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.
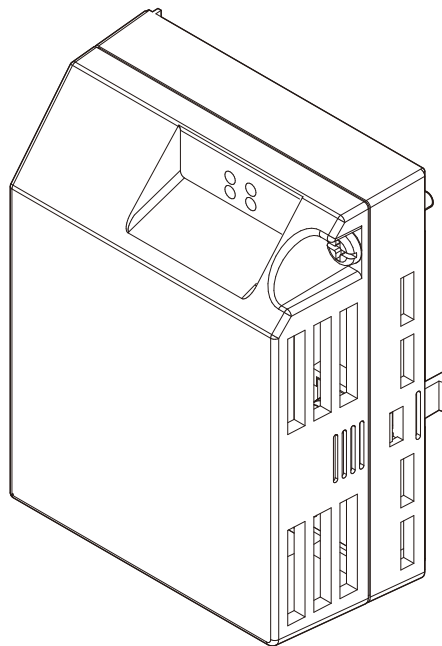
Table of Contents

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 **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 Technical 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. : SIEP 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
	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.

■ **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.
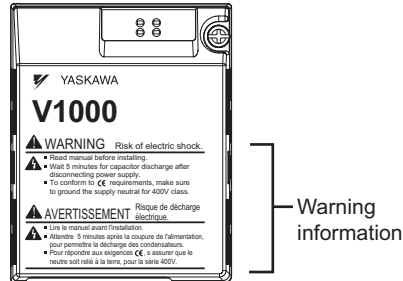
■ **Warning Contents**

⚠ 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 <1>
CIMR-V□□A□□□□BA□	5010, 1010 or later
CIMR-V□□A□□□□FA□	5010, 1010 or later
CIMR-V□□A□□□□JA□	5010, 1010 or later

<1> See "PRG" on the drive nameplate for the software version number.
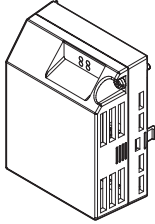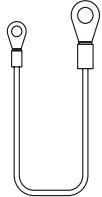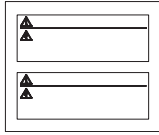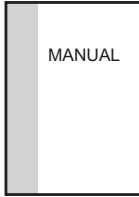
3 Receiving

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
–				MANUAL
Quantity:	1	4	1	1

◆ Tool Requirements

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

<1> 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

CANopen with cover attached

CANopen with cover removed

underside

A – LED (RUN: green)
B – LED (ERR: red)
C – Option cover
D – CANopen PCB
E – Attachment screw hole for option cover
F – PCB part number
G – Function Earth cable connection (FE)
H – Mounting clip
I – Cable *<1>*
J – Through-hole for cable
K – Communication cable connector (9 pin D-SUB)
L – Option board connector
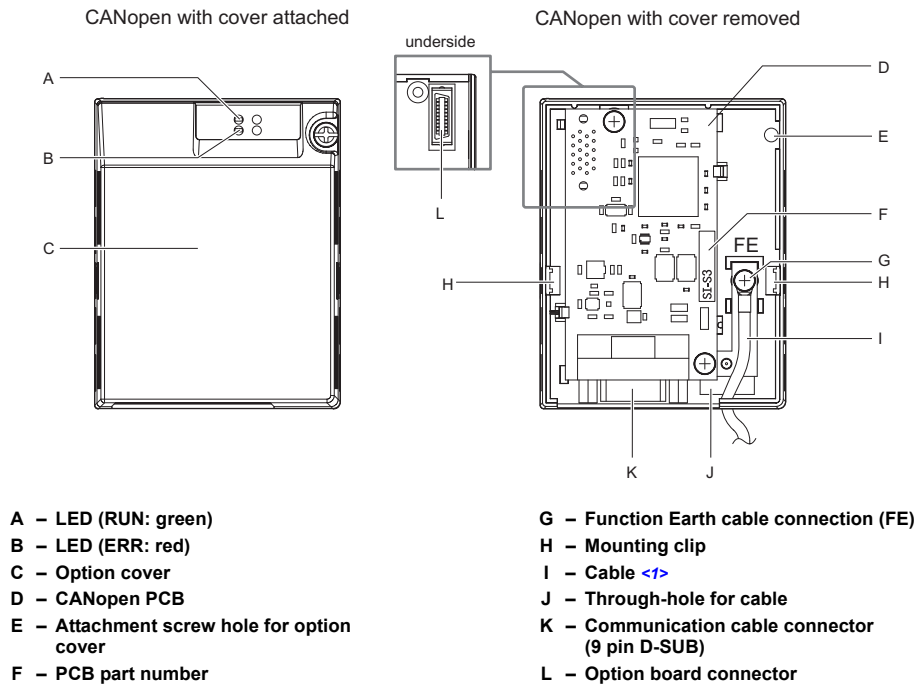
Figure 1 Option Unit

<1> 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.

27 mm (1.06 in.)

Figure 2 Dimensions

◆ **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*.
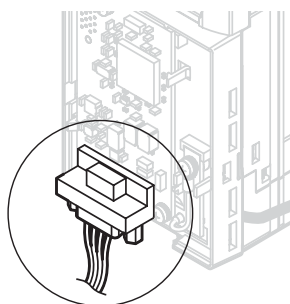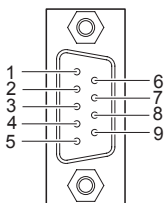
Figure 3 Communication connector location

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.
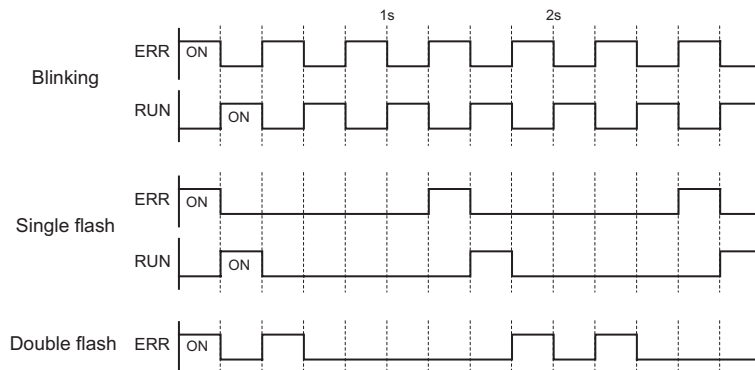
Figure 4 LED Flash Rates and Meaning

◆ **Setting Node Address**

Set the node address in the drive parameter F6-35. The node address can be set between 1 and 127 but has to be unique in the network. If the Node address is set to 0, communications will not be possible and the ERR LED will flash.

5 Installation Procedure

◆ **Section Safety**

<table>
<tr><td align="center">⚠ DANGER</td></tr>
</table>

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.

<table>
<tr><td align="center">⚠ WARNING</td></tr>
</table>

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.

<table>
<tr><td align="center">NOTICE</td></tr>
</table>

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.

◆ 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 Quick Start Guide 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.
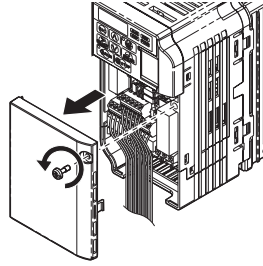
Figure 5 Remove Front Cover

3. Remove the bottom cover and connect the CANopen Option ground cable to the ground terminal.
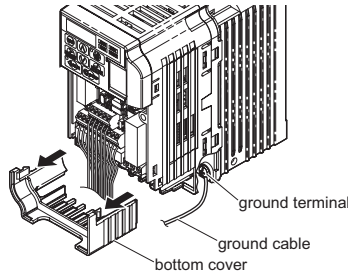
Figure 6 Connect Ground Cable

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.
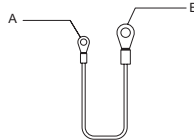
A – **Option unit connection: screw size = M3**

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

Figure 7 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 ground cable. Replace the terminal cover after wiring the CANopen Option ground cable.
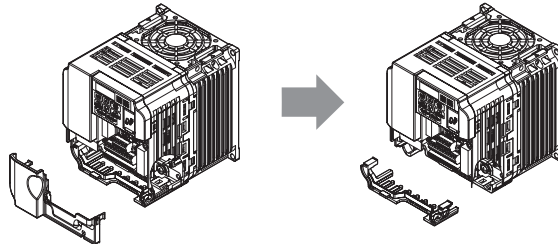
Figure 8 Models with Terminal Cover

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.
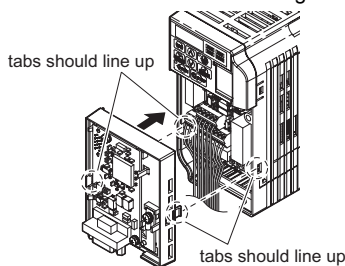
Figure 9 Attach CANopen Option

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.
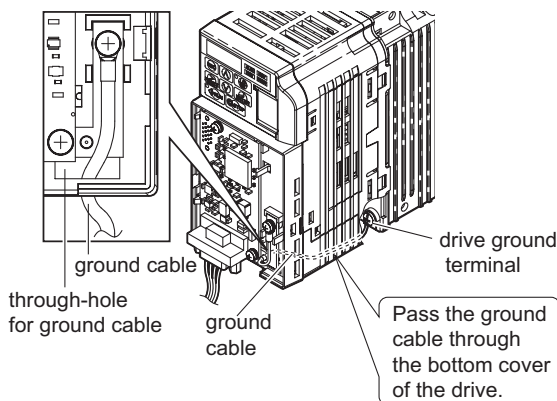
Figure 10 Ground Cable Connection

7. Attach the CANopen Option cover to the front of the CANopen Option.
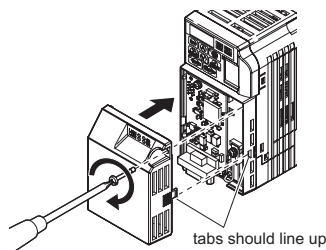
Figure 11 Attach Cover

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

Use a CANopen-dedicated communication cable only; To ensure proper performance Yaskawa recommends using CANopen dedicated communication cables only.

◆ Wiring the CANopen Option

The CANopen option must be connected to the network using a 9 pin D-SUB connector like shown in *Figure 12*.
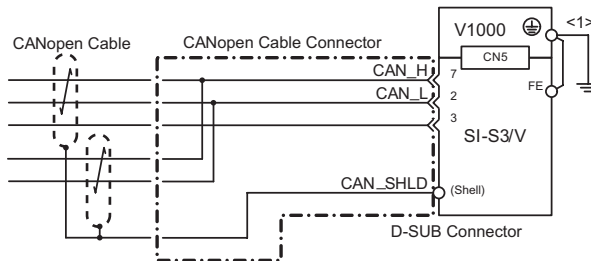
Figure 12 Wiring Diagram

<1> 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 13* if the SI-S3/V is the last node in the network.
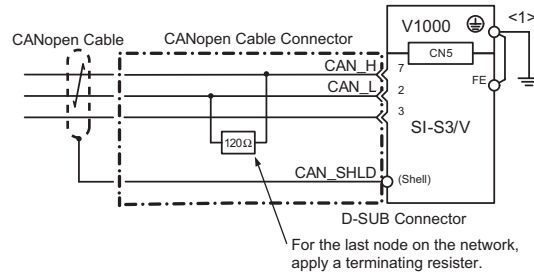
Figure 13 Terminating Diagram

<1> The FE terminal on the CANopen Option must be connected to the drive ground terminal using one of the 4 delivered ground wires.

◆ **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 127	[7]
F6-36	Communication Speed	0: Disabled 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 [8]	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: Hz 1: % (100% = E1-04) 2: min^{-1} (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 127 is entered.

[7] Default setting is 99 for software versions 5010, 1010, and 1011, 0 for software version 1012 or later.

[8] 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 productsthat 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 Objects (DS 301)

Index (Hex.)	Name	Page
1000	Device Type	*18*
1001	Error Register	*18*
1003	Pre-defined Error Field	*18*
1005	COB-ID SYNC Message	*18*
1008	Manufacturer Device Name	*18*
1009	Manufacturer Hardware Version	*18*
100A	Manufacturer Software Version	*18*
100C	Guard Time	*18*
100D	Life Time Factor	*18*
100E	Node Guarding Identifier	*18*
1010	Store Parameters	*19*
1011	Restore Default Parameters	*19*
1014	COB-ID Emergency Object	*19*
1016	Consumer Heartbeat Time	*19*
1017	Producer Heartbeat Time	*19*
1018	Identity Object	*19*

◆ Manufacturer Specific Objects (DS 301)

■ Input Objects

Index (Hex.)	Name	Page
2000	Operation Command	*19*
2010	Speed Command	*19*
2020	Torque Limit	*19*
2030	Torque Compensation	*20*
2040	MEMOBUS Read Command	*20*
2050	MEMOBUS Write Command	*20*
2060	MEMOBUS Not Limited Enter Command	*20*
2070	MEMOBUS Limited Enter Command	*20*

■ Output Objects

Index (Hex.)	Name	Page
2100	Drive Status	*20*
2110	Output Frequency	*21*
2120	Output Current	*21*
2130	Output Torque	*21*
2140	MEMOBUS Read Command Response	*21*
2150	MEMOBUS Write Command Response	*21*
2160	MEMOBUS Not Limited Enter Command Response	*21*
2200	Motor Speed	*21*

◆ 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.)	Name	Page
60FD	Digital Input *<1>*	*21*
60FE	Digital Output *<2>*	*21*

<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.)	Name	Page
6040	Controlword	*22*
6041	Statusword	*22*
6061	Modes_of_operation_display	*22*

■ Velocity Mode

Index (Hex.)	Name	Page
6042	vl_target_velocity	*22*
6043	vl_velocity_demand	*22*
6044	vl_control_effort	*22*
6046	vl_velocity_min_max_amount	*22*
6048	vl_velocity_acceleration	*22*
6049	vl_velocity_deceleration	*22*
604A	vl_velocity_quick_stop	*23*
604C	vl_dimension_factor	*23*
604D	vl_pole_number	*23*

8 Object Description

◆ **Communication Objects (DS 301)**

■ **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.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1000	–	Device Type	Read Only	No	Unsigned 32

■ **Error Register**

This register shows the fault status of the device. If any errors occurs in the device bit 0 (generic error) is set to one.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1001	–	Error Register	Read Only	Optional	Unsigned 8

■ **Pre-defined Error Field**

This register provides a history of errors that occurred in the drive and have been signalized via the Emergency object. Subindex 0 contains the number of errors. Subindexes 1 to FF contains a rolling list of error codes where subindex 1 always contains the last occurred error. *Refer to Drive Error List on page 23* for a list of possible error codes.

Writing a 0 into subindex 0 resets the error field.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1003	0	Number of Errors	Read / Write	No	Unsigned 8
	1 to FF	Standard Error field	Read Only		Unsigned 32

■ **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.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1005	–	COB-ID SYNC Message	Read / Write	No	Unsigned 32

■ **Manufacturer Device Name**

This object contains the Manufacturer device name.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1008	–	Manufacturer Device Name	Read Only	No	Visible string

■ **Manufacturer Hardware Version**

This object contains the Manufacturer hardware version.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1009	–	Manufacturer Hardware Version	Read Only	No	Visible string

■ **Manufacturer Software Version**

This object contains the Manufacturer software version It indicates the version number of the EEPROM.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
100A	–	Manufacturer Software Version	Read Only	No	Visible string

■ **Guard Time**

This object contains the guard time.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Units
100C	–	Guard Time	Read / Write	No	Unsigned 16	1 ms

■ **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.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
100D	–	Life Time Factor	Read / Write	No	Unsigned 8

■ **Node Guarding Identifier**

This object contains the node guarding identifier. It defines the identifier for the node guarding.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
100E	–	Node Guarding Identifier	Read / Write	No	Unsigned 32

■ **Store Parameters**

By writing "SAVE" (s = 73H, a = 61H, v = 76H, e = 65H) into this object, the SI-S3/V settings are saved in the non-volatile memory. The SI-S3/V will operate using these settings when a Reset Node or Reset Communications command was performed or when the power supply was cycled.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1010	1	Store Parameters	Read / Write	No	Unsigned 32

■ **Restore Default Parameter**

Writing "LOAD" (l = 6CH, o = 6FH, a = 61H, d = 64H) into this object restores the SI-S3/V default settings.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1011	1	Restore Default Parameters	Read / Write	No	Unsigned 32

■ **COB-ID Emergency Object**

This object defines the COB-ID of the emergency object.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1014	–	COB-ID Emergency Object	Read Only	No	Unsigned 32

■ **Consumer Heartbeat Time**

This object defines the Consumer heartbeat time. It must be set to a higher value than the producer heartbeat time set in the master. When set to 0, consumer heartbeat is disabled.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Units
1016	1	Consumer Heartbeat Time	Read / Write	No	Unsigned 32	1 ms

■ **Producer Heartbeat Time**

This object determines the cycle time the SI-S3/V uses to produce a heartbeat signal. When set to 0, the SI-S3/V does not produce a heartbeat signal.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Units
1017	–	Producer Heartbeat Time	Read / Write	No	Unsigned 32	1 ms

■ **Identity Object**

This object contains general information about the drive.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
1018	–	Identity Object	Read Only	No	Unsigned 32

◆ **Manufacturer Specific Objects**

■ **Operation Command**

This object is used to operate the drive, set digital inputs and to trigger or reset a drive fault.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2000	0	Operation Commands	Read / Write	Possible	2 byte

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	Terminal S3 enable/disable	Depends on H1-03 setting
3	Terminal S4 enable/disable	Depends on H1-04 setting
4	Terminal S5 enable/disable	Depends on H1-05 setting
5	Terminal S6 enable/disable	Depends on H1-06 setting
6	Terminal S7 enable/disable	Depends on H1-07 setting
7	Not used	
8	External Fault (EF0)	
9	Fault Reset	
A to F	Not used	

■ **Speed Command**

Sets the frequency reference. The unit of this value depends on the setting of the drive parameter o1-03.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2010	0	Speed Command	Read / Write	Possible	2 byte

■ **Torque Limit**

This object sets the torque limit in units of 0.1%. It can be used in Open Loop Vector control only.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2020	0	Torque Limit	Read / Write	Possible	2 byte

■ **Torque Compensation**

This object sets the torque compensation in units of 0.1%. It can be used in Open Loop Vector control only.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2030	0	Torque Compensation	Read / Write	Possible	2 byte

■ **Memobus Read Request**

Using this object the content of drive MEMOBUS registers can be read out. The address of the MEMOBUS must be written in byte 1 and 2 of Subindex 1, bytes 3 and 4 have to be set to 0. After sending a MEMOBUS Read Request to the drive the MEMOBUS register content can be read out from object 2140H.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2040	0	Number of Entries	Read / Write	Possible	1 byte
	1	MEMOBUS Read Request			2 + 2 byte MEMOBUS Address + 00H

■ **Memobus Write Request**

Using this object drive MEMOBUS registers can be written. The address of the MEMOBUS must be written in byte 1 and 2 of Subindex 1, the data must be written in bytes 3 and 4. After sending a MEMOBUS Write Request to the drive, the response can be read from out from object 2150H.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2050	0	Number of Entries	Read / Write	Possible	1 byte
	1	MEMOBUS Write Request			2 + 2 byte MEMOBUS Address + Data

■ **Memobus Not Limited ENTER Command**

Depending on the drive parameter H5-11 setting, an ENTER command must be used to activate drive parameters changed via MEMOBUS Write Commands. The not limited ENTER command activates parameters in the drive RAM only. If the drive power is cycled, parameter changes are lost. If more than one parameter has been changed it is enough to send only one ENTER command after the last parameter change. Doing so will activate all changed parameters. This ENTER command can be used without limitations.

To execute an ENTER command "SAVE" (73H + 61H + 76H + 65H) has to be written in object 2060H, subindex 0.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2060	0	Not Limited Enter Command	Read / Write	Possible	4 byte

■ **Memobus Limited ENTER Command**

Depending on the drive parameter H5-11 setting, an ENTER command must be used to activate drive parameters changed via MEMOBUS Write Commands. The Limited enter command activates parameters in the drives RAM and saves them into the EEPROM. When power supply loss occurs or the power supply is cycled, the drive will operate using the saved parameters. If more than one parameter has been changed it is enough to send only one ENTER command after the last parameter change. Doing so will activate all changed parameters. This ENTER command can be applied approximately 100,000 times and should be used only when necessary.

To execute an ENTER command "SAVE" (73H + 61H + 76H + 65H) has to be written in object 2070H, subindex 0.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2070	0	Limited Enter Command	Read / Write	Possible	4 byte

■ **Drive Status**

This object can be used to monitor the drive status.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2100	0	Drive Status	Read Only	Possible	2 byte

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

■ Output Frequency

This object can be used to read out the drive output frequency. The unit of this value depends on the setting of drive parameter o1-03.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2110	0	Output Frequency	Read Only	Possible	2 byte

■ Output Current

This object can be used to read out the drive output current. Units are determined by parameter o1-03.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2120	0	Output Current	Read Only	Possible	2 byte

■ Output Torque

This object can be used to read out the drive output torque. It can be used in Open Loop Vector control only.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2130	0	Output Torque	Read Only	Possible	2 byte

■ MEMOBUS Read Response

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

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2140	0	Number of Entries	Read Only	Possible	1 byte
	1	MEMOBUS Read Response			2 + 2 byte MEMOBUS Address + 00H

■ MEMOBUS Write Response

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

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2150	0	Number of Entries	Read Only	Possible	1 byte
	1	MEMOBUS Write Response			2 + 2 byte MEMOBUS Address + Data

■ MEMOBUS Not Limited Enter Command Response

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2160	0	MEMOBUS Not Limited Enter Command Response	Read Only	Possible	4 byte

■ Motor Speed

Monitors the value of the motor speed. The unit of this value depends on the setting of drive parameter o1-03. The register content is zero if the drive is set for V/f control.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Length
2200	0	Motor Speed	Read Only	Possible	4 byte

◆ Drive and Motion Control (DSP402)

■ Digital Input

This object contains the drive digital output status (seen as input to the network).

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
60FD	–	Drive Digital Output Status	Read Only	Possible	$0...(2^{32}-1)$

Bit No	Description
0 to F	Not used
10	Terminal MA-MB-MC Output
11	Terminal P1-PC Output
12	Terminal P2-PC Output
13 to 1F	Not used

■ Digital Output

This object is used to set drive digital inputs (seen as output from the network).

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
60FE	–	Drive Digital Input Command	Read / Write	Possible	$0...(2^{32}-1)$

Bit No	Description	Function
0 to 11	Not used	
12	Terminal S3 enable/disable	Depends on H1-03 setting
13	Terminal S4 enable/disable	Depends on H1-04 setting
14	Terminal S5 enable/disable	Depends on H1-05 setting
15	Terminal S6 enable/disable	Depends on H1-06 setting
16	Terminal S7 enable/disable	Depends on H1-07 setting

Bit No	Description	Function
17	Not used	
18	External Fault (EF0)	
19	Fault Reset	
1A to 1F	Not used	

■   Controlword

This object sets the device to different states.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
6040	–	Controlword	Read / Write	Possible	0...65535

■   Statusword

This object shows different states of the device.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
6041	–	Statusword	Read Only	Possible	0...65535

■   Modes_of_Operation_Display

This object shows the mode of the device. The object supports 2 (Velocity Mode) only.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
6061	–	Modes_of_Operation_Display	Read Only	Possible	-128...127

■   Vl_Target_Velocity

This object sets the speed reference. It is internally multiplied with the vl_dimension_factor (604C). Prior to using this object, drive parameter o1-03 has to be set to min^{-1}.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
6042	–	Vl_Target_Velocity	Read / Write	Possible	-32768...0...32767	min^{-1}

■   Vl_Velocity_Demand

The vl_target_demand is the speed reference provided by the ramp function and limiting functions in units of min^{-1}.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
6043	–	Vl_Velocity_Demand	Read Only	Possible	-32768...0...32767	min^{-1}

■   Vl_Control_Effort

The vl_control_effort is the output frequency of the drive to the motor. The unit is min^{-1}. In case of close loop vector control mode the motor speed can be read out.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
6044	–	Vl_Control_Effort	Read Only	Possible	-32768...0...32767	min^{-1}

■   Vl_Velocity_Min_Max_Amount

This object provides two subindexes to set the minimum and maximum speed reference in min^{-1}.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
6046	1	Vl_Velocity_Min_Amount	Read / Write	Possible	0...(2^{32}-1)	min^{-1}
	2	Vl_Velocity_Max_Amount				

■   Vl_Velocity_Acceleration

The vl_velocity_acceleration specifies the acceleration time. The quotient of the subindexes delta_speed and delta_time determines the acceleration time. The object values correspond to the acceleration time setting in the drive.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
6048	1	Dalta_Speed	Read / Write	Possible	0...(2^{23}-1)	min^{-1}
	2	Delta_Time			0...65535	Second

■   Vl_Velocity_Deceleration

The vl_velocity_min_max_amount specifies the deceleration time. The quotient of the subindexes delta_speed and delta_time determines the deceleration time. The object values correspond to the deceleration time setting in the drive.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
6049	1	Dalta_Speed	Read / Write	Possible	0...(2^{23}-1)	min^{-1}
	2	Delta_Time			0...65535	Second

■   Vl_Velocity_Quick_Stop

The vl_velocity_quick_stop specifies the quick stop ramp. The quotient of the subindexes delta_speed and delta_time determines the quick stop ramp time. The object values correspond to the fast stop time setting in the drive.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
604A	1	Dalta_Speed	Read / Write	Possible	0...(2^{23}-1)	min^{-1}
	2	Delta_Time			0...65535	Second

■ **Vl_Dimension_Factor**

The vl_dimension_factor is multiplied with the target velocity. The quotient of the subindexes vl_dimension_factor_numerator and vl_dimension_factor_denumerator determines the vl_dimension_factor.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range	Unit
604C	1	Vl_Dimension_Factor Numerator	Read / Write	Possible	$0...(2^{32}-1)$	min^{-1}
	2	Vl_Dimension_Cactor Denumerator			0...65535	Second

■ **Vl_Pole_Number**

The vl_pole_number sets the number of motor poles and is used to calculate all speed related values in min^{-1}. This value corresponds to the number of motor poles setting in the drive.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Value Range
604D	–	Vl_Pole_Number	Read / Write	Possible	0...255

◆ **Drive Error List**

The table below lists up error codes that are used in the Emergency object and in object 1003H (Pre-defined Error Field) when a drive fault occurs.

Object No.	Content	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 hear	rH
5200	Control power supply under voltage	Uv 2
5300	LCD 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	Controler 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.

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

◆ **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	Not assigned	1405	Subindex 1: 6040 Subindex 2: 6042	1605
7	Not assigned	1406	Subindex 1: 6040 Subindex 2: 60FE	1606
8	Not assigned	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	Not assigned	1805	Subindex 1: 6041 Subindex 2: 6044	1A05
7	Not assigned	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: 2150 sub1	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	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
oFA00	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
oFA01	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	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
oFAO4	oFA04	CANopen Option Fault
		CANopen Option Flash write mode
Cause		**Possible Solution**
CANopen Option hardware fault.		⇒ Replace the CANopen Option.

10   MEMOBUS/Modbus Data Table

◆ Command Data

It is possible to both read and write command data.

> **Note:** Bits that are not used should be set to 0. Refrain from writing to reserved registers.

Register No.	Contents	
0000H	Reserved	
0001H	Operation Signals and Multi-function Inputs	
	bit 0	H5-12 = 0: Forward Run Command (0 = Stop, 1 = Forward Run) H5-12 = 1: Run Command (0 = Stop, 1 = Run)
	bit 1	H5-12 = 0: Reverse Run Command (0 = Stop, 1 = Reverse Run) H5-12 = 1: Forward/Reverse (0 = Forward, 1 = Reverse)
	bit 2	External Fault (EF0)
	bit 3	Fault Reset
	bit 4	Multi-Function Input 1 Function is ComRef when H1-01 = 40 (Forward/Stop).
	bit 5	Multi-Function Input 2 Function is ComCtrl when H1-02 = 41 (Reverse/Stop).
	bit 6	Multi-Function Input 3
	bit 7	Multi-Function Input 4
	bit 8	Multi-Function Input 5
	bit 9	Multi-Function Input 6
	bit A	Multi-Function Input 7
	bit B to bit F	Reserved
0002H	Frequency Reference	Units are determined by parameter o1-03.
0003H	V/f Gain (V/f Control only)	
0004H-0005H	Reserved	
0006H	PID Target, 0.01% units, signed	
0007H	Analog Output Terminal AM Setting (10 V / 4000 H)	
0008H	Reserved	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Contact Output (terminal MA/MB-MC)
	bit 1	Photocoupler Output 1 (terminal P1-PC)
	bit 2	Photocoupler Output 2 (terminal P2-PC)
	bit 3 to bit 5	Reserved
	bit 6	Enable Fault Contact Output (1 = enable bit 7)
	bit 7	Fault Contact (terminal MA/MB-MC)
	bit 8 to bit F	Reserved
000AH	Pulse Output Terminal MP Setting, 1 Hz units, Setting Range: 0 to 32000	
000BH-000EH	Reserved	
000FH	Control Selection Setting	
	bit 0	Reserved
	bit 1	PID Target Input
	bit 2 to bit B	Reserved
	bit C	Enable Terminal S5 Input for Broadcast Data
	bit D	Enable Terminal S6 Input for Broadcast Data
	bit E	Enable Terminal S7 Input for Broadcast Data
	bit F	Reserved

◆ Monitor Data

Monitor data can be read only.

Register No.	Contents	
0020H	Drive Status 1	
	bit 0	During Run
	bit 1	During Reverse
	bit 2	Drive Ready
	bit 3	Fault
	bit 4	Data Setting Error
	bit 5	Multi-Function Contact Output (terminal MA/MB-MC)
	bit 6	Multi-Function Photocoupler Output 1 (terminal P1 - PC)
	bit 7	Multi-Function Photocoupler Output 2 (terminal P2 - PC)
	bit 8 to bit D	Reserved
	bit E	ComRef status
	bit F	ComCtrl status

Register No.	Contents	
0021H	Fault Contents 1	
	bit 0	Overcurrent (oC), Ground fault (GF)
	bit 1	Overvoltage (ov)
	bit 2	Drive Overload (oL2)
	bit 3	Overheat 1 (oH1), Drive Overheat Warning (oH2)
	bit 4	Dynamic Braking Transistor Fault (rr), Braking Resistor Overheat (rH)
	bit 5	PID Feedback Loss (FbL / FbH)
	bit 6	Overcurrent (oC), Ground Fault (GF)
	bit 7	EF0 to 7: External Fault
	bit 8	CPF□□: Hardware Fault (includes OFx)
	bit 9	Motor Overload (oL1), Overtorque Detection 1/2 (oL3/oL4), Undertorque Detection 1/2 (UL3/UL4)
	bit A	PG Disconnected (PGo), Overspeed (oS), Excessive Speed Deviation (dEv),
	bit B	Main Circuit Undervoltage (Uv)
	bit C	Undervoltage (Uv1), Control Power Supply Undervoltage (Uv2), Soft Charge Circuit Fault (Uv3)
	bit D	Output Phase Loss (LF), Input Phase Loss (PF)
	bit E	MEMOBUS/Modbus Communication Error (CE), Option Communication Error (bUS)
	bit F	Operator Connection Fault (oPr)
0022H	Data Link Status	
	bit 0	Writing data or switching motors
	bit 1	Reserved
	bit 2	
	bit 3	Upper or lower limit error
	bit 4	Data conformity error
	bit 5	Writing to EEPROM
	bit 6 to bit F	Reserved
0023H	Frequency Reference, *<1>*	
0024H	Output Frequency, *<1>*	
0025H	Output Voltage Reference, 0.1 V units (units are determined by parameter H5-10)	
0026H	Output Current, *<2>*	
0027H	Output Power	
0028H	Torque Reference (OLV only)	
0029H	Fault Contents 2	
	bit 0	Reserved
	bit 1	Ground Fault (GF)
	bit 2	Input Phase Loss (PF)
	bit 3	Output Phase Loss (LF)
	bit 4	Braking Resistor Overheat (rH)
	bit 5	Reserved
	bit 6	Motor Overheat 2 (PTC input) (oH4)
	bit 7 to bit F	Reserved
002AH	Alarm Contents1	
	bit 0 to bit 1	Reserved
	bit 2	Run Command Input Error (EF)
	bit 3	Drive Baseblock (bb)
	bit 4	Overtorque Detection 1 (oL3)
	bit 5	Heatsink Overheat (oH)
	bit 6	Overvoltage (ov)
	bit 7	Undervoltage (Uv)
	bit 8	Cooling Fan Error (FAN)
	bit 9	MEMOBUS/Modbus Communication Error (CE)
	bit A	Option Communication Error (bUS)
	bit B	Undertorque Detection 1/2 (UL3/UL4)
	bit C	Motor Overheat (oH3)
	bit D	PID Feedback Loss (FbL, FbH)
	bit E	Serial Communication Transmission Error (CALL)
	bit F	Run Command Input Error (EF)
002BH	Input Terminal Status	
	bit 0	Terminal S1 Closed
	bit 1	Terminal S2 Closed
	bit 2	Terminal S3 Closed
	bit 3	Terminal S4 Closed
	bit 4	Terminal S5 Closed
	bit 5	Terminal S6 Closed
	bit 6	Terminal S7 Closed
	bit 7 to bit F	Reserved

Register No.	Contents	
002CH	Drive Status 2	
	bit 0	During Run
	bit 1	Zero Speed
	bit 2	Speed Agree
	bit 3	User Speed Agree
	bit 4	Frequency Detection 1
	bit 5	Frequency Detection 2
	bit 6	Drive Ready
	bit 7	During Undervoltage
	bit 8	During Baseblock
	bit 9	Frequency Reference from Operator Keypad
	bit A	Run Command from Operator Keypad
	bit B	Over/Undertorque 1, 2
	bit C	Frequency Reference Loss
	bit D	During Fault Restart
	bit E	Fault
	bit F	Communication Timeout
002DH	Output Terminal Status	
	bit 0	Multi-Function Contact Output (terminal MA/MB-MC)
	bit 1	Multi-Function Photocoupler Output 1 (terminal P1 - PC)
	bit 2	Multi-Function Photocoupler Output 2 (terminal P2 - PC)
	bit 3 - 6	Reserved
	bit 7	Fault Contact (terminal MA/MB-MC)
	bit 8 to bit F	Reserved
002EH	Reserved	
002FH	Frequency Reference Bias (from Up/ Down 2 Function), 0.1% units	
0030H	Reserved	
0031H	DC Bus Voltage, 1 V units	
0032H	Torque Monitor, 1% units	
0033H	Reserved	
0034H	Product Code 1 [ASCII], Product Type (V0 for V1000)	
0035H	Product Code 2 [ASCII], Region Code	
0036H to 0037H	Reserved	
0038H	PID Feedback, 0.1% units, unsigned, 100% / max. output frequency	
0039H	PID Input, 0.1% units, signed, 100% / max. output frequency	
003AH	PID Output, 0.1% units, signed, 100% / max. output frequency	
003B to 003CH	Reserved	
003DH	Communications Error Contents *<3>*	
	bit 0	CRC Error
	bit 1	Data Length Error
	bit 2	Reserved
	bit 3	Parity Error
	bit 4	Overrun Error
	bit 5	Framing Error
	bit 6	Timeout
	bit 7 to bit F	Reserved
003EH	Output Frequency	r/min *<4>*
003FH		0.01% units
0040H to 004AH	Used for various monitors U1-□□.	
004BH	Drive status (U1-12)	
	bit 0	During Run
	bit 1	During Zero Speed
	bit 2	During Reverse Run
	bit 3	During Fault Reset Signal Input
	bit 4	During Speed Agree
	bit 5	Drive Ready
	bit 6	Alarm
	bit 7	Fault
	bit 8	During Operation Error (oPE□□)
	bit 9	During Momentary Power Loss
	bit A	Motor 2 selected
	bit B	Reserved
	bit E	ComRef status, NetRef status
	bit F	ComCtrl status, NetCtrl status
004CH to 007E	Used for various monitors U1-□□, U4-□□, U5-□□ and U6-□□.	
007FH	Alarm Code, refer to *Alarm Register Contents on page 33* for alarm codes.	
0080H to 0097H	Used for monitors U2-□□, U3-□□. Refer to *Fault Trace / History Register Contents on page 32* for register value descriptions.	
0098H	High Word of Accumulated Operation Time Monitor (U4-01)	
0099H	Low Word of Accumulated Operation Time Monitor (U4-01)	
009AH	High Word of Cooling Fan Operation Time Monitor (U4-03) *<5>*	
009BH	Low Word of Cooling Fan Operation Time Monitor (U4-03) *<5>*	
00ABH	Drive Rated Current *<2>*	

Register No.	Contents	
00ACH	Motor Speed (Open Loop Vector only)	r/min units <4>
00ADH		0.01% units
00B0H	Option Code	Register contains ASCII code of 3rd and 4th digit of the option card type number. Example: Register value is 5343H for "P3" if a SI-P3 option card is installed.
00B5H	Frequency Reference After Soft-starter	r/min units <4>
00B6H		0.01% units
00B7H	Frequency Reference	r/min <4>
00B8H		0.01% units
00BFH	oPE Error Number	
00C0H	Fault contents 3	
	bit 0	Reserved
	bit 1	Undervoltage (Uv1)
	bit 2	Control Power Supply Undervoltage (Uv2)
	bit 3	Soft Charge Circuit Fault (Uv3)
	bit 4	Reserved
	bit 5	Ground Fault (GF)
	bit 6	Overcurrent (oC)
	bit 7	Overvoltage (ov)
	bit 8	Heatsink Overheat (oH)
	bit 9	Heatsink Overheat (oH1)
	bit A	Motor Overload (oL1)
	bit B	Drive Overload (oL2)
	bit C	Overtorque Detection 1 (oL3)
	bit D	Overtorque Detection 2 (oL4)
	bit E	Dynamic Braking Transistor Fault (rr)
	bit F	Braking Resistor Overheat (rH)
00C1H	Fault contents 4	
	bit 0	External Fault at input terminal S3 (EF3)
	bit 1	External Fault at input terminal S4 (EF4)
	bit 2	External Fault at input terminal S5 (EF5)
	bit 3	External Fault at input terminal S6 (EF6)
	bit 4	Reserved
	bit 5	Overspeed (oS)
	bit 6	Excessive Speed Deviation (dEv)
	bit 7	PG Disconnected (PGo)
	bit 8	Input Phase Loss (PF)
	bit 9	Output Phase Loss (LF)
	bit A	Motor Overheat (PTC input) (oH3)
	bit B	Digital Operator Connection Fault (oPr)
	bit C	EEPROM Write Error (Err)
	bit D	Motor Overheat Fault (PTC input) (oH4)
00C2H	Fault contents 5	
	bit 0	MEMOBUS/Modbus Communication Error (CE)
	bit 1	Option Communication Error (bUS)
	bit 4	Control Fault (CF)
	bit 5	Reserved
	bit 6	Option External Fault (EF0)
	bit 7	PID Feedback Loss (FbL)
	bit 8	Undertorque Detection 1 (UL3)
	bit 9	Undertorque Detection 2 (UL4)
	bit A	High Slip Braking Overload (oL7)
	bit F	Hardware fault (includes oFx)
00C3H	Fault contents 6	
	bit 0 to 4	Reserved
	bit 5	Output Current Imbalance (LF2)
	bit 6	Pullout Detection (Sto)
	bit 7	PG Disconnected (PGo)
	bit 8	Reserved
	bit A	Too many speed search restarts (SEr)
	bit B to F	Reserved
00C4H	Fault contents 7	
	bit 0	PID Feedback Loss (FbH)
	bit 1	External Fault 1, input terminal S1 (EF1)
	bit 2	External Fault 2, input terminal S2 (EF2)
	bit 3	Mechanical Weakening Detection 1 (oL5)
	bit 4	Mechanical Weakening Detection 2 (UL5)
	bit 5	Current Offset Fault (CoF)
	bit 6	Reserved
	bit 7	Reserved
	bit 8	DriveWorksEZ fault (dWFL)

Register No.	Contents	
00C8H	Alarm contents 2	
	bit 0	Undervoltage (Uv)
	bit 1	Overvoltage (ov)
	bit 2	Heatsink Overheat (oH)
	bit 3	Drive Overheat (oH2)
	bit 4	Overtorque 1 (oL3)
	bit 5	Overtorque 2 (oL4)
	bit 6	Run Commands Input Error (EF)
	bit 7	Drive Baseblock (bb)
	bit 8	External Fault 3, input terminal S3 (EF3)
	bit 9	External Fault 4, input terminal S4 (EF4)
	bit A	External Fault 5, input terminal S5 (EF5)
	bit B	External Fault 6, input terminal S6 (EF6)
	bit C	External Fault 7, input terminal S7 (EF7)
	bit D	Reserved
	bit E	Cooling Fan Error (FAN)
	bit F	Overspeed (oS)
00C9H	Alarm contents 3	
	bit 0	Excessive Speed Deviation (dEv)
	bit 1	PG Disconnected (PGo)
	bit 2	Digital Operator Connection Fault (oPr)
	bit 3	MEMOBUS/Modbus Communication Error (CE)
	bit 4	Option Communication Error (bUS)
	bit 5	Serial Communication Transmission Error (CALL)
	bit 6	Motor Overload (oL1)
	bit 7	Drive Overload (oL2)
	bit 8	Reserved
	bit 9	Option Card External fault (EF0)
	bit A	Motor 2 Switch command input during run (rUn)
	bit B	Reserved
	bit C	Serial Communication Transmission Error (CALL)
	bit D	Undertorque Detection 1 (UL3)
	bit E	Undertorque Detection 2 (UL4)
	bit F	MEMOBUS/Modbus Test Mode Fault (SE)
00CAH	Alarm contents 4	
	bit 0	Reserved
	bit 1	Motor Overheat 1 (PTC Input) (oH3)
	bit 2 to 5	Reserved
	bit 6	PID Feedback Loss (FbL)
	bit 7	PID Feedback Loss (FbH)
	bit 9	Drive Disabled (dnE)
	bit A	PG Disconnected (PGo)
	bit B to F	Reserved
00CBH	Alarm contents 5	
	bit 0 to 2	Reserved
	bit 3	High Current Alarm (HCA)
	bit 7	Reserved
	bit 8	External Fault 1 (input terminal S1) (EF1)
	bit 9	External Fault 2 (input terminal S2) (EF2)
	bit A	Safe Disable Input (HbbF)
	bit B	Safe Disable Input (Hbb)
	bit C	Mechanical Weakening Detection 1 (oL5)
	bit D	Mechanical Weakening Detection 2 (UL5)
	bit E to F	Reserved
00D0H	CPF Contents 1	
	bit 0 to 1	Reserved
	bit 2	A/D Conversion Error (CPF02)
	bit 3	PWM Data Fault (CPF03)
	bit 4 to 5	Reserved
	bit 6	Drive specification mismatch during Terminal Board or Control Board replacement (CPF06)
	bit 7	Terminal Board Communications Fault (CPF07)
	bit 8	EEPROM Serial Communications Fault (CPF08)
	bit 9 to A	Reserved
	bit B	RAM Fault (CPF11)
	bit C	FLASH Memory Fault (CPF12)
	bit D	Watchdog Circuit Exception (CPF13)
	bit E	Control Circuit Fault (CPF14)
	bit F	Reserved

Register No.	Contents		
00D1H	CPF Contents 2		
	bit 0	Clock Fault (CPF16)	
	bit 1	Timing Fault (CPF17)	
	bit 2	Control Circuit Fault (CPF18)	
	bit 3	Control Circuit Fault (CPF19)	
	bit 4	Hardware fault at power up (CPF20)	
	bit 5	Hardware fault at communication start up (CPF21)	
	bit 6	A/D Conversion Fault (CPF22)	
	bit 7	PWM Feedback Fault (CPF23)	
	bit 8	Drive capacity signal fault (CPF24)	
	bit 9 to F	Reserved	
00D8H	Option Card Fault Contents		
	bit 0	Option Compatibility Error (oFA00)	
	bit 1	Option not properly connected (oFA01)	
	bit 3	Option Self-diagnostics Error (oFA03)	
	bit 4	Option Flash Write Mode Error (oFA04)	
	bit 5 to F	Reserved	
00FBH	Output current, *<2>*		

<1> Units are determined by parameter o1-03.

<2> 0.01 A units for drives set to 11 kW in Heavy or Normal Duty and 0.1 A units for drives set to 15 kW and above.

<3> The contents of a communication error are saved until the fault is reset.

<4> Depending on the motor used the correct motor pole number must be set to parameter E2-04, E4-04 or E5-05.

<5> For drive software version 1011 and later.

◆ **Fault Trace / History Register Contents**

The table below shows the fault codes that can be read out by MEMOBUS/Modbus commands from the U2-□□ and U3-□□ monitor parameters.

Table 7 Fault Trace / History Register Contents

Fault Code	Fault Name	Fault Code	Fault Name
0001H	Undervoltage (Uv1)	002BH	High Slip Braking Overload (oL7)
0002H	Control Power Supply Undervoltage (Uv2)	0030H	Hardware Fault (including oFx)
0004H	Soft Charge Circuit Fault (Uv3)	0036H	Output Current Imbalance (LF2)
0006H	Ground Fault (GF)	0037H	Pullout Detection (Sto)
0007H	Overcurrent (oC)	0038H	PG Disconnected (PGo)
0008H	Overvoltage (ov)	003BH	Too many speed search restarts (SEr)
0009H	Heatsink Overheat (oH)	0041H	PID Feedback Loss (FbH)
000AH	Heatsink Overheat (oH1)	0042H	External Fault 1, input terminal S1 (EF1)
000BH	Motor Overload (oL1)	0043H	External Fault 2, input terminal S2 (EF2)
000CH	Drive Overload (oL2)	0044H	Mechanical Weakening Detection 1 (oL5)
000DH	Overtorque Detection 1 (oL3)	0045H	Mechanical Weakening Detection 2 (UL5)
000EH	Overtorque Detection 2 (oL4)	0046H	Current Offset Fault (CoF)
000FH	Dynamic Braking Transistor (rr)	0049H	DriveWorksEZ Fault (dWFL)
0010H	Braking Resistor Overheat (rH)	0083H	A/D Conversion Error (CPF02)
0011H	External Fault at input terminal S3 (EF3)	0084H	PWM Data Fault (CPF03)
0012H	External Fault at input terminal S4 (EF4)	0087H	Drive specification mismatch during Terminal Board or Control Board replacement (CPF06)
0013H	External Fault at input terminal S5 (EF5)	0088H	Terminal Board Communication Fault (CPF07)
0014H	External Fault at input terminal S6 (EF6)	0089H	EEPROM Serial Communication Fault (CPF08)
0015H	External Fault at input terminal S7 (EF7)	008CH	RAM fault (CPF11)
0018H	Overspeed (oS)	008DH	Flash memory circuit exception (CPF12)
0019H	Excessive Speed Deviation (dEv)	008EH	Watchdog circuit exception (CPF13)
001AH	PG Disconnect (PGo)	008FH	Control Circuit Fault (CPF14)
001BH	Input Phase Loss (PF)	0091H	Clock Fault (CPF16)
001CH	Output Phase Loss (LF)	0092H	Timing Fault (CPF17)
001DH	Motor Overheat (PTC input) (oH3)	0093H	Control Circuit Fault (CPF18)
001EH	Digital Operator Connection (oPr)	0094H	Control Circuit Fault (CPF19)
001FH	EEPROM Write Error (Err)	0095H	Hardware fault at power up (CPF20)
0020H	Motor Overheat (PTC input) (oH4)	0096H	Hardware fault at communication start up (CPF21)
0021H	MEMOBUS/Modbus Communication Error (CE)	0097H	A/D Conversion Fault (CPF22)
0022H	Option Communication Error (bUS)	0098H	PWM Feedback Fault (CPF23)
0025H	Control fault (CF)	0099H	Drive capacity signal fault (CPF24)
0027H	PROFIBUS-DP Option External Fault (EF0)	0101H	Option compatibility error (oFA00)
0028H	PID Feedback Loss (FbL)	0102H	Option not properly connected (oFA01)
0029H	Undertorque Detection 1 (UL3)	0104H	Option Self-diagnostics Error (oFA03)
002AH	Undertorque Detection 2 (UL4)	0105H	Option Flash Write Mode Error (oFA04)

◆ **Alarm Register Contents**

The table below shows the alarm codes that can be read out from MEMOBUS/Modbus register 007FH.

Table 8 Alarm Register 007FH Content

Alarm Code	Fault Name	Alarm Code	Fault Name
0001H	Undervoltage (Uv)	0017H	Motor Overload (oL1)
0002H	Overvoltage (ov)	0018H	Drive Overload (oL2)
0003H	Heatsink Overheat (oH)	001AH	Option Card External Fault (EF0)
0004H	Drive Overheat (oH2)	001BH	Motor Switch command input during run (rUn)
0005H	Overtorque 1 (oL3)	001DH	Serial Communication Transmission Error (CALL)
0006H	Overtorque 2 (oL4)	001EH	Undertorque Detection 1 (UL3)
0007H	Run commands input error (EF)	001FH	Undertorque Detection 2 (UL4)
0008H	Drive Baseblock (bb)	0020H	MEMOBUS/Modbus Test Mode Fault (SE)
0009H	External Fault 3, input terminal S3 (EF3)	0022H	Motor Overheat (oH3)
000AH	External Fault 4, input terminal S4 (EF4)	0027H	PID Feedback Loss (FbL)
000BH	External Fault 5, input terminal S5 (EF5)	0028H	PID Feedback Loss (FbH)
000CH	External Fault 6, input terminal S6 (EF6)	002AH	Drive Disabled (dnE)
000DH	External Fault 7, input terminal S7 (EF7)	002BH	PG Disconnected (PGo)
000FH	Cooling Fan Error (FAN)	0034H	High Current Alarm (HCA)
0010H	Overspeed (oS)	0039H	External Fault (input terminal S1) (EF1)
0011H	Excessive Speed Deviation (dEv)	003AH	External Fault (input terminal S2) (EF2)
0012H	PG Disconnected (PGo)	003BH	Safe Disable Input (HbbF)
0013H	Digital operator connection fault (oPr)	003CH	Safe Disable Input (Hbb)
0014H	MEMOBUS/Modbus Communication Error (CE)	003DH	Mechanical Weakening Detection 1 (oL5)
0015H	Option Communication Error (bUS)	003EH	Mechanical Weakening Detection 2 (UL5)
0016H	Serial Communication Transmission Error (CALL)	0049H	DriveWorksEZ Alarm (dWAL)

11 Specifications

◆ Specifications

Table 9 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.

MANUAL NO.   SIEP C730600 24A

Ⓒ Published in Japan   September 2007 07-9

     └ Date of
      publication
         └ Date of original
          publication

Date of Publication	Revision Number	Section	Revised Content
September 2007	–	–	First Edition

YASKAWA AC Drive-V1000 Option

CANopen
Technical Manual

YASKAWA ELECTRIC CORPORATION