

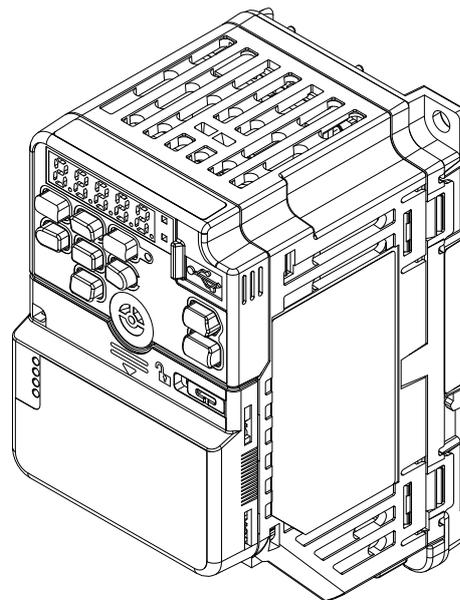
YASKAWA AC Drive GA501

# EtherCAT

# Technical Manual

Model CIPR-GA51xxxxxxxxx

To correctly use the product, read this manual thoroughly and keep it for easy reference, inspection, and maintenance.  
Make sure that the end user receives this manual.



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# 1 Preface and Safety

YASKAWA Electric supplies component parts for use in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer 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 products designed to incorporate a component part 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 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

Document	Description
YASKAWA AC Drive GA501 EtherCAT Technical Manual Manual No.: SIEP C710617 4U (This book)	The Technical Manual contains detailed information about the EtherCAT protocol. For questions, contact Yaskawa or a Yaskawa representative.
YASKAWA AC Drive GA501 Manuals	Drive manuals contain basic installation and wiring information in addition to detailed parameter setting, fault diagnostic, and maintenance information. The manuals also include important information about parameter settings and tuning the drive. The drive product Quick Setup Procedures/Quick Start Guides are packaged with the drive. The most recent versions of these documents are available for download on these documentation websites; U.S.: <a href="https://www.yaskawa.com/ga501manuals">https://www.yaskawa.com/ga501manuals</a> , Europe: <a href="https://www.yaskawa.eu.com/manuals/ga501">https://www.yaskawa.eu.com/manuals/ga501</a> , China: <a href="https://yaskawa.com.cn/manual/ga501g5e.aspx?from=NTdfNF80">https://yaskawa.com.cn/manual/ga501g5e.aspx?from=NTdfNF80</a> , Asia: <a href="https://dlc.e-mechatronics.com/dqr/qr/ga501en_AT.html">https://dlc.e-mechatronics.com/dqr/qr/ga501en_AT.html</a> . Refer to the back cover of these documents for other locations. For questions, contact Yaskawa or a Yaskawa representative.

## ◆ Glossary

Terms	Definition
Keypad	<ul style="list-style-type: none"> <li>• HOA Operator</li> <li>• LCD Operator</li> <li>• LED Operator</li> <li>• HOA Keypad</li> <li>• LCD Keypad</li> <li>• LED Keypad</li> </ul>
Hex. (Example: 900 (Hex.))	Identifies a unit for hexadecimal number format.

## ◆ Registered Trademarks

- Modbus TCP/IP is a trademark of Modbus-IDA.
- EtherNet/IP is a registered trademark of Open DeviceNet Vendor Association, Inc. (ODVA).
- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
- PROFINET is a registered trademark of PROFIBUS Nutzerorganisation e.V. (PNO).
- BACnet is a trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- MECHATROLINK-4 is a trademark of the MECHATROLINK Members Association (MMA).
- Ethernet is a registered trademark of FUJIFILM Business Innovation Corp.
- Trademarks are the property of their respective owners.

## ◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this product. The product 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** *This signal word identifies a hazard that will cause serious injury or death if you do not prevent it.*

**⚠ WARNING** *This signal word identifies a hazard that can cause death or serious injuries if you do not prevent it.*

**⚠ CAUTION** *This signal word identifies a hazard that can cause minor or moderate injuries if you do not prevent it.*

**NOTICE** *This signal word identifies a property damage message that is not related to personal injury.*

## ■ Section Safety

### General Precautions

- The diagrams in this section may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option should be used according to the instructions described in this manual.
- The diagrams in this manual are provided as examples only and may not pertain to all products covered by this manual.
- 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.
- Contact Yaskawa or a Yaskawa representative and provide the manual number shown on the front cover to order new copies of the manual.

**⚠ DANGER** *Do not ignore the safety messages in this manual. If you ignore the safety messages in this manual, it will cause serious injury or death. The manufacturer is not responsible for injuries or damage to equipment.*

**⚠ WARNING** *Electrical Shock Hazard. Do not modify the drive circuitry. Failure to obey can cause serious injury or death, or cause damage to the drive and will void warranty. Yaskawa is not responsible for modifications of the product made by the user.*

**NOTICE** *Damage to Equipment. Do not use steam or other disinfectants to fumigate wood for packaging the drive. Use alternative methods, for example heat treatment, before you package the components. Gas from wood packaging fumigated with halogen disinfectants, for example fluorine, chlorine, bromine, iodine or DOP gas (phthalic acid ester), can cause damage to the drive.*

## 2 Overview

This drive provides a communications connection between the drive and an EtherCAT network.

The controller can do these functions:

- Operate the drive
- Monitor the drive operation status
- Change drive parameter settings

The drive contains support for the Velocity mode according the CANopen Device Profile and Motion Control (DSP 402) profile. It also contains YASKAWA vendor-specific CANopen objects based on the present CANopen option specification.

The EtherCAT supports the following communication profiles:

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

## 3 Component Names

### ◆ PCB

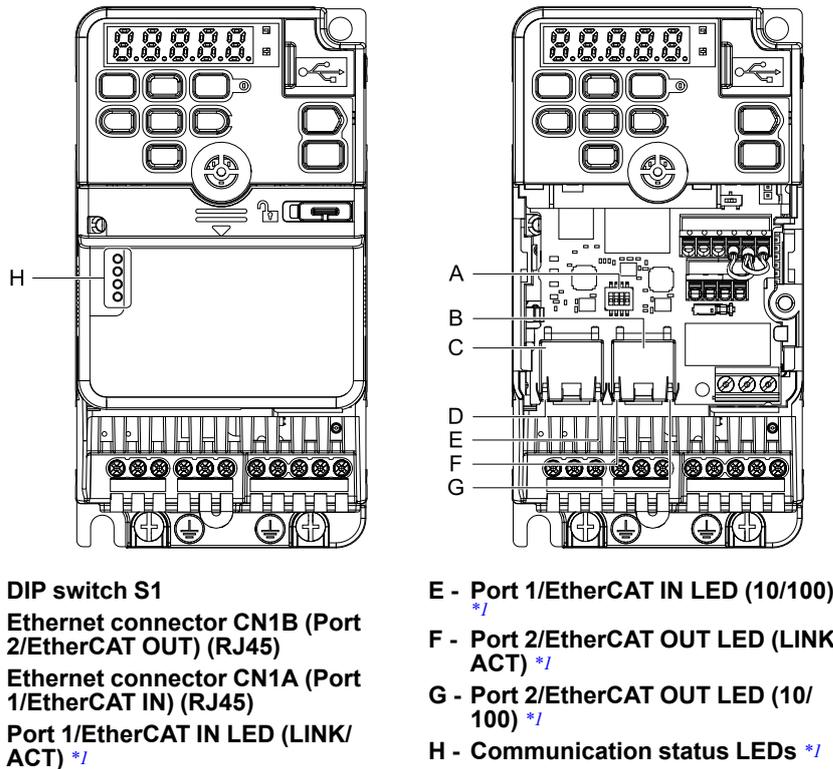


Figure 3.1 PCB Components

\*1 Refer to [Communication LED States on page 10](#) for more information about the LEDs.

### ◆ Communication Connector

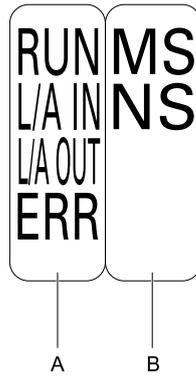
Ports CN1A (Port 1) and CN1B (Port 2) are connection points for male 8-way Ethernet modular RJ45 connectors on customer-supplied communication cables.

Table 3.1 Male 8-way Ethernet Modular Connector (Customer-Supplied)

Male 8-way Ethernet Modular Connector	Pin	Description
	1 (Pair 2)	Transmit data (TXD) +
	2 (Pair 2)	Transmit data (TXD) -
	3 (Pair 3)	Receive data (RXD) +
	4 (Pair 1)	Not used
	5 (Pair 1)	Not used
	6 (Pair 3)	Receive data (RXD) -
	7 (Pair 4)	Not used
	8 (Pair 4)	Not used

◆ **Communication LED States**

Use LED label A when you use EtherCAT.



**A - For EtherCAT**

**B - For Modbus TCP/IP, EtherNet/IP, PROFINET, BACnet/IP, MECHATROLINK-4**

**Figure 3.2 Communication LED Labels**

■ **LEDs L/A OUT and L/A IN: Ethernet Link/Activity for Input and Output Ports**

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

LED	Color	Display	Meaning
Link Activity IN (L/A IN) Link Activity OUT (L/A OUT)	-	OFF	No link. The communication cable is not physically connected. The communication controller is not started up.
	Green	ON	The drive is connected to Ethernet. A communication cable is physically connected, but there is no data exchange.
	Green	Flickering	There is traffic on Ethernet, data is being exchanged.

■ **RUN LED**

A green lit RUN LED indicates the status of the communication network state machine.

A red lit RUN LED is only used when updating the drive firmware.

LED	Color	Display	Meaning
RUN	-	OFF	The drive EtherCAT state is in Init state.
	Green	Blinking	The drive EtherCAT state is in Pre-Operational State.
	Green	Single Flash	The drive EtherCAT state is in Safe-Operational State.
	Green	ON	The drive EtherCAT state is in Operational State.
	Red	Blinking (1 Hz or 6 Hz)	The firmware upgrade process for the drive is in progress. 1 Hz: Firmware loader in IDLE state (waiting for commands from the drive) 6 Hz: Firmware loader is processing commands

■ **ERR LED**

The red error LED indicates the presence of any errors.

LED	Color	Display	Meaning
ERR	-	OFF	No link. The EtherCAT communication is in working condition.
	Red	Blinking	General configuration error.
		Single Flash	The slave device application changed the communication state autonomously: The parameter "Change" in the AL status register is set to 01 (Hex.): change/error.
		Double Flash	There was a sync manager watchdog time out.
		ON	Possible causes: 1. There was a Process Data Interface error, the NOID application interface failed. 2. A FATAL event occurred.
		Blinking (1 Hz)	An EEPROM error occurred.

## ■ 10/100

The 10/100 LED indicates the status of the physical link.

LED	Color	Display	Meaning
10/100	-	OFF	Link is not established.
	Green	ON	Link is established.

## ■ Meaning of LED Flash Rates

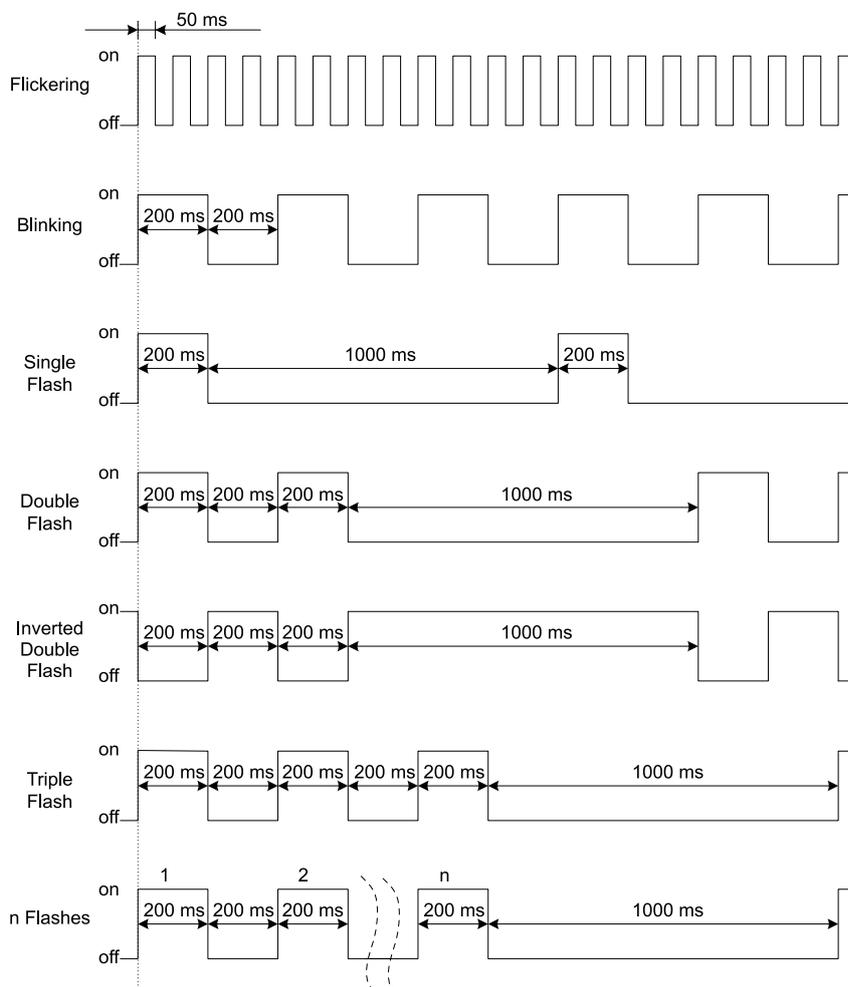


Figure 3.3 Meaning of LED Flash Rates

## 4 Installation

### ◆ Section Safety

**⚠ DANGER** *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

**⚠ WARNING** *Electrical Shock Hazard. Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.*

**⚠ WARNING** *Electrical Shock Hazard. Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive. If personnel are not approved, it can cause serious injury or death.*

**⚠ WARNING** *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

**⚠ WARNING** *Electrical Shock Hazard. Do not use damaged wires, put too much force on the wiring, or cause damage to the wire insulation. Damaged wires can cause serious injury or death.*

**⚠ WARNING** *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

**NOTICE** *Damage to Equipment. When you touch the product, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*

**NOTICE** *Damage to Equipment. Do not de-energize the drive while the drive is outputting voltage. Incorrect equipment sequencing can cause damage to the drive.*

**NOTICE** *Do not operate a drive or connected equipment that has damaged or missing parts. You can cause damage to the drive and connected equipment.*

**NOTICE** *Use Yaskawa connection cables or recommended cables only. Incorrect cables can cause the drive to function incorrectly.*

**NOTICE** *Damage to Equipment. Correctly connect the connectors. Incorrect connections can cause malfunction or damage to the equipment.*

**NOTICE** *Damage to Equipment. Make sure that all connections are correct after you install the drive and connecting peripheral devices. Incorrect connections can cause damage to the product.*

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### ◆ Settings for DIP Switch S1

Use DIP switch S1 on the PCB to select the communication protocol.

Use non-conductive tweezers or a tool with a tip width of approximately 0.5 mm (0.02 in) to set DIP switch S1.

Figure 4.1 shows the default settings for DIP switch S1.

**Note:**

Remove the front cover to set DIP switch S1.

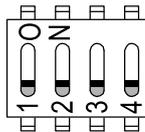


Figure 4.1 Default Settings for DIP Switch S1

When you use EtherCAT, set DIP switch S1 as shown in Figure 4.2.

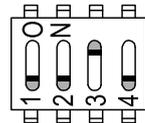


Figure 4.2 Settings for DIP Switch S1

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### ◆ Communication Cable Specifications

Yaskawa recommends using shielded Cat5e cable. The Yaskawa warranty does not cover other cable types.

**Note:**

The maximum Ethernet cable length is 100 m (328 ft).

### ■ Communication Topology Specifications

When you use EtherCAT, drives can be connected to network in a ring or line topology.

- **Daisy-Chained Topology**  
Use the communication connectors CN1A (Port 1) and CN1B (Port 2) at the same time. A switch is not necessary for this connection.
- **Ring Topology**  
Use both communication connectors CN1A (Port 1) and CN1B (Port 2) to create a ring. A switch is not necessary for this connection.

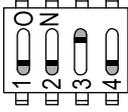


## 5 Related Drive Parameters

No. (Hex.)	Name	Description	Default (Range)
		<ul style="list-style-type: none"> <li>Parameter is available when <math>A1-02 = 0, 2</math> [Control Method Selection = <i>V/f Control, Open Loop Vector</i>].</li> </ul>	
E5-04 (032C)	PM Motor Pole Count	Sets the number of PM motor poles. <b>Note:</b> <ul style="list-style-type: none"> <li>Necessary to set up when Drive Profile DSP402 objects are used.</li> <li>Parameter is available when <math>A1-02 = 5, 6</math> [Control Method Selection = <i>PM Open Loop Vector, PM Advanced Open Loop Vector</i>].</li> </ul>	Determined by E5-01 (2 - 120)
E9-08 (11EB)	PM Motor Pole Count	Sets the number of motor poles. <b>Note:</b> <ul style="list-style-type: none"> <li>Necessary to set up when Drive Profile DSP402 objects are used.</li> <li>Parameter is available when <math>A1-02 = 8</math> [Control Method Selection = <i>EZ Vector Control (EZOLV)</i>].</li> </ul>	4 (2 - 120)
F6-01 (03A2)	Communication Error Selection	Selects drive response when the drive detects a <i>bUS [Ethernet Communication Error]</i> error during communications. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only 4 : Alarm (Run at <i>d1-04</i> ) 5 : Alarm - Ramp Stop <b>Note:</b> <ul style="list-style-type: none"> <li>When you set this parameter to 3 or 4, the drive will continue operation after it detects a fault. Separately prepare safety protection equipment and systems, for example fast-stop switches.</li> <li>Changes to this parameter take effect immediately. It is not necessary to cycle power on the drive.</li> </ul>	1 (0 - 5)
F6-02 (03A3)	Comm External Fault (EF0) Detect	Selects the conditions at which <i>EF0 [Ethernet External Fault]</i> is detected. 0 : Always Detected 1 : Detected during RUN Only	0 (0, 1)
F6-03 (03A4)	Comm External Fault (EF0) Select	Selects the operation of the drive when <i>EF0 [Ethernet External Fault]</i> is detected. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only <b>Note:</b> <ul style="list-style-type: none"> <li>When you set this parameter to 3, the drive will continue operation after it detects a fault. Separately prepare safety protection equipment and systems, for example fast stop switches.</li> </ul>	1 (0 - 3)
F6-06 (03A7)	Torque Limit by Comm. Ethernet	Sets the function that enables and disables the torque reference and torque limit received from Ethernet. 0 : Disabled 1 : Enabled <b>Note:</b> <ul style="list-style-type: none"> <li>Parameter is available in <math>A1-02 = 2, 6, 8</math> [Control Method Selection = <i>Open Loop Vector, PM Advanced Open Loop Vector, EZ Vector Control</i>]. The drive reads this value as the Torque Limit.</li> <li>If the PLC does not supply a torque reference or torque limit when <math>F6-06 = 1</math> [Torque Limit by Comm. Ethernet = <i>Enabled</i>], the motor cannot rotate.</li> </ul>	0 (0, 1)
F6-07 (03A8)	Multi-Step Ref @ NetRef/ ComRef	0 : Disable Multi-Step References 1 : Enable Multi-Step References	1 (0, 1)
F6-08 (036A)	Comm Parameter Reset @Initialize	Selects whether communication-related parameters <i>F6-xx</i> and <i>F7-xx</i> are set back to original default values when you use parameter <i>A1-03 [Initialize Parameters]</i> to initialize the drive. 0 : No Reset - Parameters Retained 1 : Reset - Back to Factory Default <b>Note:</b> <ul style="list-style-type: none"> <li>When you set <i>F6-08</i> to 1 and you then use <i>A1-03</i> to initialize the drive, the drive will not change this setting value.</li> </ul>	0 (0, 1)
F6-14 (03BB)	Bus Error Auto Reset	Enables and disables the automatic reset of a <i>bUS [Ethernet Communication Error]</i> fault. 0 : Disabled 1 : Enabled <b>Note:</b> <ul style="list-style-type: none"> <li>Changes to this parameter take effect immediately. It is not necessary to cycle power on the drive.</li> </ul>	0 (0, 1)

No. (Hex.)	Name	Description	Default (Range)
H5-11 (043C)	Communications ENTER Function Selection	Sets when an Enter command is necessary to use EtherCAT communications to change parameter values. 0 : Parameter changes are activated when ENTER command is written 1 : Parameter changes are activated immediately. No ENTER command is necessary.	1 (0, 1)
o1-03 (0502)	Frequency Display Unit Selection	Sets the display units for the frequency reference and output frequency. 0 : 0.01Hz units 1 : 0.01% (100% = E1-04) 2 : min <sup>-1</sup> (Setting number of motor poles is required) 3 : User units (Set with o1-10, o1-11) <b>Note:</b> When you change o1-03, it also changes the units for input object 2010 (Hex.) (frequency reference), output object 2110 (Hex.) (output frequency), and 2200 (Hex.) (motor speed).	Determined by A1-02 (0 - 3)

Table 5.1 EtherCAT Monitor

No.	Name	Description	Range
U4-75	Ethernet Protocol	Shows the setting of DIP switch S1. • 74 (Setting to use EtherCAT (1: OFF, 2: OFF, 3: ON, 4: OFF))  • 00 to 73, 75 to FF (Setting to use other than EtherCAT) <b>Note:</b> EtherCAT will not operate with these setting values.	00 - FF (Hex.)
U4-76 - U4-78	MAC Address 1	Shows the MAC Address currently used for EoE. • U4-76: First octet, Second octet • U4-77: Third octet, Fourth octet • U4-78: Fifth octet, Sixth octet <b>Note:</b> Shows the MAC Address only when EoE is enabled. 0000 is shown when EoE is disabled.	0000 - FFFF (Hex.)
U6-80 - U6-83	Ethernet IP Address 1 - 4	Shows the local IP Address currently used for EoE. • U6-80: First octet • U6-81: Second octet • U6-82: Third octet • U6-83: Fourth octet <b>Note:</b> Shows the IP Address only when EoE is enabled. 0 is shown when EoE is disabled.	0 - 255
U6-84 - U6-87	Ethernet Subnet 1 - 4	Shows the subnet mask currently used for EoE. • U6-84: First octet • U6-85: Second octet • U6-86: Third octet • U6-87: Fourth octet <b>Note:</b> Shows the subnet mask only when EoE is enabled. 0 is shown when EoE is disabled.	0 - 255
U6-88 - U6-91	Ethernet Gateway 1 - 4	Shows the gateway address currently used for EoE. • U6-88: First octet • U6-89: Second octet • U6-90: Third octet • U6-91: Fourth octet <b>Note:</b> Shows the gateway address only when EoE is enabled. 0 is shown when EoE is disabled.	0 - 255
U6-92	Ethernet Speed	Shows CN1A Port 1 link speed currently available. <b>Note:</b> 100 [100 Mbps] is shown when EtherCAT is linked up with other devices.	10: 10 Mbps 100: 100 Mbps
U6-93	Online Duplex	Shows CN1A Port 1 duplex setting currently available. <b>Note:</b> 1 [Full/Full] is displayed when EtherCAT is linked up with other devices.	0: Half/Half 1: Full/Full
U6-94	Ethernet SPARE 1	Shows CN1B Port 2 link speed currently available. <b>Note:</b> 100 [100 Mbps] is shown when EtherCAT is linked up with other devices.	10: 10 Mbps 100: 100 Mbps
U6-95	Ethernet SPARE 2	Shows CN1B Port 2 duplex setting currently available. <b>Note:</b> 1 [Full/Full] is displayed when EtherCAT is linked up with other devices.	0: Half/Half 1: Full/Full
U6-97	Ethernet SPARE 4	Shows EtherCAT software version.	-

No.	Name	Description	Range
U6-98	Ethernet First Fault	Shows first EtherCAT fault.	-
U6-99	Ethernet Current Fault	Shows current EtherCAT fault.	-

## 6 Supported Modes of Operation

This drive supports Velocity mode (DSP 402) and Yaskawa specific mode (DS 301). DSP 402 mode is not available for converters. Operation modes DSP 402 and DS 301 are mutually exclusive. If you mix objects from both modes, it can cause incorrect operation. Also, do not transition the state of the EtherCAT state machine when the drive is in operation.

Cycle power to reset the mode.

To use DSP 402, you must satisfy these conditions:

- If at least one of these DSP 402 objects is assigned to RxPDO Mapping:
  - 6040 (Hex.), 6042 (Hex.), 6046 (Hex.), 6048 (Hex.), 6049 (Hex.), 604A (Hex.)
- If the EtherCAT state machine is NOT in the SAFEOP or OP state and an SDO write request is performed on the DSP 402 6040 (Hex.) Controlword or DSP 402 6042 (Hex.) v1 target velocity.
- In all other cases, you can access the vendor-specific control word normally.

## 7 Object Dictionary

### ◆ Object Dictionary Overview

These sections are in the Object Dictionary:

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

### ■ Communication Profile Objects (DS 301)

Index (Hex.)	Name	Ref.
1000	Device Type	17
1001	Error Register	18
1003	Pre-defined Error Field	18
1008	Manufacturer Device Name	18
1009	Manufacturer Hardware Version	18
100A	Manufacturer Software Version	18
1010	Store Parameters	19

Index (Hex.)	Name	Ref.
1011	Restore Default Parameters	19
1018	Identity Object	20
1600 - 1629	Receive PDO Mapping	20
1A00 - 1A29	Transmit PDO Mapping	21
1C00	Sync Manager Communication Type	21
1C12	Sync Manager RxPDO assign	21
1C13	Sync Manager TxPDO assign	22

### ■ Manufacturer Specific Profile Objects (DS 301)

Index (Hex.)	Name	Ref.
2000	Operation Command	22
2010	Speed Reference	22
2020	Torque Limit	23
2030	Torque Compensation	23
2040	MEMOBUS/Modbus Read Request	23
2050	MEMOBUS/Modbus Write Request	23
2051	Advanced MEMOBUS/Modbus Write Response	24
2060	MEMOBUS/Modbus Unlimited Enter Command	24
2061	MEMOBUS/Modbus Unlimited Enter Command 2	25
2070	MEMOBUS/Modbus Limited Enter Command	25

Index (Hex.)	Name	Ref.
2071	MEMOBUS/Modbus Limited Enter Command 2	25
2080	Freely Configurable Input Objects	26
2090	Freely Configurable Input Objects	26
20A0	Freely Configurable Input Objects	26
20B0	Freely Configurable Input Objects	26
20C0	Freely Configurable Input Objects	26
20F0	Multi-function DO output	27
3000	Freely Configurable Input Objects	26
3100	Freely Configurable Input Objects	26
2100	Drive Status	27

Index (Hex.)	Name	Ref.	Index (Hex.)	Name	Ref.
2110	Output Frequency	28	2318	Drive Information	32
2120	Output Current	28	251x	Main Parameter Group A	33
2130	Output Torque Reference	29	252x	Main Parameter Group B	33
2140	MEMOBUS/Modbus Read Response	29	253x	Main Parameter Group C	33
2150	MEMOBUS/Modbus Write Response	29	254x	Main Parameter Group D	34
2151	Advanced MEMOBUS/Modbus Write Response	30	255x	Main Parameter Group E	34
2155	PDO Parameter Write Response	30	256x	Main Parameter Group F	34
2160	MEMOBUS/Modbus Not Limited Enter Command Response	30	258x	Main Parameter Group H	35
2180	Freely Configurable Output Objects	30	25Cx	Main Parameter Group L	35
2190	Freely Configurable Output Objects	30	25Ex	Main Parameter Group N	35
21A0	Freely Configurable Output Objects	30	25Fx	Main Parameter Group O	36
21B0	Freely Configurable Output Objects	30	261x	Main Parameter Group Q	36
21C0	Freely Configurable Output Objects	30	262x	Main Parameter Group R	36
21E0	Freely Configurable Output Objects	30	264x	Main Parameter Group T	37
21F0	Freely Configurable Output Objects	30	265x	Main Parameter Group U	37
2200	Motor Speed	31	4001	Communication Software Info + Status Record	37
2210	DC Bus Voltage	31	4003	Network Information	38
2220	Analog input monitor A1	32	4004	Revision Number Compatibility Object	39
2270	Inverter DI Input	32	4010	Store Parameters	39
2301	Error Register	32	4011	Restore Default Parameters	39

## ■ Drives and Motion Specific Profile Objects (DSP 402)

Table 7.1 Common Entries

Index (Hex.)	Name	Ref.
60FD	Digital Inputs	47
60FE	Digital Outputs	47
6502	Supported Drive Modes	48

Table 7.2 Device Control

Index (Hex.)	Name	Ref.	Index (Hex.)	Name	Ref.
6040	Controlword	44	6060	Modes of Operation	46
6041	Status Word	44	6061	Modes of Operation Display	47

Table 7.3 Velocity Mode

Index (Hex.)	Name	Ref.	Index (Hex.)	Name	Ref.
6042	v1 target velocity	44	6049	v1 velocity deceleration	45
6043	v1 velocity demand	44	604A	v1 velocity quick stop	45
6044	v1 control effort	44	604C	v1 dimension factor	46
6046	v1 velocity min max amount	44	604D	v1 pole number	46
6048	v1 velocity acceleration	45			

## ◆ Communication Profile Objects (DS 301)

### ■ 1000 (Hex.): Device Type

This object describes the type of the device and its functionality. It has one 16-bit field that describes the device profile used and a second 16-bit field that gives additional information about EtherCAT functionality.

Bit 0 - 15	Device Profile Number = 0192 (Hex.) (402) (static)
Bit 16 - 23	Type = 01 (Hex.)
Bit 24 - 31	Mode Bits (Vendor specific) = 00 (Hex.)

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1000	0	Device Type	Read Only	No	UNS32	-

### ■ 1001 (Hex.): Error Register

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

0	No error
1	Generic error

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1001	0	Error Register	Read Only	No	UNS8	0 (0 - 1)

### ■ 1003 (Hex.): Pre-defined Error Field

This register gives a history of errors that occurred in the drive and have been signaled via the Emergency object. Subindex 0 contains the number of errors. Subindices 1 to FF contain a rolling list of error codes where subindex 1 always contains the last error that occurred.

For Error Codes, please refer to [Emergency Error Codes on page 63](#).

The number of valid logged errors in the subindex is 01 - FE (Hex.). To reset the error field, write 0 to subindex 0.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1003	0	Number of errors	Read Write	No	UNS8	00 (Hex.) (00 - FF (Hex.))
1003	1	Standard error field (Emergency error code)	Read Only	No	UNS32	0000 (Hex.) (0000 - FFB8 (Hex.))

### ■ 1008 (Hex.): Manufacturer Device Name

This object contains the manufacturer device name.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1008	0	Manufacturer Device Name	Read Only	No	String	-

### ■ 1009 (Hex.): Manufacturer Hardware Version

This object contains the manufacturer device name.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1009	0	Manufacturer Hardware Version	Read Only	No	String	x.y

**Note:**

x: Major hardware version

y: Minor hardware revision assigned during production

### ■ 100A (Hex.) Manufacturer Software Version

This object contains the manufacturer software version.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
100A	0	Manufacturer Software Version	Read Only	No	String	-

## ■ 1010 (Hex.): Store Parameters

To save the changed parameter settings in the non-volatile memory, write "save" to this object.

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

Actions: Will issue Limited Enter command. Writes data into the EEPROM of the drive and enables the data in RAM at the same time. If you cycle the power supply, the parameter changes will stay.

### Note:

You can write the EEPROM to the drive a maximum of 100,000 times. Do not frequently execute the Enter command that is written to EEPROM.

**Table 7.4 Non-volatile Stored Parameters (NVS Parameters)**

CANopen Object (Hex.)	Default Value (Hex.)	EEPROM Size	CANopen Object (Hex.)	Default Value (Hex.)	EEPROM Size
2080:2	FFFFFFFF	32 bit	2190:2	004E	16 bit
2090:2	FFFF	16 bit	21A0:2	FFFF	16 bit
20A0:2	FFFF	16 bit	21B0:2	FFFF	16 bit
20B0:2	FFFF	16 bit	21C0:2	FFFF	16 bit
20C0:2	FFFF	16 bit	21E0:2	FFFF	16 bit
3000:2	FFFF	16 bit	21F0:2	FFFFFFFF	32 bit
3100:2	FFFF	16 bit	604C:1	00000001	32 bit
2180:2	0049	16 bit	604C:2	00000001	32 bit

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1010	0	Store Parameters	Read only	No	UNS8	1
1010	1	Save all parameters	Read Write	No	UNS32	01 (Hex.) (Save on command)

## ■ 1011 (Hex.): Restore Default Parameters

To restore the parameter settings to default values, write "load" to this object.

Signature	MSB			LSB
ASCII	d	a	o	l
Hex	64	61	6F	6C

Actions: Will write value = 2220 to A1-03 [Initialize Parameters] (INVR: 0103 (Hex.)) together with an EEPROM ENTER command.

### Note:

You can write the EEPROM to the drive a maximum of 100,000 times. Do not frequently execute the Enter command that is written to EEPROM.

**Table 7.5 Non-volatile Stored Parameters (NVS Parameters)**

CANopen Object (Hex.)	Default Value (Hex.)	EEPROM Size	CANopen Object (Hex.)	Default Value (Hex.)	EEPROM Size
2080:2	FFFFFFFF	32 bit	2190:2	004E	16 bit
2090:2	FFFF	16 bit	21A0:2	FFFF	16 bit
20A0:2	FFFF	16 bit	21B0:2	FFFF	16 bit
20B0:2	FFFF	16 bit	21C0:2	FFFF	16 bit
20C0:2	FFFF	16 bit	21E0:2	FFFF	16 bit
3000:2	FFFF	16 bit	21F0:2	FFFFFFFF	32 bit
3100:2	FFFF	16 bit	604C:1	00000001	32 bit
2180:2	0049	16 bit	604C:2	00000001	32 bit

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1011	0	Restore Default Parameters	Read Only	No	UNS8	1
1011	1	Restore all default parameters	Read Write	No	UNS32	01 (Hex.) (Restore on command)

### ■ 1018 (Hex.): Identity Object

This object contains general information about the drive.

#### Vendor ID

Values: 00000539 (Hex.) for “Yaskawa Electric Corporation, Japan”

#### Product Code

The value is the four letters in ASCII format.

#### Revision History

EtherCAT software revision number

#### Serial Number

Drive serial number

#### Note:

Only a portion of the serial number is displayed. You can see the entire serial number on the Home page of the drive web pages. Refer to [Web Interface on page 58](#) for more details.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1018	0	Number of entries	Read Only	No	UNS8	4
1018	1	Vendor ID	Read Only	No	UNS32	00000539 (Hex.)
1018	2	Product code	Read Only	No	UNS32	47413531 (Hex.)
1018	3	Revision number	Read Only	No	UNS32	-
1018	4	Serial number	Read Only	No	UNS32	-

### ■ 1600 (Hex.), 1629 (Hex.): Receive PDO Mapping

These objects are automatically filled by the master.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1600, 1629	0	Number of entries	Read Write	No	UNS8	0 (0 - 8)
1600, 1629	1	Mapped Object #1	Read Write	No	UNS32	-
1600, 1629	2	Mapped Object #2	Read Write	No	UNS32	-
1600, 1629	n	Mapped Object #n	Read Write	No	UNS32	-

### ■ 1601 (Hex.) to 1628 (Hex.): Receive PDO Mapping

These objects are automatically filled by the master.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1601 - 1628	0	Number of entries	Read Write	No	UNS8	0 (0 - 2)
1601 - 1628	1	Mapped Object #1	Read Write	No	UNS8	-
1601 - 1628	2	Mapped Object #2	Read Write	No	UNS8	-
1601 - 1628	n	Mapped Object #n	Read Write	No	UNS8	-

### ■ 1A00 (Hex.), 1A29 (Hex.): Transmit PDO Mapping

These objects are automatically filled by the master.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1A00	0	Number of entries	Read Write	No	UNS8	0 (0 - 8)
1A29	0	Number of entries	Read Write	No	UNS8	6 (0 - 6)
1A00, 1A29	1	Mapped Object #1	Read Write	No	UNS32	-
1A00, 1A29	2	Mapped Object #2	Read Write	No	UNS32	-
1A00, 1A29	n	Mapped Object #n	Read Write	No	UNS32	-

### ■ 1A01 (Hex.) to 1A28 (Hex.): Transmit PDO Mapping

These objects are automatically filled by the master.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1A01 - 1A28	0	Number of entries	Read Write	No	UNS8	0 (0 - 2)
1A01 - 1A28	1	Mapped Object #1	Read Write	No	UNS32	-
1A01 - 1A28	2	Mapped Object #2	Read Write	No	UNS32	-
1A01 - 1A28	n	Mapped Object #n	Read Write	No	UNS32	-

### ■ 1C00 (Hex.): Sync Manager Communication Type

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
1C00	0	Number of entries	Read Only	No	UNS8	4
1C00	1	Mailbox receive	Read Only	No	UNS8	1
1C00	2	Mailbox send	Read Only	No	UNS8	2
1C00	3	Process data output	Read Only	No	UNS8	3
1C00	4	Process data input	Read Only	No	UNS8	4

### ■ 1C12 (Hex.): Sync Manager RxPDO Assign

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1C12	0	Number of entries	Read Write	No	UNS8	1 (0 - 4)
1C12	1	Assigned RxPDO #1	Read Write	No	UNS16	1600 (Hex.)
1C12	2	Assigned RxPDO #1	Read Write	No	UNS16	-
1C12	3	Assigned RxPDO #1	Read Write	No	UNS16	-
1C12	4	Assigned RxPDO #1	Read Write	No	UNS16	-

### ■ 1C13 (Hex.): Sync Manager TxPDO Assign

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
1C13	0	Number of entries	Read Write	No	UNS8	1 (0 - 4)
1C13	1	Assigned TxPDO #1	Read Write	No	UNS16	1A00 (Hex.)
1C13	2	Assigned TxPDO #2	Read Write	No	UNS16	-
1C13	3	Assigned TxPDO #3	Read Write	No	UNS16	-
1C13	4	Assigned TxPDO #4	Read Write	No	UNS16	-

### ◆ Manufacturer Specific Profile Objects (DS301) Details

This drive offers the manufacturer specific objects listed below. These objects are specific to Yaskawa products and are not available on other EtherCAT products.

The manufacturer specific objects list has static objects and configurable objects. You can link these objects to drive parameters, monitors, or MEMOBUS/Modbus registers to determine the content of configurable objects.

### ■ 2000 (Hex.): Operation Command

This object starts and stops the drive, controls the multi-function digital input terminals, and triggers and resets faults.

Bit No.	Description	Function
0	Forward Run Command	0: Stop, 1: Forward run
1	Reverse Run Command	0: Stop, 1: Reverse run
2	External Fault (EF0)	1: External Fault Input (EF0)
3	Fault Reset	1: Fault Reset
4	Terminal S1 Function	Multi-Function Input 1
5	Terminal S2 Function	Multi-Function Input 2
6	Ethernet DI3 Function	Multi-Function Input 3
7	Ethernet DI4 Function	Multi-Function Input 4
8	Ethernet DI5 Function	Multi-Function Input 5
9	Ethernet DI6 Function	Multi-Function Input 6
10	Ethernet DI7 Function	Multi-Function Input 7
11 - 15	Reserved	Reserved

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2000	0	Number of entries	Read Only	No	UNS8	2
2000	1	Value	Read Write	Rx/Tx	UNS16	-
2000	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0001 (Hex.) (Operation command and multi-function inputs)	Read Only	No	UNS16	0001 (Hex.)

### ■ 2010 (Hex.): Speed Reference

Sets the speed reference. The unit of this value depends on the setting of the drive parameter *o1-03* [Frequency Display Unit Selection]. Refer to [Related Drive Parameters on page 13](#) for information.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2010	0	Number of entries	Read Only	No	UNS8	2
2010	1	Value	Read Write	Rx/Tx	UNS16	0
2010	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0002 (Hex.) (Frequency reference)	Read Only	No	UNS16	0002 (Hex.)

### ■ 2020 (Hex.): Torque Limit

Sets the torque limit in units of 0.1%. Only usable when  $F6-06 = 1$  [Torque Limit by Comm. Ethernet = Enabled]. Refer to [Related Drive Parameters on page 13](#) for information.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2020	0	Number of entries	Read Only	No	UNS8	2
2020	1	Value	Read Write	Rx/Tx	UNS16	0 (0 - 3000)
2020	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0004 (Hex.) (Torque limit)	Read Only	No	UNS16	0004 (Hex.)

### ■ 2030 (Hex.): Torque Compensation

This object sets the torque compensation in units of 0.1%.

**Note:**

Only usable when  $F6-06 = 1$  [Torque Limit by Comm. Ethernet = Enabled].

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2030	0	Number of entries	Read Only	No	UNS8	2
2030	1	Value	Read Write	Rx/Tx	UNS16	0 (0 - 2000)
2030	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0005 (Hex.) (Torque compensation)	Read Only	No	UNS16	0005 (Hex.)

### ■ 2040 (Hex.): MEMOBUS/Modbus Read Request

Objects 2040 (Hex) and 2140 (Hex) are used as a pair to read out the contents of drive's MEMOBUS/Modbus registers.

The PLC reads the drive output frequency at register at 2040 (Hex.). After sending a MEMOBUS/Modbus Read Request to the drive, you can read the MEMOBUS/Modbus register content from object 2140 (Hex.).

You must write the address of the MEMOBUS/Modbus in bytes 3 and 4 of Subindex 1, and set bytes 1 and 2 to 0.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	yy	xx	00	00

For more information about MEMOBUS/Modbus addresses and data, refer to the drive manuals.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2040	0	Number of entries	Read Only	No	UNS8	1
2040	1	MEMOBUS/Modbus read request	Read Write	Rx/Tx	UNS32	0

### ■ 2050 (Hex.): MEMOBUS/Modbus Write Request

Object 2050 (Hex.) writes the contents of the drive MEMOBUS/Modbus registers. When you write this object, it will automatically issue an Unlimited Enter command, which applies changes immediately. This happens regardless of the Communications ENTER Function Selection ( $H5-11$  [Comm ENTER Command Mode]).

The automatic ENTER command makes the writing process slower, but it also makes the process of writing registers less complicated. For these reasons, Yaskawa recommends that you use object 2050 (Hex.) for most applications.

You must write the address of the MEMOBUS/Modbus in bytes 3 and 4 of Subindex 1, and you must write the value to bytes 1 and 2.

**Note:**

Object 2050 (Hex.) cannot access MEMOBUS/Modbus registers 0001 and 0002 (Hex.).

Signature	MSB			LSB
Byte	4	3	2	1
Hex	Address		Value	

For more information about MEMOBUS/Modbus addresses and data, refer to the drive manuals.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2050	0	Number of entries	Read Only	No	UNS8	1
2050	1	MEMOBUS/Modbus write request	Read Write	Rx/Tx	UNS32	0

### ■ 2051 (Hex.): Advanced MEMOBUS/Modbus Write Response

Object 2051(Hex.) is used to write the contents of drive's MEMOBUS/Modbus registers. With this object, you can specify whether an Unlimited Enter command is issued using the *H5-11 [Comm ENTER Command Mode]* setting.

Writing this object with *H5-11 = 0 [Comm ENTER Command Mode = ENTER Command Required]* does not automatically issue an Unlimited Enter command. You must issue an Unlimited Enter command separately to enable changes to parameters.

Writing this object with *H5-11 = 1 [Comm ENTER Command Mode = ENTER Command Not Required]* automatically issues an Unlimited Enter command.

The speed of the writing process increases with *H5-11 = 0 [Comm ENTER Command Mode = ENTER Command Required]*. However, because YASKAWA AC Drives check for inconsistencies when you issue an Unlimited Enter command, the drive may write the incorrect values.

For these reasons, Yaskawa recommends that you use object 2051 (Hex.) with *H5-11 = 0* only for applications where the writing speed is critically important.

You must write the address of the MEMOBUS/Modbus in bytes 3 and 4 of Subindex 1, and you must write the value to bytes 1 and 2.

**Note:**

Object 2051 (Hex.) cannot access MEMOBUS/Modbus registers 0001 and 0002 (Hex.).

Signature	MSB			LSB
Byte	4	3	2	1
Hex	Address		Value	

For more information about MEMOBUS/Modbus addresses and data, refer to the drive manuals.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2051	0	Number of entries	Read Only	No	UNS8	1
2051	1	MEMOBUS/Modbus write request	Read Write	Rx/Tx	UNS32	0

### ■ 2060 (Hex.): MEMOBUS/Modbus Unlimited ENTER Command

To activate parameter changes, you must execute this ENTER command. This ENTER command activates parameters in the drive RAM only. If you cycle power to the drive, you will lose your parameter changes. When you change more than one parameter, you can send only one ENTER command after the last parameter change.

It is not necessary to execute the ENTER command each time you make a parameter change. You can execute this ENTER command as many times as necessary. There are no limits.

**Note:**

You can execute the ENTER command according to the following settings except for this ENTER command.

- Activating the Communications ENTER Function ( $H5-11 = 1$  [Comm ENTER Command Mode = ENTER Command Not Required]).
- Using object 2050 (Hex.) to issue MEMOBUS write commands.

To save the data, input “save” (73H + 61H + 76H + 65H).

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2060	0	Limited ENTER command Mapped to MEMOBUS/Modbus address 0910 (Hex.) (Un-Memorized ENTER command)	Read Write	Rx/Tx	UNS32	00000001 (Hex.) (00000001, 65766173 (Hex.))

### ■ 2061 (Hex.): MEMOBUS/Modbus Unlimited ENTER Command 2

To activate parameter changes, you must execute this ENTER command. This ENTER command activates parameters in the drive RAM only. If you cycle power to the drive, you will lose your parameter changes. When you change more than one parameter, you can send only one ENTER command after the last parameter change. It is not necessary to execute the ENTER command each time you make a parameter change. You can execute this ENTER command as many times as necessary. There are no limits.

**Note:**

You can execute the ENTER command according to the following settings except for this ENTER command.

- Activating the Communications ENTER Function ( $H5-11 = 1$  [Comm ENTER Command Mode = ENTER Command Not Required]).
- Using object 2050 (Hex.) to issue MEMOBUS write commands.

To execute this type of ENTER command, toggle subindex 0 from 0 to 1.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2061	0	Unlimited ENTER command 2 Mapped to MEMOBUS/Modbus address 0910 (Hex.) (Un-Memorized ENTER command)	Read Write	Rx/Tx	UNS8	0 (Hex.) (0, 1 (Hex.))

### ■ 2070 (Hex.): MEMOBUS/Modbus Limited ENTER Command

To activate parameter changes, you must execute this ENTER command. The limited ENTER command activates parameters in the drive RAM and saves them to the EEPROM. If the drive loses power or if you cycle the power supply, the drive will operate using the saved parameters. When you change more than one parameter, you can send only one ENTER command after the last parameter change. It is not necessary to execute the ENTER command each time you make a parameter change.

**Note:**

You can execute this command approximately 100,000 times.

To save the data, input “save” (73H + 61H + 76H + 65H).

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2070	0	Limited ENTER command Mapped to MEMOBUS/Modbus address 0900 (Hex.) (Memorized ENTER command)	Read Write	No	UNS32	00000001 (Hex.) (00000001, 65766173 (Hex.))

### ■ 2071 (Hex.): MEMOBUS/Modbus Limited ENTER Command 2

To activate parameter changes, you must execute this ENTER command. The limited ENTER command activates parameters in the drive RAM and saves them to the EEPROM. If the drive loses power or if you cycle the power supply, the drive will operate using the saved parameters. When you change more than one parameter, you can

send only one ENTER command after the last parameter change. It is not necessary to execute the ENTER command each time you make a parameter change.

**Note:**

You can execute this command approximately 100,000 times.

To execute this type of ENTER command, toggle subindex 0 from 0 to 1.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2071	0	Limited ENTER command 2 Mapped to MEMOBUS/Modbus address 0900 (Hex.) (Memorized ENTER command)	Read Write	No	UNS8	0 (Hex.) (0, 1 (Hex.))

### ■ 2080 (Hex.) to 3100 (Hex.): Freely Configurable Input Objects

These objects can write selectable MEMOBUS content through fieldbus communication. You can assign any MEMOBUS address to this object. After you assign the address, you can use PDO or SDO until Power Off to write the content of this MEMOBUS address. Although this object can be read, please note that this is not necessarily the content of the register. Subindex 2 determines the MEMOBUS address to be written.

Subindex 1 reads and writes the content.

For more information about MEMOBUS/Modbus addresses and data, refer to the drive manuals.

#### 2080 (Hex.): Freely Configurable Input Object

Use this object to write up to two registers at the same time. To write to only one register, set the other register value to FFFF (Hex.).

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2080	0	Number of entries	Read Only	No	UNS8	2
2080	1	Value	Read Write	Rx/Tx	UNS32	-
2080	2	MEMOBUS/Modbus address of content 1 and 2	Read Write	No	UNS32	FFFF (Hex.) + FFFF (Hex.) (00000000 - FFFFFFFF (Hex.))

### 2090 (Hex.) to 3100 (Hex.): Freely Configurable Input Objects

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2090 20A0 20B0 20C0 3000 3100	0	Number of entries	Read Only	No	UNS8	2
2090 20A0 20B0 20C0 3000 3100	1	Value	Read Write	Rx/Tx	UNS16	-
2090 20A0 20B0 20C0 3000 3100	2	MEMOBUS/Modbus address of content	Read Write	No	UNS16	FFFF (Hex.) (0000 - FFFF (Hex.))

#### Limitations of Object Content Selection

Consider these limitations when you set the content of an object.

- You cannot switch the drive EtherCAT state to the Operational state until the content selection process is complete. If the process is incomplete, it will trigger an emergency message (code 6301 (Hex.))
- When object content selection is ongoing, you cannot send a different request or command, including Run, to the drive. If you send a different request or command, it will trigger an error message or an emergency message (code 6301 (Hex.)).

- For 4 byte input objects, you can link MEMOBUS/Modbus register numbers up to 00FF (Hex.) in any combination. When you link MEMOBUS/Modbus register numbers from 0100 (Hex.) to a 4 byte object, the MEMOBUS/Modbus register numbers must be consecutive.

Mapped Register 1	Mapped Register 2	Combination possible?
0007 (Hex.)	0009 (Hex.)	Possible
0201 (Hex.)	0202 (Hex.)	Possible
0202 (Hex.)	0201 (Hex.)	No
0201 (Hex.)	0203 (Hex.)	No
0202 (Hex.)	0202 (Hex.)	No
0200 (Hex.)	FFFF (Hex.)	Possible
FFFF (Hex.)	FFFF (Hex.)	Possible

- Register numbers must not be consecutive for 4-byte output objects.
- You cannot map a MEMOBUS/Modbus register to two or more objects at the same time.
- MEMOBUS/Modbus registers 0001 (Hex.), 0002 (Hex.), 0004 (Hex.), 0005 (Hex.), 0007 (Hex.), 0008 (Hex.), and 0014 (Hex.) are already linked to not changeable input objects. You cannot link them to any object with selectable content. If you try to map one of those registers to an input object, it will trigger an error message.

#### Example

- To map the drive output power monitor (*UI-08*, 0047 (Hex.)) to output object 21A0 (Hex.), write 0047 (Hex.) to subindex 2 of object 21A0 (Hex.).
- To map the speed reference 1 (*dI-01*, 0280 (Hex.)) to input object 2090 (Hex.), write 0280 (Hex.) to subindex 2 of object 2090 (Hex.).
- To map the digital input status (*UI-10*, 0049 (Hex.)) and digital output status (*UI-11*, 004A (Hex.)) to output object 21F0 (Hex.) (4 Byte), write 0049 (Hex.) to the higher and 004A (Hex.) to the lower word of object 2090 (Hex.), subindex 2.

### ■ 20F0 (Hex.): Multi-function DO Output

This object controls the multi-function DO outputs.

Signature	Bit	Content
LSB	0	Terminals MA-MB-MC
	1	Ethernet DO1
	2	Ethernet DO2
	3 - F	Reserved
MSB	8 - 15	Reserved

Value	Description
1	ON
0	OFF

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
20F0	0	Number of entries	Read Only	No	UNS8	2
20F0	1	Value	Read Write	Rx/Tx	UNS16	-
20F0	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0009 (Hex.) (Multi-function DO)	Read Only	No	UNS16	0009 (Hex.)

### ■ 2100 (Hex.): Drive Status

These objects monitor the drive status. The value in object 2100 (Hex.) is not filtered.

Bit	Description	Function
0	During Run	1: During Run 0: During Stop
1	During Zero Speed	1: During Zero Speed

Bit	Description	Function
2	During Reverse Running	1: During Reverse Running 0: During Forward Running
3	During Fault Reset Signal Input	1: During Fault Reset Signal Input
4	During Speed Agree	1: During Speed Agree
5	During Drive Ready	1: During Drive Ready 0: Not Ready
6	During Alarm	1: During Alarm
7	During Fault	1: During Fault
8	During Operation Error	1: During Operation Error
9	During Momentary Power Loss	1: During Momentary Power Loss 0: During Power Loss
10	NetCtrl Status	1: NetCtrl
11	Digital Output 1 Status (function set in drive parameter H2-01 [Term MA-MB-MC Function Selection])	1: ON 0: OFF
12	Digital Output 2 Status (function set in drive parameter H2-02 [Ethernet DO1 Function Selection])	1: ON 0: OFF
13	Digital Output 3 Status (function set in drive parameter H2-03 [Ethernet DO2 Function Selection])	1: ON 0: OFF
14	Motor 2 Selected	1: Motor 2 Selected
15	Zero-Servo End	1: Zero-Servo End

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2100	0	Number of entries	Read Only	No	UNS8	2
2100	1	Value	Read Only	Tx	UNS16	-
2100	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 00FC (Hex.) (Drive Status)	Read Only	No	UNS16	00FC (Hex.) (0 - FFFF (Hex.))

### ■ 2110 (Hex.): Output Frequency

This object monitors the drive output frequency. The unit of this value depends on the setting of the drive parameter *o1-03* [Frequency Display Unit Selection].

*o1-03* = 0: Hz

*o1-03* = 1: %

100% equal *E1-04* [Maximum Output Frequency].

*o1-03* = 2: min<sup>-1</sup>

Enter the number of motor poles into *E2-04* [Motor Pole Count]/*E4-04* [Motor 2 Motor Poles]/*E5-04* [PM Motor Pole Count]/*E9-08* [Motor Pole Count].

*o1-03* = 3: User units (Set with *o1-10* [User Units Maximum Value], *o1-11* [User Units Decimal Position])

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2110	0	Number of entries	Read Only	No	UNS8	2
2110	1	Value	Read Only	Tx	UNS16	0 (0 - FFFF (Hex.))
2110	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0041 (Hex.) (Output frequency)	Read Only	No	UNS16	0041 (Hex.)

### ■ 2120 (Hex.): Output Current

Monitors drive output current. The current value resolution is the same as drive monitor *U1-03*. For more information, refer to the drive manuals.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2120	0	Number of entries	Read Only	No	UNS8	2
2120	1	Value	Read Only	Tx	UNS16	0 (0 - FFFF (Hex.))
2120	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 00FB (Hex.) (Output current)	Read Only	No	UNS16	00FB (Hex.)

### ■ 2130 (Hex.): Output Torque Reference

You can use this object to monitor the drive internal calculated torque reference. To set the torque reference from the PLC, use object 2020 (Hex.).

This object is available when  $A1-02 = 2, 6, 8$  [Control Method Selection = Open Loop Vector, PM Advanced Open Loop Vector, EZ Vector Control]. When  $A1-02 = 0, 5$  [Control Method Selection = V/f Control, PM Open Loop Vector], the torque reference monitor value will be 0.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2130	0	Number of entries	Read Only	No	UNS8	2
2130	1	Value	Read Only	Tx	UNS16	-
2130	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0048 (Hex.) (Output torque reference)	Read Only	No	UNS16	0048 (Hex.)

### ■ 2140 (Hex.): MEMOBUS/Modbus Read Response

This object responds the data of the drive MEMOBUS/Modbus register content specified in object 2040 (Hex.). Bytes 1 and 2 of subindex 1 will contain the data, bytes 3 and 4 will contain the MEMOBUS/Modbus Address that was read out.

**Note:**

SDO Abort codes are responded when the access to the MEMOBUS/Modbus registers fails.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	AA		BB	
Content	MEMOBUS/Modbus address		Data	

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2140	0	Number of entries	Read Only	No	UNS8	1
2140	1	MEMOBUS/Modbus read response	Read Only	Tx	UNS32	0 (0 - FFFFFFFF (Hex.))

### ■ 2150 (Hex.): MEMOBUS/Modbus Write Response

Object 2150 (Hex.) confirms register changes made by object 2050 (Hex.). Bytes 1 and 2 of subindex 1 will contain the data that were written, bytes 3 and 4 will contain the MEMOBUS/Modbus Address that was written to.

**Note:**

SDO Abort codes are responded when the access to the MEMOBUS/Modbus registers fails.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	AA		BB	
Content	MEMOBUS/Modbus address		Data	

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2150	0	Number of entries	Read Only	No	UNS8	1
2150	1	MEMOBUS/Modbus write response	Read Only	Tx	UNS32	0 (0 - FFFFFFFF (Hex.))

### ■ 2151 (Hex.): Advanced MEMOBUS/Modbus Write Response

Object 2151 (Hex.) confirms register changes made by object 2051 (Hex.). Bytes 1 and 2 of subindex 1 will contain the data that were written, bytes 3 and 4 will contain the MEMOBUS/Modbus Address that was written to.

#### Note:

SDO Abort codes are responded when the access to the MEMOBUS/Modbus registers fails.

Signature	MSB			LSB
Byte	4	3	2	1
Hex	AA		BB	
Content	MEMOBUS/Modbus address		Data	

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2151	0	Number of entries	Read Only	No	UNS8	1
2151	1	MEMOBUS/Modbus write response	Read Only	Tx	UNS32	0 (0 - FFFFFFFF (Hex.))

### ■ 2155 (Hex.): PDO Parameter Write Response

Object 2155 displays the RxPDO number and the number of errors that have occurred when writing an RxPDO, if any. This object contains the response from the drive when writing a drive parameter directly using an RxPDO. Bytes 1 and 2 contain the last RxPDO number that caused the error. Byte 3 contains the number of errors. The error counter increases when the drive flags a control data write as invalid.

Signature	MSB		LSB
Byte	3	2	1
Content	8 bit error counter	Last RxPDO number that caused the error	

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2155	0	PDO Parameter Write Response	Read Only	Tx	UNS24	-

### ■ 2160 (Hex.): MEMOBUS/Modbus Unlimited Enter Command Response

Object 2160 (Hex.) contains the response from the drive when you use object 2060 (Hex.) to write an Enter command.

Response values:

OK	65766173 (Hex.)
ERR	MEMOBUS error code or SDO abort code if SDO request

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2160	0	MEMOBUS/Modbus Not Limited Enter Command Response	Read Only	Tx	UNS32	0

### ■ 2180 (Hex.) to 21F0 (Hex.): Freely Configurable Output Objects

These objects can read selectable MEMOBUS content through fieldbus communication. You can assign any MEMOBUS address to this object. After you assign the address, you can use PDO or SDO until Power Off to read the content of this MEMOBUS address.

Subindex 2 sets the MEMOBUS address to be read. Subindex 1 reads the content of the register specified by Subindex 2.

You can link these objects to MEMOBUS/Modbus registers to determine the content.

### 2180 (Hex.) to 21E0 (Hex.): Freely Configurable Output Objects

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2180 2190 21A0 21B0 21C0 21E0	0	Number of entries	Read Only	No	UNS8	2
2180 2190 21A0 21B0 21C0 21E0	1	Value	Read Only	Tx	UNS16	0 (0 - FFFF (Hex.))
2180	2	MEMOBUS/Modbus address of content 1 and 2	Read Write	No	UNS16	0049 (Hex.)
2190	2					004E (Hex.)
21A0 21B0 21C0 21E0	2					FFFF (Hex.)

### 21F0 (Hex.): Freely Configurable Output Object

Use this object to read two registers at the same time. To read only one register, set the other register value specified to Subindex 2 to FFFF (Hex.).

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
21F0	0	Number of entries	Read Only	No	UNS8	2
21F0	1	Value	Read Only	Tx	UNS32	0 (0 - FFFF (Hex.))
21F0	2	MEMOBUS/Modbus address of content 1 and 2	Read Write	No	UNS32	FFFF (Hex.) + FFFF (Hex.)

### ■ 2200 (Hex.): Motor Speed

This object monitors the motor speed (drive parameter *U1-05 [Motor Speed]*). The value in object 2200 (Hex.) is not filtered. Setting units are determined by *o1-03 [Frequency Display Unit Selection]*.

This object is available when *A1-02 = 2, 6, 8 [Control Method Selection = Open Loop Vector, PM Advanced Open Loop Vector, EZ Vector Control]*.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2200	0	Number of entries	Read Only	No	UNS8	0
2200	1	Motor Speed	Read Only	Tx	UNS16	0
2200	2	MEMOBUS/Modbus write response	Read Only	No	UNS16	0044 (Hex.)

### ■ 2210 (Hex.): DC-Bus Voltage

This object monitors the DC BUS voltage.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2210	0	Number of entries	Read Only	No	UNS8	2
2210	1	DC Bus Voltage	Read Only	Tx	UNS16	0
2210	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0046 (Hex.) (DC bus voltage)	Read Only	No	UNS16	0046 (Hex.)

### ■ 2220 (Hex.): Analog Input Monitor A1

This object displays the analog input terminal A1 level: 100% when input is 10 V.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2220	0	Number of entries	Read Only	No	UNS8	2
2220	1	Value	Read Only	Tx	UNS16	0 (0.0 - 100.0)
2220	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 004E (Hex.) (Terminal A1 Input Level)	Read Only	No	UNS16	004E (Hex.)

### ■ 2270 (Hex.): Drive DI Input

This object displays the input terminal status.

Bit defines:

Signature	Bit	Content
LSB	0	Terminal S1 (MFDI 1)
	1	Terminal S2 (MFDI 2)
	2	Ethernet DI3 (MFDI 3)
	3	Ethernet DI4 (MFDI 4)
	4	Ethernet DI5 (MFDI 5)
	5	Ethernet DI6 (MFDI 6)
	6	Ethernet DI7 (MFDI 7)

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2270	0	Number of entries	Read Only	No	UNS8	2
2270	1	Value	Read Only	Tx	UNS16	0
2270	2	MEMOBUS/Modbus address Mapped to MEMOBUS/Modbus address 0049 (Hex.) (Input Terminal Status)	Read Only	No	UNS16	0049 (Hex.)

### ■ 2301 (Hex.): Error Register

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

Values:

- 00 (Hex.) = No error
- 01 (Hex.) = Generic error

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
2301	0	Error register	Read Only	Tx	UNS8	0 (0 - 1)

### ■ 2318 (Hex.): Drive Information

This object contains information read from the device.

#### Power Rating

This object shows the drive power rating read from drive parameter *o2-04 [Drive Model (KVA) Selection]*.

#### Drive Model Code

This object entry shows the drive model code.

Example: CIPR-GA51U2006

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
2318	0	Number of entries	Read Only	No	UNS8	2
2318	1	Power Rating	Read Only	No	UNS16	Determined by drive model
2318	2	Drive Model Number	Read Only	No	String	

### ■ 251x (Hex.): Main Parameter Group A

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter *A1-02 [Control Method Selection]* of the drive, you must write this value to object 2511 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
251x	0	Number of entries	Read Only	No	UNS8
251x	1 - FF	Parameter Ax-yy	Read Write	No	UNS16

### ■ 252x (Hex.): Main Parameter Group B

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter *b1-02 [Run Command Selection 1]* of the drive, you must write this value to object 2521 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
252x	0	Number of entries	Read Only	No	UNS8
252x	1 - FF	Parameter Bx-yy	Read Write	No	UNS16

### ■ 253x (Hex.): Main Parameter Group C

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.

## 7 Object Dictionary

- Refer to the drive manuals for more information.

To write a value into a parameter *CI-02 [Deceleration Time 1]* of the drive, you must write this value to object 2531 (Hex.), sub-index 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
253x	0	Number of entries	Read Only	No	UNS8
253x	1 - FF	Parameter Cx-yy	Read Write	No	UNS16

### ■ 254x (Hex.): Main Parameter Group D

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when *H5-11 = 0 [Comm ENTER Command Mode = ENTER Command Required]*, the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter *d1-02 [Reference 2]* of the AC drive, you must write this value to object 2541 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
254x	0	Number of entries	Read Only	No	UNS8
254x	1 - FF	Parameter Dx-yy	Read Write	No	UNS16

### ■ 255x (Hex.): Main Parameter Group E

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when *H5-11 = 0 [Comm ENTER Command Mode = ENTER Command Required]*, the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter *E1-01 [Input AC Supply Voltage]* of the drive, you must write this value to object 2551 (Hex.), subindex 1.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
255x	0	Number of entries	Read Only	No	UNS8
255x	1 - FF	Parameter Ex-yy	Read Write	No	UNS16

### ■ 256x (Hex.): Main Parameter Group F

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.

- If this object is written when  $H5-11 = 0$  [*Comm ENTER Command Mode = ENTER Command Required*], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter  $F1-02$  [*Encoder Signal Loss Detect Sel*] of the drive, you must write this value to object 2561 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
256x	0	Number of entries	Read Only	No	UNS8
256x	1 - FF	Parameter Fx-yy	Read Write	No	UNS16

### ■ 258x (Hex.): Main Parameter Group H

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [*Comm ENTER Command Mode = ENTER Command Required*], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter  $H1-02$  [*Terminal S2 Function Selection*] of the drive, you must write this value to object 2581 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
258x	0	Number of entries	Read Only	No	UNS8
258x	1 - FF	Parameter Hx-yy	Read Write	No	UNS16

### ■ 25Cx (Hex.): Main Parameter Group L

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [*Comm ENTER Command Mode = ENTER Command Required*], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter  $L1-02$  [*Motor Overload Protection Time*] of the drive, you must write this value to object 25C1 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
25Cx	0	Number of entries	Read Only	No	UNS8
25Cx	1 - FF	Parameter Lx-yy	Read Write	No	UNS16

### ■ 25Ex (Hex.): Main Parameter Group N

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter  $n1-02$  [Hunting Prevention Gain Setting] of the drive, you must write this value to object 25E1 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
25Ex	0	Number of entries	Read Only	No	UNS8
25Ex	1 - FF	Parameter Nx-yy	Read Write	No	UNS16

### ■ 25Fx (Hex.): Main Parameter Group O

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter  $o1-02$  [Monitor Selection at Power-up] of the drive, you must write this value to object 25F1 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
25Fx	0	Number of entries	Read Only	No	UNS8
25Fx	1 - FF	Parameter Ox-yy	Read Write	No	UNS16

### ■ 261x (Hex.): Main Parameter Group Q

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter  $Q1-02$  [Custom Parameter 2] of the drive, you must write this value to object 2611 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
261x	0	Number of entries	Read Only	No	UNS8
261x	1 - FF	Parameter Qx-yy	Read Write	No	UNS16

### ■ 262x (Hex.): Main Parameter Group R

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter *R1-02 [Connection 1 Data (low word)]* of the drive, you must write this value to object 2621 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
262x	0	Number of entries	Read Only	No	UNS8
262x	1 - FF	Parameter Rx-yy	Read Write	No	UNS16

### ■ 264x (Hex.): Main Parameter Group T

To write a value into a parameter of the drive, you must write the value to the corresponding subindex of this object.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- If this object is written when  $H5-11 = 0$  [Comm ENTER Command Mode = ENTER Command Required], the MEMOBUS/Modbus unlimited ENTER command will not be executed automatically. You must issue ENTER commands separately to apply changes to registers.
- Refer to the drive manuals for more information.

To write a value into a parameter *T1-02 [Motor Rated Power]* of the drive, you must write this value to object 2641 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
264x	0	Number of entries	Read Only	No	UNS8
264x	1 - FF	Parameter Tx-yy	Read Write	No	UNS16

### ■ 265x (Hex.): Main Parameter Group U

This object is read only. To read the monitor value of the drive, you must read the subindex of this object as follows.

x: Parameter subgroup

yy: Parameter number

**Note:**

- If parameter number is 00, then the value for yy must be set to FF.
- Refer to the drive manuals for more information.

To read a value from a monitor *U1-02 [Output Frequency]* of the drive, you must read the value of object 2651 (Hex.), subindex 2.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type
265x	0	Number of entries	Read Only	No	UNS8
265x	1 - FF	Parameter Ux-yy	Read Only	Tx	UNS16

### ■ 4001 (Hex.): Communication Software Info + Status Record

This object provides general information of communication software parts and internal system states.

#### OptBootFwRev

This object entry shows the version of the communication software bootloader.

Values:

- AA = Major revision
- BB = Minor revision
- CC = Build

### OptAppFwRev

Application firmware revision.

Values:

- AA = Major revision
- BB = Minor revision
- CC = Build

### OptRunTimeMS

Total running time in milliseconds since power-up.

### NOISystem: iSysErrorBits

Not used.

### NOISystem: iSysErrorBitsLatched

Not used.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
4001	0	Number of entries	Read Only	No	UNS8	5
4001	1	OptBootFwRev	Read Only	No	UNS32	00AABBCC
4001	2	OptAppFwRev	Read Only	No	UNS32	00AABBCC
4001	3	OptRunTimeMS	Read Only	No	UNS32	0 (0 - FFFFFFFF (Hex.))
4001	4	NOISystem: iSysErrorBits	Read Only	No	UNS16	0 (0 - FFFF (Hex.))
4001	5	NOISystem: iSysErrorBitsLatched	Read Only	No	UNS16	0 (0 - FFFF (Hex.))

## ■ 4003 (Hex.): Network Information

This object provides general information of EoE related network adjustments.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
4003	0	Number of entries	Read Only	No	UNS8	8
4003	1	EoE active <b>0 : OFF</b> <b>1 : ON</b>	Read Only	No	UNS8	0 (0, 1 (Hex.))
4003	2	DHCP enabled <b>Note:</b> This subindex is available only when the value of EoE active (subindex 1) is 1. <b>0 : OFF</b> <b>1 : ON</b>	Read Only	No	UNS8	0 (0, 1 (Hex.))
4003	3	IP Address Shows the IPv4 address using 4 octets. <b>Note:</b> This subindex is available only when the value of EoE active (subindex 1) is 1.	Read Only	No	UNS32	0 (0 - FFFFFFFF (Hex.))
4003	4	Subnet Mask Shows the IPv4 subnet mask using 4 octets. <b>Note:</b> This subindex is available only when the value of EoE active (subindex 1) is 1.	Read Only	No	UNS32	0 (0 - FFFFFFFF (Hex.))
4003	5	Gateway Shows the IPv4 gateway address using 4 octets. <b>Note:</b> This subindex is available only when the value of EoE active (subindex 1) is 1.	Read Only	No	UNS32	0 (0 - FFFFFFFF (Hex.))

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
4003	6	MAC Address Shows the MAC Address currently used for EoE. <b>Note:</b> This subindex is available only when the value of EoE active (subindex 1) is 1.	Read Only	No	String	-
4003	7	MAC Address EEPROM Shows the MAC address from EEPROM.	Read Only	No	String	-
4003	8	WebData Revision Shows the revision of the Web interface.	Read Only	No	UNS16	0 (0 - FFFF (Hex.))

### ■ 4004 (Hex.): Revision Number Compatibility Object

With this object, you can set a Revision Number of ESI file for the drive.

Check Revision Number of the ESI file you are using from "RevisionNo" in the Device tag.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
4004	0	Number of entries	Read Only	No	UNS8	3
4004	1	Active User Revision Shows currently available Revision Number. If it shows 0, then the Drive Revision Number is available.	Read Only	No	UNS32	0 (0 - FFFFFFFF (Hex.))
4004	2	Requested User Revision Writes Revision Number to use. Cycle the power to the drive after writing "save" to Save User Revision (subindex 3) to enable the written Revision Number. Example: Revision Number 92420202 (Hex.) of SI-ES3 VST924202	Read Write	No	UNS32	0 (0 - FFFFFFFF (Hex.))
4004	3	Save User Revision When you write "save" (73 (Hex.) + 61 (Hex.) + 76 (Hex.) + 65 (Hex.)) in ASCII, the value of Requested User Revision (subindex 2) will be saved to non-volatile memory. You can use Active User Revision (subindex 1) to read revisions saved to non-volatile memory. Cycle the power to the drive to enable the saved Revision Number.	Read Write	No	UNS32	0 (0 - FFFFFFFF (Hex.))

### ■ 4010 (Hex.): Store Parameters

Write "save" to this object to save the changed parameter settings in the non-volatile memory.

Signature	MSB			LSB
ASCII	e	v	a	s
Hex	65	76	61	73

Actions: Will issue Limited Enter command. Writes data into the EEPROM of the drive and enables the data in RAM at the same time. Parameter changes will stay even if you cycle the power supply.

**Note:**

You can write the EEPROM to the drive a maximum of 100,000 times. Do not frequently execute the Enter command that is written to EEPROM.

Refer to [1010 \(Hex.\): Store Parameters on page 19](#) for information.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
4010	0	Store parameters	Write Only	No	UNS32	01 (Hex.) (Save on command)

### ■ 4011 (Hex.): Restore Default Parameters

Write "load" to this object to restore the parameter settings to default values.

Signature	MSB			LSB
ASCII	d	a	o	l
Hex	64	61	6F	6C

Actions: Will write value = 2220 to *A1-03 [Initialize Parameters]* (INVR:0103 (Hex)) together with an EEPROM ENTER command.

**Note:**

You can write the EEPROM to the drive a maximum of 100,000 times. Do not frequently execute the Enter command that is written to EEPROM.

Refer to *1011 (Hex): Restore Default Parameters on page 19* for information.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
4011	0	Restore Default Parameters	Write Only	No	UNS32	01 (Hex.) (Restore on command)

◆ **CANopen DSP402 Controlword/Statusword**

This section describes how to use controlword/statusword to control the drive and how to access drive parameters.

■ **CANopen DSP402 Controlword**

**Table 7.6 Controlword**

Bit Number	Controlword	Description	Ref.
0	Switch on	This bit controls the DSP402 state machine.	<a href="#">Table 7.10</a>
1	Enable voltage	This bit controls the DSP402 state machine.	<a href="#">Table 7.10</a>
2	Quick stop	This bit controls the DSP402 state machine.	<a href="#">Table 7.10</a>
3	Enable operation	This bit controls the DSP402 state machine.	<a href="#">Table 7.10</a>
4	rfg enable (Operation mode specific)	This bit makes settings related to the speed reference from network.	<a href="#">Table 7.8</a>
5	rfg unlock (Operation mode specific)	This bit makes settings related to the speed reference from network.	<a href="#">Table 7.8</a>
6	rfg use ref (Operation mode specific)	This bit makes settings related to the speed reference from network.	<a href="#">Table 7.8</a>
7	Fault reset	This bit controls the DSP402 state machine.	<a href="#">Table 7.10</a>
8	Halt	Not implemented	-
9	Reserved (Operation mode specific)	Not used	<a href="#">Table 7.8</a>
10	Reserved	Not used	-
11	Manufacturer specific	N/A	-
12	Manufacturer specific	N/A	-
13	Manufacturer specific	N/A	-
14	Manufacturer specific	N/A	-
15	Manufacturer specific	N/A	-

■ **CANopen DSP402 Statusword**

**Table 7.7 Statusword**

Bit Number	Statusword	Description	Ref.
0	Ready to switch on	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
1	Switched on	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
2	Operation enabled	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
3	Fault	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
4	Voltage enabled	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
5	Quick stop	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
6	Switch on disabled	This bit controls the DS402 state machine.	<a href="#">Table 7.11</a>
7	Warning	1: Minor fault	-
8	Manufacturer specific	N/A	-

Bit Number	Statusword	Description	Ref.
9	Remote	1: Force speed reference/Run command from network	-
10	Target reached (Operation mode specific)	-	Table 7.9
11	Internal limit active	0: Always, not used	-
12	Reserved (Operation mode specific)	0: Always, not used	Table 7.9
13	Reserved (Operation mode specific)	0: Always, not used	Table 7.9
14	Manufacturer specific	N/A	-
15	Manufacturer specific	N/A	-

## ■ Controlword Operation Mode Specific Bits in Velocity Mode

Table 7.8 Controlword Operation Mode Specific Bits in Velocity Mode

Bit Number	Controlword	Description
4	rfg enable	0: Speed reference from network not forced 1: Force Speed reference from network
5	rfg unlock	0: Discard received speed reference 1: Use received speed reference
6	rfg use ref	0: Force speed reference to zero 1: Use received speed reference
9	Not implemented	Not implemented

## ■ Statusword Operation Mode Specific Bits in Velocity Mode

Table 7.9 Statusword Operation Mode Specific Bits in Velocity Mode

Bit Number	Statusword	Description
10	Target reached	1: Speed agree
12	Reserved	0: Always, not applicable in Velocity Mode
13	Reserved	0: Always, not applicable in Velocity Mode

## ■ Controlword State Transition Bits

Table 7.10 Controlword State Transition Bits

DSP402 Command	Controlword Bits					Controlword Example (Hex.)	Transitions
	Bit 7	Bit 3	Bit 2	Bit 1	Bit 0		
0: Shutdown	0	X	1	1	0	06	2, 6, 8
1: Switch on	0	0	1	1	1	07	3
2: Switch on + enable operation	0	1	1	1	1	0F	3 + 4 * 2
3: Disable voltage	0	X	X	0	X	00	7, 9, 10, 12
4: Quick stop	0	X	0	1	X	02	7, 10, 11
5: Disable Operation	0	0	1	1	1	07	5
6: Enable Operation	0	1	1	1	1	0F	4, 16
7: Fault Reset	0 → 1	X	X	X	X	00	15

\*1 Automatic transition to Enable operation state after executing Switch on state processing.

\*2 If the network does not have the Run command it will not process any command orders against the drive.

## ■ Statusword State Transition Bits

After a change in the control word (remote control) as specified in Table 7.10, the node state will change and the state result will be identified in the status word as specified in Table 7.11.

Table 7.11 Statusword State Transition Bits

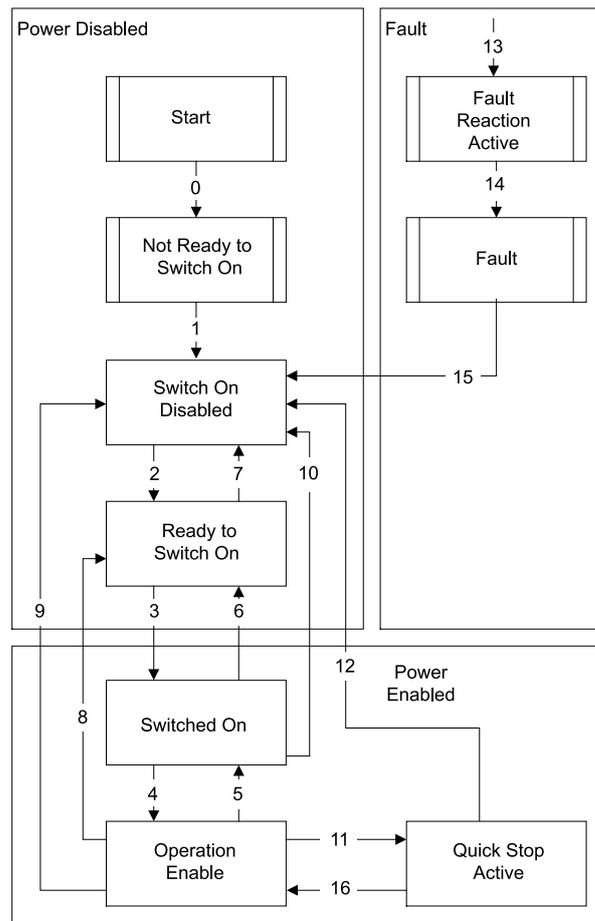
DSP402 State	Statusword Bits						Statusword Example (Hex.)
	Bit 6	Bit 5	Bit 3	Bit 2	Bit 1	Bit 0	
1: Not ready to switch on	0	X	0	0	0	0	00
2: Switch on disabled	1	X	0	0	0	0	20
3: Ready to switch on	0	1	0	0	0	1	11
4: Switch on	0	1	0	0	1	1	13
5: Operation enabled	0	1	0	1	1	1	17
6: Quick stop active	0	0	0	1	1	1	07
7: Fault reaction active	0	X	1	1	1	1	0F
8: Fault	0	X	1	0	0	0	08

### ■ CANopen DSP402 State Transition Definition

The drive has the state transitions and states as shown in Figure 7.1. To accept frequency and operation commands, the EtherCAT must be in the Operation Enable state. Table 7.12 describes the events that are necessary to change between different states. The control word from the EtherCAT triggers most of these events, but others are internally triggered.

### ■ CANopen DSP402 State Diagram

The drive is always in one of the states shown below. The events that trigger transitions between the states are either sent with the control word or triggered by an internal action. All the possible events and the corresponding transition numbers are listed in Table 7.12.



When the drive goes to the Quick Stop Active state by Transition 11, the drive will do a Quick Stop according to *CI-09*. Transition 16 is only available while the drive is in the Quick Stop Active state (during Quick Stop). When the Quick Stop is completed, the drive will automatically go to the Switch On Disabled state by Transition 12.

Figure 7.1 DSP402 State Diagram

## ■ CANopen DSP402 Event Description

The state transitions in [Table 7.12](#) are available in the CANopen DSP402 drive profile. Transitions 0 and 1 are triggered at start-up. After all start-up tests are complete, the drive will be in state 3. You can trigger some commands from more than one place. For example, you can trigger the fault reset command from the bus with the control word or from the application drive.

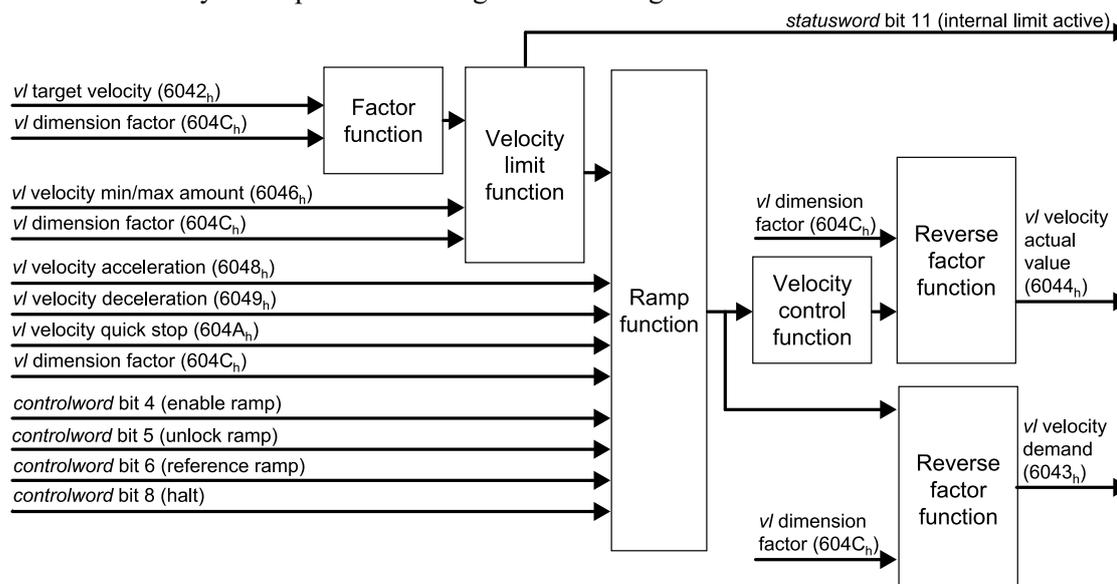
**Table 7.12 Event Description**

State Transition Number	Transition Name	DSP402 Event
0	Startup → Not Ready To Switch On	Reset
1	Not ready to switch on → Switch on disabled	Self test and init successful
2	Switch on disabled → Ready to switch on	Shutdown command received
3	Ready to switch on → Switch on disabled	Switch on command received
4	Switched on → Operation enabled	Enable operation command received
5	Operation enabled → Switched on	Disable operation command received
6	Switch on → Ready to switch on	Shutdown command received
7	Ready to switch on → Switch on disabled	Disable voltage command received or Quickstop command received
8	Operation enabled → Ready to switch on	Shutdown command received
9	Operation enabled → Switch on disabled	Disable voltage command received
10	Switched on → Switch on disabled	Disable voltage command received or Quickstop command received
11	Operation enabled → Quick stop active	Quickstop command received
12	Quick stop active → Switch on disabled	Quickstop command completed or Disable voltage command received
13	All states → Fault reaction active	Fatal fault has occurred in the drive
14	Fault reaction active → Fault	The fault action is completed
15	Fault → Switch on disabled	Fault reset command received
16	Quick stop active → Operation enabled	Enable operation command received

## ◆ Drives and Motion Profile Objects (DS402) Details

The drive supports the Drive and Motion Profile DSP 402 Velocity Mode.

When using DSP 402 Velocity Mode, it is recommended to set parameter  $o1-03 = 2$  [*Frequency Display Unit Selection =  $\text{min}^{-1}$  (Setting number of motor poles is required)*]. Deviated frequency reference or output frequency due to unit conversion may be output if the setting value is changed to another value.



**Figure 7.2 Velocity mode with all objects**

### ■ 6040 (Hex.): Controlword

This object sets the device to different states.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
6040	0	Controlword	Read Write	Rx/Tx	UNS16	-

### ■ 6041 (Hex.): Statusword

This object shows different states of the device.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
6041	0	Statusword	Read Only	Tx	UNS16	-

### ■ 6042 (Hex.): v1 Target Velocity

This object sets the drive internal speed reference. It is internally multiplied with the 604C (Hex.) v1 dimension factor. The drive works internally with absolute values of v1 target velocity only. Negative values written to this object set the internal reverse Run command.

Index (Hex.)	Subindex	Description	Access	PDO Mapping	Data Type	Value (Range)
6042	0	v1 Target Velocity Mapped to MEMOBUS/Modbus address 0002 (Hex.) (Reference frequency in min <sup>-1</sup> )	Read Write	Rx/Tx	S16	0 (-32768 - 32767)

### ■ 6043 (Hex.): v1 Velocity Demand

This object shows the output frequency (rpm) of the drive to the motor. The drive works internally with absolute values of v1 target velocity only. Negative values read from this object depend on the internal reverse Run command.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
6043	0	v1 Velocity Demand Mapped to MEMOBUS/Modbus address 0041 (Hex.) (Output frequency in min <sup>-1</sup> )	Read Only	Tx	S16	0 (-32768 - 32767)

### ■ 6044 (Hex.): v1 Velocity Control Effort/Actual Value

This object shows the output frequency (rpm) of the drive to the motor. The drive works internally with absolute values of v1 target velocity only. Negative values read from this object depend on the internal reverse Run command.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
6044	0	v1 Velocity Control Effort/Actual Value Mapped to: <ul style="list-style-type: none"> <li>If A1-02 = 0 or 5 [Control Method Selection = V/f Control or PM Open Loop Vector], MEMOBUS/Modbus address 0041 (Hex.) (Output frequency in min<sup>-1</sup>)</li> <li>else MEMOBUS/Modbus address 00AC (Hex.) (Motor speed in min<sup>-1</sup>)</li> </ul>	Read Only	Tx	S16	0 (-32768 - 32767)

### ■ 6046 (Hex.): v1 Velocity Min Max Amount

This object sets the minimum and maximum allowable speed of the drive. Subindices 1 and 2 are mapped to d2-02 [Frequency Reference Lower Limit] and d2-01 [Frequency Reference Upper Limit], respectively. The drive does an internal calculation on the value entered into this object. The formula to determine the d2-01 or d2-02 value is as shown here:

$$d2-02 = \frac{6046:1 \text{ (Hex)} \times 604D:0 \text{ (Motor Poles)}}{120 \times \text{Max. Motor Speed (Hz)}^{*1}}$$

\*1 The parameter used for the maximum motor speed depends on the drive control method and motor selection. Refer to [Maximum Motor Speed on page 48](#) for details.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
6046	1	v1 Velocity Min Amount; in rpm Mapped to MEMOBUS/Modbus address 028A (Hex.)/ d2-02 [Frequency Reference Lower Limit]	Read Write	Rx/Tx	UNS32	0 (0 - 2 <sup>32</sup> -1)
6046	2	v1 Velocity Max Amount; in rpm Mapped to MEMOBUS/Modbus address 0289 (Hex.)/ d2-01 [Frequency Reference Upper Limit]	Read Write	Rx/Tx	UNS32	0 (0 - 2 <sup>32</sup> -1)

### ■ 6048 (Hex.): v1 Velocity Acceleration

This object sets the acceleration ramp of the drive. Subindices 1 and 2 are mapped to *C1-01 [Acceleration Time 1]*. The drive does an internal calculation on the value entered into this object. The formula to determine the *C1-01* value is shown here:

$$C1-01 = \frac{120 \times 6048:2 \text{ (Hex)} \times \text{Max. Motor Speed (Hz)}^{*1}}{6048:1 \text{ (Hex)} \times 604D:0 \text{ (Motor Poles)}}$$

\*1 The parameter used for the maximum motor speed depends on the drive control method and motor selection. Refer to [Maximum Motor Speed on page 48](#) for details.

**Note:**

When motor 2 is enabled, the calculated value will be mapped to *C1-05 [Acceleration Time 1 for Motor 2]*, not to *C1-01*.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
6048	1	Acceleration Delta Speed; in rpm	Read Write	Rx/Tx	UNS32	(0 - 2 <sup>32</sup> -1)
6048	2	Acceleration Delta Time; in sec	Read Write	Rx/Tx	UNS16	(0 - 65535)

### ■ 6049 (Hex.): v1 Velocity Deceleration

This object sets the deceleration ramp of the drive. Subindices 1 and 2 are mapped to *C1-02 [Deceleration Time 1]*. The drive does an internal calculation on the value entered into this object. The formula to determine the *C1-02* value is as shown here:

$$C1-02 = \frac{120 \times 6049:2 \text{ (Hex)} \times \text{Max. Motor Speed (Hz)}^{*1}}{6049:1 \text{ (Hex)} \times 604D:0 \text{ (Motor Poles)}}$$

\*1 The parameter used for the maximum motor speed depends on the drive control method and motor selection. Refer to [Maximum Motor Speed on page 48](#) for details.

**Note:**

When motor 2 is enabled, the calculated value will be mapped to *C1-06 [Deceleration Time 1 for Motor 2]*, not to *C1-02*.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
6049	1	Deceleration Delta Speed; in rpm	Read Write	Rx/Tx	UNS32	(0 - 2 <sup>32</sup> -1)
6049	2	Deceleration Delta Time; in sec	Read Write	Rx/Tx	UNS16	(0 - 65535)

### ■ 604A (Hex.): v1 Velocity Quick Stop

This object sets the Fast-Stop deceleration ramp of the drive. Subindices 1 and 2 are mapped to *C1-09 [Fast Stop Time]*. The drive does an internal calculation on the value entered into this object. The formula to determine the *C1-09* value is as shown here:

$$C1-09 = \frac{120 \times 604A:2 \text{ (Hex)} \times \text{Max. Motor Speed (Hz)}^{*1}}{604A:1 \text{ (Hex)} \times 604D:0 \text{ (Motor Poles)}}$$

\*1 The parameter used for the maximum motor speed depends on the drive control method and motor selection. Refer to [Maximum Motor Speed on page 48](#) for details.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
604A	1	Quick Stop Delta Speed; in rpm	Read Write	Rx/Tx	UNS32	(0 - 2 <sup>32</sup> - 1)
604A	2	Quick Stop Delta Time; in sec	Read Write	Rx/Tx	UNS16	(0 - 65535)

### ■ 604C (Hex.): 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 denominator determines the vl dimension factor.

The drive multiplies the following objects by the dimension factor and are always used in a product (multiplication):

Object (Hex.)	Object Name	Ref.
6042	vl Target Velocity	44
6043	vl Velocity Demand	44
6044	vl Velocity Control Effort/Actual Value	44
6046	vl Velocity Min Max Amount	44
6048	vl Velocity Acceleration	45
6049	vl Velocity Deceleration	45
604A	vl Velocity Quick Stop	45

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
604C	1	vl Dimensions Factor numerator	Read Write	Rx/Tx	SINT32	1 (-2 <sup>31</sup> - 2 <sup>32</sup> -1)
604C	2	vl Dimensions Factor denominator	Read Write	Rx/Tx	SINT32	1 (-2 <sup>31</sup> - 2 <sup>32</sup> -1)

### ■ 604D (Hex.): vl Pole Number

This object sets the number of motor poles and calculates all speed related values in min<sup>-1</sup>. This value aligns with the number of motor poles setting in the drive.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
604D	0	vl Pole Number <sup>*1</sup>	Read Write	Tx	UNS8	4 (2 - 254)

\*1 Mapped MEMOBUS/Modbus register is different for different control method and motor selection as follows:

A1-02 [Control Method Selection]	Parameter	Register (Hex.)
0, 2	E2-04 (Motor 2 not selected)	0311
	E4-04 (Motor 2 selected)	0324
5, 6	E5-04	032C
8	E9-08	11EB

### ■ 6060 (Hex.): Modes of Operation

This object shows the mode of the device. The object supports 2 (Velocity Mode) only. Refer to [Supported Modes of Operation on page 16](#) for information.

Supported modes:

Value	Description
2	Velocity Mode

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
6060	0	Modes of Operation	Read Write	Rx/Tx	SINT8	2

## ■ 6061 (Hex.): Modes of Operation Display

This object shows the mode of the device. Refer to [Supported Modes of Operation on page 16](#) for information.

Supported modes:

Value	Description
2	Velocity Mode
-2	Vendor Control Mode

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
6061	0	Modes of Operation	Read Only	Tx	SINT8	- (-2, 2)

## ■ 60FD (Hex.): Digital Inputs

This object contains the drive digital output status (seen as input to the network). The content of this object is equal to drive MEMOBUS/Modbus register 004A (Hex.)/U1-11 [*Digital Output Status*].

Bit defines:

Signature	Bit	Content
LSB	0 - 15	0 (reserved)
	16	Terminals MA-MB-MC
	17	Ethernet DO1
	18	Ethernet DO2
	19	0 (reserved)
	20	0 (reserved)
	21	0 (reserved)
	22	0 (reserved)
MSB	23	0 (reserved)
	24 - 31	0 (reserved)

Value	Description
1	ON
0	OFF

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
60FD	0	Drive Digital Input Status	Read Only	Tx	UNS32	- (0 - 2 <sup>32</sup> -1)

## ■ 60FE (Hex.): Digital Outputs

This object sets drive digital inputs (seen as output from the network).

Bit defines:

Signature	Bit	Content
LSB	0 - 15	0 (reserved)
	16	Multi-function input command 1
	17	Multi-function input command 2
	18	Multi-function input command 3
	19	Multi-function input command 4
	20	Multi-function input command 5
	21	Multi-function input command 6
	22	Multi-function input command 7
	23	0 (reserved)

## 8 Process Data Objects (PDO)

Signature	Bit	Content
	24	External Fault (EF0)
	25	Fault Reset
MSB	26 - 31	0 (reserved)

Value	Description
1	ON
0	OFF

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value (Range)
60FE	0	Number of Elements	Read Only	-	UNS8	1
60FE	1	Physical Outputs	Read Write	Rx/Tx	UNS32	- (0 - 2 <sup>32</sup> -1)

### ■ 6502 (Hex.): Supported Drive Modes

This object displays the supported drive modes.

Index (Hex.)	Subindex	Content	Access	PDO Mapping	Data Type	Value
6502	-	Supported Drive Modes	Read Only	Tx	UNS32	00020002 (Hex.)

### ■ Maximum Motor Speed

With objects 6046, 6048, 6049, and 604A (Hex.), the parameter used for the maximum motor speed at calculation depends on the drive control method and motor selection as shown in this table:

A1-02 [Control Method Selection]	Parameter	Register (Hex.)
0, 2	E1-04 (Motor 2 not selected)	0303
	E3-04 (Motor 2 selected)	031A
5, 6	E1-04	0303
8	E9-02	11E5

## 8 Process Data Objects (PDO)

### ◆ 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 transfer data from the drive and RxPDOs transfer data to the drive.

The drive supports at least 8 parameters mapped to RxPDO and 8 parameters mapped to TxPDO.

The drive supports 16 Receive and 17 Transmit PDOs. The following tables 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. You can write to the map objects 1A00 (Hex.) - 1A29 (Hex.) to re-map Transmit PDOs. Refer to [Communication Profile Objects \(DS 301\) on page 16](#) for information.

Table 8.1 Transmit PDO Mapping

PDO Number	Mapped Objects (Hex.)	Index (Hex.)
1	Sub-index 1: 6041:0, 2-bytes (DSP402 status word)	1A00
2	Sub-index 1: 6041:0, 2-bytes (DSP402 status word) Sub-index 2: 6061:0, 2-bytes (DSP402 Modes of operation display)	1A01
6	Sub-index 1: 6041:0, 2-bytes (DSP402 status word) Sub-index 2: 6044:0, 2-bytes (v1 control effort)	1A05
7	Sub-index 1: 6041:0, 2-bytes (DSP402 status word) Sub-index 2: 60FD:0, 4-bytes (Digital inputs)	1A06

PDO Number	Mapped Objects (Hex.)	Index (Hex.)
21	Sub-index 1: 6042:0, 2-bytes (v1 target velocity)	1A14
22	Sub-index 1: 6043:0, 2-bytes (v1 velocity demand)	1A15
23	Sub-index 1: 6048:1, 4-bytes (v1 Accel delta speed) Sub-index 2: 6048:2, 2-bytes (v1 Accel delta time)	1A16
24	Sub-index 1: 6049:1, 4-bytes (v1 Decel delta speed) Sub-index 2: 6049:2, 2-bytes (v1 Decel delta time)	1A17
25	Sub-index 1: 604A:1, 4-bytes (v1 quick-stop delta speed) Sub-index 2: 604A:2, 2-bytes (v1 quick-stop delta time)	1A18
26	Sub-index 1: 604C:1, 4-bytes (v1 Dimension factor) Sub-index 2: 604C:2, 4-bytes (v1 Dimension factor)	1A19
36	Sub-index 1: 2100:1, 2-bytes (Drive status)	1A23
37	Sub-index 1: 2110:1, 2-bytes (Output frequency)	1A24
38	Sub-index 1: 2120:1, 2-bytes (Output current)	1A25
39	Sub-index 1: 2130:1, 2-bytes (Output torque reference)	1A26
40	Sub-index 1: 2140:1, 2-bytes (MEMOBUS/Modbus read response)	1A27
41	Sub-index 1: 2150:1, 2-bytes (MEMOBUS/Modbus write response)	1A28
42	Sub-index 1: 6041:0, 2-bytes (DSP402 status word) Sub-index 2: 6061:0, 1-byte (DSP402 Modes of operation display) Sub-index 3: 6044:0, 2-bytes (DSP402 v1 velocity actual value) Sub-index 4: 60FD:0, 4-bytes (DSP402 Digital inputs) Sub-index 5: 6042:0, 2-bytes (DSP402 v1 target velocity) Sub-index 6: 6043:0, 2-bytes (DSP402 v1 velocity demand)	1A29

### ■ Receive PDOs (RxPDO)

The Receive PDOs have a default mapping as specified by the table below. You can write to the map objects 1600 (Hex.) - 1629 (Hex.) to re-map Receive PDOs. Refer to *Communication Profile Objects (DS 301) on page 16* for information.

**Table 8.2 Receive PDO Mapping**

PDO Number	Mapped Objects (Hex.)	Index (Hex.)
1	Sub-index 1: 6040:0, 2-bytes (DSP402 control word)	1600
2	Sub-index 1: 6040:0, 2-bytes (DSP402 control word) Sub-index 2: 6060:0, 1-bytes, (DSP402 Modes of operation)	1601
6	Sub-index 1: 6040:0, 2-bytes (DSP402 control word) Sub-index 2: 6042:0, 2-bytes, (v1 target velocity)	1605
7	Sub-index 1: 6040:0, 2-bytes (DSP402 control word) Sub-index 2: 60FE:1, 4-bytes, (Physical digital outputs)	1606
8	Sub-index 1: 6040:0, 2-bytes (DSP402 control word) Sub-index 2: 6060:0, 1-bytes, (DSP402 Modes of operation)	1607
21	Sub-index 1: 6048:1, 4-bytes (v1 Accel delta speed) Sub-index 2: 6048:2, 2-bytes (v1 Accel delta time)	1614
22	Sub-index 1: 6049:1, 4-bytes (v1 Decel delta speed) Sub-index 2: 6049:2, 2-bytes, (v1 Decel delta time)	1615
23	Sub-index 1: 604A:1, 4-bytes (v1 quick-stop delta speed) Sub-index 2: 604A:2, 2-bytes, (v1 quick-stop delta time)	1616
24	Sub-index 1: 604C:1, 4-bytes (v1 Dimension factor) Sub-index 2: 604C:2, 4-bytes, (v1 Dimension factor)	1617
36	Sub-index 1: 2000:1, 2-bytes (Operation command)	1623
37	Sub-index 1: 2010:1, 2-bytes (Speed reference/limit)	1624
38	Sub-index 1: 2020:1, 2-bytes (Torque reference/limit)	1625
39	Sub-index 1: 2030:1, 2-bytes (Torque compensation)	1626
40	Sub-index 1: 2040:1, 4-bytes (MEMOBUS read request)	1627

PDO Number	Mapped Objects (Hex.)	Index (Hex.)
41	Sub-index 1: 2050:1, 4-bytes (MEMOBUS write request)	1628
42	Sub-index 1: 6040:0, 2-bytes (DSP402 control word) Sub-index 2: 6042:0, 2-bytes (v1 target velocity) Sub-index 3: 6048:1, 4-bytes (v1 Accel delta speed) Sub-index 4: 6048:2, 2-bytes (v1 Accel delta time) Sub-index 5: 6049:1, 4-bytes (v1 Decel delta speed) Sub-index 6: 6049:2, 2-bytes (v1 Decel delta time) Sub-index 7: 6046:1, 4-bytes (v1 velocity min amount) Sub-index 8: 6046:2, 4-bytes (v1 velocity max amount)	1629

**■ Precautions When Mapping Objects for RxPDO**

When you map objects linked to the drive registers above 00FF (Hex.) range to RxPDO, the internal writing process cannot be done at a high speed. In such cases, the internal writing process will be done at a low speed. Table 8.3 shows objects linked to the drive registers above 00FF (Hex.) range.

Among the registers above 00FF (Hex.) range, when the values are written to the registers mapped to the drive parameters, a RAM Enter command is necessary to apply changes to registers. A RAM Enter command will be executed once after the low-speed writing processes of objects mapped for RxPDO are complete.

**Note:**

You must issue a RAM Enter command separately for some objects. Refer to Table 8.3 for more information.

**Table 8.3 Objects Managed in the Slow IO Channel**

CoE Object (Hex.)	Linked INV Register	Information
2080, 2090, 20A0, 20B0, 20C0, 3000, 3100	If subindex 2 MEMOBUS register is > 0100 (Hex.) a low-speed writing process is used.	Configurable input objects
2050	Register specified for object	MEMOBUS/Modbus write object
2051	Register specified for object	MEMOBUS/Modbus write object <b>Note:</b> When <i>H5-11 = 0</i> , no RAM Enter command is executed. You must issue a RAM Enter command separately.
2060, 2061	0910 (Hex.) (RAM Enter)	MEMOBUS RAM (un-memorized) Enter command
6046:1	028A (Hex.) / <i>d2-02 [Frequency Reference Lower Limit]</i>	Inverter frequency reference lower limit
6046:2	0289 (Hex.) / <i>d2-01 [Frequency Reference Upper Limit]</i>	Inverter frequency reference upper limit
6048:1, 6048:2	0200 (Hex.) / <i>C1-01 [Acceleration Time 1]</i>	v1 velocity acceleration #1 = delta speed #2 = delta time
6049:1, 6049:2	0201 (Hex.) / <i>C1-02 [Deceleration Time 1]</i>	v1 velocity deceleration #1 = delta speed #2 = delta time
604A:1, 604A:2	0208 (Hex.) / <i>C1-09 [Fast Stop Time]</i>	v1 velocity quick stop #1 = delta speed #2 = delta time

**9 Examples**

**◆ Example Project with SPEED7**

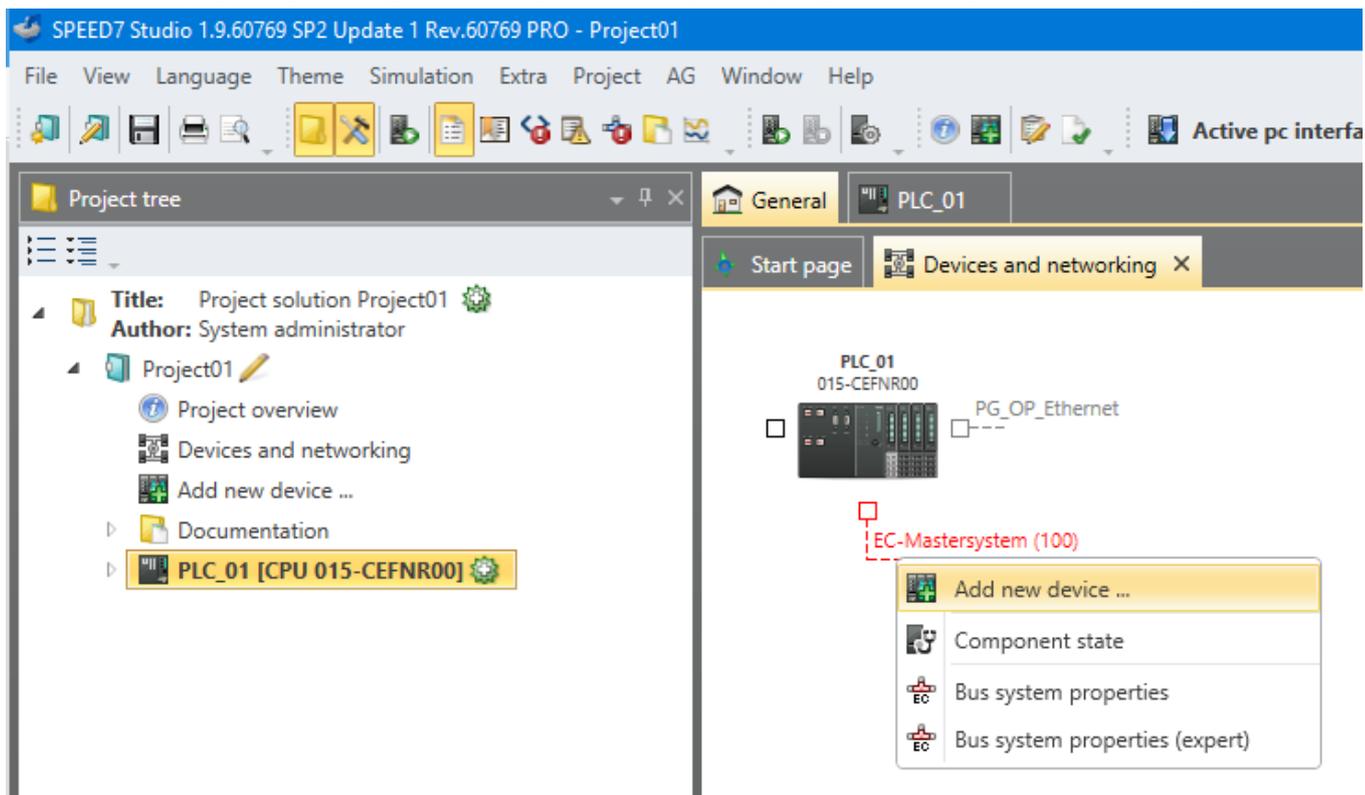
The following example shows how to make the GA501 available in a SPEED7 Studio project.

**Note:**

The graphics were created using SPEED7 Studio version 2016 [clarify]. The software user interface is different for different versions.

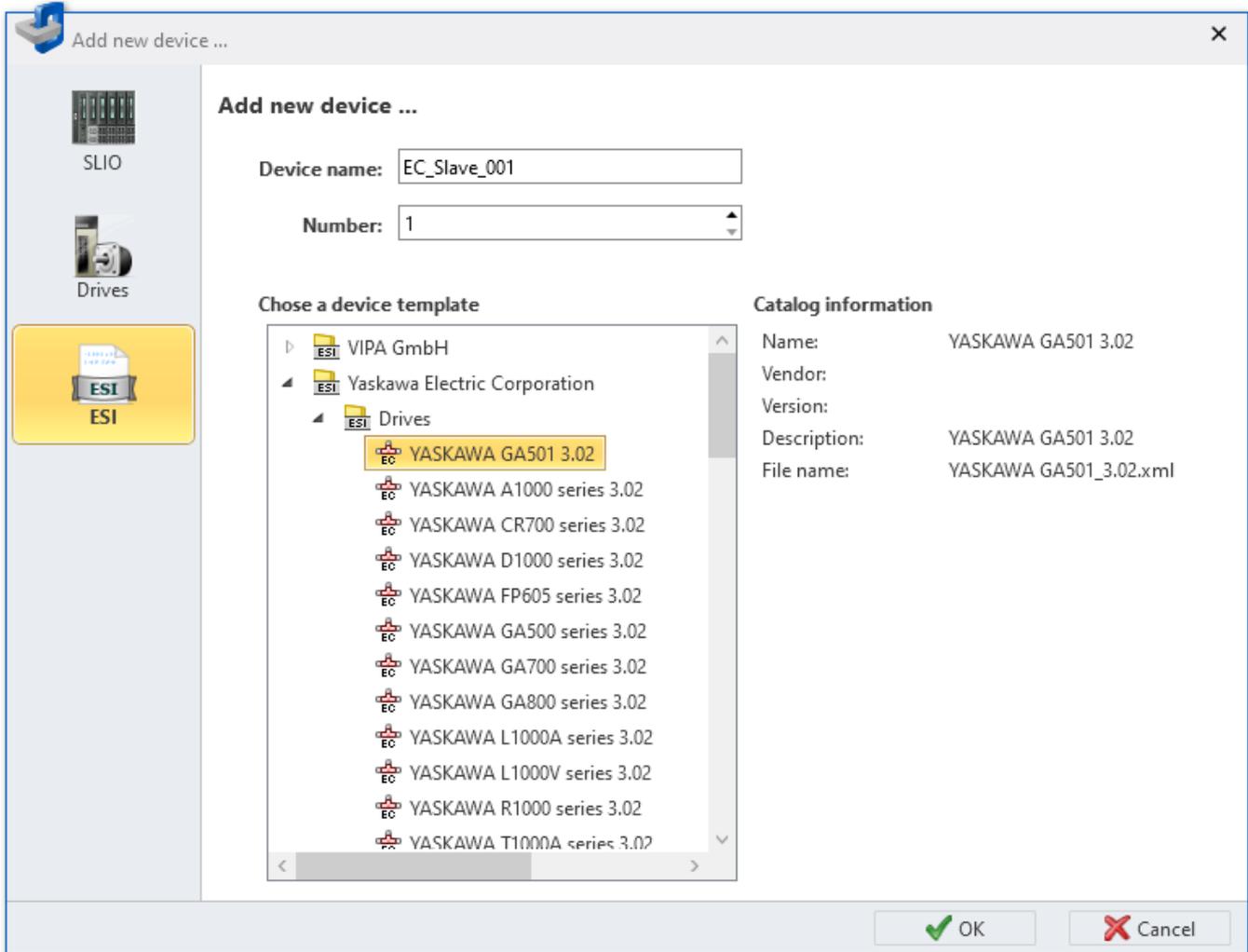
1. Click [Extra] > [Install device description file (EtherCAT ESI)] to import the device description file for the drive.

2. In the projecting view, right-click the [EC-Mastersystem (100)] and select [Add new device....].



3. In the dialog box, select [ESI] on the left pane.

4. Navigate to [Vendor] > [Yaskawa Electric Corporation] > [Drives] and click [Yaskawa GA501]. Confirm with [OK].



After following the procedure, the drive is ready for further use.

## ◆ Enable EoE Using SPEED7 Studio

When you receive the product, the drive does not have an IP address. You must assign the drive an IP address to access the drive via EoE using SPEED7 Studio.

Use the following method:

1. Download the ESI file from the Yaskawa website, and install the file to use it in SPEED7 Studio.
2. Connect a drive to your network.
3. In SPEED7 Studio, select [Configuration] > [Slave station] > [Ethernet (EoE)].
4. Select one of the two modes, and configure the drive accordingly:
  - Port Mode
    - IP Port
  - Overwrite IP Settings
    - IP address
    - Subnet Mask
    - Default Gateway

### Note:

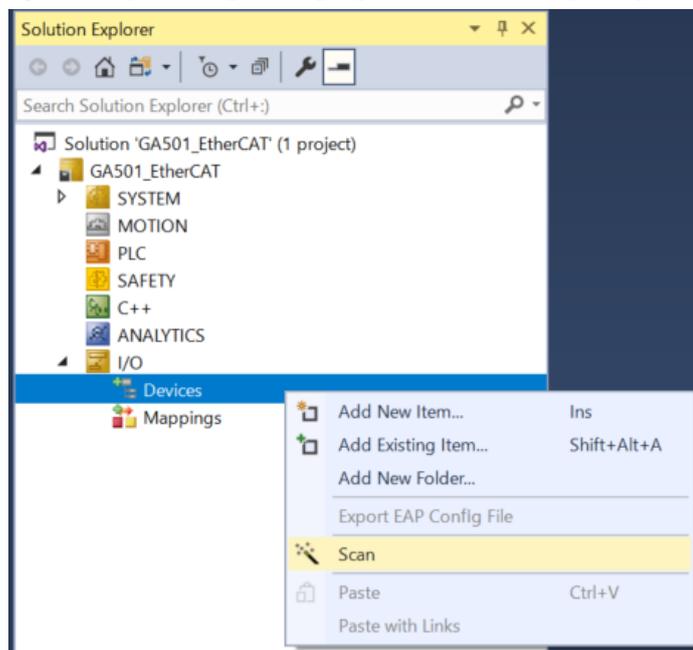
The GA501 does not support “Switch Port”, “DNS Server”, and “DNS Name”.

5. Confirm with [OK].

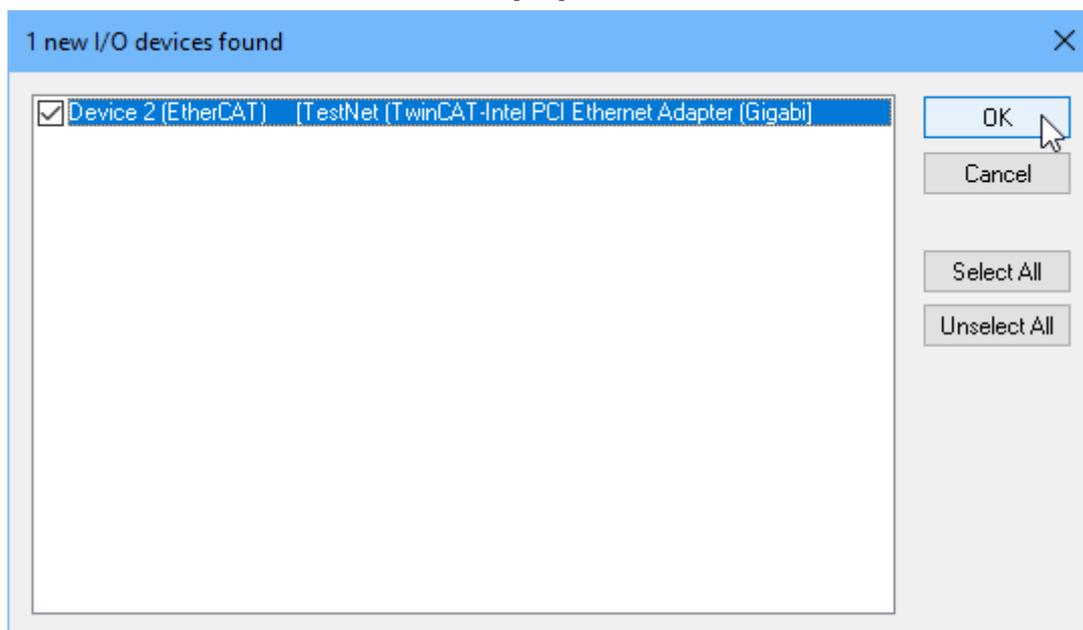
## ◆ Example Project with TwinCAT Project

The following example shows how to make the GA501 available in a TwinCAT project.

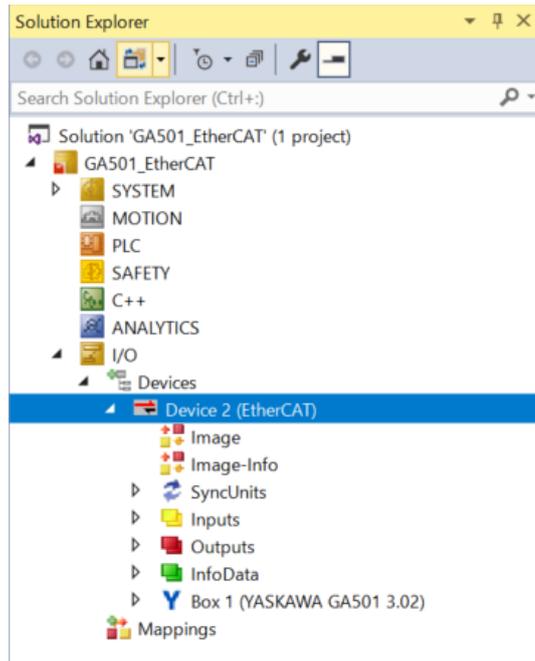
1. Click [Action] > [Import XML Description...] to import the device description file for the drive.
2. In the project tree, right-click [Devices] in the [I/O] node and select [Scan].



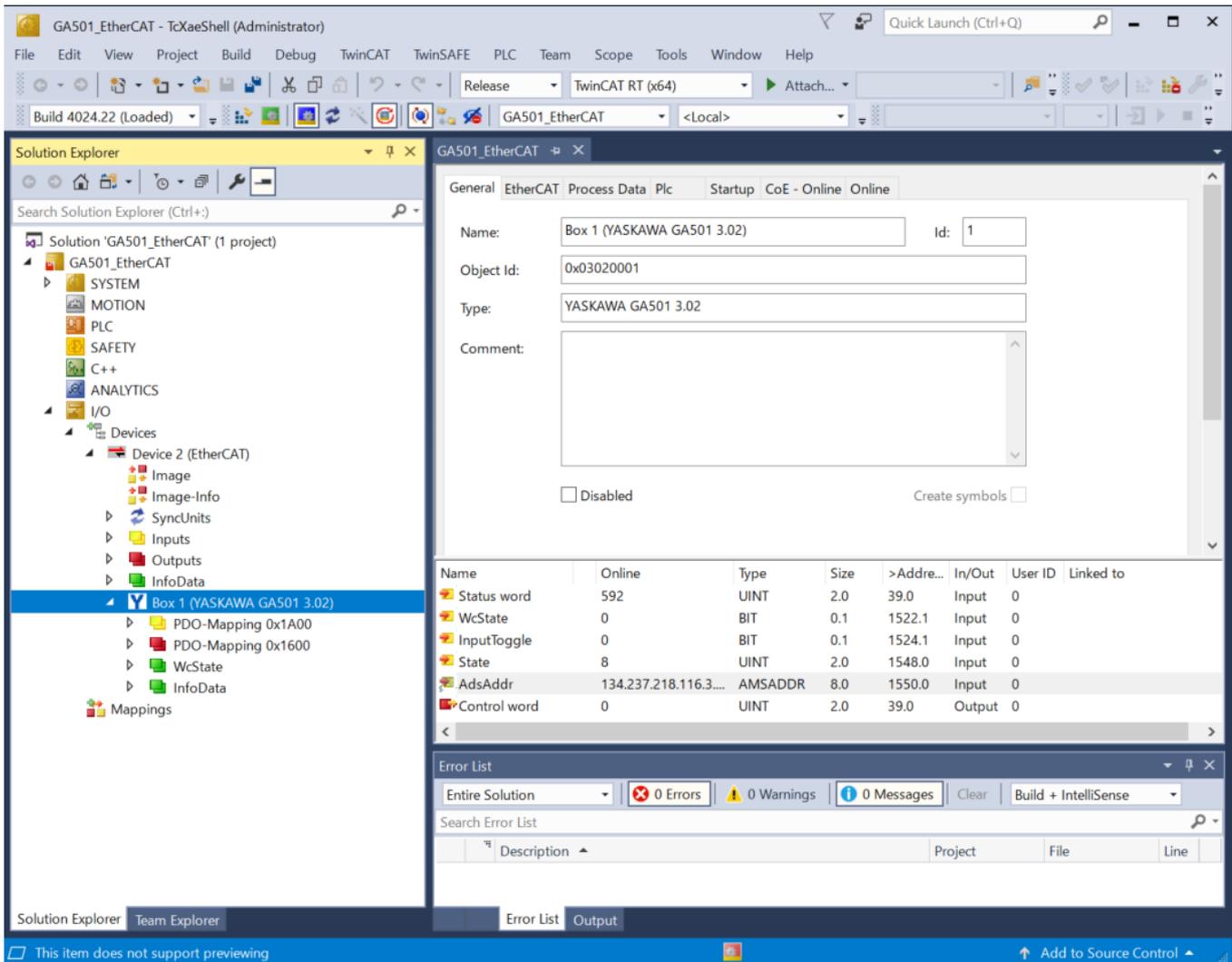
3. Select the EtherCAT device and confirm with [OK].



4. TwinCAT System Manager will ask you to scan for boxes. Select [Yes].



After following the procedure, the drive is ready for further use.

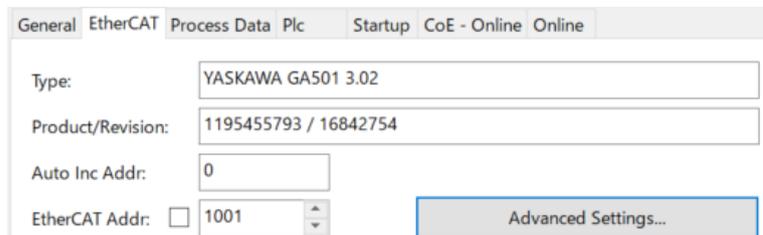


## ◆ Enable EoE Using TwinCAT

When you receive the product, the drive does not have an IP address. You must assign the drive an IP address to access the drive via EoE using TwinCAT.

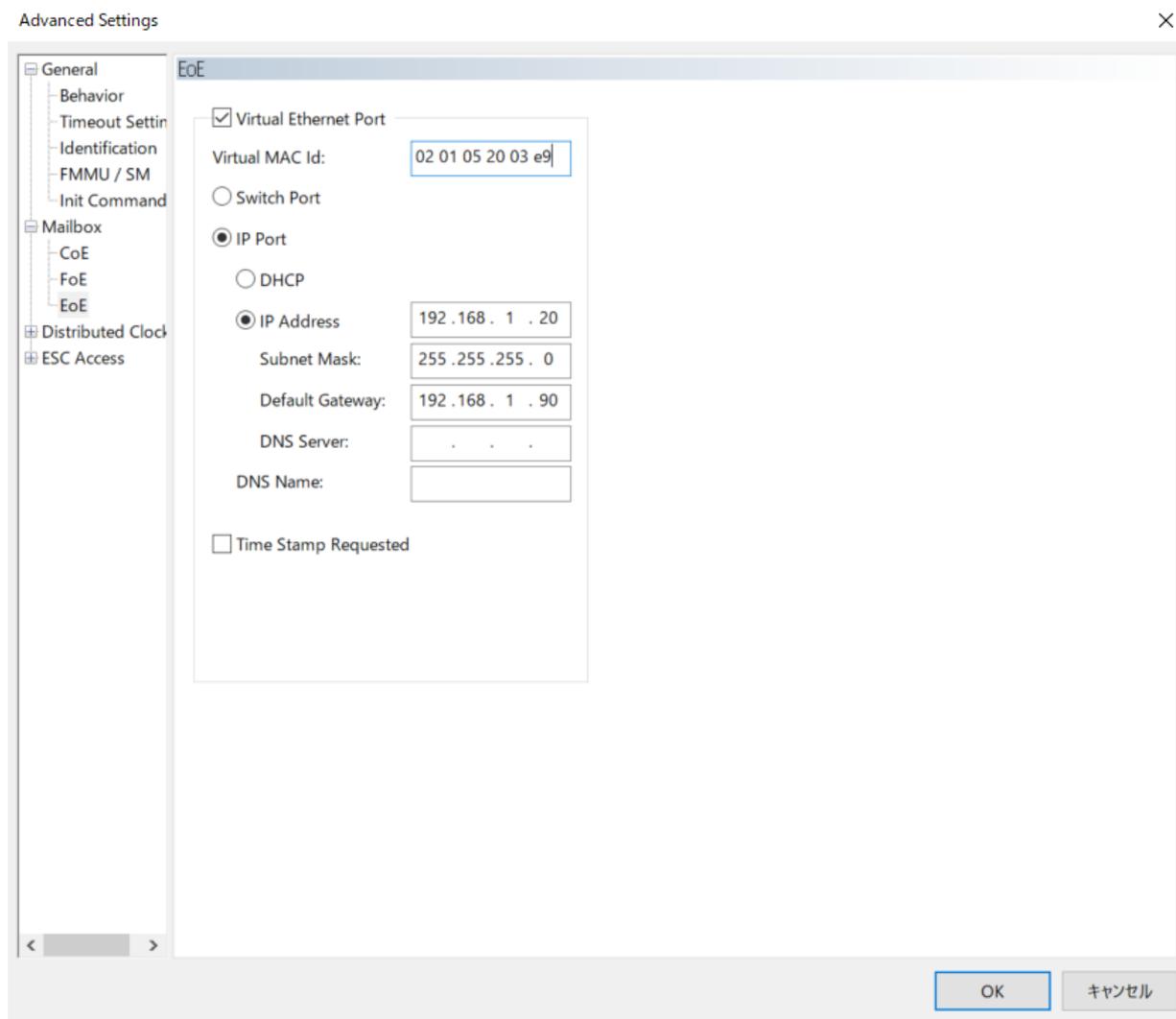
Use the following method:

1. Download the ESI file from the Yaskawa website, and install the file to use it in TwinCAT.
2. Connect a drive to your network.
3. The software will do a scan and then list your drive.
4. Click the drive. In the main view of TwinCAT, you can see the details of the connected drive.



**Figure 9.1 Details of the Connected Drive**

5. Select [EtherCAT] tab, and click [Advanced Settings...]. The [Advanced Settings] window opens.



**Figure 9.2 [Advanced Settings] Window**

6. Navigate to [Mailbox] > [EoE], and make these settings.
  - Virtual MAC Id
  - IP Address

- Subnet Mask
- Default Gateway

**Note:**

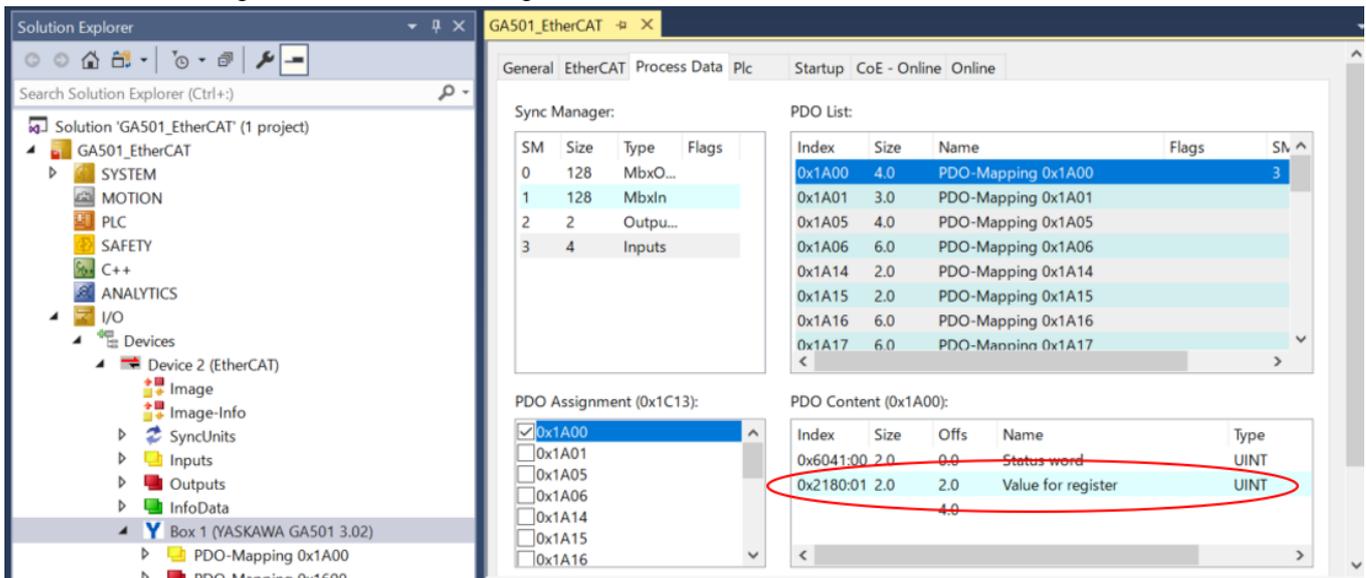
The GA501 does not support “Switch Port” and “DHCP”.

7. Confirm with [OK].

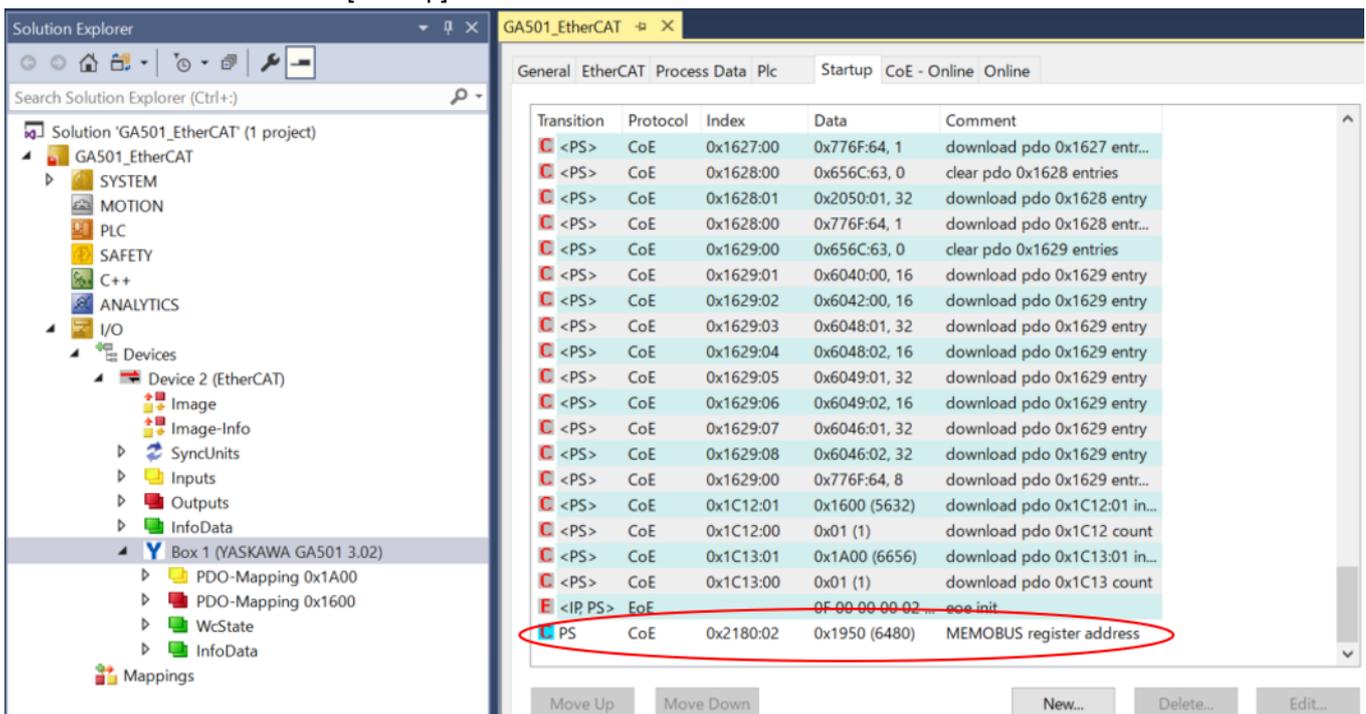
### ◆ Example to Select MEMOBUS/Modbus Register into Freely Configurable Output Objects

The following example shows how to select MEMOBUS/Modbus register into freely configurable output objects. Example: Select MEMOBUS/Modbus register 1950 (Hex.) into freely configurable output object 2180 (Hex.) in TwinCAT 3.

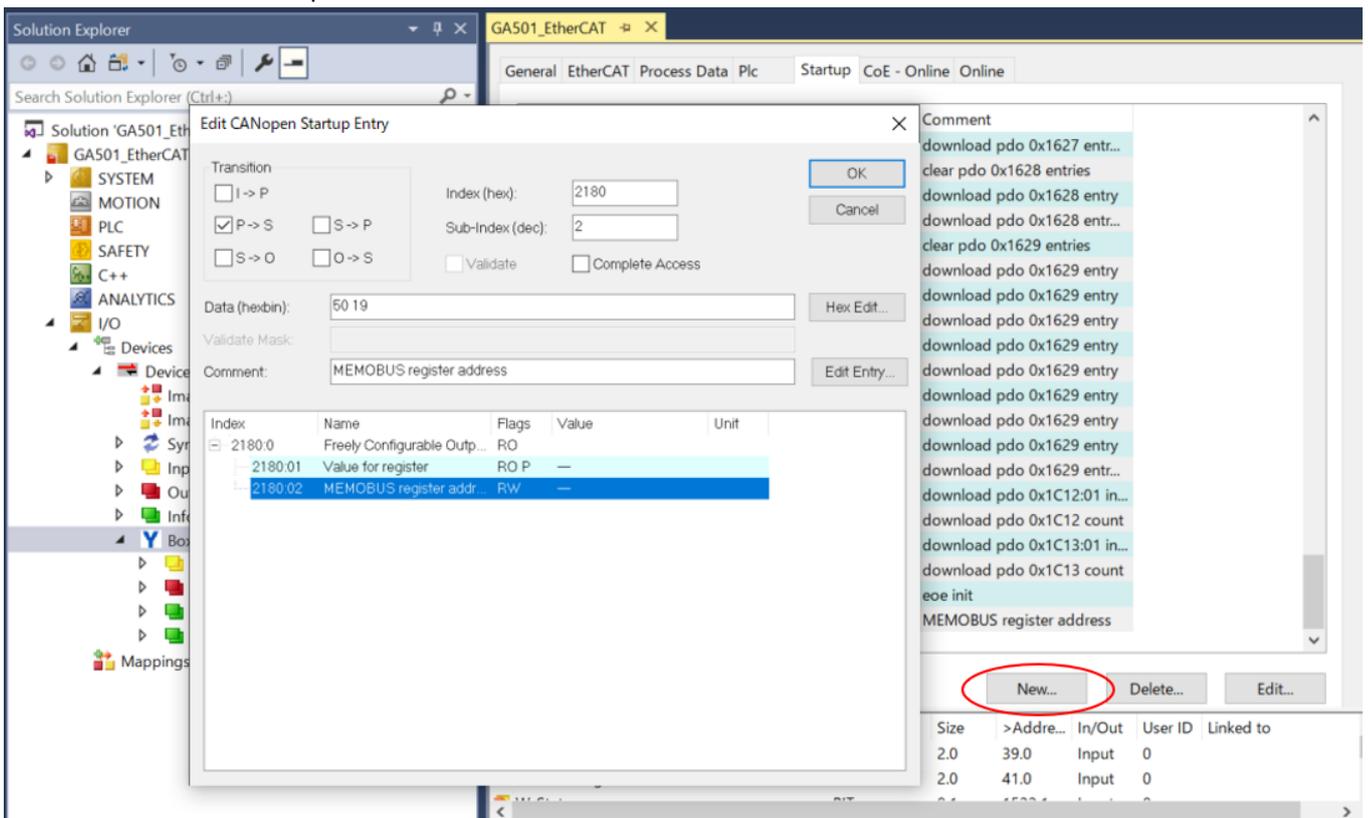
1. Select the freely configurable output object 2180 (Hex.) subindex 1 into the input TxPDO of the PLC.  
The freely configurable output object 2180 (Hex.) subindex 1 will contain the value of the MEMOBUS/Modbus register that we are reading.



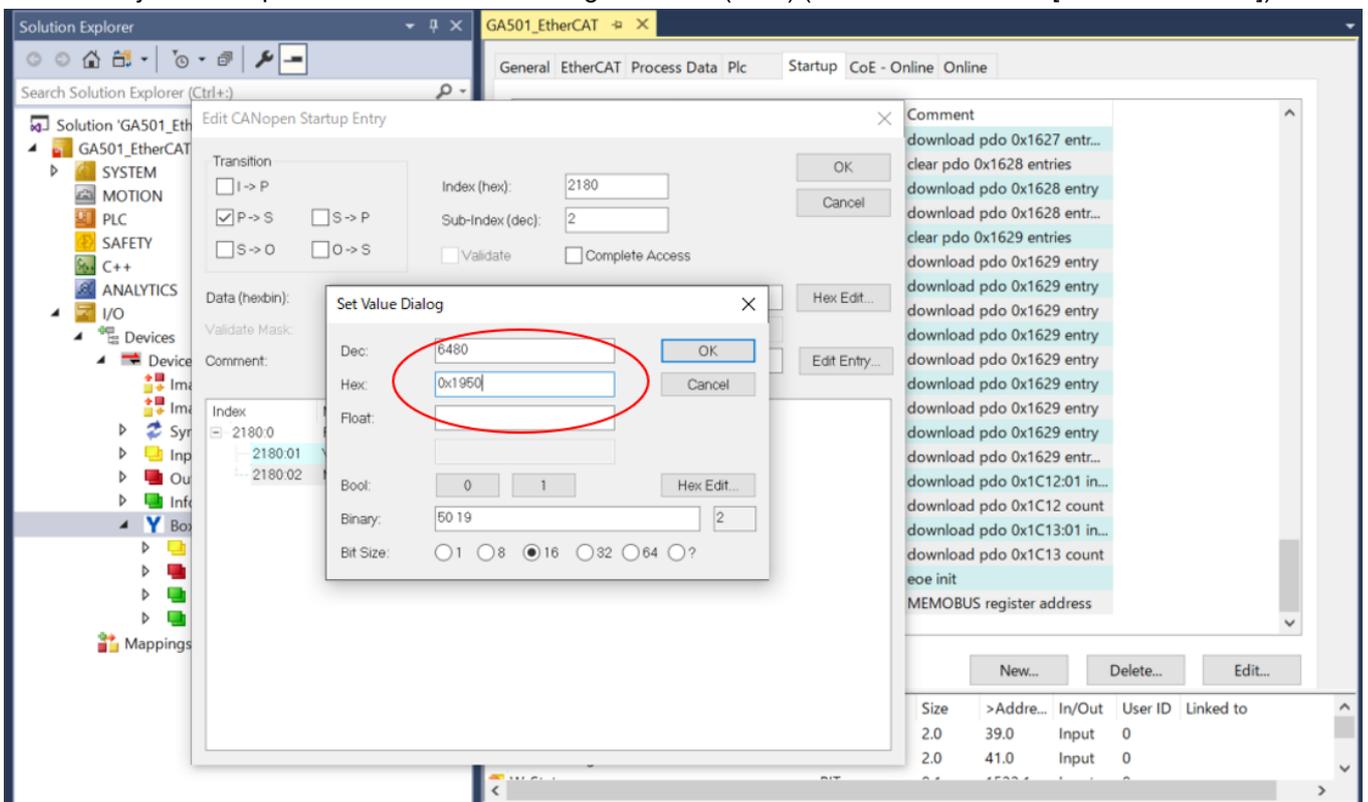
2. Write a MEMOBUS/Modbus register to the freely configurable output object 2180 (Hex.) and determine the MEMOBUS/Modbus register to be read.  
This can be done in [Startup].



3. In the [Startup], you can add a new startup message by clicking on [New...] on the bottom right to open a new window where you can select [2180 02 MEMOBUS register address].  
Be careful that you select [2180 02 MEMOBUS register address], otherwise you will get an error during TwinCAT 3 startup.



4. By double clicking on [2180 02 MEMOBUS register address], you can set a startup value which will be written in the freely configurable output object 2180 (Hex.) subindex 2 during P->S (PREOP to SAFEOP). There you should set the MEMOBUS/Modbus register you want to read with the freely configurable input object. Example: MEMOBUS/Modbus register 1950 (Hex.) (drive monitor U8-01 [DWEZ Monitor 1]).



5. Now after the TwinCAT 3 startup, the freely configurable output object 2180 (Hex.) subindex 1 will show the value of the MEMOBUS/Modbus register 1950 (Hex.).

## 10 Web Interface

The drive contains a series of web pages that let you use a standard web browser to view status and diagnostic information.

You can access the web page through a self-contained web server at port 80. Type the IP address of the drive into a web browser to access the Home page.

Example: <http://192.168.1.20>

If you do not know the IP address, use monitors *U6-80 to U6-83 [Ethernet IP Address 1 to Ethernet IP Address 4]* on the keypad to read the IP address of the drive. Refer to [Table 5.1](#) for more information.

**Note:**

When you use the web interface with EtherCAT, enable EoE.

### ◆ Home Page

The Home page shows the status of the drive and the I/O. It also shows identifying information about the drive.

The screenshot shows the Yaskawa web interface for a CIPR-GA51U2006 EtherCAT / GA501 drive. The page is titled 'Home' and includes a 'Login' button. The main content area is divided into several sections:

- Drive Status:** Shows 'Running - Forward' with a row of status buttons: RUN (green), ZERO SPD, REV, RESET, AT SPD, READY (green), ALARM, and FAULT.
- Drive Monitors:** A table showing:
 

Frequency Reference	40.00 Hz
Output Frequency	40.00 Hz
Output Current	0.1 A
DC Bus Voltage	291 VDC
Torque Reference	0.0 %
- Digital Inputs:** A list of inputs S1 through S7 (virtual), each with a checkbox.
- Digital Outputs:** A single output MA-MB-MC with a checkbox.
- Analog Inputs:** A single input A1 with a value of 0.0 %.
- Drive Information:**

Model	GA501
Full Model	CIPR-GA51U2006
Version	2010
Serial Number	0123456789ABCDE
- Ethernet Information:**

Version	VST908211
Protocol	EtherCAT-Ver4204

The footer contains the copyright notice '©2018-2024 Yaskawa America, Inc. All Rights Reserved - WEB 9005' and 'Update Time: 1 sec'.

**Figure 10.1 Home Page View**

When a fault or minor fault occurs in the drive, the details of the fault or minor fault are displayed on the Home page.

**YASKAWA** CIPR-GA51U2006  
EtherCAT / GA501

Home EtherCAT Network Chart Login

Status Extended Status

**Drive Status**

**FAULT - External Fault (Terminal S1) (EF1)**

RUN ZERO SPD REV RESET AT SPD READY ALARM **FAULT**

Drive Monitors		Digital Inputs		Digital Outputs	
Frequency Reference	0.00 Hz	<input checked="" type="checkbox"/>	S1	<input checked="" type="checkbox"/>	MA-MB-MC
Output Frequency	0.00 Hz	<input type="checkbox"/>	S2		
Output Current	0.0 A	<input type="checkbox"/>	S3 (virtual)		
DC Bus Voltage	291 VDC	<input type="checkbox"/>	S4 (virtual)		
Torque Reference	0.0 %	<input type="checkbox"/>	S5 (virtual)		
		<input type="checkbox"/>	S6 (virtual)		
		<input type="checkbox"/>	S7 (virtual)		

**Analog Inputs**

A1  0.0 %

Drive		Ethernet	
Model	GA501	Version	VST908211
Full Model	CIPR-GA51U2006	Protocol	EtherCAT-Ver4204
Version	2010		
Serial Number	0123456789ABCDE		

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If a fault or minor fault occurs in the drive and only the fault or minor fault code is displayed on the Home page, refer to the drive manuals for details on the fault or minor fault.

**YASKAWA** CIPR-GA51U2006  
EtherCAT / GA501

Home EtherCAT Network Chart Login

Status Extended Status

**Drive Status**

**FAULT - Code 71H**

RUN ZERO SPD REV RESET AT SPD READY ALARM **FAULT**

Drive Monitors		Digital Inputs		Digital Outputs	
Frequency Reference	0.00 Hz	<input type="checkbox"/>	S1	<input checked="" type="checkbox"/>	MA-MB-MC
Output Frequency	0.00 Hz	<input type="checkbox"/>	S2		
Output Current	0.0 A	<input type="checkbox"/>	S3 (virtual)		
DC Bus Voltage	291 VDC	<input type="checkbox"/>	S4 (virtual)		
Torque Reference	0.0 %	<input type="checkbox"/>	S5 (virtual)		
		<input type="checkbox"/>	S6 (virtual)		
		<input type="checkbox"/>	S7 (virtual)		

**Analog Inputs**

A1  0.0 %

Drive		Ethernet	
Model	GA501	Version	VST908211
Full Model	CIPR-GA51U2006	Protocol	EtherCAT-Ver4204
Version	2010		
Serial Number	0123456789ABCDE		

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## ◆ EtherCAT Page

**YASKAWA** CIPR-GA51U2006  
EtherCAT / GA501

Home EtherCAT Network Chart Login

**EtherCAT Product Information**

Vendor ID	0x00000539
Product Code	0x47413531
Revision	0x01010002

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Figure 10.2 EtherCAT Page View

## ◆ Network Page

The Network page shows the status of the drive network traffic and the status of open I/O connections.

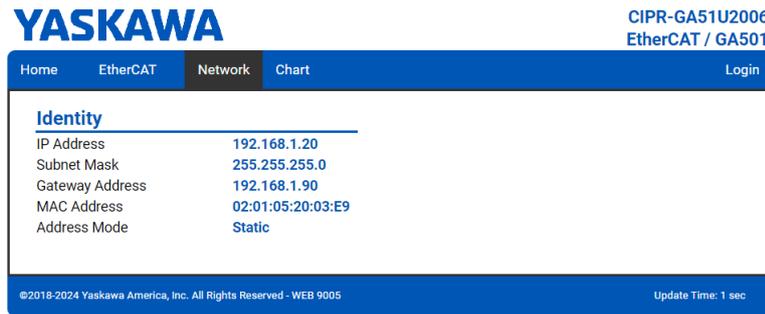


Figure 10.3 Network Page View

**Note:**

Cumulative counters are reset when the power supply is cycled.

## ◆ Chart Page

**Note:**

You can only select objects mapped to TxPDO on the Chart page.

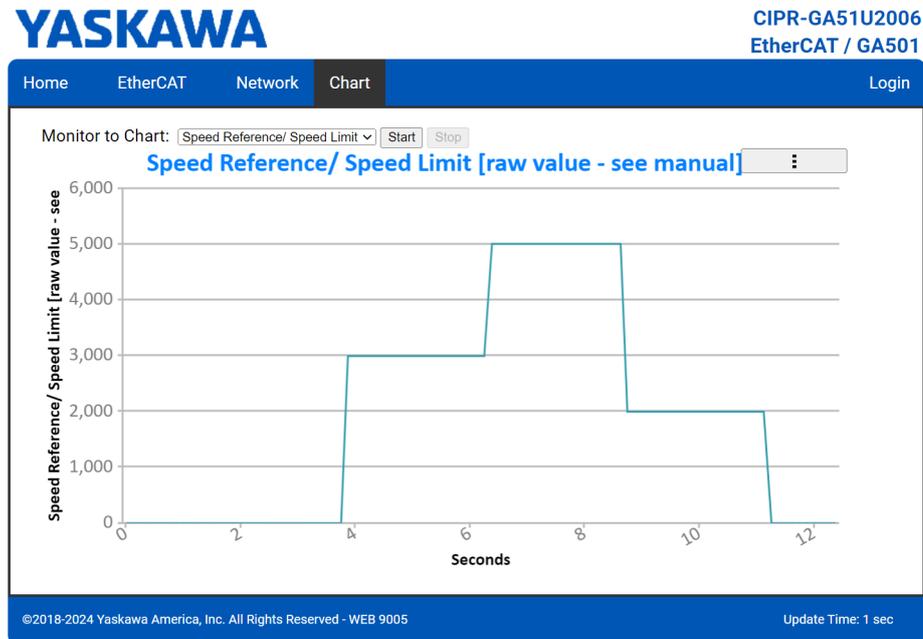


Figure 10.4 Chart Page View

## ◆ Email Alerts Page

The Email Alerts page allows the user to configure four Email Fault/Alarm conditions. When the condition is true, one email will be sent to the provided email address. Another email will not be sent until the condition becomes false and then true again. A 30-second timer prevents emails from being sent when conditions reoccur immediately after being removed. The timer helps limit the amount of emails sent regarding the same intermittent condition and helps to reduce network traffic by reducing emails about reoccurring errors.

Click [Save Email Settings] when you save the entered information.

**Note:**

You can only use objects mapped to TxPDO with the E-mail notification function. If you enable the E-mail notification function for an unmapped object, this function stays disabled.

Figure 10.5 Email Alerts Page View

### ■ Procedure: Conditional Email Set-up

1. Click the “Enable” check box to enable the alert.
2. Define the condition that will trigger the email by selecting a monitor parameter, a comparator, and a value.  
Set the conditions to send alerts from the “Condition” drop-down selection. If choosing only one condition and no OR or AND are needed, set the “OR/AND” drop-down selection to “—”.
3. Enter the email address where the alert will be sent.
4. Enter the message that will appear in the email contents.
5. Enter the email subject.

### ◆ Parameter Access Page

The Parameter Access page lets you read and write parameters, monitors and other MEMOBUS/Modbus registers from the drive.

**Figure 10.6 Parameter Access Page View**

The MEMOBUS/Modbus address for the drive parameter being accessed must be entered in hexadecimal.

Clicking [Read] will load and display the current value of the given MEMOBUS/Modbus Address.

Clicking [Set] will save the given value to the given MEMOBUS/Modbus address.

After a [Read] or [Set] command is given, Status will display [Waiting] while the action is being carried out, then [Read Successful] or [Write Successful] is displayed when finished.

## ◆ Settings Page

The Settings page sets web page behavior parameters. Access is restricted unless a valid password is entered. The default password is yaskawa.

**Figure 10.7 Settings Page View**

## ■ Security Login

Click “Login” and enter a valid password. The button text will change to “Log out” and the status will change to “Logged in”.

**Note:**

The default security password is “yaskawa”.

This password can be changed in the “Change Password” section of the Settings page.

Entering a valid password allows access to the settings in the Settings page, Email Alerts page, and the Parameter Access page.

## ■ Webpage Password

To change the password, enter the new password in the “New Password:” and “Confirm Password:” text boxes. Click “Save password”.

## ■ Webpage Settings

The values displayed in the various tabs are refreshed at the rate defined in the “Data Update Time” select box.

## ■ Email Settings

The “Email Server IP Address” text box must contain the IP address of the email server. The configured email alerts will use the server at this address when sending emails.

Enter the email server port in the “Email Server Port” text box.

The value in the “From Email Address” text box identifies the origin of the email alerts to the recipient.

To save the entered information, click “Save Email Settings”.

# 11 Troubleshooting

## ◆ Emergency Error

If there is a fault or alarm in the drive, the fault or alarm will be stored in consecutive subindices of object 1003 (Hex.). Additionally, an emergency telegram will be sent once.

Index (Hex.)	Subindex	Description	Access	PDO Mapping	Data Type	Value (Range)
1003	0	Number of errors	Read Write	No	UNS8	00 (Hex.) (00 - FF (Hex.))
1003	1	Standard error field (Emergency error code)	Read Only	No	UNS32	0000 (Hex.) (0000 - FF8 (Hex.))

**Table 11.1 Emergency Telegram Specification**

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error Code			Error register object 1001 (Hex.) = 1	Manufacturer specific error info. Not used. Set to zero.			

## ■ Emergency Error Codes

**Table 11.2 Error Code List**

Error Code (Hex.)	Meaning	Drive Display	Numeric Value of MEMOBUS/Modbus Address 0080 (Hex.)
0000	No error	No error	00
5450	DC Bus Fuse Open	FUd	01
3220	DC Bus Undervoltage	Uv1	02
5200	Control Power Undervoltage	Uv2	03
3221	Soft Charge Answerback Fault	Uv3	04
2340	Short Circuit/IGBT Failure	SC	05
2330	Ground Fault	GF	06
2220	Overcurrent	oC	07
3210	Overvoltage	ov	08
4280	Heatsink Overheat	oH	09
4210	Heatsink Overheat	oH1	0A
2310	Motor Overload	oL1	0B
2221	Drive Overload	oL2	0C
2311	Overtorque Detection 1	oL3	0D
2312	Overtorque Detection 2	oL4	0E
5420	Dynamic Braking Transistor Fault	rr	0F
4410	Braking Resistor Overheat	rH	10
5441	External Fault (Ethernet DI3)	EF3	11
5442	External Fault (Ethernet DI4)	EF4	12
5443	External Fault (Ethernet DI5)	EF5	13
5444	External Fault (Ethernet DI6)	EF6	14
5445	External Fault (Ethernet DI7)	EF7	15

## 11 Troubleshooting

Error Code (Hex.)	Meaning	Drive Display	Numeric Value of MEMOBUS/Modbus Address 0080 (Hex.)
FF01	Internal Fan Fault	FAn	17
7180	Overspeed	oS	18
8321	Speed Deviation	dEv	19
7305	Encoder (PG) Feedback Loss	PGo	1A
3130	Input Phase Loss	PF	1B
3300	Output Phase Loss	LF	1C
FF02	Motor Overheat (PTC Input)	oH3	1D
5300	Keypad Connection Fault	oPr	1E
5530	EEPROM Write Error	Err	1F
4310	Motor Overheat Fault (PTC Input)	oH4	20
FF03	USB Communication Error	CE	21
FF04	Ethernet Communication Error	bUS	22
FF05	Control Fault	CF	25
8313	Zero Servo Fault	SvE	26
5481	Ethernet External Fault	EF0	27
FF06	PID Feedback Loss	FbL	28
FF07	Undertorque Detection 1	UL3	29
FF08	Undertorque Detection 2	UL4	2A
FF09	High Slip Braking Overload	oL7	2B
6000	Hardware Fault	oFx	30
FF0E	Z Pulse Fault	dv1	32
FF0F	Z Pulse Noise Fault Detection	dv2	33
FF10	Inversion Detection	dv3	34
FF11	Inversion Prevention Detection	dv4	35
FF12	Output Current Imbalance	LF2	36
FF13	Motor Step-Out Detected	STPo	37
FF14	Encoder (PG) Hardware Fault	PGoH	38
FF15	MECHATROLINK Watchdog Timer Err	E5	39
FF16	Speed Search Retries Exceeded	SEr	3B
FF17	Reserved	CASEFAL1	3C
FF18	Reserved	CASEFAL2	3D
FF19	Reserved	CASEFAL3	3E
FF1A	Reserved	CASEFAL4	3F
FF1B	Reserved	CASEFAL5	40
FF1C	Excessive PID Feedback	FbH	41
FF1D	External Fault (Terminal S1)	EF1	42
FF1E	External Fault (Terminal S2)	EF2	43
FF1F	Mechanical Weakening Detection 1	oL5	44
FF20	Mechanical Weakening Detection 2	UL5	45
FF21	Current Offset Fault	CoF	46
FF22	PLC Fault 1	PE1	47
FF23	PLC Fault 2	PE2	48
FF24	DriveWorksEZ Fault	dWFL	49
6301	Error during object content selection	-	-
FF25	EEPROM Memory DWEZ Data Error	dWF1	4A
FF26	DriveWorksEZ Fault 2	dWF2	4B

Error Code (Hex.)	Meaning	Drive Display	Numeric Value of MEMOBUS/Modbus Address 0080 (Hex.)
FF27	DriveWorksEZ Fault 3	dWF3	4C
FF28	Output Voltage Detection Fault	voF	4D
FF29	Braking Resistor Fault	rF	4E
FF2A	BrakingTransistor Overload Fault	boL	4F
FF2B	Motor Overheat (NTC Input)	oH5	50
FF2C	Low Speed Motor Step-Out	LSo	51
FF2D	Node Setup Error	nSE	52
FF2E	Thermistor Disconnect	THo	53
FF2F	Over Jerk	dv6	54
FF30	Motor Contactor Response Error	SE1	55
FF31	Starting Current Error	SE2	56
FF32	Output Current Error	SE3	57
FF33	Brake Response Error	SE4	58
FF34	Speed Reference Missing	FrL	59
FF35	Polarity Judge Timeout	dV7	5B
FF36	GF1 Error	GF1	5C
FF37	Output Phase Loss 3	LF3	5F
FF38	Current Imbalance	UnbC	60
FF39	Gate Drive Board Power Supply Voltage Low	Uv4	61
FF3A	Power Supply Undervoltage	AUv	66
FF3B	Power Supply Overvoltage	Aov	67
FF3C	Power Supply Frequency Fault	Fdv	68
FF3D	Phase Order Detection Fault	SrC	69
FF3E	Power Supply Undervoltage Pre-Alarm	PAUv	6B
FF3F	DC Bus Fuse Open	FUA	70
FF40	Resonance Detection	vrE	71
FF41	Control Circuit Error	CPF00	81
FF42	Control Circuit Error	CPF01	82
FF43	A/D Conversion Failure	CPF02	83
FF44	PWM Motor Failure	CPF03	84
FF45	EEPROM Memory Data Error	CPF06	87
FF46	Terminal Board Connection Error	CPF07	88
FF47	EEPROM Serial Communications Error	CPF08	89
FF48	RAM Error	CPF11	8C
FF49	FLASH Memory Fault	CPF12	8D
FF4A	Watchdog Circuit Exception	CPF13	8E
FF4B	Control Circuit Error	CPF14	8F
FF4C	Clock Fault	CPF16	91
FF4D	Timing Fault	CPF17	92
FF4E	Control Circuit Fault	CPF18	93
FF4F	Control Circuit Fault	CPF19	94
FF50	Hardware Fault (at power ON)	CPF20	95
FF51	Hardware Fault (after communication start up)	CPF21	96
FF52	A/D Conversion Failure	CPF22	97
FF53	PWM Feedback Fault	CPF23	98
FF54	Drive Unit Signal Fault	CPF24	99

## 11 Troubleshooting

Error Code (Hex.)	Meaning	Drive Display	Numeric Value of MEMOBUS/Modbus Address 0080 (Hex.)
FF55	Terminal Board not Connected	CPF25	9A
FF56	ASIC BB Circuit Error	CPF26	9B
FF57	ASIC PWM Setting Register Error	CPF27	9C
FF58	ASIC PWM Pattern Error	CPF28	9D
FF59	ASIC On-Delay Error	CPF29	9E
FF5A	ASIC BB On Error	CPF30	9F
FF5B	ASIC Code Error	CPF31	A0
FF5C	ASIC Start-up Error	CPF32	A1
FF5D	Watchdog Circuit Exception Circuit Fault	CPF33	A2
FF5E	ASIC Power, Clock Error	CPF34	A3
FF5F	External A/D Conversion Failure	CPF35	A4
FF60	ASIC COM Error	CPF36	A5
FF61	ASIC COM Error	CPF37	A6
FF62	EEPROM Data Error	CPF38	A7
FF63	Control Circuit Error	CPF40	A9
FF64	Control Circuit Error	CPF41	AA
FF65	Control Circuit Error	CPF42	AB
FF66	Control Circuit Error	CPF43	AC
FF67	Control Circuit Error	CPF44	AD
FF68	Control Circuit Error	CPF45	AE
FF69	Ethernet Not Compatible	oFA00	101
FF6A	Ethernet Fault/Connection Error	oFA01	102
FF6C	Ethernet Error	oFA03	104
FF6D	Ethernet Error	oFA04	105
FF70	Ethernet RAM Error	oFA10	111
FF71	Ethernet Operation Mode Error	oFA11	112
FF72	Drive Receive CRC Error	oFA12	113
FF73	Drive Receive Frame Error	oFA13	114
FF74	Drive Receive Abort Error	oFA14	115
FF75	Ethernet Receive CRC Error	oFA15	116
FF76	Ethernet Receive Frame Error	oFA16	117
FF77	Ethernet Receive Abort Error	oFA17	118
FF78	COM ID Error	oFA30	131
FF79	Type Code Error	oFA31	132
FF7A	SUM Check Error	oFA32	133
FF7B	Ethernet Receive Time Over	oFA33	134
FF7C	Memobus Time Over	oFA34	135
FF7D	Drive Receive Time Over 1	oFA35	136
FF7E	CI Check Error	oFA36	137
FF7F	Drive Receive Time Over 2	oFA37	138
FF80	Control Reference Error	oFA38	139
FF81	Drive Receive Time Over 3	oFA39	13A
FF82	Control Response Selection 1 Error	oFA40	13B
FF83	Drive Receive Time Over 4	oFA41	13C
FF84	Control Response Selection 2 Error	oFA42	13D
FF85	Drive Receive Time Over 5	oFA43	13E

Error Code (Hex.)	Meaning	Drive Display	Numeric Value of MEMOBUS/Modbus Address 0080 (Hex.)
FFB4	Damping Resistor Overheat	doH	408
FFB5	Snubber Discharge Resistor Overheat	SoH	409
FFB6	Internal Resistance Fault	Srr	40A
FFB7	Safety Circuit Fault	SCF	40F
FFB8	Drive Cooling Fan Fault	FAn1	413
FFC0	Comparator 1 Limit Error	CP1	414
FFC1	Comparator 2 Limit Error	CP2	415
FFC2	Bluetooth Communication Fault	bCE	416
FFC3	Communication Error1	dCE1	41A
FFC4	Communication Error2	dCE2	41B
FFC5	Overcurrent 2	oC2	45F

## ■ SDO Abort Codes

SDO abort codes are supported as specified in DS301.

## ◆ Drive-Side Error Codes

Drive-side error codes appear on the drive keypad. *Fault on page 67* lists causes of the errors and possible corrective actions. Refer to the drive manuals for additional error codes that may appear on the drive keypad.

## ■ Fault

A *bUS [Ethernet Communication Error]* and *EF0 [Ethernet External Fault]* can appear as a fault. When a fault occurs, the keypad ALM LED stays lit. When an alarm occurs, the ALM LED flashes.

If communication stops while the drive is running, use these questions as a guide to help remove the fault:

- Is the communication line connected correctly to the drive?
- Is the PLC program working? Is the controller/PLC CPU stopped?
- Did a momentary power loss interrupt communications?

Code	Name	Causes	Possible Solutions
bUS	Ethernet Communication Error	The drive did not receive a signal from the controller.	<ul style="list-style-type: none"> <li>• Check for wiring errors.</li> <li>• Correct the wiring.</li> </ul>
		The communications cable wiring is incorrect.	
		An existing short circuit or communications disconnection	Check disconnected cables and short circuits and repair as needed
		A data error occurred due to electric interference	<ul style="list-style-type: none"> <li>• Prevent noise in the control circuit, main circuit, and ground wiring.</li> <li>• If you identify a magnetic contactor as a source of noise, install a surge absorber to the contactor coil.</li> <li>• Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side.</li> <li>• Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input.</li> <li>• Decrease the effects of electrical interference from the controller.</li> </ul>
		Connection Time-out	Check if the CPU of the controller stopped.
EF0	Ethernet External Fault	The drive received an external fault from the controller.	<ol style="list-style-type: none"> <li>1. Find the device that caused the external fault and remove the caus.</li> <li>2. Clear the external fault input from the controller.</li> </ol>
		A programming error occurred on the controller side.	Examine the operation of the controller program.
oFA00	Ethernet HW Error	Invalid DIP switch S1 setting	Check if the DIP switch S1 setting is correct for the communication protocol you are using.
PSE	Protocol Set Error	Invalid DIP switch S1 setting	Check if the DIP switch S1 setting is correct for the communication protocol you are using.

■ **Minor Faults and Alarms**

Code	Name	Causes	Possible Solutions
CyPo	Cycle Power to Active Parameters	<i>F6-15 = 1 [Ethernet Parameters Reload = Reload Now]</i> has been set. <i>F6-15</i> is not supported in EtherCAT protocol.	Re-energize the drive to update the Ethernet parameters.

◆ **EtherCAT Error Management**

This section describes the errors that the EtherCAT manages and also gives possible solutions.

EtherCAT Error	Description	Error Indication	Possible Solution
OP > SAFEOP/ PREOP when Drive running	An EtherCAT state transition from OP > SAFEOP/PREOP was made when the drive was in OPERATION enabled.	The drive triggered a <i>bUS [Ethernet Communication Error]</i> Error. When the EtherCAT state transitions to OP while the drive is stopped, the drive error will clear.	Check and correct state machine transitions in control word.
OP > SAFEOP EtherCAT WD time out	If the EtherCAT watchdog time out is enabled (Default in native XML description file) and output data from PLC to the drive does not update in the necessary time, it will trigger an error.	The drive triggered a <i>bUS Error</i> . When the EtherCAT state transitions to OP while the drive is stopped, the drive error will clear.	<ul style="list-style-type: none"> <li>Check network connection (for example, make sure that the cables are plugged into each node).</li> <li>Check telegram timing. Determine whether telegrams were sent to the slave where the error occurred.</li> </ul>
OP > SAFEOP 1. Drive FCS error 2. Drive COMID error	<ol style="list-style-type: none"> <li>Drive detected a Sum check error.</li> <li>Drive detected a Communication ID error.</li> </ol> Possible cause: <ol style="list-style-type: none"> <li>Communication software is overloaded.</li> <li>Communication software is not correctly processing the state.</li> </ol>	<ol style="list-style-type: none"> <li>Drive fault: <i>oFx32 [SUM Check Error]</i></li> <li>Drive fault: <i>oFx30 [COM ID Error]</i></li> </ol>	1 + 2 actions: <ul style="list-style-type: none"> <li>Disable process data OUT sync manager channel.</li> <li>Force EtherCAT state change to SAFE_OP.</li> </ul>
OP > SAFEOP 1. Communication software FCS error 2. Communication software COMID error	<ol style="list-style-type: none"> <li>Communication software detected a Sum check error.</li> <li>Communication software detected a Communication ID error.</li> </ol> Possible cause: <ol style="list-style-type: none"> <li>Drive system is overloaded.</li> <li>Drive is not correctly processing the state.</li> </ol>	<ol style="list-style-type: none"> <li>Drive fault: <i>oFx32</i></li> <li>Drive fault: <i>oFx30</i></li> </ol>	1 + 2 actions: <ul style="list-style-type: none"> <li>Disable process data IN sync manager channel.</li> <li>Force EtherCAT state change to SAFE_OP.</li> </ul>
Initial power-up sequence not completed within 10 seconds.	Possible cause: Drive is not processing the internal interface protocol.	Drive fault: <i>oFx00 [Ethernet Not Compatible]</i> Communication software will log FATAL event record in NVS memory and set ERR LED: solid RED.	Actions: <ul style="list-style-type: none"> <li>Check drive firmware version.</li> <li>Replace the drive.</li> </ul>
I/F proc time out	Communication software has not processed any drive system frames in 1000 ms. Possible cause: Drive stopped serving the internal interface to communication software or HW failure.	Drive fault: <i>oFx00</i> Communication software will log FATAL event record in NVS memory and set ERR LED: solid RED.	Force communication state to INIT
DriveWorksEZ communication error	A connection error occurs or parameter writing fails when the drive and DriveWorksEZ are connected via EtherCAT.	One of these errors is displayed on DriveWorksEZ. <ul style="list-style-type: none"> <li>Lost Connection</li> <li>Drive write failed</li> </ul>	Open the [Connection Settings] dialog on DriveWorksEZ and set the timeout to 5000 ms or more.

◆ **EtherCAT Error Codes**

■ **Fault Monitors U6-98 and U6-99**

If any faults occur with EtherCAT, you can check error/warning conditions via drive monitor parameters on the drive keypad as shown in [Table 11.3](#).

**Table 11.3 Fault Monitor Descriptions**

Status	Fault Declared	Status Value (U6-98/U6-99)	Description
No faults	-	0	No faults
Default MAC Address	-	1103	Programmed MAC Address is not at factory default setting. <b>Note:</b> Contact Yaskawa or your nearest sales representative for more information.
Web Interface Setting Error	-	1110	Failure to read the web interface setting.

Two drive monitor parameters, *U6-98 [Ethernet First Fault]* and *U6-99 [Ethernet Current Fault]* assist the user in network troubleshooting.

- *U6-98* displays the first declared fault since the last power cycle. *U6-98* is only cleared upon drive power-up.
- *U6-99* displays the present network status. *U6-99* is cleared upon a network-issued fault reset and upon power-up.

If another fault occurs while the original fault is still active, parameter *U6-98* retains the original fault value and *U6-99* stores the new fault status value.

## ◆ Self RAM Check

Use these procedures to do a self RAM check for all areas including unused areas.

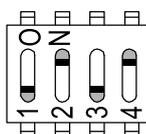
**Note:**

- The self RAM check completes in approximately 1.5 minutes.
- When you start the self RAM check, the drive will detect *oFA00 [Ethernet HW Error]*.

1. Set DIP switch S1 as shown in [Figure 11.1](#).

**Note:**

Use non-conductive tweezers or a tool with a tip width of approximately 0.5 mm (0.02 in) to set DIP switch S1.



**Figure 11.1 DIP Switch S1 Settings for the Self RAM Check**

2. Apply power to the drive.  
This will start the self RAM check.
3. Look at the LEDs to see the status of the self RAM check.  
Refer to [Table 11.4](#) for more information.

**Table 11.4 LED States during Self RAM Check**

Self RAM Check Status	LED States	
	RUN	L/A IN
Checking	Lit in green	OFF
Successful termination	Lit in green	Lit in green
Abnormal termination	Lit in red	Lit in red

## 12 Specifications

### ◆ Specifications

**Table 12.1 EtherCAT Specifications**

Items	Specifications
Communication Profile	DS 301 Ver.4.02 DSP 402 Ver.1.1 Velocity Mode
Communication Speed	100 Mbps

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## Revision History

Date of Publication	Revision Number	Section	Revised Content
October 2025	-	-	First Edition



# YASKAWA AC Drive GA501

# EtherCAT

## Technical Manual

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YASKAWA ELECTRIC  
CORPORATION

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

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

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