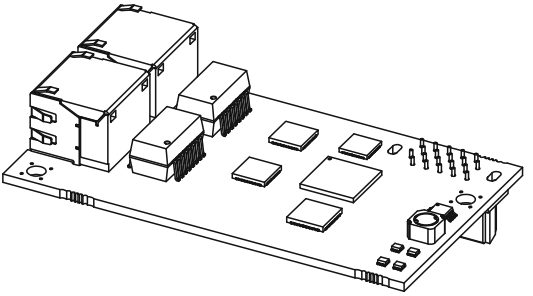
YASKAWA

YASKAWA AC Drive A1000 Option

ETHERNET
POWERLINK
Installation Manual

Type: SI-EL3 for A1000 Series

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



ATTENTION!
This product can only be used on A1000 drives with firmware version VSA901018 to VSA901099 installed.

CE

RoHS Directive
RoHS Directive Stands for the EU directive on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment.

MANUAL NO. YEU TOEP C710616 87A

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A1000 Option Powerlink

Installation Manual

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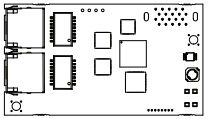
1 Preface and Safety

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

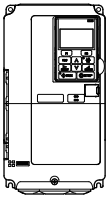
The following manuals are available for SI-EL3 Powerlink Option card:

Option Card

	**YASKAWA AC Drive A1000 Option Powerlink Installation Manual (this book)** **Manual No.: YEU TOEP C710616 87A**
	Read this manual first. The installation manual is packaged with the Powerlink Option and contains a basic overview of wiring, settings, functions, and fault diagnoses.
	YASKAWA AC Drive A1000 Option Powerlink Technical Manual **Manual No.: YEU SIEP C710616 87A**
	The technical manual contains detailed information. To obtain the technical manual access these sites: Europe: http://www.yaskawa.eu.com Other areas: contact a YASKAWA representative.

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

YASKAWA Drive

	Refer to the manual of the drive this option card is being used with. The instruction manual for the drive covers basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information. It also includes important information on parameter settings and how to tune the drive. A Quick Start Guide is included with the drive. For the more detailed technical manual, visit YASKAWA's home page. Europe: http://www.yaskawa.eu.com Other areas: contact a YASKAWA representative

◆ Terms

Note: Indicates supplemental information that YASKAWA highly recommends be followed. Content identified by Note: is not related to personnel safety or equipment damage safety messages.

Powerlink Option:	YASKAWA AC Drive SI-EL3 Powerlink option card
Powerlink:	Standard for CANopen over Ethernet according to the Ethernet POWERLINK Standardization Group
EPL:	Ethernet Powerlink
Host:	YASKAWA inverter 1000 series
LED:	Light Emitting Diode
OPT, Option:	The unit described in this document
FCS:	Frame Check Sequence
INVR:	Inverter register number
EPSG:	Ethernet Powerlink Standardization Group
NMT:	Network management
MN:	Powerlink managing node
CN:	Powerlink controlled node
RFG:	Ramp function generator

◆ Registered Trademarks

- 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 card. The option card 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 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 card.

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.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

YASKAWA is not responsible for any modification of the product made by the user. This product must not be modified.

2 Product Overview

◆ About This Product

The Powerlink Option (Model: SI-EL3) is an option card designed to connect the YASKAWA AC drive to a Powerlink network. Using this option card and a Powerlink master can:

- operate the drive
- monitor the drive operation status
- read or modify drive parameters.

The SI-EL3 option provides instant connectivity to a Powerlink network for the YASKAWA A1000 drive. The option contains support for the Velocity mode according the CANopen Device Profile and Motion Control (DSP402) profile. It also contains YASKAWA vendor specific CANopen objects based on the present CANopen option board specification.

The Powerlink Option supports the following communication profiles;

- DS 301 Ver. 4.02
- DSP 402 Ver. 3.0 Velocity Mode

◆ Applicable Models

The option can be used with the drive models in ***Table E.1***.

Table E.1 Applicable Models

Drive Series	Drive Model Number	Software Version <1>
A1000	CIMR-A□2A□□□□	VSA901018 to VSA901099
	CIMR-A□4A□□□□	

<1> See “PRG” on the drive nameplate for the software version number.

3 Receiving

Please perform the following tasks after receiving the Powerlink Option:

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

◆ Contents and Packaging

Table E.2 Option Package Contents

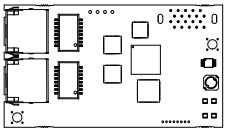
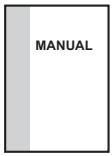
Description:	Option Card	Ground Cable	Screws (M3)
			
Quantity:	1	1	3

Table E.3 Option Package Contents (continued)

Description:	LED Label	Installation Manual
		
Quantity:	1	1

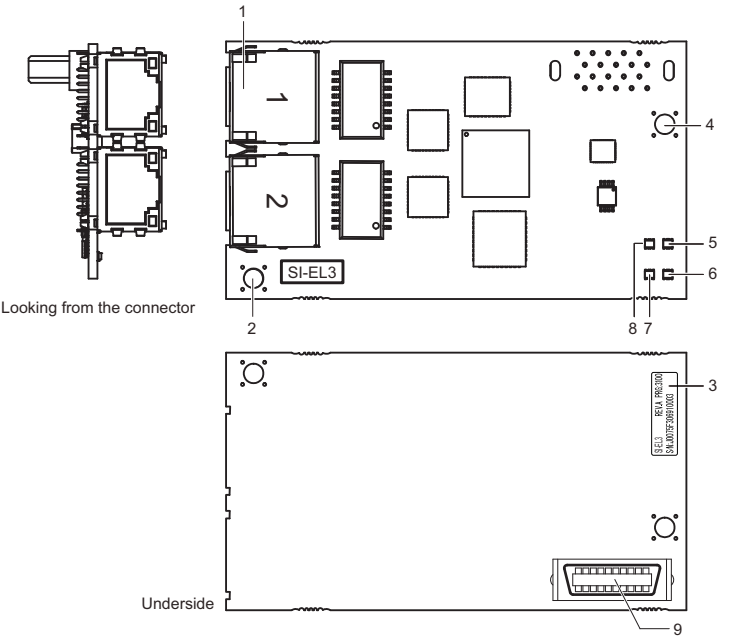
◆ Tool Requirements

A Phillips screwdriver PH1(#1) or PH2(#2) is required to install the Powerlink option.

Note: Tools required to prepare Powerlink cables for wiring are not listed in this manual.

4 Powerlink Option Components

◆ Powerlink Option



1 – Communication cable connector (RJ45)
2 – Ground terminal (installation hole)
3 – Model number
4 – Installation hole
5 – LED (S/E)
6 – LED (MS)
7 – LED (L/A 2)
8 – LED (L/A 1)
9 – Connector (CN5)

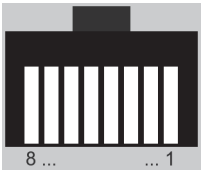
Option Card

Refer to Powerlink Option Status LEDs on page 11 for details on the LEDs.

◆ Communication Connector

The Powerlink Option is connected to the network using a RJ45 connector. The pin assignment is explained in *Table E.4*.

Table E.4 Communication connector (RJ45)

Powerlink Connector	Pin	Signal	Description
	1	TD+	Send data
	2	TD-	
	3	RD+	Receive data
	4	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	5	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	6	RD-	Receive data
	7	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	8	–	N.C. (Pins denoted as N.C. do not connect to any signal)
	Housing	–	Shield

◆ Powerlink Option Status LEDs

The Powerlink Option has four LEDs that indicate the communication status. The indications conform with DS301 and DS303: Indicator Specification.

■ LEDs L/A 1 and L/A 2: Ethernet Link/Activity 1 and 2

The Link/Activity indicators show the status of the physical link and show activity on the link period

■ S/E LED

A green lit Powerlink S/E LED indicates the status of the Powerlink network state machine.

A red lit Powerlink S/E LED indicates error on the EPL network side.

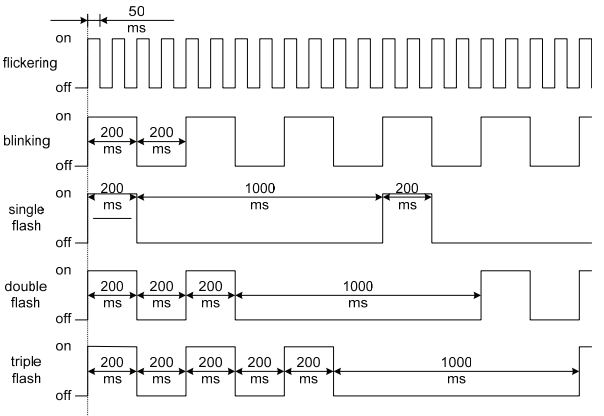
■ MS LED

The red Powerlink MS LED indicates the presence of any errors.

Table E.5 Understanding the Status LEDs

LED	Color	Display	Meaning
Link Activity 1/2	-	Continuously Off	No link
	Green	Continuously On	The module is connected to Ethernet
		Flickering	There is traffic on Ethernet, data are being exchanged
S/E	-	Continuously Off	The device is in Init state
	Green	Flickering	The device is in NMT_CS_BASIC_ETHERNET state
		Blinking	The device is in NMT_CS_STOPPED state
		Single flash	The device is in NMT_CS_PRE_OPERATIONAL_1 state
		Double flash	The device is in NMT_CS_PRE_OPERATIONAL_2 state
		Triple flash	The device is in NMT_CS_READY_TO_OPERATE state
		Continuously On	The device is in NMT_CS_OPERATIONAL state
	Red	Off	Normal operation
		On	An error has occurred
MS	Red	Off	No error
		On	Option card FATAL event has occurred (System has stalled execution. See Powerlink vendor object 0x4000 for the cause)

Figure E.2 explains the indicator flash rates.



LED Flash Rates and Meaning

5 Installation Procedure

◆ Section Safety

⚠ DANGER

Electric Shock Hazard

Power to the drive must be shut off when installing this option card.

Even though the power has been shut off, voltage still remains in the drive's DC bus. Wait before removing the front cover once the drive has been turned off.

The CHARGE light on the drive will go out after voltage in the DC bus drops below 50 V, at which point it is safe to remove the front cover.

Due to the risk of electric shock, be sure that all LEDs have gone out and that the DC bus voltage has reached a safe level prior to performing any work on the drive.

⚠ WARNING

Electrical Shock Hazard

Do not remove the front cover of the drive while the power is on.

Failure to comply could result in death or serious injury.

The diagrams in this section may include 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 touch the option card while the power supply to the drive is switched on.

Failure to comply could result in death or serious injury.

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.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge procedures (ESD) when handling the option card, 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.

NOTICE

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.

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.

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 card and connecting any other devices.
Failure to comply may result in damage to the option card.

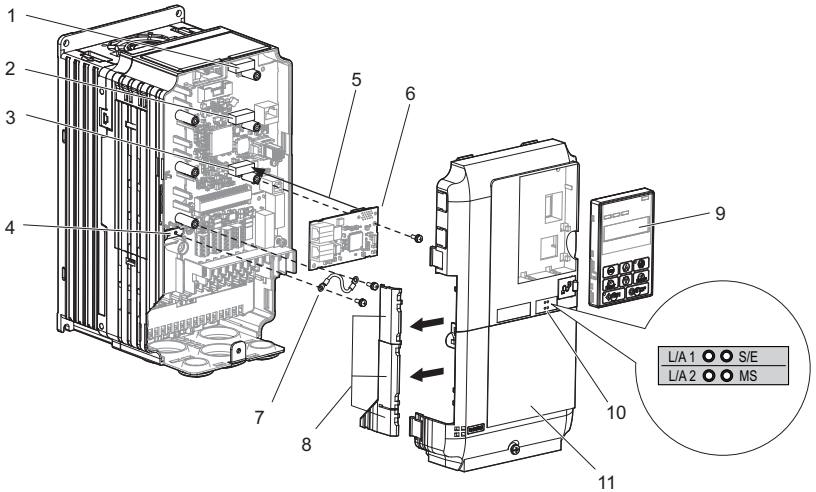
◆ Prior to Installing the Option Card

Prior to installing the Powerlink Option, wire the drive and make necessary connections to the drive terminals. For more information on wiring and connecting the drive, refer to the manual packaged with the drive. Verify that the drive runs normally without the option installed.

◆ Installing the Option

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the operator (9) and front cover (11). Refer to the drive manual for direction on removing the front cover.
2. Insert the CN5 connector on the option (5) into the CN5-A connector on the drive (3), then fasten it into place using one of the screws included with the option. Connect the ground wire (7) to the ground terminal (4) using one of the screws provided with the option.

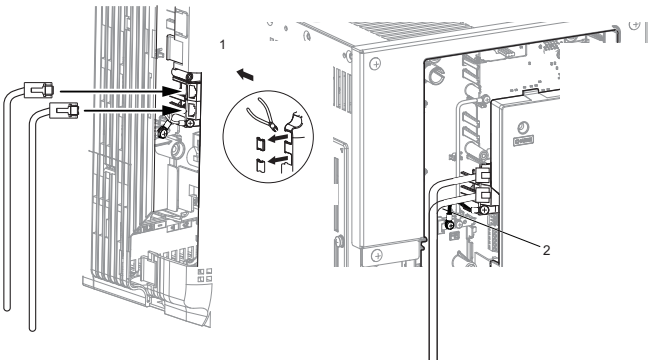
Note: There are only two screw holes on the drive for ground terminals. If three option cards are connected, two of the ground wires will need to share the same ground terminal.



1 – Connector CN5-C
2 – Connector CN5-B
3 – Connector CN5-A
4 – Drive grounding terminal (FE)
5 – Insert connector CN5 here
6 – Option card
7 – Ground wire
8 – Use with cutters to create an opening for cable lines
9 – Operator
10 – LED label
11 – Front cover

Installing the Option Card

3. Prepare RJ45 network cable connectors.
In the drives CIMR-A□2A0004 to 0040 and 4A0002 to 0023 the network cable must be routed to the outside through the drive top cover. Use a pair of diagonal cutters to cut out the perforated openings at the left side of the top cover. Make sure no sharp edges that can damage the cable remain.
Drives 2A0056 and above, and 4A0031 and above have enough space to keep all wiring inside the unit.



1 – Opening for network cables (CIMR-A□2A0004 to 0040, 4A0002 to 0023)

2 – Space for wiring (CIMR-A□2A0056 and above, 4A0031 and above)

Wiring Routing

4. Plug in the RJ45 network cable connector into the option.
   The network can be established in star, tree, line or ring architecture.
5. Reinstall the front cover back onto the drive as it was before.

Note: **1.** Take care when wiring the option card so that the front cover easily fits back onto the drive.

2. Install cable cover option to maintain the drive enclosure type integrity.

6. Attach the LED label (10) packaged with the option as shown in ***Figure E.3***.
7. Switch on the drive power supply.
   An “AEr” Alarm message indicating that the node address is set to 0 will appear on the drive display. Set the node address in parameter F6-72.
8. Cycle the power supply to activate the changed settings. Installation complete.

◆ Communication Cable Specifications

To ensure proper performance, YASKAWA recommends using Powerlink dedicated Cat5e communication cables.

◆ Network Termination

The Powerlink network does not require a termination resistor if the drive is the last node in the network. Network termination is realized by the ASIC of the Powerlink option card.

◆ XDD File

For easy network implementation of drives equipped with an Powerlink Option, the XDD file can be obtained from:

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

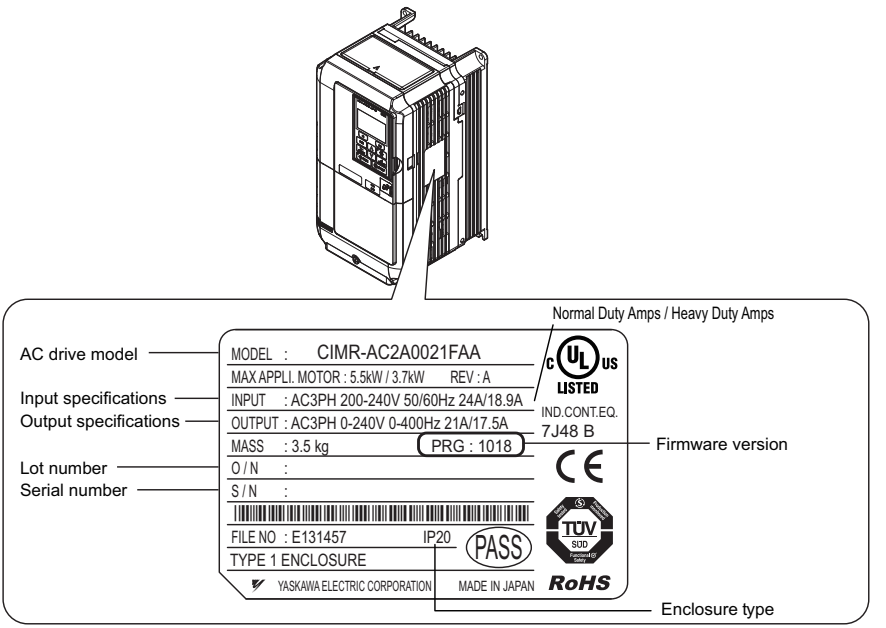
Other areas: contact a YASKAWA representative

◆ Identification of Drive Firmware Version

1. Read out firmware version from drive digital operator.

Check monitor parameter U1-25 when the drive is switched ON. The display shows the last four digits of the firmware version and the value should be in the range of 1018 ~ 1099.

2. Verifying firmware version on drive nameplate



Verifying firmware version on drive nameplate

6 Powerlink Option Related Drive Parameters

The drive parameters listed in ***Table E.6*** have influence on some functions of the SI-EL3 option card. Check these parameters before starting network communications.

Table E.6 Parameter Settings

No.	Name	Description	Default
b1-01 <1>	Frequency Reference Selection	Selects the frequency reference input source 0: Operator - Digital preset speed d1-01 to d1-17 1: Terminals - Analog input terminals 2: MEMOBUS/Modbus communications 3: Option card 4: Pulse Input (Terminal RP)	<6>
b1-02 <1>	Run Command Selection	Selects the run command input source 0: Digital Operator - RUN and STOP keys 1: Digital input terminals S□ 2: MEMOBUS/Modbus communications 3: Option card	1
E2-04 <2>	Motor 1 Motor Poles	Set the number of motor poles described on the motor nameplate. 2 to 48	4
F6-01	Operation Selection after Communications Error	Determines drive response when a bUS error is detected during communications with the Powerlink Option 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <3>	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 Powerlink communication 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only <3>	1
F6-06 <4>	Torque Reference/ Torque Limit selection from Communications Option	0: Torque reference/torque limit via network communications are disabled. 1: Torque reference/torque limit via network communications are enabled. <5>	0
F6-07	NetRef/ComRef Selection Function	0: Multi-step speed reference disabled (F7 mode) 1: Multi-step speed reference allowed (V7 mode)	0

No.	Name	Description	Default
F6-08	Reset Communication Related Parameters	Determines if communication-related parameters are set back to their original default values when the drive is initialized. 0: Do not reset F6-☐☐ and F7-☐☐ parameters when the drive is initialized using parameter A1-03. 1: Rest F6-☐☐ and F7-☐☐ parameters when the drive is initialized using parameter A1-03. **Note:** Setting this parameter does not affect communication-related parameters. Setting this parameter only determines if communication-related parameters (F6-☐☐ and F7-☐☐) are also reset when A1-03 is used to initialize the drive.	0
F6-72	Powerlink Node ID	Sets the Node ID that is used to access the drive in a Powerlink network.	0
o1-03 <7>	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: 0.01 Hz 1: 0.01% (100% = E1-04) 2: r/min (enter the number of motor poles to E2-04/E4-04/E5-04) 3: User defined by parameters o1-10 and o1-11	<6>

<1> To start and stop the drive from an Powerlink 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> E2-04 is necessary to set up when the Drive Profile DSP402 objects are used.
<3> If 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.
<4> This parameter might not appear in certain drives. Furthermore its availability is limited to depending on the control mode selection. For details refer to the technical manual for the drive the option card is used with.
<5> If the drive is set to receive the torque reference/limit from the network (F6-06 = 1) make sure the value is set appropriately by the controller. If no torque reference/limit value is entered the motor will not produce torque.
<6> The default value depends on the drive used and/or the drive software version. For details refer to the technical manual for the drive.
<7> Changing o1-03 changes the units for input object 2010 (Hex) (frequency reference), output object 2110 (Hex) (output frequency) and 2200 (Hex) (motor speed). Furthermore o1-03 must be set to 2 and E2-04 must be set to the correct value in order to use the Drive Profile DSP402.

7 Object Dictionary

◆ Object Dictionary Overview

The Object Dictionary consists of three sections:

- Communication Profile Objects
- Manufacturer Specific Profile Objects
- Drive and Motion Profile Objects

The tables below give an overview of the communication objects available in the SI-EL3 option. Refer to the page references given for further details on each object.

■ Communication Profile Objects (DSP 301)

Index (Hex)	Name
1000	Device Type
1001	Error Register
1003	Pre-defined Error Field
1006	NMT Cycle Time
1008	Manufacturer Device Name
1009	Manufacturer Hardware Version
100A	Manufacturer Software Version
1018	Identity Object
1020	Device Local Configuration Date And Time
1030	Network Interface Parameters
1300	SDO Sequence Layer Time out
1400	Receive PDO Communication Parameters
1600 - 1628	Receive PDO Mapping
1800	Transmit PDO Communication Parameters
1A00	Transmit PDO mapping
1C0B	Loss of Soc
1C0D	Loss of PReq
1C0F	CRC Error
1C14	Loss of SoC Tolerance Interval
1F82	Feature Flags
1F83	EPL Version
1F8C	NMT Current State
1F93	EPL Node ID
1F98	NMT Cycle Timing
1F99	Basic Ethernet Time out

■ Manufacturer Specific Profile Objects (DS 301)

Index (Hex)		Content
Input	2000	Operation Command
	2010	Speed Limit
	2020	Torque Limit
	2030	Torque Compensation
	2040	MEMOBUS Read Command
	2050	MEMOBUS Write Command
	2060	MEMOBUS Unlimited Enter Command
	2070	MEMOBUS Limited Enter Command
	2080	Selectable (default: none)
	2090	Selectable (default: none)
	20A0	Selectable (default: none)
	20B0	Selectable (default: none)
	20C0	Selectable (default: none)
	20D0	FM analog output 1
	20E0	AM analog output 2
	20F0	Multi-function DO output
	3000	Selectable (default: none)
	3100	Selectable (default: none)
Output	2100	Drive Status
	2110	Output Frequency
	2120	Output Current
	2130	Output Torque
	2140	MEMOBUS Read Command Response
	2150	MEMOBUS Write Command Response
	2155	PDO Parameter Write Response
	2160	MEMOBUS Not Limited Enter Command Response
	2180	Selectable (default: Input terminal status)
	2190	Selectable (default: Analog input 1 monitor)
	21A0	Selectable (default: none)
	21B0	Selectable (default: none)
	21C0	Selectable (default: none)
	21D0	Selectable (default: none)
	21E0	Selectable (default: none)
	21F0	Selectable (default: none)
	2200	Motor Speed
	2210	DC Bus Voltage
	2220	Analog input monitor A1
	2240	Analog input monitor A2
	2260	Analog input monitor A3
	2270	Inverter DI Input
	4000	Option NVS FATAL Record
	4001	Option Info + Status Record

■ Drives and Motion Profile Objects (DSP 402)

Object Type	Index (Hex)	Name
Common Entries	60FD	Digital Inputs
	60FE	Digital Outputs
Device Control	603F	Error Code
	6040	Controlword
	6041	Statusword
	6060	Modes of operation
	6061	Modes of operation display
Velocity Mode	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 Process Data Objects (PDO)

PDOs (Process Data Object) will be used for I/O exchange. PDOs are mapped to objects during configuration (PRE-OPERATIONAL state).
TxPDOs are used to transfer data from the option card and RxPDOs are used to transfer data to the option card.
The module supports 16 parameters mapped to RxPDO and 16 parameters mapped to TxPDO.

◆ PDOs and Default PDO Setup

The drive supports 15 Receive and 16 Transmit PDOs. The tables below show available PDOs, their default settings and the objects required to set up when changing the PDO configuration or the PDO mapping.

■ Transmit PDOs (TxPDO)

The Transmit PDOs have a default mapping according to the table below. The transmit PDOs can be re-mapped by the end user by writing to map objects 0x1A00-0x1A28, please see page 21.

PDO number	Transmit PDO Mapping	
	Mapped objects (Hex)	Index (Hex)
1	Sub-index 1: 0x6041#0, 2-bytes (DSP402 status word)	0x1A00
2	Sub-index 1: 0x6041#0, 2-bytes (DSP402 status word) Sub-index 2: 0x6061#0, 2-bytes, (DSP402 Modes of operation display)	0x1A01
6	Sub-index 1: 0x6041#0, 2-bytes (DSP402 status word) Sub-index 2: 0x6044#0, 2-bytes, (vl control effort)	0x1A05
7	Sub-index 1: 0x6041#0, 2-bytes (DSP402 status word) Sub-index 2: 0x60FD#0, 4-bytes, (Digital inputs)	0x1A06
21	Sub-index 1: 0x6042#0, 2-bytes (vl target velocity)	0x1A14
22	Sub-index 1: 0x6043#0, 2-bytes (vl velocity demand)	0x1A15
23	Sub-index 1: 0x6048#1, 4-bytes (vl Accel delta speed) Sub-index 2: 0x6048#2, 2-bytes, (vl Accel delta time)	0x1A16
24	Sub-index 1: 0x6049#1, 4-bytes (vl Decel delta speed) Sub-index 2: 0x6049#2, 2-bytes, (vl Decel delta time)	0x1A17
25	Sub-index 1: 0x604A#1, 4-bytes (vl quick-stop delta speed) Sub-index 2: 0x604A#2, 2-bytes, (vl quick-stop delta time)	0x1A18
26	Sub-index 1: 0x604C#1, 4-bytes (vl Dimension factor) Sub-index 2: 0x604C#2, 4-bytes, (vl Dimension factor)	0x1A19
36	Sub-index 1: 0x2100#1, 2-bytes (Drive status)	0x1A23
37	Sub-index 1: 0x2110#1, 2-bytes (Output frequency)	0x1A24
38	Sub-index 1: 0x2120#1, 2-bytes (Output current)	0x1A25
39	Sub-index 1: 0x2130#1, 2-bytes (Output torque reference)	0x1A26
40	Sub-index 1: 0x2140#1, 2-bytes (MEMOBUS/Modbus read response)	0x1A27
41	Sub-index 1: 0x2150#1, 2-bytes (MEMOBUS/Modbus write response)	0x1A28

■ Receive PDOs (RxPDO)

The Receive PDOs have a default mapping according to the table below. The end user can re-map Receive PDOs by writing to the map objects 0x1600-1628, refer to *Communication Profile Objects (DSP 301) on page 21*.

PDO number	Receive PDO Mapping	
	Mapped objects (Hex)	Index (Hex)
1	Sub-index 1: 0x6040#0, 2-bytes (DSP402 control word)	0x1600
2	Sub-index 1: 0x6040#0, 2-bytes (DSP402 control word) Sub-index 2: 0x6060#0, 1-bytes, (DSP402 Modes of operation)	0x1601
6	Sub-index 1: 0x6040#0, 2-bytes (DSP402 control word) Sub-index 2: 0x6042#0, 2-bytes, (vl target velocity)	0x1605
7	Sub-index 1: 0x6040#0, 2-bytes (DSP402 control word) Sub-index 2: 0x60FE#1, 4-bytes, (Physical digital outputs)	0x1606
8	Sub-index 1: 0x6040#0, 2-bytes (DSP402 control word) Sub-index 2: 0x6060#0, 1-bytes, (DSP402 Modes of operation)	0x1607
21	Sub-index 1: 0x6048#1, 4-bytes (vl Accel delta speed) Sub-index 2: 0x6048#2, 2-bytes, (vl Accel delta time)	0x1614
22	Sub-index 1: 0x6049#1, 4-bytes (vl Decel delta speed) Sub-index 2: 0x6049#2, 2-bytes, (vl Decel delta time)	0x1615
23	Sub-index 1: 0x604A#1, 4-bytes (vl quick-stop delta speed) Sub-index 2: 0x604A#2, 2-bytes, (vl quick-stop delta time)	0x1616
24	Sub-index 1: 0x604C#1, 4-bytes (vl Dimension factor) Sub-index 2: 0x604C#2, 4-bytes, (vl Dimension factor)	0x1617
36	Sub-index 1: 0x2000#1, 2-bytes (Operation command)	0x1623
37	Sub-index 1: 0x2010#1, 2-bytes (Speed reference/limit)	0x1624
38	Sub-index 1: 0x2020#1, 2-bytes (Torque reference/limit)	0x1625
39	Sub-index 1: 0x2030#1, 2-bytes (Torque compensation)	0x1626
40	Sub-index 1: 0x2040#1, 4-bytes (MEMOBUS/Modbus read request)	0x1627
41	Sub-index 1: 0x2050#1, 4-bytes (MEMOBUS/Modbus write request)	0x1628

9 Fault Diagnosis and Possible Solutions

◆ Powerlink Option Card Error Codes

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

■ Inverter and Powerlink Faults

■ Emergency Object (EMCY)

The emergency object is used for sending fault information from the communication module to the CANopen/Powerlink network.

The emergency object is triggered by a fault event from the host or the option card itself. An emergency object is transmitted only once per 'error event'.

Emergency error codes are specified for a number of events. Emergency word specification:

Table E.7 Emergency Word Specification

Byte	0	1	2	3	4	5	6	7
Content	Emergency error code	Error register object 0x1001	Manufacturer specific error info. Not used. Set to zero.					

■ Emergency Messages, DSP301 & DSP402

The error codes specified in the list below can be read from CANopen object 0x1003 (Pre-defined error field)

Table E.8 Error Codes

Error Code (Hex)	Meaning	Drive Display	INVR:0x0080 Enum Value
0000	No error	No error	0x00
3220	DC bus undervoltage	Uv1	0x02
5200	Control power supply undervoltage	Uv2	0x03
3221	DC bus charging circuit fault	Uv3	0x04
2330	Ground fault	GF	0x06
2220	Over current	oC	0x07
3210	DC bus overvoltage	ov	0x08
4280	Heatsink overheat	oH	0x09
4210	Heatsink overheat	oH1	0x0A

Error Code (Hex)	Meaning	Drive Display	INVR:0x0080 Enum Value
2310	Motor overload	oL1	0x0B
2221	Drive overload	oL2	0x0C
2311	Overtorque detection 1	oL3	0x0D
2312	Overtorque detection 2	oL4	0x0E
5420	Braking transistor fault	rr	0x0F
4410	Internal braking resistor overheat	rH	0x10
5441	External fault 3	EF3	0x11
5442	External fault 4	EF4	0x12
5443	External fault 5	EF5	0x13
5444	External fault 6	EF6	0x14
5445	External fault 7	EF7	0x15
5446	External fault 8	EF8	0x16
FF17	Cooling FAN fault	FAn	0x17
7180	Motor over speed (control mode using PG)	oS	0x18
8321	Speed deviation (control mode using PG)	dEv	0x19
7305	PG fault (control mode using PG)	PGo	0x1A
3130	Input phase loss	PF	0x1B
3300	Output phase loss	LF	0x1C
FF01	Motor overheat alarm	oH3	0x1D
5300	Digital operator disconnected	oPr	0x1E
5530	EEPROM error	Err	0x1F
4310	Motor overheat (PTC input)	oH4	0x20
FF08	MEMOBUS/Modbus Error	CE	0x21
FF07	BUS error	bUS	0x22
FF06	Control fault	CF	0x25
8313	Zero servo fault	SvE	0x26
5481	Fault input from option card	EF0	0x27
FF02	PID feedback lost	FbL	0x28
FF03	Undertorque detected 1	UL3	0x29
FF04	Undertorque detected 2	UL4	0x2A
FF05	High slip braking OL	oL7	0x2B
6000	Hardware fault DPRAM	CPSDPRAM	0x30
FF31	Intermediary voltage fault	VCF	0x31
FF32	Z-phase pulse fall detection (Closed Loop Vector for PM motors)	dv1	0x32

Error Code (Hex)	Meaning	Drive Display	INVR:0x0080 Enum Value
FF33	Z-phase noise fault detection (Closed Loop Vector for PM motors)	dv2	0x33
FF34	Inversion detection (Closed Loop Vector for PM motors)	dv3	0x34
FF35	Inversion prevention detection (Closed Loop Vector for PM motors)	dv4	0x35
FF36	Output current imbalance	LF2	0x36
FF37	Pullout detection 2	STo	0x37
FF38	PG Disconnect	PGo	0x38
FF3B	Too many speed search restarts	SEr	0x3B
FF41	PID feedback loss	FbH	0x41
FF0D	External fault at input terminal S1	EF1	0x42
FF0E	External fault at input terminal S2	EF2	0x43
FF44	Mechanical weakening detection 1	oL5	0x44
FF45	Mechanical weakening detection 2	UL5	0x45
FF46	Current offset fault	CoF	0x46
FF47	Programming Error 1	PE1	0x47
FF49	Current offset fault	dWFL	0x49
6301	Error during object content selection	-	-

◆ SDO Abort Codes

SDO abort codes are supported as specified in DS301. Additionally the abort codes listed below are implemented.

Table E.9 SDO Abort Codes

SDO Abort Code	Description
0602 0010 (Hex)	Consecutive MEMOBUS/Modbus Read/Write/Enter commands are sent but the wait time between messages is too short.
	A MEMOBUS/Modbus Read or Write Response (2140 (Hex) and 2150 (Hex)) was attempted but no or an incorrect MEMOBUS/Modbus address has been written to object 2040 (Hex) or 2050 (Hex) before.
	A MEMOBUS/Modbus write request has been sent during DC bus under voltage.
0602 0022 (Hex)	Drive Profile DSP402 is used and a value is written to object 6042 (Hex) (vl Target Velocity) while the drive status is not “Operation Enable”.
	Object 2155 (Hex) is tried to be read while the SI-EL3 option is not in “Operational” state.
	A MEMOBUS/Modbus Read or Write command (2040 (Hex) and 2050 (Hex)) was performed with an invalid MEMOBUS/Modbus address.

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive's digital operator. Causes of the errors and corrective actions are listed in *Table E.10* and *Table E.8*. For additional error codes, refer to the technical manual for the drive.

The bUS (Powerlink Option Communication Error) and EF0 (External Fault Input from the Powerlink Option) may appear as an alarm or a fault. If they occur as an alarm, the "ALM" LED on the drive digital operator will blink and the alarm code will flash in the display. When these occur as a fault, the "ALM" LED will light and the display will show the fault code.

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

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

■ Faults

Table E.10 lists possible faults when using a communication option. The drive's fault contact will close if one of these faults occur.

Table E.10 Fault Display and Possible Solutions

Digital Operator Display		Fault Name
bUS	bUS	Powerlink Option Communication Error
		After establishing initial communication, the connection was lost. Only detected when the run command or frequency reference is assigned to the option (b1-01=3 or b1-02=3).
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 Powerlink requirements. Ground the shield on the controller side and on the Powerlink Option side.
Powerlink Option is damaged.		If there are no problems with the wiring and the error continues to occur, replace the Powerlink Option.
A Powerlink state transition from OP→PRE_OP_1 was made when the drive was in OPERATION enabled.		Check and correct state machine transitions in control word.

Digital Operator Display		Fault Name
EF0	EF0	External Fault Input from Powerlink 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.

Digital Operator Display		Fault Name
oFA00	oFA00	Powerlink Option Card Fault
		The drive does not support the option board plugged in.
Cause		**Possible Solution**
Non-compatible option connected to the drive.		1. Check drive firmware version as described on page 18. 2. If drive firmware version is correct, replace option card. 3. Replace the drive.

Digital Operator Display		Fault Name
oFA01	oFA01	Powerlink Option Card Fault
		Option card is not properly connected.
Cause		**Possible Solution**
Problem with the connectors between the drive and Powerlink Option.		Turn the power off and check the connectors between the drive and Powerlink Option.

Digital Operator Display		Fault Name
oFA30 and oFA32	oFA30 and oFA32	Option card has detected a Communication Option card ID error
		Option card has detected a Sum check error
Cause		**Possible Solution**
Drive system is overloaded.		Force Powerlink state change to NOT_ACTIVE/BASIC_ETHERNET
Drive is not properly processing the state		

Digital Operator Display		Fault Name
oFA30 to oFA43	oFA30 to oFA43	Powerlink Option Card Fault
		Communication ID error
Cause		**Possible Solution**
Option card hardware fault		Replace the Powerlink Option. Contact YASKAWA for assistance.

Digital Operator Display		Fault Name
oFb00	oFb00	Option Card Fault at Connector CN5-B
		Non-compatible option card is connected.
Cause		**Possible Solution**
The Powerlink option card has been plugged into option port CN5-B.		Always use option port CN5-A for communication option cards.

Digital Operator Display		Fault Name
oFb02	oFb02	Option Card Fault at Connector CN5-B
		Two of the same option cards are connected at the same time.
Cause		**Possible Solution**
Two or more input option cards (analog, digital or communication) have been connected to the drive at the same time.		Use either an analog input option AI-A3 or a digital input option DI-A3 or a communication option card. Never use two of these cards at the same time.

Digital Operator Display		Fault Name
oFc00	oFc00	Option Card Fault at Connector CN5-C
		Non-compatible option card is connected
		Drive is not processing the internal interface protocol. Drive does not support Powerlink option card
Cause		**Possible Solution**
The POWERLINK option card has been plugged into option port CN5-C		Always use option port CN5-A for communication option cards.

Digital Operator Display		Fault Name
oFc02	oFc02	Option Card Fault at Connector CN5-C
		Two of the same option cards are connected at the same time.
Cause		**Possible Solution**
Two or more input option cards (analog, digital or communication) have been connected to the drive at the same time.		Use either an analog input option AI-A3 or a digital input option DI-A3 or a communication option card. Never use two of these cards at the same time.

■ Minor Faults and Alarms

Table 6 lists up alarms that might occur during operation using a communication option board. If a multi function digital output of the drive is programmed for H2-□□ = 10, the output will close if these alarms occur.

Digital Operator Display		Minor Fault Name
CALL	CALL	Serial Communication Transmission Error
		Communication has not yet been established.
Cause		**Possible Solution**
Communication wiring is faulty, there is a short circuit, or something is not connected properly.		Check for wiring errors. Correct the wiring. Remove and ground shorts and reconnect loose wires.
Programming error on the master side		Check communications at start-up and correct programming errors.
Communication circuitry is damaged.		Replace the drive if the fault continues to occur.

Digital Operator Display		Minor Fault Name
EEP	EEP	EEPROM Error
		EEPROM checksum error
Cause		**Possible Solution**
Communication wiring is faulty, there is a short circuit, or something is not connected properly.		Check for wiring errors. Correct the wiring. Remove and ground shorts and reconnect loose wires.
EEPROM checksum error		If these errors occur, the object dictionary will be reset to its default values. After the object dictionary has been changed and object dictionary contents are then changed, execute a Store Parameter command (Index = 1010 (Hex)). If the object dictionary has not been changed, execute a Restore Parameter command (Index = 1011 (Hex)).

10 Specifications

◆ Specifications

Table E.11 Option Card Specifications

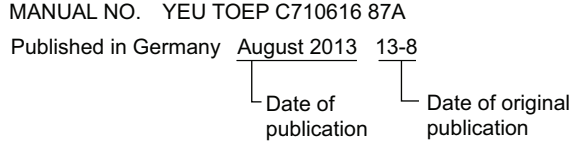
Items	Specifications
Model	SI-EL3
Communication Profile	DS 301 Ver. 4.02 DSP 402 Ver. 3.0 Velocity Mode
Connector	RJ45 connector
Communications Speed	10/100 Mbps
Ambient Temperature	–10 °C to +50 °C
Humidity	up to 95% RH (no condensation)
Storage Temperature	–20 °C to +60 °C (allowed for short-term transport of the product)
Area of Use	Indoor (free of corrosive gas, airborne particles, etc.)

◆ Internal Scan Cycle

A1000: 1 ms

◆ Revision History

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



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YASKAWA AC Drive A1000 Option

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POWERLINK
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