



GA500 Communication Interfaces

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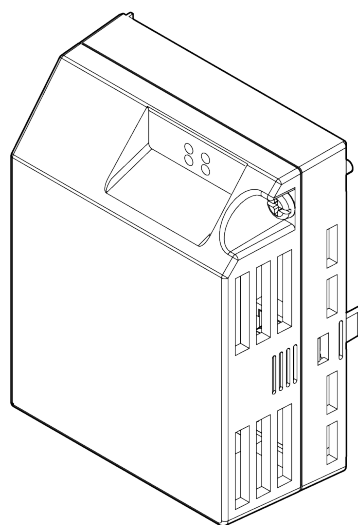
Part Numbers

Profibus - 112005A78

Multi-Protocol Module

With casing - 0017000176

Without casing - 0017000175



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Published: 5/2/2024

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We accept no liability for loss of profit, loss of market or any other indirect or consequential loss whatsoever.

Product warranty and limit of liability are dealt with in our standard terms and conditions of sale or negotiated contract under which this document is supplied.

You must use this product as described in this manual. Read the manual before you install, operate, or maintain the product.

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1 Safety and compliance

For safe operation from the start, read these instructions carefully before you install or commission the equipment and keep them safe for future use. Read all the safety instructions in this section and the rest of this manual carefully and make sure that you obey these instructions.

The instruction manual is an important safety document that we often deliver digitally. It is your responsibility to keep the instruction manual available and visible while working with the equipment. Please download the digital version of the instruction manual for use on your device or print it if a device will not be available.

1.1 Definition of Warnings and Cautions

Important safety information is highlighted as warning and caution instructions which are defined as follows. Different symbols are used according to the type of hazard.

WARNING:

If you do not obey a warning, there is a risk of injury or death.

CAUTION:

If you do not obey a caution, there is a risk of minor injury, damage to equipment, related equipment or process.

NOTICE:

Information about properties or instructions for an action which, if ignored, will cause damage to the equipment.

We reserve the right to change the design and the stated data. The illustrations are not binding.

1.2 Trained personnel

For the operation of this equipment “trained personnel” are:





- skilled workers with knowledge in the fields of mechanics, electrical engineering, pollution abatement and vacuum technology and
- personnel specially trained for the operation of vacuum pumps

Safety and compliance

1.3 Safety symbols

The safety symbols on the products show the areas where care and attention is necessary.

The safety symbols that we use on the product or in the product documentation have the following meanings:

	Warning/Caution Risk of injury and/or damage to equipment. An appropriate safety instruction must be followed or a potential hazard exists.
	Warning - Automatic start up Risk of injury. The equipment can be started remotely and without warning.
	Warning - Dangerous voltage Risk of injury. Identifies possible sources of hazardous electrical shock.
	Warning - Hot surfaces Risk of injury. Identifies a surface capable of inflicting burns through contact.

Important safety information

2 Important safety information

2.1 Electrical hazards



WARNING: DANGEROUS VOLTAGES

Risk of electric shock. Potentially lethal voltages are present at the mains connections. Before you begin any maintenance or service work on the pump, disconnect the pump from all power supplies (lockout/tagout). In addition, there is the danger of residual voltage for up to 5 minutes after disconnection. When touching parts at high electric voltages, there is the risk of suffering severe injuries by an electric shock. Covers marked with this symbol must only be opened by trained electricians after having reliably de-energised (lockout/tagout) the equipment.

1. The electrical connection must only be provided by a trained person. Please observe the national regulations in the country of use like EN 50110-1 for Europe, for example.
2. Install a device for a safe disconnection from the power supply.
3. Note the information on the IP type of protection.
4. Before starting, check to ensure that the junction box is undamaged, run a visual inspection on the seals.
5. Lay the connecting lines so that these cannot be damaged. Protect the lines against humidity and contact with water. Avoid thermally stressing the lines by unfavourable laying. Comply with the required standards when designing and laying the electrical connections.
6. Provide strain relief for the connecting lines so that the plugs and the line connectors are not subjected to excessively high mechanical stresses.
7. Lay electric lines so that there is no risk of tripping.

2.2 Thermal hazards



WARNING: HOT SURFACE

Risk of burns. During operation the pump is hot and some surfaces can reach a temperature higher than 80 °C. Note the danger symbols on the pump and in the case of a hot pump wear the required protection equipment. If there is the risk of touching hot surfaces inadvertently, install corresponding protection. When working on a pump which is still warm from operation, always wear protective gloves.

1. Handle the pump only while vented and after having let it cool down.
2. Before disassembling any cooling water lines, leave the pump to cool down first, then shut off the feed line.

2.3 Hazards caused by materials and substances



WARNING: HAZARDOUS GASES

Risk of injury or damage to the equipment. Danger of escaping or emitting pumped hazardous gases, vapours or substances. If the pump has pumped hazardous materials before installation of the interfaces, take appropriate safety measures.

Description

3 Description

The vacuum pumps are equipped with a remote interface (digital inputs and outputs) and an RS 485 interface (MEMOBUS/Modbus). These two interfaces are described in the instruction manual for the pump.

In addition, further bus interfaces can be retrofitted, which are described in this manual.

JOHB-GA50 Option card carrier is needed when using any network communication option card with the GA500.

For installation and operation of the bus interface, refer to the instructions of YASKAWA enclosed with the module. This manual describes the settings required for the respective pump interface.

4 Installation

For mechanical installation, refer to the Yaskawa Option Card Mounting Kit Installation Manual for JOHB-GA500.

5 Profibus

GSD file

The GSD file and the manual can be downloaded from <https://www.leybold.com/en/download-center/download-software/pc-software-dryvac-ruvac>.

The GSD file for the versions in this manual is different from the GSD file for the DRYVAC-i versions. Do not mix them up.

Table 1. Parameter Settings

No.	Name	Description	Setting
b1-01	Frequency Reference Selection*1	Selects the frequency reference input source 3: Option PCB	3
b1-02	Run Command Selection*1	Selects the run command input source 3: Option PCB	3
F6-30	Node Address*2	0 to 125	6
F6-31	Clear Mode Selection	Selects the action to take when a "Clear Mode" command is received 0: Resets back to 0 1: Maintains the previous value	0
F6-32	PROFIBUS Map Selection	0: PPO Type 1: Conventional	1

*1. To start and stop the drive through the PROFIBUS-DP network, set b1-02 to "3". To control the frequency reference of the drive via the PROFIBUS-DP network, set b1-01 to "3".

*2. All node addresses must be unique. Node addresses 0, 1, and 2 are typically reserved for control, maintenance, and diagnostic equipment. The ERR light will illuminate when 0 or greater than 125 is entered.

MEMOBUS/Modbus Message

MEMOBUS/Modbus Message is not active.

5.1 Data register

Table 2. Basic Data Register Map Detail

Output		Input	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency setpoint High Byte*1	2	Motor Speed High Byte*1
3	Frequency setpoint Low Byte*1	3	Motor Speed Low Byte*1

Output		Input	
Byte	Description	Byte	Description
4	Reserved	4	Output Current High Byte*2
5	Reserved	5	Output Current Low Byte*2

*1. The unit is 0.01 Hz

*2. The unit is 0.01 A for drives set up to 11 kW in Heavy Duty or Normal Duty and 0.1 A for drives set up for 15 kW and above.

Table 3. Extended Data 1 Register Map

Output		Input	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency setpoint High Byte*3	2	Motor Speed High Byte*3
3	Frequency setpoint Low Byte*3	3	Motor Speed Low Byte *3
4	Reserved	4	Torque Reference Monitor High Byte *4
5	Reserved	5	Torque Reference Monitor Low Byte *4
6, 7	Reserved	6, 7	Reserved
8	Reserved	8	Frequency setpoint High Byte
9	Reserved	9	Frequency setpoint Low Byte
10	Analog Output Channel 1 High Byte *1	10	Output Frequency High Byte
11	Analog Output Channel 1 Low Byte *1	11	Output Frequency Low Byte
12	Reserved	12	Output Current High Byte *5
13	Reserved	13	Output Current Low Byte *5
14	Digital Output High Byte *2	14	Reserved
15	Digital Output Low Byte *2	15	Reserved
16 to 31	Reserved	16 to 31	Reserved

*1. To select drive analog output channel for communications, set H4-01 (Multi-Function Analog Output Terminal AM) to 31 (Not used).

*2. Drive digital output ON/OFF during communications, set H2-01 (Terminal MA, MB and MC Function Selection (relay)), H2-02 (Terminal P1 Function Selection (open collector)), and H2-03 (Terminal P2 Function Selection (open-collector)) to F.

*3. The unit is 0.01 Hz

*4. Cannot be used when setting A1-02 (Control Method Selection) to 0 (V/f Control without PG).

*5. The unit is 0.01 A for drives set up to 11 kW in Heavy Duty or Normal Duty and 0.1 A for drives set up for 15 kW and above.

Profibus

Table 4. Extended Data 2 Register Map

Output		Input	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency setpoint High Byte*1	2	Motor Speed High Byte*1
3	Frequency setpoint Low Byte*1	3	Motor Speed Low Byte*1
4 to 11	Reserved	4 to 11	Reserved

*1. The unit is 0.01 Hz

Table 5. Operation Command

Byte	Command Bits	Description
Byte 1	0	Start/Stop (1 = Start, 0 = Stop)
Byte 1	1 to 7	Reserved
Byte 0	8	Reserved
Byte 0	9	Reset
Byte 0	A to F	Reserved

Basically set reserved bits to 0

Table 6. Drive Status

Byte	Command Bits	Description
Byte 1	0	Pump rotating
Byte 1	1	Pump stands still
Byte 1	2, 3	Reserved
Byte 1	4	Normal operation (frequency setpoint reached)
Byte 1	5	Drive ready (ready to start, no fault)
Byte 1	6	Alarm
Byte 1	7	Fault
Byte 0	8 to F	Reserved

MEMOBUS/Modbus Message Area

MEMOBUS/Modbus Message Area is not active.

Handshaking Register

Handshaking Register is not active.

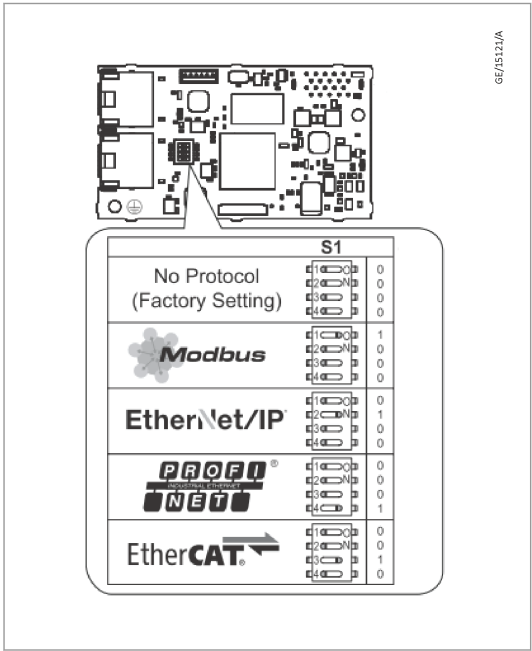
6 Multi-Protocol Ethernet

The Multi-Protocol Ethernet option supports multiple industrial Ethernet protocols, such as Modbus TCP/IP, EtherNet/IP, EtherCAT and ProfiNet. You can use a series of configuration switches on the circuit board to select the correct protocol for your application.

Set the communication protocol using DIP switch S1 on the option, and the protocol is selected by the DIP switch setting when the power is applied.

 **Note:**

With default settings, the communication protocol is not selected.



7 Profinet

ProfiNet is covered by Multi-Protocol Ethernet module JOHB-SMP3.

GSDML file

The GSDML file is an xml file that can be downloaded from
<https://www.leybold.com/en/download-center/download-software/pc-software-dryvac-ruvac>.

Table 7. Parameter Settings

No.	Name	Description	Setting
b1-01	Frequency Reference Selection	Selects the frequency reference input source 3: Option PCB	3
b1-02	Run Command Selection	Selects the run command input source 3: Option PCB	3
F7-01	IP address	First octet of the IP address	192
F7-02	IP address	Second octet of the IP address	168
F7-03	IP address	Third octet of the IP address	1
F7-04	IP address	Fourth octet of the IP address	20
F7-05	Subnet mask	First octet of the subnet mask	255
F7-06	Subnet mask	Second octet of the subnet mask	255
F7-07	Subnet mask	Third octet of the Subnet mask	255
F7-08	Subnet mask	Fourth octet of the subnet mask	0
F7-09	Gateway	First octet of the Gateway address	192
F7-10	Gateway	Second octet of the Gateway address	168
F7-11	Gateway	Third octet of the Gateway address	1
F7-12	Gateway	Fourth octet of the Gateway address	1

After setting the parameters, reboot the system.

Note the parameters for later use in the PLC or PC program.

Assignment of the PROFINET address

The PROFINET address can only be assigned through the hardware configuration tool of the PLC. To assign the PROFINET IP address through hardware configuration tool of the PLC, refer to the documentation of the PLC.

Configuration I/O parameters

The decision to use either the PROFIdrive control and status words or the Yaskawa-specific control and status words is done in a hardware configuration tool (customer supplied). The default value is the Yaskawa-specific format.

SI-EP3/V uses slots 0 and 1. Slot 0 does not have any sub-slots and the attached DAP module represents the device. Other functional modules and sub-modules described in the GSD file can be assigned to slot 1 and its subslots.

- Slot 0 = Device Access Point (DAP)
- Slot 1, sub-slot 1 = Standard telegram 1, Standard telegram 1 + 5 configurable inputs, outputs, Forty byte IO with 5 configurable input, outputs

The services provided by the SI-EP3/V option can be defined using the F7-XX parameters in the drive or by using a configuration tool. To define the service using the F7-XX parameters, set the parameter to a value other than 0. If all F7-XX parameters are set to 0, the value from the configuration tool will be used.

The SI-EP3/V option provides the following services:

- Cyclic messaging in PROFIdrive or Yaskawa-specific mode
- Acyclic parameter access mechanism
- Identification & Maintenance functions (I&M0)
- PROFIdrive parameters
- Diagnostic and alarm mechanism
- Fault buffer mechanism

Standard telegram 1

Minimal information

- Frequency specification
- Commands to frequency converter
- Output frequency feedback
- Status frequency converter feedback

Standard telegram 1 + 5 configurable inputs, outputs

Standard plus, maximum information, a little slower

- Write 5 self-defined parameters
- 5 self-defined parameters return
- Input and output independently

I/O 40 profiles

- 40 bytes of inputs and outputs including general operating parameters

Ethernet IP

8 Ethernet IP

EDS File

For easy network implantation, download the EDS file from <https://www.leybold.com/en/download-center/download-software/pc-software-dryvac-ruvac>.

Refer to the option package labeling in the field designated “PRG” (four digit number)” to identify the option software version

Before you install the option on a YASKAWA AC Drive GA500, make sure that the option software version is PRG: 4103 or later.

Table 8. Parameter Settings

No.	Name	Description	Setting
b1-01	Frequency Reference Selection	Selects the frequency reference input source 3: Option PCB	3
b1-02	Run Command Selection	Selects the run command input source 3: Option PCB	3
F7-13	Address Mode at Startup	Method to set option card IP addresses 0: Static 1: BOOTP (not for Profinet SI-EP3) 2: DHCP	2

8.1 Control and Monitor Parameters

If 0 is selected, set the following values:

No.	Name	Description	Setting
F7-01	IP address	First octet of the IP address	192
F7-02	IP address	Second octet of the IP address	168
F7-03	IP address	Third octet of the IP address	1
F7-04	IP address	Fourth octet of the IP address	20
F7-05	Subnet mask	First octet of the subnet mask	255
F7-06	Subnet mask	Second octet of the subnet mask	255
F7-07	Subnet mask	Third octet of the Subnet mask	255
F7-08	Subnet mask	Fourth octet of the subnet mask	0
F7-09	Gateway	First octet of the Gateway address	192
F7-10	Gateway	Second octet of the Gateway address	168
F7-11	Gateway	Third octet of the Gateway address	1
F7-12	Gateway	Fourth octet of the Gateway address	1

Current IP addresses and errors are in:

Ethernet IP

No.	Name	Description	Setting
U6-80 to U6-83	Online IP Address	IP Address currently available; U6-80 is the most significant octet	0 to 255
U6-84 to U6-87	Online Subnet	Subnet currently available; U6-84 is the most significant octet	0 to 255
U6-88 to U6-91	Online Gateway	Gateway currently available; U6-88 is the most significant octet	0 to 255
U6-92	Online Speed	Link Speed	10: 10 Mbps, 100: 100 Mbps
U6-93	Online Duplex	Duplex Setting	0: Half, 1: Full
U6-98	First Fault	First Option Fault	-
U6-99	Current Fault	Current Option Fault	-

Enter IP address in browser to access website.

Make sure that the gateway and IP address information are added within the same Address.

Example:

IP Address (Primary) : **192.100.5.XX**

IP Address (GA500 device): **192.100.5.XX**

Gateway Address : **192.100.5.X**

If the information is not added, the drive will give an error.

8.3 Configuration of Messages / Input and Output Assemblies

The following is a summary of the necessary functions, the complete description can be found in the Yaskawa manual.

Output assemblies (Drive consumes)

The convention in this manual is from the PLC perspective. As such, an assembly is called an "Output Assembly" when outputted from the PLC and received by this node. This section details "Output Assemblies" that are "Consumed" by this drive.

Table 9 Basic Speed Control Output - 20 (0x14)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0	-	-	-	-	-	Fault Reset	-	Run Fwd
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Ethernet IP

Table 10 Extended Speed Control Output - 21 (0x15)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
21	0	-	NetRef	NetCtrl	-	-	Fault Reset	Run Rev	Run Fwd
	1	-							
	2	Speed Reference (Low Byte)							
	3	Speed Reference (High Byte)							

Table 11. Output Assembly Data Information

Name	Description
Run Fwd	Forward Run Command 0: Stop 1: Forward Run
Run Rev	Reverse Run Command 0: Stop 1: Reverse Run
Fault Reset	Fault Reset (0 to 1 transition: Fault Reset)
NetCtrl	Run command from Network 0: Depends on b1-02 1: Enables the run command from network
NetRef	Speed reference from Network 0: Depends on b1-01 1: Enables the speed reference from network
Speed Reference	Speed Command Sets drive speed reference. Speed reference data: Frequency reference/2SS (SS: Speed scale) Setting range: 0 to 0xFFFF For example, when setting a reference of 4096 with a speed scale of 2: Speed reference data = $4096/22 = 1024 = 0x0400$ Unit depends on o1-03.

Input Assemblies (Drive Produces)

The convention in this manual is from the PLC perspective. An "Input Assembly" is outputted from this node and read by the PLC. This section details "Input Assemblies" that are "Produced" by this drive.

Table 12 Basic Speed Control Input - 70 (0x46)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0	-	-	-	-	-	Running 1 (FWD)	-	Faulted
	1	-							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Table 13 Extended Speed Control Input - 71 (0x47)

Output Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
71	0	At Speed	Ref from Net	Ctrl from Net	Ready	Running 2 (REV)	Running 1 (FWD)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (Low Byte)							
	3	Speed Actual (High Byte)							

Table 14. Input Assembly Data Information

Name	Description
Faulted	Faulted 0: No Faults Occurred 1: Fault Occurred
Warning	Warning 0: No Warning Occurred 1: Warning Occurred
Running 1 (FWD)	Forward Running 0: Stop or Reverse Running 1: Forward Running
Running 2 (REV)	Reverse Running 0: Stop or Forward Running 1: Reverse Running
Ready	Drive ready 0: Not ready 1: Ready
Ctrl from Net	Status of Run Command from Network 0: Run command is not from network 1: Run command is from network
Ref from Net	Status of Speed reference from Network 0: Speed reference is not from network 1: Speed reference is from network
At Speed	Speed Agree 0: No Speed Agree 1: Speed actual at speed reference

Ethernet IP

8.4 Error Codes

Display	Description
BUS	Option Communication Error
	After establishing initial communication, the connection was lost Only detected when the run command or frequency reference is assigned to the option (b1-01 = 3 or b1-02 = 3)
EFO	Option Card External Fault
	The alarm function for an external device has been triggered
0FA00	Option Card Fault
	Option is not properly connected.
0FA01	Option Card Fault
	Option is not properly connected.
0FA03	Option Card Fault
	Option self-diagnostics error.
0FA04	Option Card Fault
	Option flash write mode.
0FA30 TO 0FA43	Communication Option Card Connection Error
	Communication ID error
CALL	Serial communication transmission error
	Communication is not established.

Table 15 LED Status Indicators

Name	Indication		Operating status	Remarks
	Color	Status		
MS	-	OFF	Power supply OFF	Power is not being supplied to the drive
	Green	ON	Option operating	The option is operating normally
	Green	Flashing	Option initializing	The option is configuring an IP address
	Red	ON	Fatal error occurred	The option has detected a fatal (unrecoverable) error
	Red	Flashing	Non-fatal error occurred	The option has detected a non-fatal (recoverable) error
	Green/Red	Flashing	Option self-test	The option is in self-test mode
NS	-	OFF	Offline or Power supply OFF	-
	Green	ON	Online communications established	The option is online and has established connections
	Green	Flashing	Online communications not established	The option is online without an established connection
	Red	ON	Communications error (fatal)	The option detected a duplicate IP address
	Red	Flashing	Communications time-out (nonfatal)	A communications time-out occurred
	Green/Red	Flashing	Option self-test	The option is in self-test mode

Ethernet IP

Name	Indication		Operating status	Remarks
	Color	Status		
10/100	Green	OFF	10 Mbps is established	
	Green	ON	100 Mbps is established	
LINK/ACT	Green	OFF	Link is not established	
	Green	ON	Link is established	
	Green	Flashing	Link is established and there is network activity	

Power-Up Diagnostics

An LED test is performed each time the drive is powered up. The initial boot sequence may take several seconds. After the LEDs have completed the diagnostic LED sequence, the option is successfully initialized. The LEDs then assume operational conditions as shown in [Table: LED Status Indicators](#).

Table 16. Power-Up Diagnostic LED Sequence

Sequence	Module Status (MS)	Network Status (NS)	Time (ms)
1	Green	OFF	250
2	Red	OFF	250
3	Green	OFF	-
4	Green	Green	250
5	Green	Red	250
6	Green	OFF	-

9 EtherCAT

ESI file

For easy network implementation of drives equipped with a Communication Option card, the ESI file can be obtained from from <https://www.leybold.com/en/download-center/download-software/pc-software-dryvac-ruvac>.

Refer to the option package labeling in the field designated “PRG” (four digit number) to identify the option software version.

The option contains support for the Velocity mode according the CANopen Device Profile and Motion Control (DSP402) profile.

It also contains YASKAWA vendor specific CANopen objects based on the present CANopen option board specification.

Communication profile:

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

9.1 Drive parameters

No.	Name	Description	Default
b1-01	Frequency Reference Selection	Selects the frequency reference input source 3: Option PCB	3
b1-02	Run Command Selection	Selects the run command input source 3: Option PCB	3
F6-06 <4>	Torque Reference/Torque Limit selection from Communications Option	0: Torque reference/torque limit via network communications are disabled. 1: Torque reference/torque limit via network communications are enabled. <5>	0
F6-07	NetRef/ComRef Selection Function	0: Multi-step speed reference disabled (F7 mode) 1: Multi-step speed reference allowed (V7 mode)	0

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

<4> This parameter might not appear in certain drives. Furthermore its availability is limited to depending on the control mode selection. For details refer to the technical manual for the drive the option card is used with.

<5> If the drive is set to receive the torque reference/limit from the network (F6-06 = 1) make sure the value is set appropriately by the controller. If no torque reference/limit value is entered the motor will not produce torque.

<6> The default value depends on the drive used and/or the drive software version. For details refer to the technical manual for the drive.

<7> Changing o1-03 changes the units for input object 2010 (Hex) (frequency reference), output object 2110 (Hex) (output frequency) and 2200 (Hex) (motor speed). Furthermore o1-03 must be set to 2 in order to use the Drive Profile DSP402.

9.2 Object dictionary

The object dictionary consists of three sections:

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

Refer to [Table: Communication Profile Objects \(DSP 301\)](#), [Table: Manufacturer Specific Profile Objects \(DS 301\)](#) and [Table: Drives and Motion Profile Objects \(DSP 402\)](#) for an overview of the communication objects available in the SI-ES3 option.

Table 17. Communication Profile Objects (DSP 301)

Index (Hex)	Name
1000	Device Type
1001	Error Register
1003	Pre-defined Error Field
1008	Manufacturer Device Name
1009	Manufacturer Hardware Version
100A	Manufacturer Software Version
1010	Store Parameters
1011	Restore Default Parameters
1018	Identity Object
1600 - 1628	Receive PDO Mapping
1A00 - 1A28	Transmit PDO Mapping
1C00	Sync Manager Communication Type
1C12	Sync Manager RxPDO assign
1C13	Sync Manager TxPDO assign

Table 18. Manufacturer Specific Profile Objects (DS 301)

Index (Hex)		Content
Input	2000	Operation Command
	2010	Speed Command
	2040	MEMOBUS/Modbus Read Command
	2050	MEMOBUS/Modbus Write Command
	2060	MEMOBUS/Modbus Unlimited Enter Command
	2070	MEMOBUS/Modbus Limited Enter Command
	20D0	FM analog output 1
	20F0	Multi-function DO output

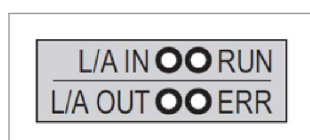
Index (Hex)		Content
Output	2100	Drive Status
	2110	Output Frequency
	2120	Output Current
	2140	MEMOBUS/Modbus Read Command Response
	2150	MEMOBUS/Modbus Write Command Response
	2155	PDO parameter write response
	2160	MEMOBUS/Modbus Not Limited Enter Command Response
	2180	Selectable (default: Input terminal status)
	2190	Selectable (default: Analog input 1 monitor)
	2200	Motor Speed
	2210	DC Bus Voltage
	2220	Analog input monitor A1
	2240	Analog input monitor A2
	2270	Inverter DI Input
	4000	Option NVS FATAL Record
	4001	Option Info + Status Record

Table 19. Drives and Motion Profile Objects (DSP 402)

Object Type	Index (Hex)	Name
Common Entries	60FD	Digital Inputs
	60FE	Digital Outputs
Device Control	6040	Controlword
	6041	Statusword
	6060	Modes of operation
	6061	Modes of operation display
Velocity Mode	6042	vl target velocity
	6043	vl velocity demand
	6044	vl control effort
	6046	vl velocity min max amount
	6048	vl velocity acceleration
	6049	vl velocity deceleration
	604A	vl velocity quick stop
	604C	vl dimension factor
	604D	vl pole number

9.3 Status LEDs

The EtherCAT Option has four LEDs that indicate the communication status. The indications conform with DS303, Part 3: Indicator Specification.



EtherCAT

LEDs L/A OUT and L/A IN: Ethernet Link/Activity 1 and 2

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

RUN LED

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

A red lit RUN LED is only used by the NOID firmware loader, refer to [Table: LED indicators](#).

ERROR indicator

The red error LED indicates the presence of any errors.

Table 20 LED indicators

LED	Color	Display	Meaning
Link Activity 1/2	-	Continuously Off	No link. The communication cable is not physically connected. The EtherCAT controller is not started up.
	Green	Continuously On	The module is connected to Ethernet. A communication cable is physically connected, but no data are being exchanged.
		Flickering	There is traffic on Ethernet, data are being exchanged.
RUN	-	Continuously Off	The device is in Initial state.
	Green	Blinking	The device is in Pre-Operational State (flashing rate about 2.5 Hz)
		Single flash	The device is in Safe-Operational State (one short flash (approximately 200 ms) followed by a long off condition (approximately 1000 ms))
		Continuously On	The device is in Operational State
	Red	Blinking (1 Hz or 6 Hz)	The Option BOOT or APP firmware is executing the NOID firmware loader. 1 Hz: Firmware loader protocol in IDLE state (waiting for commands from the drive) 6 Hz: Firmware loader protocol is processing commands

LED	Color	Display	Meaning
ERR	Red	Continuously Off	No link. The EtherCAT communication is in working condition.
		Blinking	General configuration error
		Single flash	The slave device application has changed the EtherCAT state autonomously: The parameter Change in the AL status register is set to 0x01: change/error. Single flash is one short flash (approximately 200 ms) followed by a long off phase (approximately 1000 ms).
		Double flash	The sync manager watchdog time out has occurred. Double flash is two short flashes (approximately 200 ms each), separated by an off condition (approximately 200 ms), and then a long off phase (approximately 1000 ms)
		Continuously On	Possible causes: 1 An EtherCAT PDI (Process Data Interface) error has occurred, the NOID application interface has failed. 2 An option card FATAL event has occurred (system has stalled execution, see EtherCAT vendor object 0x4000 for the cause).
		Blinking (1 Hz or 6 Hz)	The option BOOT or APP firmware is executing the NOID firmware loader. 1 Hz: Firmware loader protocol in IDLE state (waiting for commands from drive) 6 Hz: Firmware loader protocol is processing commands.

MEMOBUS/Modbus

10 MEMOBUS/Modbus

The frequency converter is equipped with a serial RS 485 interface with MEMOBUS/Modbus (RTU) protocol. To active the MEMOBUS, the DIP S2 must be set to ON. Further details are available on request.

MEMOBUS/Modbus Message

MEMOBUS/Modbus Message is not active.

10.1 Data register

Table 21. Basic Data Register Map Detail

Output		Input	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency setpoint High Byte*1	2	Motor Speed High Byte*1
3	Frequency setpoint Low Byte*1	3	Motor Speed Low Byte*1
4	Reserved	4	Output Current High Byte*2
5	Reserved	5	Output Current Low Byte*2

*1. The unit is 0.01 Hz

*2. The unit is 0.01 A for drives set up to 11 kW in Heavy Duty or Normal Duty and 0.1 A for drives set up for 15 kW and above.

Table 22. Extended Data 1 Register Map

Output		Input	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency setpoint High Byte*3	2	Motor Speed High Byte*3
3	Frequency setpoint Low Byte*3	3	Motor Speed Low Byte *3
4	Reserved	4	Torque Reference Monitor High Byte *4
5	Reserved	5	Torque Reference Monitor Low Byte *4
6, 7	Reserved	6, 7	Reserved
8	Reserved	8	Frequency setpoint High Byte
9	Reserved	9	Frequency setpoint Low Byte
10	Analog Output Channel 1 High Byte *1	10	Output Frequency High Byte
11	Analog Output Channel 1 Low Byte *1	11	Output Frequency Low Byte
12	Reserved	12	Output Current High Byte *5
13	Reserved	13	Output Current Low Byte *5
14	Digital Output High Byte *2	14	Reserved

MEMOBUS/Modbus

Output		Input	
Byte	Description	Byte	Description
15	Digital Output Low Byte *2	15	Reserved
16 to 31	Reserved	16 to 31	Reserved

* 1. To select drive analog output channel for communications, set H4-01 (Multi-Function Analog Output Terminal AM) to 31 (Not used).

* 2. Drive digital output ON/OFF during communications, set H2-01 (Terminal MA, MB and MC Function Selection (relay)), H2-02 (Terminal P1 Function Selection (open collector)), and H2-03 (Terminal P2 Function Selection (open-collector)) to F.

* 3. The unit is 0.01 Hz

* 4. Cannot be used when setting A1-02 (Control Method Selection) to 0 (V/f Control without PG).

* 5. The unit is 0.01 A for drives set up to 11 kW in Heavy Duty or Normal Duty and 0.1 A for drives set up for 15 kW and above.

Table 23. Extended Data 2 Register Map

Output		Input	
Byte	Description	Byte	Description
0	Operation Command High Byte	0	Drive Status High Byte
1	Operation Command Low Byte	1	Drive Status Low Byte
2	Frequency setpoint High Byte*1	2	Motor Speed High Byte*1
3	Frequency setpoint Low Byte*1	3	Motor Speed Low Byte*1
4 to 11	Reserved	4 to 11	Reserved

* 1. The unit is 0.01 Hz

Table 24. Operation Command

Byte	Command Bits	Description
Byte 1	0	Start/Stop (1 = Start, 0 = Stop)
Byte 1	1 to 7	Reserved
Byte 0	8	Reserved
Byte 0	9	Reset
Byte 0	A to F	Reserved

Basically set reserved bits to 0

Table 25. Drive Status

Byte	Command Bits	Description
Byte 1	0	Pump rotating
Byte 1	1	Pump stands still
Byte 1	2, 3	Reserved
Byte 1	4	Normal operation (frequency setpoint reached)
Byte 1	5	Drive ready (ready to start, no fault)
Byte 1	6	Alarm

MEMOBUS/Modbus

Byte	Command Bits	Description
Byte 1	7	Fault
Byte 0	8 to F	Reserved

Example for control data in the “Basic data” format:

Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
0000 0000	0000 0000	1101 1000	0010 1110	0000 0001	0000 0000
Reserved	Reserved	Frequency set-point low byte	Frequency set-point high byte	Start	Reset

In addition to the start bit, a speed in the range of 10 to 120 Hz must be set. (2E D8hex = 119.92 Hz).

Example for status data in the “Basic data” format:

Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
0111 0110	0000 0111	1101 1000	0010 1110	0011 0001	0000 0000
Actual motor current low byte (07 76hex = 19.10 A)	Actual motor current high byte	Actual frequency low byte	Actual frequency high byte	0 Fault	Reserved
				0 Alarm	
				1 Pump ready	
				1 Normal operation	
				0 Reserved	
				0 Reserved	
				0 Pump stands still	
				1 Pump rotating.	

Example for reading out the pump temperature via the Profibus

Applies to control data in the “Extended Data 1” format only:

Byte 32	Byte 20	Byte 19	Byte 18	Byte 17	Byte 16
1000 0000	0000 0000	0000 0010	0110 0010	0000 0110	0000 0011
Bit for data updating	Reserved	Number of 2 bytes	662 hex parameter	Number	Read parameter

Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
0000 0000	1101 1000	0010 1110	0000 0000	0000 0000
Reserved	Frequency setpoint low byte	Frequency setpoint high byte	Start	Reset

Explanation: through a parameter channel it is possible to query in the control word the parameter X662 hex which represents the pump temperature and read out in the bytes 20/21 the status data. By activating, respectively deactivating the seventh bit in the last byte of the control data, the temperature value in the status data is updated.

MEMOBUS/Modbus

Example for status data in the “Extended Data 1” format:

Byte 21	Byte 20	Byte 19	Byte 18	Byte 17	Byte 16
0001 1010	0000 0000	0000 0010	0110 0010	0000 0110	0000 0011
Temperature low byte 1A = 26 °C	Temperature high byte	Number of 2 bytes	662 hex param- eter	Number	Read parameter

Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
0000 0000	1101 1000	0010 1110	0000 0000	0000 0000
Actual motor current high byte	Actual frequency low byte	Actual frequency high byte	0 Error	Reserved
			0 Warning,	
			1 Pump ready	
			1 Normal operation	
			0 Reserved 0 Reserved 0 Pump at a stand- still 1 Pump is running	

MEMOBUS/Modbus Message Area

MEMOBUS/Modbus Message Area is not active.

Handshaking Register

Handshaking Register is not active.

Accessories

11 Accessories

Table 26. Ordering Information

Bus Interfaces	Part number
Profibus Module	112005A78
Multi-Protocol Module	
▪ with casing	0017000176
▪ without casing	0017000175

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