POWER ELECTRONICS®

SD500 ACCESORIES
PROFINET BOARD

SD500

A C C E S O R I E S

Profinet Module

Accessories Manual

Edition: October 2017

SD50MA01AI

ABOUT

PURPOSE

This manual contains important instructions for the installation and maintenance of the optional Profinet communication module for Power Electronics SD500 variable speed drives.

AUDIENCE

This manual is intended for qualified customers who will install, operate and maintain Power Electronics SD500 variable speed drives.

Only trained electricians approved by the installation company may install and commission the drives. The instructions assume that the installer is familiar with electrical installation rules and regulations.

REFERENCE MANUALS

The following reference guide is available for the SD500 variable speed drives:

- Hardware and Installation Manual
- Programming and Software Manual

POWER ELECTRONICS CONTACT INFORMATION

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SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.

In this manual, safety messages are classified as follows:

WARNING	Identifies potentially hazardous situations where dangerous voltage may be present, which if not avoided, could result in minor personal injury, serious injury or death.
	Be extremely careful and follow the instructions to avoid the risk of electrical shocks.
CAUTION	Identifies potentially hazardous situations, which if not avoided, could result in product damage, or minor or moderate personal injury.
	Read the message and follow the instructions carefully.
NOTICE	Identifies important measures to take in order to prevent damage equipment and warranty lost, as well as encouraging good use and environmental practices

The following CAUTION symbols can be used in this manual and they symbolize:

	Hot surface. Be careful and follow the instructions to avoid burns and personal injuries.
	Risk of fire. Be careful and follow the instructions to prevent causing an unintentional fire.
	Caution, risk of electric shock. Energy storage timed discharge. Wait for the indicated time to avoid electrical hazards.

Caution, risk of hearing damage. Wear hearing protection.

SAFETY INSTRUCTIONS

IMPORTANT

Read carefully this manual to maximize the performance of the product and to ensure its safe use.

In order to appropriately use the drive, please, follow all instructions described in the installation manual which refer to transportation, installation, electrical connection and commissioning of the equipment.

Power Electronics accepts no responsibility or liability for partial or total damages resulting from incorrect use of equipment.

⚠ **WARNING**

Be cautious when handling the CMOS components of the communication board. Static may lead to product malfunctioning.

Turn the drive power off before changing the communication cable. Otherwise, you may damage the module or a communication error may occur.

Make sure to insert precisely the communication module connector to the drive. Otherwise, you may damage the module or a communication error may occur.

Check the parameter unit before setting up the parameters. Otherwise, a communication error may occur.

Do not remove the cover while the power is applied or the unit is in operation. Otherwise, electric shock could occur.

Do not remove the cover while power supply is connected or the drive is operating. Otherwise, you may get an electric shock.

Do not run the drive with the front cover removed.
Otherwise, you may get an electric shock.

The drive does not remove the voltage from the input terminals. Before working on the drive, isolate the whole drive from the supply. If you do not remove the power supply, you may get an electric shock.

Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied. Otherwise, you get an electric shock.

Operate the drive with dry hands.
Otherwise, you may get an electric shock.

Do not use cables with damaged insulation.
Otherwise, you may get an electric shock.

Do not subject the cables to abrasions, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

⚠ CAUTION

Install the drive on a non-flammable surface. Do not place flammable material nearby. Otherwise, a fire could occur.

Disconnect the input power if the drive is damaged.
Otherwise, it could result in a secondary accident or fire.

Do not allow lint, paper, wood chips, dust, metallic chips or other foreign matter into the drive.
Otherwise, a fire or an accident could occur.

The drive becomes hot during operation. Wait until it cools down before performing any actions.
Touching hot parts may result in skin burns.

Do not apply power to a damaged drive or to a drive with parts missing, even if the installation is complete.
Otherwise, you may get an electric shock.

🛈 NOTICE

RECEPTION

- The SD500 are carefully tested and perfectly packed before delivering.

- In the event of transport damage, please ensure to notify the transport agency and POWER ELECTRONICS: 902 40 20 70 (International +34 96 136 65 57), or your nearest agent, within 24hrs from receiving the goods.

UNPACKING

- Make sure model and serial number of the variable speed drive are the same on the box, delivery note and unit.

- Each variable speed drive is delivered with Hardware and Software technical manuals.

RECYCLING

Equipment packaging must be recycled. Separate all different materials (plastic, paper, cardboard, wood…) and place them in the corresponding containers. Ensure waste collection is properly managed with a Non-Hazardous Waste Agent.

To guarantee health and natural environmental sources protection, the European Union has adopted the WEEE directive concerning discarded electric and electronic equipment (SEEA).

Waste of electrical and electronic equipment (WEEE) must be collected selectively for proper environmental management.

Our products contain electronic cards, capacitors and other electronic devices that should be separated when they are no longer functional. These WEEEs should be managed accordingly with a Hazardous Waste Agent.

Power Electronics promotes good environmental practices and recommends that all its products sold outside of the European Union, once they reach the end of their life, are separated and the WEEE managed according to the particular country applicable legislation (especially: electronic cards, capacitors and other electronic devices)

If you have any questions about the electric and electronic equipment waste, please contact Power Electronics.

CYBER SECURITY DISCLAIMER

This product is designed to be connected to and to communicate information and data via a network interface. The customer is the sole responsible for providing and continuously ensuring a secure connection between the product and customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Power Electronics and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ELECTROMAGNETIC COMPATIBILITY (EMC)

- The drive is intended to be used in industrial environments (Second Environment). It achieves compliance with C3 category defined in IEC/EN 61800-3 standard when the installation recommendation within this manual are followed.

- Select communication and control system according to the drive EMC environment. Otherwise, systems could suffer from interferences due to a low EMS level.

SAFETY

Before operating the drive, read this manual thoroughly to gain an understanding of the unit. If any doubt exists, please contact POWER ELECTRONICS, (902 40 20 70 / +34 96 136 65 57) or your nearest agent.

- Wear safety glasses when operating the drive with power applied or for when the front cover is removed.

- Handle and transport the drive following the recommendations within this manual.

- Install the drive according to the instructions within this manual and local regulations.

- Do not place heavy objects on the drive.

- Ensure that the drive is mounted vertically and keeping the minimum clearance distances.

- Do not drop the drive or subject it to impact.

- The SD500 drives contain static sensitive printed circuits boards. Use static safety procedures when handling these boards.

Avoid installing the drive under conditions that differ from those described in the Environmental Ratings section.

CONNECTION PRECAUTIONS

- To ensure a correct operation of the drive, it is recommended to use a SCREENED CABLE for the control wiring.

- The motor cable should comply with the requirements within this manual. Due to increased leakage capacitance between conductors, the external ground fault protection threshold value should be adjusted ad hoc.

- Do not disconnect motor cables if the input power supply remains connected.

- The internal circuits of the SD500 Series will be damaged if the incoming power is connected and applied to the output terminals (U, V, W).

- Do not use power factor correction capacitor banks, surge suppressors, or RFI filters on the output side of the drive. Doing so may damage these components.

- Before wiring the terminals, make sure that the drive keypad display is turned off and the front cover is off as well. The drive may hold a high voltage electric charge long after the power supply has been turned off.

EARTH CONNECTION

- Ground the drive and adjoining cabinets to ensure a safe operation and to reduce electromagnetic emission.

- Connect the input PE terminal only to the dedicated PE terminal of the drive. Do not use the case, nor chassis screws for grounding.

- Ground the drive chassis through the labelled terminals. Use appropriate conductors to comply with local regulations. The ground conductor should be connected first and removed last.

- Motor ground cable must be connected to the PE output terminal of the drive and not to the installation's ground. We recommend that the section of the ground conductor (PE) is equal or greater than the active conductor (U, V, W).

TRIAL RUN

- Verify all parameters before operating the drive. Alteration of parameters may be required depending on application and load.

- Always apply voltage and current signals to each terminal that are within the levels indicated in this manual. Otherwise, damage to the drive may occur.

CAPACITORS DEPLETION

If the drive has not been operated for a long time, capacitors lose their charging characteristics and are depleted. To prevent depletion, once a year run the device under no-load conditions during 30-60 minutes. For further information, please contact Power Electronics.

INTRODUCTION

Description of Profinet Communication Module

The SD500 Profinet communication module provides Profinet network communication for the SD500 drive. Profinet is a communication protocol compliant with IEC 61158 Type 10. The Profinet communication module provides full-duplex data transfer which enables real-time communication without transmission collisions. Using a Profinet connection, the SD500 drive can be controlled and monitored via a PLC sequence program or any master PLC module. In addition, Profinet is easy to connect, enabling faster installation and easier maintenance.

Components

The Profinet module kit contains the following parts:

- 1 Profinet communication card
- 1 Profinet module manual
- 2 Mounting screws

PROFINET COMMUNICATION MODULE FEATURES

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Common Features

Communication protocol	Profinet IO CC-A
Communication speed	100 Mbps
Communication type	Full Duplex
Max. number of nodes	64
Distance	100m (Twisted Pair)
Service	Profidrive Class 1
Topology	Line, Tree, Star topology

GSDML File

The GSDML file contains information about the Profinet communication module installed in a drive. When you configure the Profinet network, the network configuration software requires the GSDML file.

** For downloading the file, please contact Power Electronics.

PART NAMES AND INSTALLATION

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Installation

⚠ **WARNING**

Turn the power supply off before connecting a communication network. If the Profinet communication module is removed or installed, the power supply should be switched off.
Otherwise, the SD500 drive may get damaged and warranty will be voided.

Install or remove the Profinet communication module when the drive capacitor is fully discharged.
When installing the Profinet communication module, ensure that the connectors of the drive body and the communication module are correctly aligned.

To install the Profinet communication module, please follow these steps:

① Remove the front cover

② Connect the Profinet communication module by inserting it into the connector on the drive body.

③ Secure the Profinet communication module with the two mounting screws.

④ Replace the cover
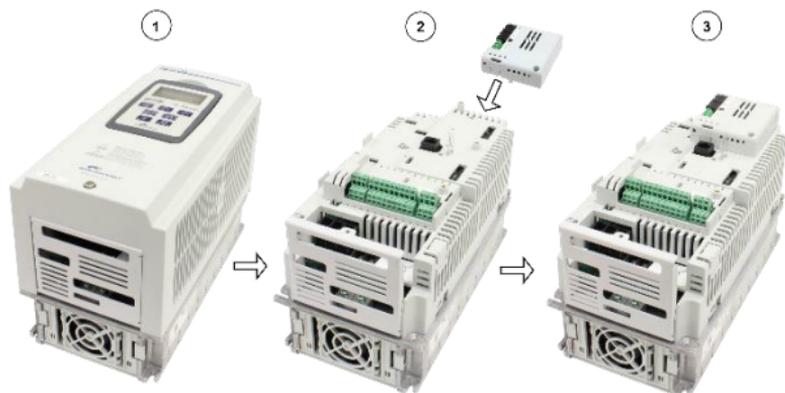
Profinet communication module
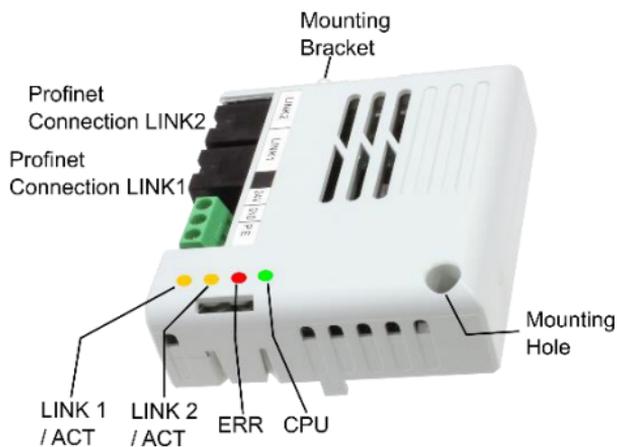
LED	INDICATOR	COLOR	DESCRIPTION	STATUS	REMARKS
LED0	LINK1/ACT1	Green	Normal operation	ON	LINK1 is connected to a network.
				OFF	LINK1 is not connected to a network.
		Yellow	Normal operation	OFF	Network LINK1 is not transmitting/receiving data.
				Flashing	Data transmission between the Master unit and the communication module is in progress at network LINK1.
LED1	LINK2/ACT2	Green	Normal operation	ON	LINK2 is connected to a network.
				OFF	LINK2 is not connected to a network.
		Yellow	Normal operation	OFF	Network LINK2 is not transmitting/receiving data.
				Flashing	Data transmission between the Master unit and the communication module is in progress at network LINK2.
LED2	ERROR	Red	Normal operation	OFF	Communication between the Communication module and the drive is normal.
			Communication fault	CPU and ERROR indicators flash simultaneously	Communication error (no communication is established) occurred between the communication module and the drive.
				CPU and ERROR indicators flash asynchronously, in 2 second intervals	Abnormal communication (failures) conditions exist between the communication module and the drive.
				ON	The communication module failed to boot up.
LED3	CPU	Green	Abnormal operation	ON	The CPU is not operating.
				OFF	
			Normal operation	Flashing (1 second interval)	The communication module is installed correctly in the drive.

24V External Power Input

PIN Nº	NAME	DESCRIPTION
1	+24 V	24 V External Power (+)
2	GND (0V)	0 V External Power
3	P.E.	Protective Earth for 24 V External Power

1. The most significant pin is Pin#1. See the following illustration.
2. Rated Power (Power Consumption): 1.3 W

Pin #1: 24V (+)
Pin #2: GND [0V]
Pin #3: P.E
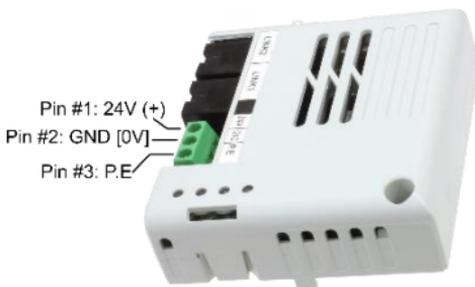
⚠️ **CAUTION**

Acceptable supply voltage range for the 24 V external source is -15% to +20%. Ensure that the power source meets this requirement before connecting it to the communication module.

The 24 V external power source supplies power only to the communication module. Do not use it to power neither the drive nor the keypad.

The 24 V external power input is a redundant power source which ensures an uninterrupted operation of the communication module even when the main power source from the drive is interrupted. The Profinet communication module installed in a drive (INV #1) keeps operating with this 24 V external power source even if the drive (INV #1) does not work properly and cannot

supply power to the module. This allows the communication module to continue the network communication with other functioning drive units (INV #n) at the same network.
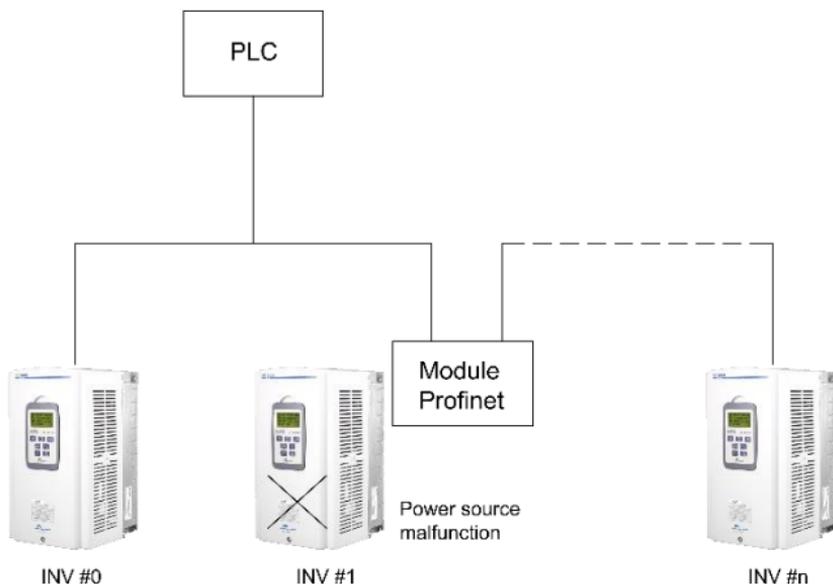
When the 24 V external power source is connected and the main power source is interrupted, the Profinet communication module sends a "Fault Alarm" to the PLC. After the PLC receives the alarm, the most significant bit for "H/W Diagnosis Trip Information (communication address 0h0333)" is set to "1".

NETWORK CONNECTIONS

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Network Cable Contacts

Pin No.	Signal	Description	Cable color
1	TX+	Data Transmission (+)	White / Yellow
2	TX-	Data Transmission (-)	Yellow
3	RX+	Data Reception (+)	White / Green
4	None	Not used	Blue
5	None	Not used	White / Blue
6	RX-	Data Reception (-)	Green
7	None	Not used	White / Brown
8	None	Not used	Brown

Communication Cable Connector
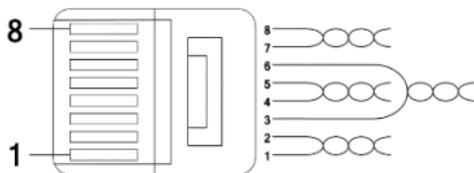
Notes:

1- Wires connected to pin#1 and pin#2 must be twisted.

2- Wires connected to pin#3 and pin#6 must be twisted.

Network Cable Specification

Profinet network communication requires STP (category 6a, or higher) network cables.

PARAMETERS CONFIGURATION

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Drive parameters related to Profinet communication are listed below.

To operate a SD500 drive using the Profinet communication module, set G4.1.1 (Main Control Mode) to [3 COMMS]. Set G3.1/G3.2 (Speed Reference Source 1/2) to [COMMS] to provide a frequency reference to the drive using the Profinet communication module.

Note: For further information about SD500 programming parameters, please refer to the Programming and Software Manual.

Code	Parameter Name	Value	Description
G.3	**G3.1** / Speed Reference Source 1	COMMS	Selects the frequency reference source of the SD500 drive. Set the parameter to [COMMS] to set Profinet communication as the frequency reference source.

OPTION	FUNCTION
LOCAL	The reference will be introduced by the use of the keypad and set on [G3.3LOCAL].
AI1	The reference will be introduced through the Analogue Input 1.
AI2	The reference will be introduced through the Analogue Input 2.
AI3	The reference will be introduced through the Analogue Input 3. **Note:** This option is only available if the I/O expansion board has been installed.
AI4	The reference will be introduced through the Analogue Input 4. **Note:** This option is only available if the I/O expansion board has been installed.
MDBUS	The reference will be installed by the use of MODBUS communications.

Note: Continues in the next page.

Code	Parameter Name	Value	Description
	G3.2 / Speed Reference Source 2		**Note:** Comes from the previous page.

OPTION	FUNCTION
COMMS	The reference will be installed by the use of the optional communications board installed in the drive. **Note**: This option is only available if any of the communication boards have been installed.
PLC	The reference will be introduced through a programmable Logic Controller. **Note:** This option is only available if the optional PLC board has been installed.

Code	Parameter Name	Value	Description		
G4	**G4.1** / Main Control Mode	COMMS	The user is able to set the main control mode to order the command functions (Start/Stop, Reset, etc.).		

OP.	DESCRIP.	FUNCTION
0	LOCAL	The drive is controlled from the keypad.
1	REMOTE	The drive is controlled from the control terminals.
2	MODBUS	The drive is controlled through the communications bus integrated in the equipment.
3	COMMS	The drive control is carried out by the use of any of the optional communication boards. **Note:** This option is only available if any of the communication boards have been installed.
4	PLC	The drive control is carried out through a programmable Logic Controller. **Note:** This option is only available if the optional PLC board has been installed.
5	LOCAL	The drive is controlled from the keypad.

Note: In case an unavailable option is selected, the parameter will return to the previously selected option.

Code	Parameter Name	Value	Description
G11	**G11.1** / Response in case of a Speed Reference Loss	NONE	Set the action to be taken if the drive loses a speed reference. **Set Value**: **Lost Command Mode**: **Note**: Continues in the next page.

Set the action to be taken if the drive loses a speed reference.

Set Value:

OPT.	FUNCTION
None	Protection is disabled.
FreeRun	The drive cuts the output voltage and allows the motor free run.
Dec	A deceleration until stop is produced in the time defined in parameter [G5.15 'FltDecT'].
Hold I/P	The drive will keep operating to the input value, mean value obtained from the last 10 seconds until the moment the reference loss has been detected.
Hold O/P	The drive will keep operating to the output value, mean value obtained from the last 10 seconds until the moment the reference loss has been detected.
LostPrst	The drive operates to the frequency defined in parameter [G11.4 'RfLRf'].

Lost Command Mode:

Code Number	Description
None	Protection is disabled.
FreeRun	The drive cuts the output voltage and allows the motor free run.

Note: Continues in the next page.

Code	Parameter Name	Value	Description
			Note: Comes from the previous page

Lost Command Mode:

Code Number	Description
Dec	The motor decelerates and then stops at the time set at G9.7 (Pr.7).
Hold I/P	The drive will keep operating to the input value, mean value obtained from the last 10 seconds until the moment the reference loss has been detected.
Hold O/P	The drive will keep operating to the output value, mean value obtained from the last 10 seconds until the moment the reference loss has been detected.
LostPrst	The drive operates to the frequency defined in parameter G9.14 (Pr.14).

⚠️ **Caution**: Users should ensure that disabling this protection does not compromise the operation of the equipment.

Code	Parameter Name	Value	Description
	G11.3 / Trip Delay Time Due to Speed Reference Loss	1.0s	Delay time setting after which the speed reference loss protection will enable.
	G11.4 / Speed in case of Reference Loss	0.00Hz	In order to set the frequency value at which the drive will operate in case a speed reference loss occurs. Therefore, the parameter [G11.1 'RIRLs'] must be set to the value 'LostPrst'.

Code	Parameter Name	Value	Description
G20	**G20.1** / ComUpdate	N	This parameter enables the possibility of reconnecting communications when a parameter has been changed. For example, the communication speed, frame definition, etc. Press Yes to reflect the values setup with keypad on the Profinet option.
	G20.5 .1/ G20.5.1 Profinet SW Ver		When the Profinet communications module is installed, the module type "Profinet" is automatically detected and displayed.
	G20.5.2 / Profinet	-	Displays the communication module status indicator (LED) information on the drive keypad. For more information, refer to "Part Names and Installation". Example of "[G20.5.2] Profinet" LED status displayed on the keypad:
	G20.5.3 / IPA	0	
	G20.5.4 / IPB	0	
	G20.5.5 / IPC	0	
	G20.5.6 / IPD	0	The IP version supported by Profinet Module is v4. All the addresses and masks are expressed in (decimal).(decimal).(decimal).(decimal) and each decimal number is within 0~255.
	G20.5.7 / Subnet Mask	0	
	G20.5.8 / Subnet Mask	0	
	G20.5.9 / Subnet Mask	0	
	G20.5.10 / Subnet Mask	0	

Within the G20.5.2 cell, the LED status table:

Indicator Name	LINK1/ACT1	LINK2/ACT2	ERR	CPU
Status	OFF	ON	ON	ON

Code	Parameter Name	Value	Description
	G20.5.11 / Gateway	0	
	G20.5.12 / Gateway	0	
	G20.5.13 / Gateway	0	
	G20.5.14 / Gateway	0	
	G20.5.15 / Profinet mode	0	The Profinet Communication module supports two different types of telegrams. Refer to "Supported Profidrive Cyclic Telegram" for the supported telegram types and its details. | Setting	Selected Telegram Type
---	---
0	Standard Telegram
1	Vendor Specific Telegram	

PROFIDRIVE STATUS DIAGRAM

<div style="float:right">

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</div>

The following diagram shows the operation status that the Profinet communication module uses.
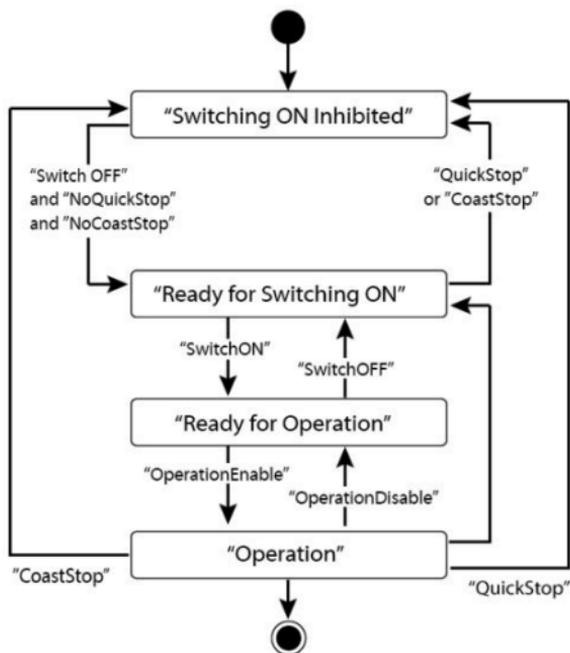
Status	Description
S1: Switching On Inhibited	The communication module cannot be switched ON at the moment.
S2: Ready for Switching On	The communication module can be switched ON at any moment.
S3: Ready for Operation	Communication module operation is ready to be enabled.
S4: Operation enable	The motor is running.

Status transitions are managed by the commands which are periodically transmitted from the PLC. The command types are as follow (Refer to "Control word (STW1)" for more information):

- NoQuickStop Command
- NoCoastStop Command
- SwitchOFF Command
- SwitchON Command
- OperationEnable Command
- OperationDisable Command
- QuickStop Command
- CoastStop Command

The following table lists the status transition events and the drive operations:

Source Status	Target Status	Event	Action (Drive operation)
"Switch On Inhibited"	"Ready for Switching On"	"SwitchOFF" and "NoQuickStop" and "NoCoastStop"	None (Motor is stopped)
"Ready for Switching On"	"Switch On Inhibited"	"QuickStop" or "CoastStop"	None (Motor is stopped)
"Ready for Switching On"	"Ready for Operation"	"SwitchON"	None (Motor is stopped)
"Ready for Operation"	"Ready for Switching On"	"SwitchOFF"	None (Motor is stopped)

Source Status	Target Status	Event	Action (Drive operation)
"Ready for Operation"	"Operation"	"OperationEnable"	Motor is run.
"Operation"	"Ready for Operation"	"OperationDisable"	Motor is stopped (the SD500 drive stops the motor according to the G7.3 "Stop Mode" settings).
"Operation"	"Switch On Inhibited"	"CoastStop"	Motor is stopped (Free Run Stop).
"Operation"	"Switch On Inhibited"	"QuickStop"	Motor is stopped (the SD500 drive stops the motor according to the G7.3 "Stop Mode" settings).

SUPPORTED PROFIDRIVE CYCLIC TELEGRAM

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The SD500 communication module supports "Standard" and "Vendor Specific" telegrams. On a Profinet network it is possible to exchange cyclic telegrams with a PLC at a minimum cycle time of 8 ms. Each telegram is expressed as a submodule in Profinet network communication, and can be assigned to either Slot1 or Subslot 2 at the communication module.

Standard telegram (Mode:0)

Standard telegram1	Byte 1-2	Byte 3-4
PLC to SD500	Control word (STW1)	Setpoint value
SD500 to PLC	Status word (ZSW1)	Current speed value

Vendor Specific Telegram (Mode: 1)

Vendor Specific telegram1	Byte 1-2	Byte 3-4	Byte 5-6	Byte 7-8	Byte 9-10
PLC to SD500	Control word (STW1)	Setpoint value	Dummy	Dummy	Dummy
SD500 to PLC	Status word (ZSW1)	Current speed value	Alarm Info	Torque	Current

The following table lists settings for Standard and Vendor Specific Telegrams.

Control word (STW1)

Bit	Name	Value	Description
0	ON	1	Ready for operation (Operation by a PLC is available).
	OFF1	0	NOT Ready for operation (Operation by a PLC is not available).
1	No OFF2	1	OFF2 (Coast Stop) feature is disabled. Current operation is maintained.
	OFF2 (Coast Stop)	0	Stops the motor using a free-run stop (emergency stop).
2	No OFF3	1	OFF3 (Quick Stop) feature is disabled. Current operation is maintained.
	OFF3 (Quick Stop)	0	Stops the motor using the setting at SD500 drive (G7.3 "Stop Mode").
3	Enable Operation	1	Operates the motor using the Setpoint value (frequency reference received from a PLC via the Profinet network communication.
	Disable Operation	0	Stops the motor using the setting at SD500 drive (G7.3 "Stop Mode").
4	Enable Ramp Generator	1	Performs acceleration and deceleration based on the acceleration and deceleration time settings at SD500 drive (G5 "Ramps") to reach the Setpoint (frequency reference).
	Reset Ramp Generator	0	Forces the operation frequency to "0". (Operating frequency drops to "0" after decelerating based on the Dec Time set at the drive).
5	Unfreeze Ramp Generator	1	A fixed Ramp Generator operation is not assigned. Acceleration and deceleration is performed based on the Acc/Dec times configured in the drive group (G5 "Ramps") parameter settings to reach the Setpoint (frequency reference).
	Freeze Ramp Generator	0	Speed reference from the PLC is ignored and the Ramp Generator operation is fixed. The motor is operated via the network communication by the Profinet, and

Bit	Name	Value	Description
			the current operation frequency is maintained.
6	Enable Setpoint	1	The motor is operated based on the speed reference from the PLC.
	Disable Setpoint	0	Forces the motor operation frequency to "0".
7	Fault Acknowledge	(0->1)	Set to 1 to release fault conditions at the SD500 drive.
8	Jog1 ON/OFF	-	Not supported.
9	Jog2 ON/OFF	-	Not supported.
10	Control By PLC	1	The SD500 drive is controlled by the PLC control word (STW1) received via the Profinet network communication.
	No Control By PLC	0	The PLC control word (STW1) received via the Profinet network communication is ignored.
11-15	-	-	Reserved.

The status transition explained in <Accessing the Common Parameters using the Profidrive Parameters> can be performed by setting the four control word bits, from bit 0 to bit 3. For example, setting the four bits to 1 (XXXX XXXX XXXX 1111) changes the status to "Operation."

The bit "X" indicates that the relevant bit can be set to either 0 or 1 without affecting the control word bit settings.

The following table lists the status transition controlled by the control word bits (Bits 0 to 3).

Command	Bit3	Bit2	Bit1	Bit0
QuickStop	X	0	X	X
CoastStop	X	X	0	X
NoQuickStop	X	1	X	X
NoCoastStop	X	X	1	X
SwitchOFF	X	1	1	0
SwitchON	X	1	1	1
OperationEnable	1	1	1	1
OperationDisable	0	1	1	1

Internally, the control uses the drive operation command at communication address 0x0382, and the Control Word (STW1) for basic motor operation by using address 0x47F (bits 0, 1, 2, 3, 4, 5, 6, 10). When a PLC sets the bits at 0x47F, motor operation is possible simply by providing a frequency reference.

Example. Bit Settings for Motor Operation

Bit	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Setting	1	⌐[1]	⌐[1]	0	1	1	1	1	1	1	1

Status Word (ZSW1)

Bit	Name	Value	Description
0	RDY_ON	1	Ready for Switch ON (Operation is available).
		0	NOT Ready for Switch ON (Operation is not available).
1	RDY_OPERATION	1	Bit0 input control word value (STW1)
		0	
2	OPERATION	1	Bit3 input control word value (STW1)
		0	
3	Fault Present	1	Fault condition is present at the drive.
	No Fault	0	Fault condition is not present at the drive.
4	No OFF2	1	Bit1 input control word value (STW1)
	OFF2	0	
5	No OFF3	1	Bit2 input control word value (STW1)
	OFF3	0	
6	SWC_ON_INHIB	1	Switching On inhibited (Control is not available)
		0	Switching On Not inhibited (Control is available)
7	Warning Present	1	Warning condition is present at the drive
	No Warning Present	0	Warning condition is not present at the drive
8	Speed Error within tolerance	1	The motor speed has reached the frequency reference ("Setpoint value")

---

[1] Indicates that the bit can be set to either 0 or 1 without affecting the motor operation.

Bit	Name	Value	Description
	Speed Error out of tolerance	0	The motor speed has not reached the frequency reference ("Setpoint value")
9	Control Requested	1	Bit 10 value of the control word (STW1) that has been input
	No Control Requested	0	
10	ABOVE_LIMIT	-	Not supported
11-15	-	-	Reserved.

Note: "bits 0 to 2" and "bit 6" indicate the following communication module status, as explained in <Accessing the Common Parameters using the Profidrive Parameters>.

Status Word	Status
XXXX XXXX X1XX X000	"Switching On Inhibited"
XXXX XXXX X0XX X001	"Ready For Switching On"
XXXX XXXX X0XX X011	"Ready For Operation"
XXXX XXXX X0XX X111	"Operation"

Note: The letter "X" in the bit indicates that it can be set to either 0 or 1 without affecting the control word bit settings.

Setpoint Value

It is the frequency reference for drive operation. The Setpoint Value is expressed in Hz and can be increased or decreased by 0.01 Hz.

Current Speed Value

It represents the drive current output frequency. The Current Speed Value is expressed in Hz and can be increased or decreased by 0.01 Hz.

Alarm Information

Bit	Name	Description
0	Bit for displaying "latch type trip information-1"	This bit is set to 1 when more than one bit in the "latch type trip information-1" parameter bit field is set to 1. Otherwise, it is set to 0. This bit references address 0h0330 in the drive compatible parameter communication addresses
1	Bit for displaying "latch type trip information-2"	This bit is set to 1 when more than one bit in the "latch type trip information-2" parameter bit field is set to 1. Otherwise, it is set to 0. This bit references address 0h0331 in the drive compatible parameter communication addresses.
2	Bit for displaying "level type trip information"	This bit is set to 1 when more than one bit in the "level type trip information" parameter bit field is set to 1. Otherwise, it is set to 0. This bit references address 0h0332 in the drive compatible parameter communication addresses.
3	Bit for displaying "H/W Diagnosis Trip information"	This bit is set to 1 when more than one bit in the "H/W Diagnosis Trip information" parameter bit field is set to 1. Otherwise, it is set to 0. This bit references address 0h0333 in the drive compatible parameter communication addresses.
4	Bit for displaying "Warning information"	This bit is set to 1 when more than one bit in the "Warning information" parameter bit field is set to 1. Otherwise, it is set to 0. This bit references address 0h0334 in the drive compatible parameter communication addresses.
5 to 15	-	Reserved.

Torque

It is the drive output torque. Torque is expressed in percentages (%) and can be increased and decreased by 0.1%.

⚠ CAUTION

Torque value is displayed correctly only if the drive control mode is set to "Sensorless" or "Vector".

Current

It is the drive output current. Torque is expressed in amperes (A) and can be increased or decreased by 0.1A.

Dummy

Not used.

SUPPORTED PROFIDRIVE PARAMETERS

8

Parameters

PNU	R/W	Description
922	R	Displays the selected Profidrive Cyclic Telegram type. 1 → Standard Telegram 100 → Vendor Specific Telegram *This parameter does not support writing via Profidrive protocol. Set this parameter using the drive keypad. Go to G20.5.15 "Profinet Mode" and set it to "0" to select "Standard Telegram," and to "1" to select "Vendor Specific Telegram.
944	R	Fault message counter. The parameter value increases by 1 each time a fault condition occurs. The controller, such as a PLC, on the Profinet is notified by this parameter.
947	R	Fault number * Refer to <Fault Message Counter (PNU [944]) and Fault Number (PNU [947])>.
953	R	Warning word * Displays the "Warning information" parameter value at communication address 0h0334.
964	R	An array of five 16-bit word values that expresses the SD500 communication module information. 0: Manufacturer (the Profinet vendor ID "849" for Power Electronics), as defined by the Profibus.org, is displayed (referenced from communication address 0h351). 1. Device Type: "1" is displayed for SD500 Profinet communication module. 2. Version: Displays the software version. E.g.,) "102" for Version 1.2 3. Firmware Date (yyyy): Displays the year of the software release. E.g.,) "2015" for the year 2015 4. Firmware Data (dd/mm): Displays the date and month of the software release. E.g,) "2512" for December 25
965	R	Indicates the Profile ID. (0h328 – Profile 3 v4.0)

PNU	R/W	Description
967	R	Displays the control word (STW1) value that is currently input via the Profinet communication network.
968	R	Displays the status word (ZSW1) value that is currently input via the Profinet communication network.
972	R/W	The SD500 communication module is reset when the parameter value is changed to "1" from "0".
61000	R	Displays the device name of the SD500 Profinet communication module.
61001	R	Displays the IP address of the SD500 Profinet communication module.
61002	R	Displays the MAC address of the SD500 Profinet communication module.
61003	R	Displays the gateway IP address of the SD500 Profinet communication module.
61004	R	Displays the subnet mask of the SD500 Profinet communication module.
1000	R/W	SD500 Parameter Access Address (communication address for reading or writing drive parameters)
1001	R/W	SD500 Parameter Access Data (data value of drive parameters for reading or writing)
1002	R/W	SD500 Parameter Access Command 1: write 2: read
1003	R/W	SD500 Parameter Access Acknowledge 0: Not completed 1: OK completed 2: Not OK completed

FAULT MESSAGE COUNTER (PNU[944]) AND FAULT NUMBER (PNU[947])

9
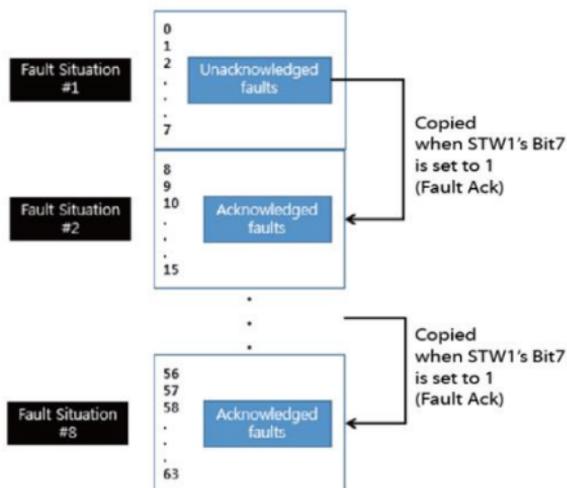
The Fault Message Counter (PNU[944]) parameter value increases by 1 each time a drive fault occurs and the fault is saved at the Fault Number (PNU[947]) parameter.

The Fault Number (PNU[947]) parameter can save 8 Fault Situations, each of them contains 8 Fault Messages. A Fault Message consists of one 16bit word. The Fault Number (PNU[947]) parameter consists of 64 words.

See the following diagram for the basic operation.

In the diagram, the current Fault Message is saved at Fault Situation #1. Each fault message is saved based on the time of occurrence, from index 0 to 63.

The fault messages are written (overwritten) to the memory when every eighth fault message in each Fault Situation is saved at index 7, 15, 23, 31, 39, 47, 55 and 63. When the PLC control word bit 7 is set to 1, a "Fault Ack" is triggered, which in turn increases the Fault Situation number by 1 until it becomes 7 (Fault Situation #7).

The saved Fault Messages match the drive trip information (latch type trip info-1, latch type trip info-2, level type trip info, H/W Diagnosis Trip info) as defined in the following table.

TRIP NAMES	FAULT MESSAGE
Overload Trip	1
Underload Trip	2
Drive Overload Trip	3
E-Thermal Trip	4
Ground Fault Trip	5
Missing Output Phase Trip	6
Missing Input Phase Trip	7
Overspeed	8
Overspeed Deviation	9
NTC Trip	10
Overcurrent Trip	11
Overvoltage Trip	12
External Trip	13
Arm Short	14
Overheat Trip	15
Fuse Open Trip	16
MC Fail Trip	17
Encoder Error Trip	18
PTC (Thermal sensor) Trip	19
FAN Trip	20
Reserved	21
Parameter Write Error	22

TRIP NAMES	FAULT MESSAGE
Pre PID Fail	23
IO Board Connection Fault	24
External Brake Trip	25
No Motor Trip	26
Slot1 Option Card Connection Fault	27
Slot2 Option Card Connection Fault	28
Slot3 Option Card Connection Fault	29
Drive Output Cutoff by Optional Safety Device Terminal Input (For 90 kW and higher drive models)	30
Reserved	31
Reserved	32
BX	33
LV	34
Lost Command	35
Keypad Lost Command	36
Reserved	37
Reserved	38
Reserved	39
Reserved	40
Reserved	41
Reserved	42
Reserved	43
Reserved	44
Reserved	45
Reserved	46
Reserved	47
Reserved	48
ADC Error	49
EEPROM Error	50
Watchdog-1 Error	51
Watchdog-2 Error	52

TRIP NAMES	FAULT MESSAGE
Gate Drive Power Loss	53
Reserved	54
Reserved	55
Reserved	56
Reserved	57
Reserved	58
Reserved	59
Reserved	60
Reserved	61
Reserved	62
Reserved	63
Internal Communication Error between the Drive and the Option Card	64

ACCESSING THE COMMON PARAMETERS USING THE PROFIDRIVE PARAMETERS

10

Using the Profidrive parameters (PNU [1000–1003]), you can access to the SD500 drive parameters for data reading and writing.

The following diagram explains the parameter writing procedure.

SD500 Parameter Writing

PNU[1000] := Address

PNU[1001] := Data

PNU[1003] := 0

PNU[1002] := 1

PNU[1003] equal to 0

PNU[1003] not equal to 0
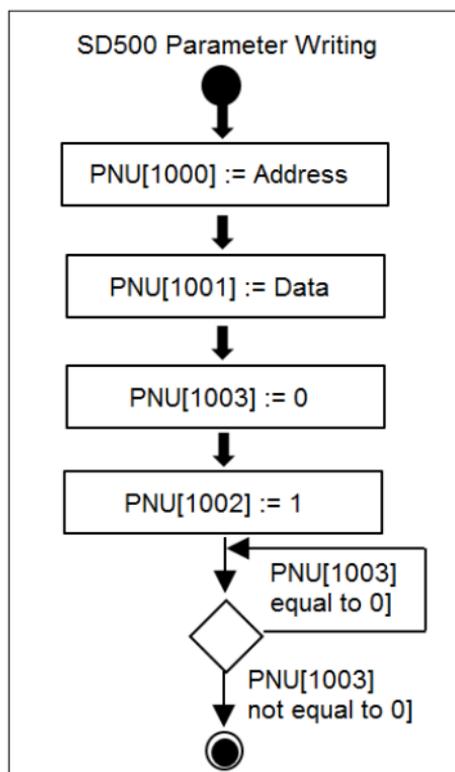
1. Drive communication address is assigned to PNU [1000].

2. Drive setting data is assigned to PNU [1001].

3. PNU [1003] is set to 0.

4. When PNU [1002] is set to 1, the SD500 Profinet communication module references the values assigned at PNU [1000] and PNU [1001] and writes the values to the drive internal parameters.

5. After writing the drive internal parameters, the SD500 Profinet communication module saves the result to PNU [1003].

6. PNU [1003] is used to verify successful completion of writing procedure.

The following diagram explains the parameter reading procedure.

```
┌─────────────────────────────────────┐
│        SD500 Parameter Reading       │
│                  ●                   │
│                  │                   │
│                  ▼                   │
│        ┌─────────────────────┐       │
│        │ PNU[1000] := Address │       │
│        └─────────────────────┘       │
│                  │                   │
│                  ▼                   │
│        ┌─────────────────────┐       │
│        │  PNU[1003] := 0      │       │
│        └─────────────────────┘       │
│                  │                   │
│                  ▼                   │
│        ┌─────────────────────┐       │
│        │  PNU[1002] := 2      │       │
│        └─────────────────────┘       │
│                  │                   │
│                  ▼◄──────────┐       │
│               ◇  PNU[1003]   │       │
│                  equal to 0  │       │
│                  │                   │
│        [PNU[1003] not equal to 0]    │
│                  ▼                   │
│        ┌─────────────────────┐       │
│        │   Data := PNU[1001]  │       │
│        └─────────────────────┘       │
│                  │                   │
│                  ▼                   │
│                  ◉                   │
└─────────────────────────────────────┘
```
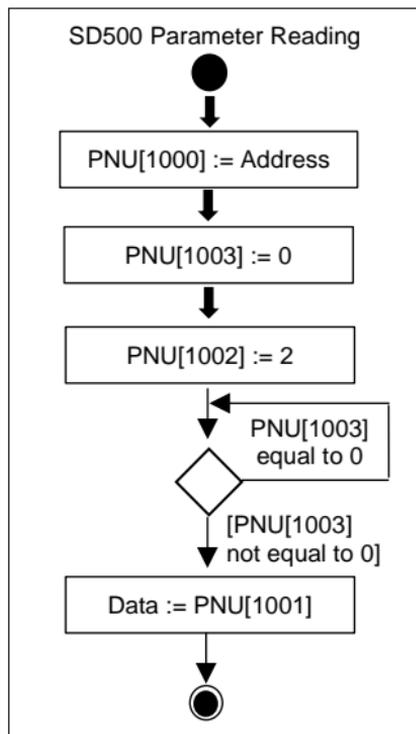
1- Drive communication address is assigned to PNU [1000].

2- PNU [1003] is set to 0.

3- When PNU [1002] is set to 2, the SD500 Profinet communication module references PNU [1000] and reads the data saved in the drive internal address pointed by it.

4- After reading the drive internal parameters, the SD500 Profinet communication module saves the result to PNU [1003]. If the reading procedure is successful, it saves the read data to PNU[1001].

5- PNU [1003] is used to verify successful completion of reading procedure. If the reading procedure is successful, the PLC reads the data saved at PNU[1001].

ACCESSING PARAMETERS USING THE PROFINET RECORD DATA OBJECT

11

Using the Profinet Record Data object you can access the SD500 drive parameters for data reading and writing without the Profidrive communication protocol.

The drive parameter data is assigned to the Profinet Record Data from the index address 0h5000. Using the Profinet IO RW service, you can directly access the addresses to perform reading and writing.

E.g.) The drive common parameter address 0h0001 is assigned to a Profinet index address 0h5001.

PROCESSING THE ALARMS

12

The SD500 communication module sends a Profinet alarm notification to the PLC when a fault trip occurs or when it is released.

Fault Alarm Packet Details

Type	API	Slot Number	Subslot Number	Alarm Specifier	User Structure Identifier	Channel Properties	Channel Error Type
Fault Occurrence	0h3 A00	1	2	Diagnosis	0h8000	0h0800	9012
Fault Release	0h3 A00	1	2	Diagnosis	0h8000	0h1000	9012

After a fault alarm is received, the PLC has to read the drive trip parameters to collect detailed information about the fault trip, such as the fault trip type (latch type trip-1, latch type trip-2, level type trip, or H/W diagnosis trip).

TROUBLESHOOTING

<div style="text-align:right">**13**</div>

No.	Symptoms	Resolution
1	ERROR indicator and CPU indicator are both turned off.	Power is not supplied to the communication module. • Correctly Install the communication module to the drive. • Check the connector pins on the communication module for bends or other defects. • If the problem persists after taking the measures listed above, it may indicate that the hardware is malfunctioning. Contact a service agent near you or the Power Electronics customer support.
2	ERROR indicator is turned on, and CPU indicator is turned off.	The hardware is malfunctioning. Contact a service agent near you or the Power Electronics customer support.
3	ERROR indicator and CPU indicator are flashing synchronously in 1 second intervals.	• Check the connector pins on the communication module for bends or other defects. • If the problem persists after taking the measures listed above, it may indicate that the hardware is malfunctioning. Contact a service agent near you or the Power Electronics customer support.
4	CPU indicator is flashing in 1 second intervals, and ERROR indicator is flashing in 2 second intervals.	• Check the communication link where the LAN cable is connected and ensure that the LINK indicator is turned on. If the LINK indicator is turned off, check the LAN cable and ensure that it is properly connected to the link port. • Check to ensure that the communication module device name and [G20.5.15] Telegram Mode parameter settings match the network configuration at the PLC. • Check to ensure that the IP address assigned to the communication module is not already used by other devices on the same network. • If the problem persists after taking the measures listed above, it may indicate that the hardware is malfunctioning. Contact a service agent near you or the Power Electronics customer support.

No.	Symptoms	Resolution
5	The communication module's IP address is randomly changed.	• A PLC can forcibly change the communication module IP address based on the PLC settings. Check the PLC configuration software and see if the IP change by the PLC is allowed. • Set the PLC software to use the IP address set at the communication module if you do not want the communication module IP to be changed.

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