control terminal S7 closed	
004AH	Output terminal status (U1-11)		
	0	Contact output (MA/MB-MC)	
	1	Photocoupler output 1 (P1)	
	2	Photocoupler output 2 (P2)	

1. See [Faults on page 24](#) for information on fault contents.
2. See [Alarms on page 28](#) for information on alarm contents.

Register	Command Name		Comments
	BIT		
004BH		Drive status (U1-12)	
	0	During run	
	1	During zero speed	
	2	During reverse run	
	3	During fault reset signal input	
	4	During Speed Agree	
	5	Drive ready	
	6	Alarm	
	7	Fault	
	8	During operation error (oPE□□)	
	9	During momentary power loss	
	A	Motor 2 selected	
	B	1: Zero-servo ready	
	E	ComRef status, NetRef status	
	F	ComCtrl status, NetCtrl status	
004CH		Accumulated operation time in 10 hour units (U4-01)	
004DH		Software number (U1-25)	
004EH		Terminal A1 input voltage (U1-13)	
004FH		Terminal A2 input voltage (U1-14)	
0051H		Motor secondary current (U6-01)	
0052H		Motor excitation current (Iq) (U6-02)	
0053H		Output frequency after soft start (U1-16)	
0054H		ASR input (U6-03)	
0055H		ASR output (U6-04)	
0057H		PID feedback (U5-01)	
0059H		Output voltage reference (Vq) (U6-05)	
005AH		Output voltage reference (Vd) (U6-06)	
005BH		Software No. (ROM) (U1-26)	
005CH		kWH, lower 4 digits (U4-10)	
005DH		kWH, upper 5 digits ((U4-11)	
005FH		q axis ACR output (U6-07)	
0060H		d axis ACR output (U6-08)	
0061H		oPE fault parameter (U1-18)	
0062H		Reserved	
0063H		PID input (U5-02)	
0064H		PID output (U5-03)	
0065H		PID setpoint (U5-04)	
0066H		MEMOBUS/Modbus error code (U1-19)	
0067H		Cooling fan operation time (U4-03)	
0068H		Reserved	
0070H		Reserved	
0071H		Reserved	
0072H		Reserved	
0073H		Reserved	
0075H		Number of Run commands (U4-02)	
0076H		Pulse train input terminal RP input value	1/1Hz
007CH		Capacitor maintenance (U4-05)	
007DH		Input pulse monitor (U1-24)	
007EH		Cooling fan maintenance time period (U4-04)	
007FH		Alarm code	
0080H		Current fault (U2-01)	
0081H		Previous fault (U2-02)	
0082H		Frequency reference at previous fault (U2-03)	
0083H		Output reference at previous fault (U2-04)	
0084H		Output current at previous fault (U2-05)	
0085H		Motor speed at previous fault (U2-06)	
0086H		Output voltage at previous fault (U2-07)	
0087H		DC bus voltage at previous fault (U2-08)	
0088H		Output power at previous fault (U2-09)	
0089H		Torque reference at previous fault (U2-10)	
008AH		Input terminal status at previous fault (U2-11)	
008BH		Output terminal status at previous fault (U2-12)	
008CH		Drive operation status at previous fault (U2-13)	

1. See [Faults on page 24](#) for information on fault contents.
2. See [Alarms on page 28](#) for information on alarm contents.

10 CANopen Code Numbers

Register	Command Name		Comments
	BIT		
008DH		Cumulative operation time at previous fault (U2-14)	
008EH		Reserved	
0090H		Most recent fault (U3-01)	
0091H		2nd most recent fault (U3-02)	
0092H		3rd most recent fault (U3-03)	
0093H		4th most recent fault (U3-04)	
0094H		Cumulative operation time at most recent fault (U3-11)	
0095H		Cumulative operation time at 2nd most recent fault (U3-12)	
0096H		Cumulative operation time at 3rd most recent fault (U3-13)	
0097H		Cumulative operation time at 4th most recent fault (U3-14)	
0098H		Cumulative operation time	Shows "X" digit of the operation time, which is displayed as "XY" For the "Y" digit, see 1099H
0099H		Cumulative operation time	Shows "Y" digit of the operation time, which is displayed as "XY" For the "X" digit, see 1098H
009AH		Cooling fan operation time, upper digits	
009BH		Cooling fan operation time, lower digits	
00ABH		Drive rated current	CIMR-VA2A 0040 and higher: 0.1 A units All other models: 0.01 A units
00ACH		Motor speed (U1-05)	Units: min ⁻¹
00ADH		Motor speed (U1-05)	Units: 0.01%
00AEH		Iac monitor with filter	8192/100%
00B0H		Option A code	The option code for the communication card is the ASCII code for the first and third digits of the product model number. If the model number is SIP3, then the first and third digits are "S" and "P", for an ASCII code of 5343H.
00B2H		Reserved	
00B3H		Reserved	
00B5H		Output frequency after soft start (U1-16)	Units: min ⁻¹
00B6H		Output frequency after soft start (U1-16)	Units: 0.01%
00B7H		Frequency reference monitor	Units: min ⁻¹
00B8H		Frequency reference monitor	Units: 0.01%
00B9H		Reserved	
00BAH		Reserved	
00BFH		Operation error number (oPE□□)	
00C0H		Fault contents 1 *1	
	1	Undervoltage (Uv1)	
	2	Control power supply undervoltage (Uv2)	
	3	Soft charge circuit fault (Uv3)	
	4	Load short-circuit (SC)	
	5	Ground fault (GF)	
	6	Overcurrent (oC)	
	7	Overvoltage (ov)	
	8	Heatsink overheat (oH)	
	9	Heatsink overheat (oH1)	
	A	Motor overload (oL1)	
	B	Drive overload (oL2)	
	C	Overtorque detection 1 (oL3)	
	D	Overtorque detection 2 (oL4)	
	E	Dynamic braking transistor (rr)	
	F	Braking resistor overheat (rH)	

1. See [Faults on page 24](#) for information on fault contents.
2. See [Alarms on page 28](#) for information on alarm contents.

Register	Command Name		Comments
	BIT		
00C1H	Fault contents 2 *1		
	0	External fault at input terminal S3 (EF3)	
	1	External fault at input terminal S4 (EF4)	
	2	External fault at input terminal S5 (EF5)	
	3	External fault at input terminal S6 (EF6)	
	4	External fault at input terminal S7 (EF7)	
	7	Overspeed (oS)	Possible only when using Simple V/f with PG
	8	Excessive speed deviation (dEv)	Possible only when using Simple V/f with PG
	9	PG disconnect (PGo)	Possible only when using Simple V/f with PG
	A	Input phase loss (PF)	
	B	Output phase loss (LF)	
	C	Motor overheat (PTC input) (oH3)	
	D	Digital operator connection fault (oPr)	
	E	EEPROM write error (Err)	
	F	Motor overheat fault (PTC input) (oH4)	
00C2H	Fault contents 3 *1		
	0	MEMOBUS/Modbus communication error (CE)	
	1	Option communication error (bUS)	
	4	Control fault (CF)	
	5	Reserved	
	6	CANopen Option external fault (EF0)	
	7	PID feedback loss (FbL)	
	8	Undertorque detection 1 (UL3)	
	9	Undertorque detection 2 (UL4)	
	A	High Slip Braking overload (oL7)	
	F	Hardware fault (includes oFx)	
00C3H	Fault contents 4 *1		
	0	Reserved	
	5	Output current imbalance (LF2)	
	6	Pullout detection (Sto)	
	7	PG disconnect (PGo)	Possible only when using Simple V/f with PG
	8	Reserved	
	A	Too many speed search restarts (SEr)	
	B	Reserved	
	C	Reserved	
	D	Reserved	
	E	Reserved	
	F	Reserved	
00C4H	Fault contents 5 *1		
	0	Excessive PID feedback (FbH)	
	1	External fault 1, input terminal S1 (EF1)	
	2	External fault 2, input terminal S2 (EF2)	
	3	Mechanical weakening detection 1 (oL5)	
	4	Mechanical weakening detection 2 (UL5)	
	5	Current offset fault (CoF)	
	6	Reserved	
	7	Reserved	
	8	DriveWorksEZ fault (dWFL)	

1. See [Faults on page 24](#) for information on fault contents.2. See [Alarms on page 28](#) for information on alarm contents.

10 CANopen Code Numbers

Register	Command Name		Comments
	BIT		
00C8H	Alarm contents 1 *2		
	0	Undervoltage (Uv)	
	1	Overvoltage (ov)	
	2	Heatsink overheat (oH)	
	3	Drive overheat (oH2)	
	4	Overtorque 1 (oL3)	
	5	Overtorque 2 (oL4)	
	6	Run commands input error (EF)	
	7	Drive baseblock (bb)	
	8	External fault 3, input terminal S3 (EF3)	
	9	External fault 4, input terminal S4 (EF4)	
	A	External fault 5, input terminal S5 (EF5)	
	B	External fault 6, input terminal S6 (EF6)	
	C	External fault 7, input terminal S7 (EF7)	
	E	Cooling fan error (FAN)	
	F	Overspeed (oS)	Possible only when using Simple V/f with PG
00C9H	Alarm contents 2 *2		
	0	Excessive speed deviation (dEv)	Possible only when using Simple V/f with PG
	1	PG disconnect (PGo)	Possible only when using Simple V/f with PG
	2	Digital operator connection fault (oPr)	
	3	MEMOBUS/Modbus communication error (CE)	
	4	Option communication error (bUS)	
	5	Serial communication transmission error (CALL)	
	6	Motor overload (oL1)	
	7	Drive overload (oL2)	
	8	Reserved	
	9	CANopen Option external fault (EF0)	
	A	During run 2, Motor switch command input (rUn)	
	C	Serial communication transmission error (CALL)	
	D	Undertorque detection 1 (UL3)	
	E	Undertorque detection 2 (UL4)	
	F	MEMOBUS/Modbus test mode fault (SE)	
00CAH	Alarm contents 3 *2		
	1	Motor overheat 1 (PTC Input) (oH3)	
	6	PID feedback loss (FbL)	
	7	Excessive PID feedback (FbH)	
	9	Drive disabled (dnE)	
	A	PG disconnect (PGo)	Possible only when using Simple V/f with PG
	B	Reserved	
	C	Reserved	
	D	Reserved	
	E	Reserved	
	F	Reserved	
00CBH	Fault contents 4 *2		
	0	Reserved	
	1	Reserved	
	2	Reserved	
	3	Current alarm (HCA)	
	7	Reserved	
	8	External fault 1 (input terminal S1) (EF1)	
	9	External fault 2 (input terminal S2) (EF2)	
	A	Hardwire baseblock signal input (HbbF)	
	B	Hardwire baseblock signal input (Hbb)	
	C	Mechanical weakening detection 1 (oL5)	
	D	Mechanical weakening detection 2 (UL5)	
	E	Reserved	
	F	Reserved	

1. See [Faults on page 24](#) for information on fault contents.
2. See [Alarms on page 28](#) for information on alarm contents.

Register	Command Name		Comments
	BIT		
00CCH	Alarm contents 5 *2		
	8	DriveWorksEZ alarm (dWAL)	
	2	A/D Conversion Error (CPF02)	
	3	PWM Data Fault (CPF03)	
	5	Reserved	
	6	Drive specification mismatch during Terminal Board or Control Board replacement (CPF06)	
	7	Terminal Board Communications Fault (CPF07)	
	8	EEPROM Serial Communications Fault (CPF08)	
	B	RAM Fault (CPF11)	
	C	FLASH Memory Fault (CPF12)	
	D	Watchdog Circuit Exception (CPF13)	
	E	Control Circuit Fault (CPF14)	
00D1H	CPF contents 2 *1		
	0	Clock fault (CPF16)	
	1	Timing fault (CPF17)	
	2	Control circuit fault (CPF18)	
	3	Control circuit fault (CPF19)	
	4	Hardware fault at power up (CPF20)	
	5	Hardware fault at communication start up (CPF21)	
	6	A/D conversion fault (CPF22)	
	7	PWM feedback fault (CPF23)	
	8	Drive capacity signal fault (CPF24)	
	9	Reserved	
00D8H	oFAx contents *1		
	0	Option compatibility error (oFA00)	
	1	Option not properly connected (oFA01)	
	3	Option self-diagnostics error (oFA03)	
	4	Option Flash write mode error (oFA04)	
00D9H	Reserved		
00DBH	Reserved		
00F0H	Reserved		
00F2H	Reserved		
00FBH	Output current (U1-03)		CIMR-VA2A 0040 and higher: 0.1 A units Others: 0.01 A units
00FCH	Reserved		
00FDH	Reserved		

1. See [Faults on page 24](#) for information on fault contents.
2. See [Alarms on page 28](#) for information on alarm contents.

◆ Fault Contents

Table 9 Fault Contents

Register	Fault Name	Fault Code (U2, U3)
00C0H	Fault contents 1	
	Undervoltage (Uv1)	0001H
	Control power supply undervoltage (Uv2)	0002H
	Soft charge circuit fault (Uv3)	0004H
	Load short-circuit (SC)	0005H
	Ground fault (GF)	0006H
	Overcurrent (oC)	0007H
	Overvoltage (ov)	0008H
	Heatsink overheat (oH)	0009H
	Heatsink overheat (oH1)	000AH
	Motor overload (oL1)	000BH
	Drive overload (oL2)	000CH
	Overtorque detection 1 (oL3)	000DH
	Overtorque detection 2 (oL4)	000EH
	Dynamic braking transistor (rr)	000FH
	Braking resistor overheat (rH)	0010H

10 CANopen Code Numbers

Register	Fault Name	Fault Code (U2, U3)
00C1H	Fault contents 2	
	External fault at input terminal S3 (EF3)	0011H
	External fault at input terminal S4 (EF4)	0012H
	External fault at input terminal S5 (EF5)	0013H
	External fault at input terminal S6 (EF6)	0014H
	External fault at input terminal S7 (EF7)	0015H
	Overspeed (oS) Note: Possible only when using Simple V/f with PG	0018H
	Excessive speed deviation (dEv) Note: Possible only when using Simple V/f with PG	0019H
	PG disconnect (PGo) Note: Possible only when using Simple V/f with PG	001AH
	Input phase loss (PF)	001BH
	Output phase loss (LF)	001CH
	Motor overheat (PTC input) (oH3)	001DH
	Digital operator connection fault (oPr)	001EH
	EEPROM write error (Err)	001FH
	Motor overheat fault (PTC input) (oH4)	0020H
00C2H	Fault contents 3	
	MEMOBUS/Modbus communication error (CE)	0021H
	Option communication error (bUS)	0022H
	Control fault (CF)	0025H
	Reserved	—
	CANopen Option external fault (EF0)	0027H
	PID feedback loss (FbL)	0028H
	Undertorque detection 1 (UL3)	0029H
	Undertorque detection 2 (UL4)	002AH
	High Slip Braking overload (oL7)	002BH
	Hardware fault (including oFx)	0030H
00C3H	Fault contents 4	
	Reserved	—
	Output current imbalance (LF2)	0036H
	Pullout detection (Sto)	0037H
	PG disconnect (PGo) Note: Possible only when using Simple V/f with PG	0038H
	Reserved	—
	Too many speed search restarts (SEr)	003BH
	Reserved	—
	Reserved	—
	Reserved	—
	Reserved	—
00C4H	Fault contents 5	
	Excessive PID feedback (FbH)	0041H
	External fault 1, input terminal S1 (EF1)	0042H
	External fault 2, input terminal S2 (EF2)	0043H
	Mechanical weakening detection 1 (oL5)	0044H
	Mechanical weakening detection 2 (UL5)	0045H
	Current offset fault (CoF)	0046H
	Reserved	—
	Reserved	—
	DriveWorksEZ fault (dWFL)	0049H
00D0H	CPF contents 1	
	A/D conversion error (CPF02)	0083H
	PWM data fault (CPF03)	0084H
	Reserved	0086H
	Drive specification mismatch during Terminal Board or Control Board replacement (CPF06)	0087H
	Terminal board communication fault (CPF07)	0088H
	EEPROM serial communication fault (CPF08)	0089H
	RAM fault (CPF11)	008CH
	Flash memory circuit exception (CPF12)	008DH
	Watchdog circuit exception (CPF13)	008EH
	Control circuit fault (CPF14)	008FH

Register	Fault Name	Fault Code (U2, U3)
00D1H	CPF Contents 2	
	Clock fault (CPF16)	0091H
	Timing fault (CPF17)	0092H
	Control circuit fault (CPF18)	0093H
	Control circuit fault (CPF19)	0094H
	Hardware fault at power up (CPF20)	0095H
	Hardware fault at communication start up (CPF21)	0096H
	A/D conversion fault (CPF22)	0097H
	PWM feedback fault (CPF23)	0098H
	Drive capacity signal fault (CPF24)	0099H
	Reserved	009AH
00D8H	oFAx contents	
	Option compatibility error (oFA00)	0101H
	Option not properly connected (oFA01)	0102H
	Option self-diagnostics error (oFA03)	0104H
	Option Flash write mode error (oFA04)	0105H

◆ Alarm Contents

Table 10 Alarm Contents

Register	Alarm Name	Alarm Code (007FH)
00C8H	Alarm contents 1	
	Undervoltage (Uv)	0001H
	Overvoltage (ov)	0002H
	Heatsink overheat (oH)	0003H
	Drive overheat (oH2)	0004H
	Overtorque 1 (oL3)	0005H
	Overtorque 2 (oL4)	0006H
	Run commands input error (EF)	0007H
	Drive baseblock (bb)	0008H
	External fault 3, input terminal S3 (EF3)	0009H
	External fault 4, input terminal S4 (EF4)	000AH
	External fault 5, input terminal S5 (EF5)	000BH
	External fault 6, input terminal S6 (EF6)	000CH
	External fault 7, input terminal S7 (EF7)	000DH
	Cooling fan error (FAN)	000FH
	Overspeed (oS) Note: Possible only when using Simple V/f with PG	0010H
00C9H	Alarm Contents 2	
	Excessive speed deviation (dEv) Note: Possible only when using Simple V/f with PG	0011H
	PG disconnect (PGo) Note: Possible only when using Simple V/f with PG	0012H
	Digital operator connection fault (oPr)	0013H
	MEMOBUS/Modbus communication error (CE)	0014H
	Option communication error (bUS)	0015H
	Serial communication transmission error (CALL)	0016H
	Motor overload (oL1)	0017H
	Drive overload (oL2)	0018H
	Reserved	–
	CANopen Option external fault (EF0)	001AH
	During run 2, Motor switch command input (rUn)	001BH
	Serial communication transmission error (CALL)	001DH
	Undertorque detection 1 (UL3)	001EH
	Undertorque detection 2 (UL4)	001FH
	MEMOBUS/Modbus test mode fault (SE)	0020H
00CAH	Alarm contents 3	
	Motor overheat (oH3)	0022H
	PID feedback loss (FbL)	0027H
	Excessive PID feedback (FbH)	0028H
	Drive disabled (dnE)	002AH
	PG Disconnect (PGo) Note: Possible only when using Simple V/f with PG	002BH
	Reserved	–
	Reserved	–
	Reserved	–
	Reserved	–

10 CANopen Code Numbers

Register	Alarm Name	Alarm Code (007FH)
00CBH	Alarm contents 4	
	Reserved	—
	Reserved	—
	Reserved	—
	Current alarm (HCA)	0034H
	Reserved	—
	External fault (input terminal S1) (EF1)	0039H
	External fault (input terminal S2) (EF2)	003AH
	Hardwire baseblock signal input (HbbF)	003BH
	Hardwire baseblock signal input (Hbb)	003CH
	Mechanical weakening detection 1 (oL5)	003DH
	Mechanical weakening detection 2 (UL5)	003EH
	Reserved	—
	Reserved	—
00CCH	Alarm contents 5	
	DriveWorksEZ alarm (dWAL)	0049H

11 Specifications

◆ Specifications

Table 11 Option Unit Specifications

Model	SI-S3/V (PCB model: SI-S3)
Communication Profile	DS 301 Ver. 4.02 DSP 402 Ver. 1.1 Velocity Mode
Connector	9 pin D-SUB connector (#4/40 UNC thread)
Communications Speed	10 kbps to 1 Mbps
Ambient Temperature	−10 °C to +50 °C
Humidity	up to 95% RH (no condensation)
Storage Temperature	−20 °C to +60 °C (allowed for short-term transport of the product)
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)
Altitude	up to 1000 m

◆ Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.

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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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