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# MD520 Series General-Purpose AC Drive Communication Guide









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Data code 19011716 A00

# Preface

### About This Guide

The MD520 series AC drive is a general-purpose high-performance current vector control AC drive. It is designed to control and regulate the speed and torque of three-phase AC asynchronous motors. The AC drive can be used to drive textile machines, paper machines, wire drawing machines, machine tools, packaging machines, food machines, fans, water pumps, and other automated production equipment.

This guide describes the communication mode, communication networking, and communication configuration of the AC drive.

#### **More Documents**

Document Name	Data No.	Description
MD520 Series General- Purpose AC Drive Quick Installation and Commissioning Guide	19011712	Describes the installation, wiring, commissioning, troubleshooting, parameters, and fault codes of the AC drive.
MD520 Series General- Purpose AC Drive Hardware Guide	19011713	Describes the composition, technical specifications, components, dimensions, options (including installation accessories, cables, and peripheral electrical components), and expansion cards of the MD520 series AC drive, as well as routine maintenance and repair, and certification and standard compliance of the AC drive.
MD520 Series General- Purpose AC Drive Installation Guide	19011714	Describes the installation dimensions, space design, specific installation steps, wiring requirements, routing requirements, and option installation requirements of the AC drive, as well as common EMC troubleshooting recommendations.
MD520 Series General- Purpose AC Drive Commissioning Guide	19011715	Describes the tools, processes, and specific steps of commissioning of the AC drive, as well as troubleshooting, fault codes, and parameters related to the AC drive.
MD520 Series General- Purpose AC Drive Communication Guide (this document)	19011716	Describes the communication method, networking, and communication settings of the AC drive.
MD520 Series General- Purpose AC Drive Function Guide	19011717	Introduces function application, fault codes, and parameters of the AC drive.

### **Revision History**

Date	Version	Description
January 2022	A00	First release

### How To Obtain

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# **Table of Contents**

Pre	eface	
Sa	fety P	recautions
1	Para	meter Communication Addresses 12
	1.1	Parameter Data 12
	1.2	Parameter Communication Addresses 12
	1.3	Modbus-specific Parameter Communication Addresses 13
2	List o	of Communication Protocols
3	Mod	bus Communication
	3.1	Introduction
	3.2	Networking and Interfaces 20
	3.3	Transmission Mode
	3.4	Data Frame Structure
	3.5	Related Parameters 30
	3.6	Communication Configurations 31
		3.6.1 Configuration of RS485 Communication Between AC Drive and H5U
	<b>C</b> A N	3.6.2 Configuration of RS485 Communication Between AC Drive and AM600
4	CAN	open & CANLINK Communication
	4.1	Introduction
	4.2	Networking and Interfaces
	4.3	Related Parameters
	4.4	Application         54           4.4.1         Data Frame Structure         54
		4.4.2 Operation Instance (SDO)
		4.4.3 Operation Instance (PDO) 58
	4.5	Communication Configurations
		4.5.1 Configuration of CANlink Communication Between AC Drive and H5U
	4.0	4.5.2 Configuration of Canopen Communication Between AC Drive and H50
	4.6	4.6.1 Emergency Message and AC Drive Faults 71
		4.6.2 Simple Diagnosis
5	PRO	FINET Communication
	5.1	Introduction
	5.2	Installation
	5.3	Interface Layout and Description
	5.4	Topology

	5.5	Data Transmission Formats
	5.6	PZD Data 81
	5.7	Related Parameters 83
	5.8	Communication Configurations
		5.8.1 Configuring Slaves on the S7-1200 Master.
		5.8.2 MRP Function of the MD500-PN1 Card
	5.9	Fault Diagnosis.       98         5.9.1       Communication Faults         98       98
		5.9.2 Troubleshooting
6	Ethe	rCAT Communication
	6.1	Introduction
	6.2	Installation
	6.3	Interface Layout and Description
	6.4	Topology
	6.5	PDO Data
	6.6	SDO Mailbox Data
	6.7	Related Parameters
	6.8	Communication Configurations
		6.8.1 Communication Instance of Controlling MD520 with an Omron Controller 116
		6.8.2 Communication Instance of Controlling MD520 with an H5U Controller 122
		6.8.4 Communication Instance of Controlling MD520 with an AM600 Controller 120
	6.9	Fault Diagnosis
		6.9.1 ECAT Card Communication Faults 140
7	PRO	FIBUS DP Communication
	7.1	Introduction
	7.2	Installation 143
	7.3	Interface Layout and Description
	7.4	Topology and Transmission Distance
	7.5	Protocol Description
	7.6	Related Parameters 154
		7.6.1 AC Drive Communication Card Type Setting
		7.6.2 Communication Control Parameters
	1.1	7 7 1 Configuring a Slave on the S7-300 Master in STEP 7 V5 4
		7.7.2 Configuring a Slave on the S7-1200 Master in TIA Portal V13
		7.7.3 Performing Periodic Read/Write Operations on the AC Drive Slave
		7.7.4 Performing Aperiodic Read/Write Operations on the AC Drive Slave 173
	7.8	Fault Diagnosis

		7.8.1 Troubleshooting	176
8	MD-S	SI-DP1 Communication	183
	8.1	Introduction	183
	8.2	Installation	183
	8.3	Interface Layout and Description	185
	8.4	Topology and Transmission Distance	187
	8.5	Protocol Description.	189
	8.6	Related Parameters      8.6.1      Parameters related to Communication	193 193
	8.7	Communication Configurations.	198
		8.7.1 Communication Instance Description	198
		8.7.2 Configuring a Slave on the S7-300 Master in STEP 7 V5.4	198
		8.7.4 Performing Periodic Read/Write Operations on the AC Drive Slave	204
		8.7.5 Performing Aperiodic Read/Write Operations on the AC Drive Slave	215
		8.7.6 Diagnosis	218
	8.8	Fault Diagnosis	220
		8.8.1 Troubleshooting	220
9	Ethe	rNet/IP Communication	227
	9.1	Introduction	227
	9.2	Installation	227
	9.3	Interface Layout and Description	228
	9.4	Topology	230
	9.5	Protocol Description	231
		9.5.1 I/O Messages	231
		9.5.2 Data Sent by the Master	232
	96	Palated Darameters	232
	5.0	9.6.1 AC Drive Communication Card Type Setting.	233
		9.6.2 MD500-EN1 Card IP Address Configuration	234
		9.6.3 Parameters Related to AC Drive Communication Card	237
		9.6.4 Communication Control Parameters	237
	07	Communication Configurations	230
	9.1	9.7.1 Using an MD500-EN1 Expansion Card on an Allen-Bradley L16ER Master	241
		9.7.2 Using an MD500-EN1 Expansion Card on an Inovance AM600 Master	253
	9.8	Fault Diagnosis.	255
		9.8.1 Troubleshooting	255

# **Safety Precautions**

### Safety Disclaimer

- 1. This chapter presents essential safety instructions for proper use of the AC drive. Before using the product, please read the guide and make sure you understand the safety instructions correctly. Failure to comply with the safety instructions may result in death, serious injury, or equipment damage.
- 2. "CAUTION", "WARNING", and "DANGER" items in the guide are just supplementary and do not cover all safety instructions.
- 3. Use this product in an environment that complies with the design specifications. Malfunction or component damage caused by improper usage is not covered by warranty.
- 4. Inovance shall take no responsibility for any personal injuries or property loss caused by noncompliance with this guide or improper use of this product.

### Safety Levels and Definitions

### A DANGER

personal injuries or even death.

### 

personal injuries or even death.

# A CAUTION

indicates that failure to comply with the notice may result in minor personal injury or damage to the equipment.

### **Safety Precautions**

- The drawings in this guide sometimes show the product without covers or protective guards to display more details. When using this product, be sure to install the casing or cover according to the regulations, and operate in accordance with the guide.
- The product drawings in this guide are for reference only and may be slightly different from the product you ordered.

#### **Unpacking and Acceptance**

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- Do not install the product if any damage, rust, or sign of use is found on the product and accessories.
- Do not install the product in case of water seepage in the product, part missing or part damage.
- Do not install the product if you find the packing list does not conform to the product you received.



• Only professional personnel with electrical expertise can operate this product. Operations by non-professionals are strictly prohibited.



- Read through the user guide and safety precautions before installation.
- Do not install this product in places subject to strong electric field or strong electromagnetic wave interference.
- Before installation, make sure that the installation position is mechanically strong enough to bear the weight of the equipment. Failure to comply may result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the product in a closed environment (such as a cabinet or a chassis), cool the environment with a fan or an air conditioner to prevent overheat or fire.
- Do not modify this product.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When installing this product in a cabinet or terminal equipment, equip the cabinet or terminal equipment with protective devices such as fireproof enclosures, electrical protective enclosures, and mechanical protective enclosures with the protection level that meets requirements of relevant IEC standards and local laws and regulations.
- Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device to prevent malfunctions of this product.
- Install the product on incombustible objects such as metal and keep it away from combustible materials. Failure to comply may result in a fire.



- Cover the top of the product with a piece of cloth or paper during installation to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper to prevent overtemperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the anti-vibration rubber under the motor frame or use the vibration suppression function to reduce the resonance.

Wiring



- Do not allow non-professionals to perform equipment installation, wiring, maintenance, inspection, or parts replacement.
- Cut off all power supplies before wiring. Wait for at least the time specified on the product warning label after power-off so that residual voltage can discharge safely. Measure the DC voltage on the main circuit to ensure that it is within the safe voltage range. Failure to comply may result in an electric shock.
- Do not perform wiring, remove the product cover, or touch the circuit board with power ON. Failure to comply may result in an electric shock.
- Ensure that the product is well grounded. Failure to comply may result in an electric shock.



- Never connect the power cable to an output terminal. Failure to comply may result in product damage or even fire.
- When connecting a drive with the motor, ensure that the phase sequences of the drive and motor are consistent to prevent motor reverse rotation.
- Ensure that the diameter and shielding of the cables used meet corresponding requirements, and that the shielding layer of the shielded cables is grounded reliably at one end.
- Tighten terminal screws with tightening torque specified in this guide. Failure to comply may result in overheat and damage to the connection parts or even fire.
- After wiring, check that each cable is connected properly, no screws or gaskets fall into the product, and no cables are exposed. Failure to comply may result in an electric shock or product damage.



- Follow the proper electrostatic discharge (ESD) procedures, and wear an anti-static wrist strap during wiring. Failure to comply may result in damage to the product or the circuit of the product.
- Use shielded twisted pair cables for the control circuit. Connect the shielding layer to the product grounding terminal. Failure to comply may result in product malfunction.

#### Power-on



- Before power-on, ensure that the product is properly installed, all cables are securely connected, and the motor can be restarted.
- Before power-on, ensure that the power supply meets requirements. Failure to comply may result in product damage or even fire.
- Do not open the cabinet or protective cover, touch any terminal, or dismantle any device or component when the product is powered on. Failure to comply may result in an electric shock.

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- After wiring and parameter setting, perform a trial run to check whether the device can run properly. Failure to comply may result in personal injury or device damage.
- Before power-on, check that the rated voltage of the product is consistent with that of the power supply. Failure to comply may result in fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in personal injury or even death.

#### Operation



- Do not allow non-professionals to operate the product. Failure to comply may result in personal injury or even death.
- Do not touch any wiring terminals or disassemble any unit or component of the equipment during operation. Failure to comply may result in an electric shock.



#### Disposal



- Scrap the equipment or product in accordance with relevant national regulations and standards. Failure to comply may result in property damage, personal injury, or even death.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

#### Safety Signs

For safety operations, follow the safety signs on the equipment. Do not stain or remove the safety signs. The safety signs are described as follows:

Safety Signs	Description
<u>▲</u> 団 <u>▲</u> (ご)10min	<ul> <li>Read through the safety instructions before operating the equipment. Failure to comply may result in equipment damage, personal injury, or even death.</li> <li>Do not touch terminals or remove the cover during power-on or within 10 minutes after power-off. Failure to comply may result in an electric shock.</li> </ul>

# **1** Parameter Communication Addresses

### 1.1 Parameter Data

The parameters involve basic function parameters and monitoring parameters, which are stored in the corresponding parameter group. Basic function parameters are stored in groups F, A, B, C, and H, as listed in the following table.

Parameter data	Group F (read/ write)	F0, F1, F2, F3, F4, F5, F6, F7, F8, F9, FA, FB, FC, FD, FE, and FF
	Group A (read/ write)	A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, AA, AB, AC, AD, AE, and AF
	Group B (read/ write)	B0, B1, B2, B3, B4, B5, B6, B7, B8, B9, BA, BB, BC, BD, BE, and BF
	Group C (read/ write)	C0, C1, C2, C3, C4, C5, C6, C7, C8, C9, CA, CB, CC, CD, CE, and CF
	Group H (read/ write)	H1 and H2

The following table lists the addresses for monitoring parameters, which involve the operation command, running status, running parameters, and alarm information.

Monitoring parameters	Status data (read- only)	U0, U2, and 3000H Note 1
	Control parameters (write-only)	U3, 1000H, and 2000H to 2004H <sup>Note 1</sup>
	Fault information (read-only)	H0, H3, H4, H5, H6, H7, and H8
	Connector information (read- only)	L0, L1, L2, L3, L4, L5, L6, L7, L8, L9, LA, LB, LC, and LD

Note 1: 1000 H, 2000H to 2004H, and 3000H are Modbus-specific communication addresses.

### 1.2 Parameter Communication Addresses

There are multiple function parameters in each of the parameter groups F0 to FF and A0 to AF. For example, F0-16 indicates parameter number 16 in group F0. The higher 16 bits of the communication address for a function parameter are the function parameter group ID, and the lower 16 bits are the hexadecimal format of the serial number of the parameter in the function parameter group. For example, the communication address of F0-16 is 0xF010.

Writing basic function parameters and saving them upon power failure indicate frequent operations on the EEPROM, which reduces its service life. Therefore, you can modify some basic function parameters in the RAM through communication without storing them.

For parameters in group F, you can change F in higher bits of the parameter address into 0 to obtain the corresponding RAM address. For example, the communication RAM address of F3-12 is 0x030C.

For parameters in group A, you can change A in higher bits of the parameter address into 4 to obtain the corresponding RAM address. For example, the communication RAM address of A0-05 0x4005.

For parameters in group B, you can change B in higher bits of the parameter address into 5 to obtain the corresponding RAM address. For example, the communication RAM address of B0-05 is 0x5005.

For parameters in group C, you can change C in higher bits of the parameter address into 6 to obtain the corresponding RAM address. For example, the communication RAM address of C0-05 0x6005.

Parameter Groups	Access Address	Parameter Address in RAM
F0 to FE	0xF000 to 0xFEFF	0x0000 to 0x0EFF
A0 to AF	0xA000 to 0xACFF	0x4000 to 0x4CFF
B0 to BF	0xB000 to 0xBFFF	0x5000 to 0x5FFF
C0 to CF	0xC000 to 0xCFFF	0x6000 to 0x6FFF
H0 to H6	0x8000 to 0x88FF	-
U0 to U3	0x7000 to 0x73FF	-
L0 to LD	0x9000 to 0x9DFF	-

Note the following:

- Parameters in group FF cannot be read or modified
- Parameters in groups U0 and U2 are read-only; parameters in group U3 can be read and modified.
- 1000H, 2000H to 2004H, and 3000H are Modbus-specific communication addresses.

# 1.3 Modbus-specific Parameter Communication Addresses

Parameter Address	Parameter Description	Parameter Address	Parameter Description
1000H	Communication reference (decimal)	1010H	PID reference
1001H	Running frequency	1011H	PID feedback

Table 1–1 Modbus-specific parameter communication addresses

Parameter Address	Parameter Description	Parameter Address	Parameter Description
1002H	Bus voltage	1012H	PLC process
1003H	Output voltage	1013H	Pulse input frequency (unit:
			0.01 kHz)
1004H	Output current	1014H	Feedback speed (unit: 0.1 Hz)
1005H	Output power	1015H	Remaining running duration
1006H	Output torque	1016H	All voltage before correction
1007H	Running speed	1017H	Al2 voltage before correction
1008H	DI input flag	1018H	AI3 voltage before correction
1009H	DO output flag	1019H	Linear speed
100AH	AI1 voltage	101AH	Current power-on duration
100BH	AI2 voltage	101BH	Current running duration
100CH	AI3 voltage	101CH	Pulse input frequency (unit: 1
			Hz)
100DH	Count input	101DH	Communication reference
100EH	Length input	101EH	Actual feedback speed
100FH	Load speed	101FH	Main frequency X
-		1020H	Auxiliary frequency Y

Parameter Address		Parameter Description
Frequency reference 1 set through	1000H	Communication reference (decimal)
communication		-10000 to +10000
		The communication reference is a
		relative value (percentage). 10000
		corresponds to 100.00%, and –10000
		corresponds to -100.00%.
		The communication references apply
		when the frequency, torque upper
		limit, V/f separation voltage, PID
		reference, and PID feedback of the
		MD520 AC drive are set through
		communication.
		As for frequency data, the
		communication reference is a
		percentage of the maximum frequency
		(F0-10). As for torque data, the
		communication reference is a
		percentage of the torque upper limit
		(F2-10 for motor 1 and A2-48 for motor
		2).
Frequency reference 2 set through	7310H	The unit of the written data is Hz. The
communication		number of decimal places is consistent
		with that defined by F0-22. For
		example, if the decimal value 1000 is
		written, the frequency reference is
		10.00 Hz when F0-22 is set to 2.
Control command input to AC drive 1	7311H	0: Stop according to the stop mode
(write-only)		defined by F6-10
		1: Run in forward direction
		2: Run in reverse direction
		3: Jog in forward direction
		4: Jog in reverse direction
		5: Coast to stop
		6: Stop according to the stop mode
		defined by F6-10
		7: Reset upon fault
Control command input to AC drive 2	2000H	1: Run in forward direction
(write-only)		2: Run in reverse direction
		3: Jog in forward direction
		4: Jog in reverse direction
		5: Coast to stop
		6: Decelerate to stop
		7: Reset upon fault

Paramet	Parameter Description	
Read AC drive state 1	3000H	1: Running in forward direction 2: Running in reverse direction 3: Stopped 4: Auto-tuning 5: Faulty
Read AC drive state 2	7044H	Bit0: Running state Bit1: Forward/Reverse direction Bit2: Whether a fault occurs Bit3: Whether the output frequency reaches the frequency reference Bit4: Communication normal flag Bit5 to Bit7: Reserved Bit8 to Bit15: Fault code
Parameter lock password verification	1F00H	If the actual password value is returned, password verification is passed. (If password protection is disabled, that is, the password is 0, 0000H is returned.)
Parameter initialization	1F01H	1: Restore factory settings 4: Restore user parameters from backup 501: Back up current user parameters
DO control	2001H	Bit0: DO1 output control Bit1: DO2 output control Bit2: Relay 1 output control Bit3: Relay 2 output control Bit4: FMR output control Bit5: VDO1 Bit6: VDO2 Bit7: VDO3 Bit8: VDO4 Bit9: VDO5
AO1 control (write-only)	2002H	0 to 7FFF, indicating 0% to 100%
AO2 control (write-only)	2003H	0 to 7FFF, indicating 0% to 100%
Pulse output control (write-only)	2004H	0 to 7FFF, indicating 0% to 100%

Parameter Address		Parameter Description
AC drive fault description	8000H	2: Overcurrent
		5: Overvoltage
		8: Pre-charge power fault
		9: Undervoltage
		10: AC drive overload
		11: Motor overload
		12: Input phase loss
		13: Output phase loss
		14: Overheat
		15: External fault
		17: Pre-charge circuit exception
		18: Current sampling exception
		19: Motor auto-tuning exception
		20: Encoder/PG card exception
		21: EEPROM fault
		22: Encoder card not activated
		(To be continued)
Continued	Continued	Continued
		23: Output short-to-ground
		26: Accumulative running duration
		reach
		27: User-defined fault
		28: User-defined alarm
		29: Accumulative power-on duration
		reach
		30: Output load loss
		31: PID feedback loss during running
		32: Parameter exception
		40: Pulse-by-pulse current limit fault
		42: Excessive speed deviation
		43: Motor overspeed
		45: Motor overtemperature
		47: STO fault
		(To be continued)

Parameter Address		Parameter Description
Continued	Continued	Continued
		51: Pole position auto-tuning error
		55: Master-slave control fault
		56: Self-check fault 1
		57: Self-check fault 2
		58: Self-check fault 3
		59: Self-check fault 4
		61: Braking overload
		62: Braking transistor fault
		63: External alarm
		82: Pre-charge contactor fault
		85: Timing fault
		93: Motor control exception 1
		94: Motor control exception 2
		159: Auto reset fault
		160: Modbus timeout
		161: CANopen fault
		162: CANlink fault
		164: Expansion card fault
		174: Input exception protection

# 2 List of Communication Protocols

The MD520 series AC drive supports seven communication protocols in the form of external communication expansion modules. For details, see the following table.

Communication Protocol	Communication Hardware		
Modbus	External communication expansion modules	RS485 communication interface of MD520 series AC drive	
CANopen/CANlink		CN1 interface of MD520 series AC drive	
PROFINET		MD500-PN1 communication expansion card	
PROFIBUS DP		MD38DP2 communication expansion card	
EtherCAT		MD500-ECAT communication expansion card	
MD-SI-DP1		MD-SI-DP communication expansion card	
EtherNet/IP		MD500-EN1 communication expansion card	

# 3 Modbus Communication

### 3.1 Introduction

With the RS485 communication interface, the MD520 series AC drive connects as a communication slave to the PC/PLC control network with a single master and multiple slaves, which allows centralized control by using a PC or PLC. You can set the operation commands, modify or read parameters, and read the operating status and fault information of the AC drive through the communication protocol.

The AC drive supports the Modbus RTU and Modbus ASCII slave communication protocols. These protocols define the content and format of messages transmitted during serial communication. If the slave has an error upon receiving a message or fails to complete the action required by the master, it responds with a fault message to the master.

# 3.2 Networking and Interfaces

In a network with a single master and multiple slaves, one of the devices works as the communication master (typically a PC host controller, PLC, or HMI), and the other devices work as communication slaves. The communication master initiates communication actively to read or write to parameters of communication slaves, and the slaves respond to queries or communication operations from the master. At the same moment, either the master or the slave transmits data and the other can only receive data.

Each communication slave has a unique slave address, which ranges from 1 to 247.0 indicates the broadcast address.

#### **Communication Interface**

The MD38TX1 communication card required for Modbus communication is specially designed for the MD520 series AC drive to provide the RS485 communication function. It adopts the isolation scheme and its electrical parameters conform to international standards. You can use it as required to control operation and parameter setting of the AC drive through the remote serial interface. See the following figure.



Figure 3-1 Modbus communication interface

	Table 3–1 Function description of MD38TX1 terminals			
Terminal ID Terminal Name		Function	Terminal Layout	
J2	485+	RS485 communication signal (positive)	RS485 communication terminal with isolation input	485 + 485 - CGND
	485–	RS485 communication signal (negative)	RS485 communication terminal with isolation input	
	CGND	Reference ground of RS485 communication signal	Isolated power supply	

able 3–1	Function	description	of MD38TX1	terminals

Terminal	Terminal Name	Function	Jumper/DIP Switch
ID			Position
J3	RS485 communication terminal resistor setting	Connect the terminal resistor.	
	Jumper	Disconnect the terminal resistor.	•••

Table 3-2	lumner	on the	МОЗЯТХ1	expansion card
Table 3-2	Jumper	on the	MD201VT	expansion caru

The jumper setting is based on the top view of the expansion card with the main wir-

ing terminal as the bottom side. For the position of the jumper, see the PCB

silkscreen.

#### **Communication Networking**

1. RS485 topology

The following figure shows the RS485 bus topology. You are advised to use shielded twisted pairs for the RS485 bus and use twisted pair cables to connect RS485+ and RS485–. A 120  $\Omega$  terminal matching resistor is connected at both ends of the bus to prevent signal reflection. The reference grounds of RS485 signals on all nodes are connected together. A maximum of 128 nodes are supported and the distance between each node and the bus must be less than 3 m.



Figure 3-2 RS485 bus topology

2. Multi-node connection mode

When the number of nodes is large, the RS485 bus must be daisy-chained. If branch connection is required, it is recommended that the length of the cable between the bus and the node do not exceed 3 m. The shorter, the better. Never use the star topology. The following figure shows the frequently used bus structure.



Figure 3-4 Branch connection

It is recommended that the distance between the bus and the node do not exceed 3  $\,$  m.





- 3. Terminal wiring
  - Terminal wiring for nodes with CGND

MD38TX1 provides three cables, which connect to terminals RS485+, RS485–, and CGND respectively. Check that the RS485 field bus has these three cables and the wiring terminals are not connected reversely or incorrectly. If a shielded cable is used, connect the shield layer to CGND. Never connect the shield layer to any terminal except CGND, including the drive housing and grounding terminal.

Considering cable attenuation, you are advised to use AGW26 or thicker cables if the connection length is longer than 3 m. Always use twisted pair cables to connect RS485+ and RS485–.



- Recommended cable 1: Multi-core twisted pair cables. Use one twisted pair to connect RS485+ and RS485- and twist the remaining pairs into one to connect CGND.
- Recommended cable 2: Shielded twisted pair cables. Use the twisted pair cable to connect RS485+ and RS485– and use the shield layer to connect CGND.
- In occasions where shielded cables are used, connect the shield layer to CGND only. Never connect the shield layer to the ground.
- Terminal wiring for nodes without CGND For nodes without CGND, do not connect CGND or the shield layer to the PE terminal of the node directly. Do as follows:



- Method 1: Check whether another port on this node shares a common reference ground with the RS485 circuit. If yes, connect the CGND cable (the shield layer) of the bus directly to the pin.
- Method 2: Find the reference ground of the RS485 circuit on the PCB with the node and connect the drain wire to CGND or the shield layer.
- Method 3: If the reference ground of the RS485 circuit cannot be found, keep the CGND cable or the shield layer unconnected and use an extra grounding cable to connect this node to the PE terminal of other nodes.

### **Transmission Distance**

The maximum number of nodes and transmission distance of a standard RS485 circuit vary with the transmission rate, as listed in the following table.

Transmission Distance (m)	Rate (kbps)	Number of Nodes	Cable Diameter
100	115.2	128	AWG26
1000	19.2	128	AWG26

Table 3–3 Maximum number of nodes and transmission distance

# 3.3 Transmission Mode

The RS485 communication network adopts the asynchronous serial half-duplex transmission mode. Data is transmitted frame by frame in the form of packets agreed in the Modbus RTU protocol. An interval that is longer than the transmission time of 3.5 bytes on the communication data line marks the start of a new communication frame.



With built-in Modbus RTU slave communication protocol, the AC drive can respond to the query command from the master or act according to the query command and respond to communication data.

The master can be a personal computer (PC), an industrial control device, or a programmable logic controller (PLC). It can communicate with a slave separately, or send broadcast messages to all slaves. When the master sends a query command to a single slave, the slave is required to return a response frame. For a broadcast message sent by the master, no response from the slaves is required.

### 3.4 Data Frame Structure

The following figure shows the communication data format of the Modbus RTU protocol. The AC drive allows read-write operations on only word-type parameters. The communication read command is 0x03, the write command is 0x06, and the multi-write command is 0x10. Read-write operations on bytes or bits are not allowed.



In theory, the host controller can read a maximum of 12 consecutive parameters. However, it cannot read parameters across parameter groups. Otherwise, a response error will occur.





If a slave detects a communication frame error or reading/writing failure caused by other reasons, it returns an error frame.

# Note

No response is returned for CRC check error.

The slave read response error command is 0x83, the write response error command is 0x86, and the multi-write response error command is 0x90.



Table 3-4 Data frame fields

Frame header (START)	Idle time longer than the transmission time of 3.5 characters
Slave address (ADR)	Communication address range: 1 to 247
Command code (CMD)	03: Read slave parameters; 06: Write to slave parameters; 10: Multi-write to slave parameters
Parameter address (H)	Internal parameter address of the AC drive, in hexadecimal
Parameter address (L)	format; parameter type or non- parameter type (such as the running status and running command). For details, see the address definition. Low-order bytes follow high-order bytes during transmission.
Number of parameters (H)	Number of parameters read in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes
Number of parameters (L)	during transmission. This field is unavailable because this protocol allows only one parameter to be modified at a time.
Number of data bytes	Data length, which is twice the number of parameters
Data (H)	Response data or data to be written. Low-order bytes follow
Data (L)	high-order bytes during transmission.
CRC lower bits	Check value: CRC16 check value. Low-order bytes follow high-
CRC higher bits	order bytes during transmission. For details about the calculation method, see the description of CRC in this section.
END	Transmission time of 3.5 characters

#### CRC check:

The cyclical redundancy check (CRC) adopts the RTU frame format. A Modbus message includes a CRC-based error-check field, which checks content of the entire message. The CRC field is two bytes, containing a 16-bit binary value. It is added to

the message after being calculated by the TX device. The RX device recalculates a CRC value for the received message, and compares the calculated value with the CRC value in the received CRC field. If the two CRC values are inconsistent, a transmission error occurs.

The CRC is first stored to 0xFFFF. Then a process is invoked to process the consecutive 8-bit byte in the message and the value in the register. CRC is performed on only the eight bits in each character, but not the start bit, stop bit, and parity bit.

During CRC, each eight-bit character is XORed with the content in the register. The result is shifted to the least significant bit (LSB), and the most significant bit (MSB) is filled with 0. The LSB is extracted and checked. If the LSB is 1, the register is then XORed with a preset value. If the LSB is 0, no XOR is performed. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is XORed with the register's current value, and the process repeats for eight more shifts as described above. The final value of the register, after all the bytes in the message have been checked, is the CRC value.

When CRC is added in a message, high-order bytes follow low-order bytes. The CRC simple function is as follows:

unsigned int crc\_chk\_value (unsigned char \*data\_value, unsigned char length)

```
unsigned int crc value=0xFFFF;
int i:
while (length-)
{
crc_value^=*data_value++;
for (i=0:i<8:i++)
{
if (crc_value&0x0001)
{
crc_value= (crc_value>>1) ^0xa001;
}
else
crc_value=crc_value>>1;
}
}
return (crc_value);
```

}

Definition of communication parameter addresses:

The parameters can be read and written (except those which cannot be changed because they are only for factory use or monitoring).

# 3.5 Related Parameters

Pa rame ter	Parameter Name	Default Value	Value Range	Description
FD-00	RS485 baud rate	5005	Ones: Modbus O: 300 bit/s 1: 600 bit/s 2: 1200 bit/s 3: 2400 bit/s 4: 4800 bit/s 5: 9600 bit/s 6: 19200 bit/s 7: 38400 bit/s 8: 57600 bit/s 9: 11,5200 bit/s Tens: Reserved Hundreds: Reserved Hundreds: Reserved Thousands: CAN baud rate 0: 20 1: 50 2: 100 3: 125 4: 250 5: 500 6: 1M	This parameter defines the rate of data transmission between the host controller and the AC drive. A higher baud rate indicates faster communication. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
FD-01	RS485 data format	0	0: No check (8-N-2) 1: Even parity check (8-E- 1) 2: Odd parity check (8-O- 1) 3: No check (8-N-1) 4: No check (8-N-1) 4: No check (7-N-2) 5: Even parity check (7-E- 1) 6: Odd parity check (7-O- 1) 7: No check (7-N-1) (valid for Modbus)	Note that the data format set in the host controller must be the same as that set in the AC drive. Otherwise, communication will fail.

Table 3–5 Parameters related to Modbus communication

Pa rame ter	Parameter Name	Default Value	Value Range	Description
FD-02	RS485 local address	1	1 to 247	The uniqueness of the local address is the prerequisite for point-to-point communication between the host controller and AC drive.
FD-03	RS485 response delay	2	0 ms to 20 ms (valid for Modbus)	<ul> <li>This parameter defines the interval from when the AC drive finishes receiving data to when it sends data to the host controller.</li> <li>If the response delay is shorter than the system processing time, the system processing time prevails.</li> <li>If the response delay is longer than the system processing time, the AC drive sends data to the host controller only after the response delay elapses.</li> </ul>
FD-04	RS485 communica tion timeout time	0	0.0 (invalid) 0.1s to 60.0s	When this parameter is set to a valid value, the system reports the communication error Err160 if the interval between two consecutive communications exceeds the communication timeout time. It is set to 0.0s under normal circumstances. This parameter is used to monitor communication status in a system with continuous communication.

# 3.6 Communication Configurations

### 3.6.1 Configuration of RS485 Communication Between AC Drive and H5U

### Software Acquisition and Hardware Connection

- 1. Log in to the official website of Inovance (https://newweb.inovance.com/hc/ serviceSupport/download) to obtain the H5U programming software.
- 2. Connect RS485+ and RS485– on the H5U terminal to RS485+ and RS485– on the AC drive, as shown in the following figure.

	485+	485+	
H5U	485-	485-	MD520
	GND	GND	

Figure 3-6 Connecting communication interfaces

### **Master-Slave Configuration**

1. Open AutoShop, click "New Project", check that "Series and models" is H5U, and click "OK" to enter the programming interface.

2. Click COM on the left to go to the PLC configuration interface, select the protocol and data format, and click **"OK"**.

OM Settings			
Agreement Selecti	on	H/W Type	
MODBUS-RTU	master ~	RS485 ~	
Protocol Config			
Baud rate:	9600 ~		
Data length:	8Bits 🗸 🗸		
Parity:	None ~		
Stop bit:	2Bits ~		

3. Click COM , then click "Add Modbus Config" and "OK".

COM 🐨

\_\_\_\_\_ is displayed. Double-click <sup>(2)</sup> COM0 Modbus Config , and click "Add" on the displayed interface.

You can perform operations on a variable of the AC drive each time you click "New".

4. Write operation: After clicking "Add", select the "Slave NO." and "Trigger Mode" (typically Cycle).

 NO.
 Name
 Slave NO.
 Trigger Mode
 Trigger Conditions
 Function Code
 Slave addr...
 Quantity
 Mapped Addr.
 Repeat Hum

 1
 slave
 1
 Cycle(ms)
 ...
 1000
 Write Register(16)
 1000
 1
 ...
 DO
 1

As shown in the preceding figure, **Slave NO.** is **1**, indicating that the operation will be performed on slave 1. Set **Trigger Mode** to **Cycle** and **Function Code** to **Write Register**; otherwise, the write operation will fail. Set **Quantity** to **1**. The internal variables of the AC drive are all 16-bit data. If **Quantity** is set to **2**, the write operation will fail.

5. Read operation: After clicking **"Add"**, select the **"Slave NO."** and **"Trigger Mode"** (typically Cycle).

NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions	Function Code	Slave addr	Quantity	1	Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	1000	Write Register(16)	1000	1		DO	1
2	slave	1	Cycle(ms)	1000	Write Register(16)	2000	1		D2	1
3	slave	1	Cycle(ms)	1000	Read Register(03)	7002	1		D300	1
4	slave	1	Cvcle(ms)	1000	Read Register(03)	7003	1		D302	1

As shown in the preceding figure, **Slave NO.** is **1**, indicating that the operation will be performed on slave 1. Set **Trigger Mode** to **Cycle** and **Function Code** to **Read Register**; otherwise, the read operation will fail. Set **Quantity** to **1**. The internal variables of the AC drive are all 16-bit data. If **Quantity** is set to **2**, the read operation will fail. After the read and write settings, click **"OK"** to return to the programming interface.

#### Instances

1. Write the frequency (F0-03 is set to 9).

Data conversion: Multiply the desired frequency value a by 100, convert it to an integer, and then write it into 1000H.

The following figure shows the configuration and the program.

	Fun	otion Code		Slave addr	Quantity	, Mapp	ped Addr.	Repeat	Num
	Write	Register(1	6)	1000	1		DO	1	
T	DEMOL.	D208 Axis 1 HML input value	E100. 0	D108	]				
ļ	TMIG ]	D108	D10 K10000	ы ы	D10	K-10000	]—[ MOV	D10	
⊢	₩8000	DEMOL	D208	E100.0	D108	]			
		тила ]-	D108	DEMUL D208 E100.0	D108				
		ել ‹	D10	K10000	H >	D10	K-10000	н	MOV
Ne	t 2	Axis 1 — wri	te freque	noy					
$\vdash$	M8000	моv	D4	DO	]				

2. Implement start/stop control on the AC drive (F0-02 is set to 2).

Assign a value to the D component corresponding to the station address 2000H to control forward running, reverse running, and stop of the AC drive through communication. 2000H is defined as follows: 1

1: Run in forward direction; 2: Run in reverse direction; 3: Jog in forward direction; 4: Jog in reverse direction; 5: Coast to stop; 6: Decelerate to stop; 7: Reset upon fault

The following figure shows the configuration and the program.

	Function Code		Slave addr	Quantity	Mapped Addr.
W	Write Register(16)		2000 1		D2
-[	MOV	К1	D2 Axi: wor	s 1 control 1	]

The PLC soft component address corresponding to 2000H is D2. Therefore, to control the AC drive to run in forward direction through communication, write 1 to D2. Similarly, to control the AC drive to decelerate to stop, set D2 to 6.

3. Read the bus voltage.

Convert the bus voltage address U002 to 7002 based on the conversion rule (convert U in the high-order 2 bits to 7, and convert the low-order 2 bits to a hexadecimal equivalent). The actual bus voltage is the read bus voltage a divided

by 10. According to the communication configuration, the D component address of the bus voltage is D300. Convert D300 to a floating-point number and then divide this value by 10.

The following figure shows the configuration and the program.

	Funct	ion Code	Slave	addr	Quanti ty	Map	ped Addr.
Read Register(03)			70	)02	1		D300
Ţ	DFLT	D300 Axis 1 read UO-O2 value	D350	J			
L	DEDIV	D350	E10	D50 Actua	D ] 1 bus voltage		

4. Read the output voltage.

Convert the output voltage address U003 to 7003 based on the conversion rule. The read value is the actual output voltage. According to the communication configuration, you only need to move the value of D302 to another D component (or not).

The following figure shows the configuration and the program.

	Functi	on Code	Slave addr	Quantity	Mapped A	Addr.
	Read Reg	ister(03)	7003	1	D3	02
-[	жоу	D302 Axis 1 read VO-03 value	D502 Axis 1 ac output yo	] stual sltage		

5. Read the output current.

Convert the output current address U004 to 7004 based on the conversion rule. The actual output current is the read output current divided by 100.

F	unction C	ode	Slave addr	Quantity	Mapped Addr.	
Rea	d Register	r(03)	7004	1	D304	
T	DFLT	D304 Axis V0-04	D 1 read : value	354	3	
L	DEDIV	D354	E	100	D504 Axis 1 actua output curre	l nt

The following figure shows the configuration and the program.

6. Read the AC drive state.

Read 3000H to directly obtain the current state of the AC drive (1: Running in forward direction; 2: Running in reverse direction; 3: Stopped).

The following figure shows the configuration and the program.

	Function Code		Slave addr	Quantity	Map	oped Addr.
	Read Regist	er(03)	3000	1		D308
_					_	
-	MOV	D308	D3	58	Г	

7. Read the DI state.

Convert the DI state address U007 to 7007 based on the conversion rule, and convert the read value into a binary value. The LSB indicates DI1, the second bit indicates DI2, and so on.

Function Code			Slave addr	Quantity	Ma	pped Addr.
Read Register(03)			7007	1		D310
-[	MOV	D310 DI st	) atus	D360		]

8. Read the fault code.

Convert the fault code address U045 to 702D and convert the fault subcode address U046 to 702E based on the conversion rule.

The following figure shows the configuration and the program.

Function Code	Slave addr.(H)	Quantity	Mapped Addr.
Read Register(03)	702D	1	D312
Read Register(03)	702E	1	D314
	D362 master code	]	
L MOV D314 Fault :	D364	]	

#### **Common Problems and Solutions**

The must-dos are listed as follows:

- 1. Check the wiring. Check whether the wrong pins are wired as RS485+ and RS485– incorrectly.
- 2. Check whether the communication rate defined by FD-00 of the MD520 is consistent with that of the host controller.
- 3. Check whether the data format defined by FD-01 of the MD520 is consistent with that of the host controller.
- 4. Check whether the communication address defined by FD-02 (local address) of each device is unique to avoid conflicts caused by duplicated local addresses.
| Problem                          | Solution  |
|----------------------------------|---|
| Failure to write<br>frequency    | <ol> <li>Check F0-03 to confirm that the address in the configuration<br/>table is correct (when F0-03 is 0, the address is the address of<br/>F0-08; when F0-03 is 9, the address is 1000H or 7310H).</li> <li>Check whether the terminal resistor is ON. If not, switch on the<br/>terminal resistor and then power on the AC drive again.</li> </ol> |
| Failure to start the AC<br>drive | <ol> <li>Check that F0-02 is set to 2 (0: Operating panel; 1: Terminal; 2:<br/>Communication).</li> <li>Check whether the terminal resistor is ON. If not, switch on the<br/>terminal resistor and then power on the AC drive again.</li> </ol>   |
| Unstable connection              | <ol> <li>Check that wiring on the PLC end is reliable.</li> <li>Check that wiring on the AC drive end is reliable.</li> <li>Check that the signal cables are far away from the power cable.</li> </ol>  |
| Incorrect read value             | <ol> <li>Check that the configuration address is correct.</li> <li>Check whether the program performs data conversion.</li> <li>Make sure that the D component is not occupied.</li> </ol>  |

	Table 3–6	Common	problems	and	solutions
--	-----------	--------	----------	-----	-----------

# 3.6.2 Configuration of RS485 Communication Between AC Drive and AM600

The following configuration instance illustrates how to control forward/reverse running of the AC drive by using the AM600 series PLC.

### **Hardware Connection**

Ports:

• AM600 provides two RS485 ports. The two RS485 channels share the same DB9 interface. For details, see the following figure.

RS485 port on CPU module	Pin	Channel	Assignment	Function
	1		RS485-	Negative signal of the RS485 differential pair of COM0
	2	COM0 (RS485)	RS485+	Positive signal of the RS485 differential pair of COM0
	5		GND0	Power ground of COM0
	6		RS485-	Negative signal of the RS485 differential pair of COM1
	9	COM1 (RS485)	RS485+	Positive signal of the RS485 differential pair of COM1
	3		GND1	Power ground of COM1

• MD520 supports one RS485 interface, which is located on the MD38TX1 communication card, as shown in the following figure.



Hardware connection procedure:

1. Take COM1 as an example. Connect one end of the network cable to CN1 of AM600 through the DB9 terminal, strip the other end of the cable and connect the RS485+, RS485–, and GND0 wires to RS485+, RS485–, and GND terminals of the AC drive, as shown in the following figure.

	485+	485+	
AM600	485-	485-	MD520
	GND	GND	

2. Insert the terminal resistor jumper cap J3 on the expansion card to the right.

## **AC Drive Configuration**

Set the following parameters on the AC drive: Set F0-02 to 2 (set the command source to communication), and set F0-03 to 9 (set the main frequency reference source to communication).

Set the ones place of FD-00 to 5.

Set FD-01 to 0.

Set FD-03 to 2.

Set FD-04 to 0.0.

Record the address of FD-02. It is the station number of the AC drive.

#### **PLC Configuration**

1. Connect the PC and PLC by using a network cable or USB, open InoProShop, and create a new project.



2. Click Standard Project, change the project name and location, and click "OK".

🛍 New Project		>
Categories: Loranes Exercise (Pro-	Device           Add(1):0231-0800           Add(1):0231-08000           Add(1):0240000 <td>Language (Inducted Text (5)) Device</td>	Language (Inducted Text (5)) Device
Location: D:\0	1_MD800\06_AutoShop\InoProShop	×
		OK Cancel

3. Select AM600-CPU1608TP/TN, set Language to "Structured Text (ST)", and click "OK".



4. Click **"LocalBus Config"**, and click the CPU module. Since RS485 of COM0 is connected to the RS485 terminal of MD520 during the hardware connection step, select the Modbus master of COM0.



5. Click **"MODBUS\_COM0"** on the left, and set the baud rate, parity, and stop bit according to the settings of FD-01.

Distance in the				
MERCE_TANP     MORECE_TANP     MORECE_TANP     MORECE_TANP     MORECE_TANP	Modbus Master Configuration			
Device Diagnose     Metwork Configuration	Broadcast Communication Configuration	Serial Port Configuration		Modbus Master Configuration
LocalBus Config	Device Diagnose			Time between Frames(ms) 5
PLC Logic     PLC Logic     P O Application	Status	Baudrate	9600 🗸	
Library Manager	Information	Parify	NONE V	
B 🙀 Task Configuration		Data Bits	8	
H S MainTask		Stop Bits	2	
Resources List		TransmissionMode	● RTU ○ ASCII	
SoftMotion General Axis Pool     HIGH_SPEED_IO (High Speed IO M	lodu		\	
MODBUS_COM0 (Modbus Master)				

6. Double-click "Network Configuration" on the left, choose Serial Port > COM 0 on the right, and double-click MODBUS. A new slave device is displayed on the Modbus bus in the center of the screen. If there are multiple slaves, click MODBUS multiple times to generate multiple slaves.



7. Double-click the new Modbus slave, set the slave station number according to the setting of FD-02 of the AC drive. Record the value of the slave enable variable.

Devices 👻 🗘 🗙	Hardware Configuration	MODBUS_COMO 💥 Network Configuration 🕅 modbus_protocol 🗙
MD800_Test     MD800_Test     E-     Device (AM600-CPU 1608TP/TN)	Modbus Slave Configuration	Modeus RTI I/ASCTT
Device Diagnose     Network Configuration	Modbus Slave Communication Configuration	
LocalBus Config	Device Diagnose	Unit ID[1.247]: 1 T
Application	Status	Timeout (ms):
Library Manager     DLC_PRG (PRG)	Information	Slave Enable Variable:SM 1001
Task Configuration     S MainTask		
SoftMotion General Axis Pool		
- HIGH_SPEED_JO (High Speed IO Modu		
MODBUS_COM0 (Modbus Master)     modbus_protocol (Modbus Slave)		
MCDBUS_CCM0 (Modbus Master)     modbus_protocol (Modbus Slave)		

8. Write the PLC program: The slave enable variable is enabled; the frequency of the AC drive is set to 50 Hz; the PLC runs for 4000 scanning cycles; during the first 2000 scanning cycles, it controls the AC drive to run in forward direction, and during the last 2000 scanning cycles, it controls the AC drive to run in reverse direction; then it controls the AC drive to decelerate to stop. Note that the slave enable variable must be enabled.



9. Add configuration information on the **Modbus Slave Communication Configuration** tab page.

	Name	No 🔺	Access Type	Trigger	Variable	Read Offset	Len
Modbus Slave Communication							
Configuration							
Device Diagnose							
Status							
Information							
			1				

10. Configure the register in the displayed window. The control word read address of the AC drive is 3000H, the write address is 2000H, and the frequency address is 1000H.

Modbus Channel	Set	×
Channel Name	Channel 01	
Access Type	Write Single Register(Function Code Of	s) ~
Trigger	Cyclic v Cycle Time(ms)	100 🔹
Repeated	1	\$
Connent		
Read Register		
Offset	0x0000	
Length(WORD)	1	4 ¥
Error Handling	Keep Last Value	~
Write Register		
Offset	0x2000	
Length(WORD)	1	4
	OK	Cancel

Modbus Channe	l Set	×
Channel	1	
Nane	Channel 02	
Access Type	Read Holding Registers(Function Code 03) 🗸	
Trigger	Cyclic V Cycle Time(ns)	
Repeated	1	
Comment		
Read Register Offset Longth(#0PD)	0x3000	
Error Handlin	* V	
Write Register		
Offset	0x0000	
Length(WORD)	1	
	OE	]

11. On the **Internal I/O Mapping** tab page, map the variable in the PLC to the address of the AC drive.

Modbus Slave Configuration	Find		Filter Show a	I		•				
Modbus Slave Communication	Variable	Mapping	Channel	Address	Туре		Default Value	Unit	Description	
Configuration	⊕- <b>%</b>		Channel 02	%IW1	ARRAY [00] OF WORD				Read Holding Registers	
Device Diagnose	B- <b>1</b> 9		Channel 01	%QW1	ARRAY [00] OF WORD				Write Single Register	
Internal I/O Mapping		$\mathbf{i}$								
Status										
Information										
							Reset map	ping	Always update variables:	Enabled 1
	🍫 = Create new variable	🍅 = Ma	p to existing var	iable						

12. Select the variable to be mapped.

nput Assistant					
Text Search Categories					
Variables	<ul> <li>Name</li> </ul>	Туре	Address	Origin	
	🗏 🔘 Application	Application			
	E PLC_PRG	PROGRAM			
	🧳 counter	INT			
	🧳 pinlv	INT			
	🖤 🌵 start	INT			
	🗷 🎒 IoConfig_Globals	VAR_GLOBAL			
	🕏 🚞 SDElement				
		Library		SM3_Basic, 4.2.2.0 (	
		Library		SM3_Math, 4.2.0.0 (	
	🖻 🚞 SMElement				
Structured view			<u>F</u> ilter	None	$\sim$

13. Compile the program to check whether there are errors. If no error is found, log in to the PLC, download the program, and click **Execute** to execute the program.

even v v x Prc_PRG x	*	ToolBax	
3 8.0.51 . PROCESN PLC_PRG	E	Search v 🖿	32 0 -
E Device (AM600-CPU1608TP/Th)		Hy Favorite	
Oevice Diagnose     4 pinlw: INT:		d Basic Instructions	
<ul> <li>K Network Configuration</li> <li>S counter (1977)</li> </ul>		A 🍙 ST Sentence	
The Deliver State		<ul> <li>b.</li> </ul>	Proof.
- Structure		• FOR	breet."
- C Appecion		<ul> <li>WH3.8</li> </ul>	broort "
		<ul> <li>CASE</li> </ul>	Stoert "
R 20 Test Conference		<ul> <li>REPEAT</li> </ul>	Stoort "
C 20 Mar Tank		<ul> <li>CONTINUE</li> </ul>	Jump bi
- df) PLC PRG		0.000	Jump to
□ 公果供用本	A 7 10 10 10 10 10 10 10 10 10 10 10 10 10	0 001	Jump o
SofMoton General Axe Pool pinly:+5000;		<ul> <li>A Desir Desetions</li> </ul>	-
<ul> <li>HS2H_SPEED_JD (High Speed 30 Module)</li> <li>cocaster ==cocaster +1)</li> </ul>		N Ca Trees	
MODELS_TCP (HodbusTCP Device) 4 11 counter > 2000 TIREN		* 🦕 Counters	
ELSE		N 🦕 Hath Functions	
7 start80520(=2)		× 🍙 Data Process	
0 _ 130_17		🛪 油 Data Conversion	
2 10 11 TE COMPANY & 4000 TEM		× 油 Data Shiftment	
11 counter:=0:		🛪 🧽 Selection	
12 <b>ISD_IP</b>			
13			
15 [] IF counter > 40000 THE			
14 #EastHD6201+5)			
17 130_17			
10			
		<	>
		) Expanded Instructi	2015
		Hotion Control	
		High Speed I/O In	fuctions
		CANopen Motion Co	atrol
		Communication	
YOUR TO DEVICE	100 % (A)	F 6 8 X	

# 4 CANopen & CANlink Communication

# 4.1 Introduction

The CANopen communication protocol is an international standard protocol. The CANlink communication protocol is a dedicated protocol independently developed by Inovance based on CAN bus application. This protocol can be used for communication with only Inovance PLCs such as H2U, H3U, and AM600.

## **Communication Model**

CANopen is an application layer protocol of network transmission system based on the CAN serial bus. The CAN bus follows an ISO/OSI standard model. This protocol defines the data link layer and some physical layers in the OSI model. It allows the multi-master mode, in which any node in the network can send a message to other nodes. Network nodes are assigned with different priorities based on system realtime requirements, which can reduce the bus arbitration time in case of a transmission collision. The CAN network adopts communication data block coding instead of traditional address coding. With data block coding, the number of nodes in the network is not limited theoretically, and different nodes can receive the same data at the same time. This coding mode also features short transmission byte, high speed, great fault tolerance, and reliable data transmission, making it suitable for industrial control and distributed real-time control. The following figure shows a CANopen equipment model.



Figure 4-1 CANopen communication model

The following introduces the object dictionary, common communication objects, and CANopen message format in the CANopen communication model.

### **Protocol Features**

CANopen supports six protocols:

- NodeGuard protocol, which enables the master to query device status
- Heartbeat protocol, which enables the slave to report its current state to the master regularly
- Accelerated transmission mechanism of Service Data Object (SDO) (one parameter or one object dictionary is transmitted at a time)
- Four TPDOs and four RPDOs
- Emergency objects

• Sync mode

## **Object Dictionary**

The object dictionary is an ordered set of parameters and variables. It is essentially a grouping of objects accessible through the network in an ordered predefined fashion. It includes all parameters of device profile and device network state.

Each object within the object dictionary is addressed using a 16-bit index and a 8-bit sub-index. A master node or configuration tool can access all values in the object dictionary of a slave node. The following figure shows the structure of the object dictionary.

Index	Object
000	Unused
0001—001F	Static data type (standard data type such as Boolean and Integer 16)
0020—003F	Complex data type (predefined structure consisting of simple types, such as PDOCommPar and SDOParmeter
0040—005F	Complex data type specified by the manufacturer
0060—007F	Static data type specified by the device profile
0080—009F	Complex data type specified by the device profile
00A0-0FFF	Reserved
1000—1FFF	Communication profile area (such as device type, error register, and supported PDO quantity)
2000—5FFF	Manufacturer-specific profile area
6000—9FFF	Standard device profile area (such as "DSP-401 I/O module device profile": Read State 8 Input Lines)
A000—FFFF	Reserved

Figure 4-2 Structure of object dictionary

## **Commonly-used Communication Objects**

CANopen provides multiple communication objects, each of which has different characteristics and applies to different applications. It uses predefined communication object identifiers (COB-IDs). The rules are as follows:

- NMT object: 0x000
- SYNC object: 0x080
- SDO object: Transmit SDO — 0x600+Node-Id

Receive SDO — 0x580+Node-Id

- PDO object: RPDO1 — 0x200+Node-Id
  - RPDO2 0x300+Node-Id
  - RPDO3 0x400+Node-Id
  - RPDO4 0x500+Node-Id

TPDO1 — 0x180+Node-Id

TPDO2 — 0x280+Node-Id

TPDO3 — 0x380+Node-Id

TPDO4 — 0x480+Node-Id

• EMCY object: 0x80+Node-Id Node-Id: Device ID (station address), which is defined by FD-02

Communication objects are defined as follows:

- Network management (NMT) object NMT objects include boot-up messages, the heartbeat protocol, and NMT messages. Based on the master/slave communication mode, NMT is used to manage and monitor all nodes in the network, implementing node state control, error control, and node startup.
- Service data object (SDO)

SDO enables a client to access object dictionary entries using an index and subindex. SDO is implemented via the CAN-based message specification (CMS) object of multi-domain at the CAN application layer (CAL), and can transmit data of any length (segmented into several messages when the data length exceeds four bytes). The SDO protocol produces a response for every request. The SDO request and response always contain eight bytes.

• Process data object (PDO)

PDO is used to transmit real-time data from one node to one or multiple nodes. The data length ranges from one to eight bytes. Each CANopen device has eight default PDO channels, that is, four TPDOs and four RPDOs. PDOs can be sent synchronously or asynchronously, determined by the PDO communication parameters. The content in a PDO message is predefined, determined by the PDO mapping parameters.

 Synchronization object (SYNC) The SYNC object is the message periodically broadcast by the CANopen master to the CAN bus to provide the basic network clock signal. Each device can determine whether to use the object to synchronize with other network devices based on its own configuration.

### **CANopen message format**

NMT module control message

Only an NMT master node can send NMTModuleControlNMT messages. For details about the message format, see "*Table 4–1 NMT message format*" on page 47. COB-ID is fixed at 0x000. Data0 is the command word, which occupies one byte. See "*Table 4–2 NMT message command format*" on page 47. Data1 is the CANopen

network device address, which occupies one byte. When it is 0, the message is a broadcast message for all slave devices in the network.

For example, the command for setting a device with device address "6" to operable state is "0x0000x010x06".

COB-ID	RTR	Data0	Data1
0x000	0	Command word	Node ID

Table 4–1 NMT message format

Command	Description
0x01	Start the remote node.
0x02	Stop the remote node.
0x80	Enter pre-operation state.
0x81	Reset the node.
0x82	Reset communication.

Table 4–2 NMT message command format

## NodeGuarding message

With the NodeGuarding service, the NMT master can check the current state of all nodes. This service can detect whether data transmission of the nodes is available.

The standard protocol objects 0x100C and 0x100D respectively set the guard time and the guard time multiplicative factor, which together determines the node guarding time period.

"Table 4–3 Frame sent by the NodeGuarding master" on page 47 describes the remote frame sent by the NMT master.

Table 4–3 Frame sent by the NodeGuarding master

COB-ID	RTR
0x700+Node-ID	1

"Table 4–4 Response message returned by the NodeGuarding slave" on page 47 is the response message returned by the NMT slave. "Table 4–5 Status word returned by the NodeGuarding slave" on page 48 describes the status word in the one-byte format.

Table 4–4 Response message returned by the NodeGuarding slave

COB-ID	RTR	Data0
0x700+Node-ID	0	Status word

Data Bit	Description
Bit7	0 or 1 alternative
Bit6 to bit0	State: 4: Stopped 5: Operational 127: Pre-operational

Table 4–5 Status word returned by the NodeGuarding slave

• Heartbeat message

A node can be configured to produce periodic messages, called heartbeat messages, as described in *"Table 4–6 Heartbeat message" on page 48*, in which bit7 is 0, and bit6 to bit0 are the same as those of the NodeGuarding message. The heartbeat time is defined by the standard protocol object 0x1017. A node cannot support both the NodeGuarding and Heartbeat protocols.

Table 4–6 Heartbeat message

COB-ID	RTR	Data0
0x700+Node-ID	0	Status word

# 4.2 Networking and Interfaces

### **Communication Interface**

The MD38CAN1 card is a communication expansion card designed for CANopen/ CANlink communication of the MD520 series AC drives. It enables the AC drive to access the high-speed CANopen/CANlink communication network and implements control of the field bus.



Figure 4-3 MD38CAN1 terminal layout

Table 4–7 Function description	of MD38CAN1 terminals
--------------------------------	-----------------------

Term	inal ID	Terminal	Function	Terminal Layout
		Name		
CN1	CANH	Positive CAN input	Connect to the positive end of the CAN bus.	CANH CANL CGND
	CANL	Negative CAN input	Connect to the negative end of the CAN bus.	
	CGND	Power ground	Connect to the reference ground of all CAN nodes.	

Terminal ID	Terminal Name	Function	Jumper/DIP Switch Position
	CAN terminal resistor	Connect the terminal resistor.	
		Disconnect the terminal resistor.	•

Table 4–8 Jumper on the MD38CAN1 expansion card

The jumper setting is based on the top view of the expansion card with the main wiring terminal as the bottom side. For the position of the jumper, see the PCB

silkscreen.

## **Communication Networking**

1. CAN bus topology

The following figure shows the CAN bus topology. You are advised to use shielded twisted pairs for the CAN bus and use twisted pair cables to connect CANH and CANL. A 120  $\Omega$  terminal matching resistor is connected at both ends of the bus to prevent signal reflection. The reference grounds of CAN signals on all nodes are connected together. A maximum of 64 nodes are supported and the distance between each node and the bus must be less than 0.3 m.



Figure 4-4 CANlink bus topology

The following figure shows the recommended usage of different field cables.



#### **Transmission Distance**

The CANopen/CANlink bus transmission distance is directly related to the baud rate and communication cable. The following table describes the relationship between the maximum bus length and the baud rate.

Baud Rate (bit/s)	Length (m)
1M	25
500k	100
250k	250
125k	500
100k	500
50k	1000
20k	1000

Table 4–9 Relationship	between the bus	length and baud rate
		0

# 4.3 Related Parameters

Parameter	Parameter	Default Value	Value Range	Description
	Name			
FD-00	Baud rate	5005	Ones: Modbus 0: 300 bit/s 1: 600 bit/s 2: 1200 bit/s 3: 2400 bit/s 4: 4800 bit/s 5: 9600 bit/s 6: 19200 bit/s 7: 38400 bit/s 8: 57600 bit/s 9: 11,5200 bit/s Tens: Reserved Hundreds: Reserved Thousands: CAN baud rate 0: 20 1: 50 2: 100 3: 125 4: 250 5: 500 6: 1M	This parameter defines the rate of data transmission between the host controller and the AC drive. A higher baud rate indicates faster communication. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
FD-02	Local address		1 to 247	The uniqueness of the local address (except the broadcast address) is the prerequisite for point-to-point communication between the host controller and AC drive. In the same network, all station numbers must be unique. Otherwise, communication will fail.

Table 4–10 Related parameters

Parameter	Parameter	Default Value	Value Range	Description
FD-10	Name Communication protocol	2	1: CANopen 2: CANlink	This parameter defines the CAN communication protocol. The value 1 indicates CANopen communication. The value 2 indicates CANlink communication.
FD-14	Number of CAN frames received per unit time	0	0 to 65535	This parameter is used to monitor the bus load. It defines the number of CAN frames received by the station per second.
FD-15	Maximum value of node RX error counter	0	0 to 65535	This parameter is used to monitor bus errors. It defines the maximum value of the CAN RX error counter of the node.
FD-16	Maximum value of node TX error counter	0	0 to 65535	This parameter defines the maximum value of the TX error counter of the node.
FD-17	Node bus-off count	0	0 to 65535	This parameter is used to monitor bus errors. This parameter defines the CAN bus-off count of the node.
FD-19	CAN communication disconnection coefficient	3	1 to 15	This parameter defines the CAN communication disconnection coefficient.

# 4.4 Application

## 4.4.1 Data Frame Structure

The AC drive parameters specify the mapping mode between parameters and object dictionary indexes, which facilitates operations on the parameters.

Mapping between the parameters and CANopen object dictionary indexes is described as follows:

• Mapping mode

The parameter groups of the AC drive correspond to the indexes 0x2000-0x20FF of the CANopen object dictionary. To be specific, the high-order 16 bits of a parameter address plus 0x2000 is the index of the object dictionary, and the low-order 16 bits plus 1 is the sub-index of the object dictionary.

Take the drive parameter F0-03 as an example. Its communication address is 0xF003, and the corresponding object dictionary index is 0x20F0, and the subindex is 0x04.

• Mapping

The AC drive has seven parameter groups: F0 to FF, A0 to AF, B0 to BF, C0 to CF, H0 to HF, L0 to LF, and U0 to UF.

The following table describes the mapping between the parameter groups and the object dictionary indexes.

Parameter Groups	CANopen Object Dictionary Index
F0 to FF	0x20F0 to 0x20FF
A0 to AF	0x20A0 to 0x20AF
B0 to BF	0x20B0 to 0x20BF
C0 to CF	0x20C0 to 0x20CF
H0 to HF	0x2080 to 0x208F
U0 to UF	0x2070 to 0x207F
L0 to LF	0x2090 to 0x209F

Table 4–11 Mapping between parameter groups and object dictionary indexes

A sub-index is the low-order 16 bits of a parameter address plus 1. The following table describes the mapping between parameter indexes in a group and the object dictionary sub-indexes.

Table 4–12 Mapping between parameter indexes in a group and object dictionary subindexes

Parameter Index	CANopen Object Dictionary Index
0x0 to 0xFE	0x1 to 0xFF

## 4.4.2 Operation Instance (SDO)

Take reading F0-17 as an example. The parameter address is 0xF011, the corresponding object dictionary index is 0x20F0, and the sub-index is 0x12.

1. The communication master uses the CANopen SDO to perform the read operation on the AC drive. The following table describes the format of data sent by the master.

Take F0-02 as an example. The index is 0x20F0, and the sub-index is 0x03.

CAN F	rame	CANopen Data	Description
COB-ID	11-bit ID	0x600+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Command code (0x40)	0x40 read command
	DATA1	Low-order byte of index	Parameter group (0xF0 for group F0)
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Reserved "0"
	DATA5	Data 2	Reserved "0"
	DATA6	Data 3	Reserved "0"
	DATA7	Data 4	Reserved "0"

Table 4–13 SDO sent during the read operation

 The slave returns a response message. The following table describes the data format of the SDO returned by the slave during the read operation. If the operation is successful, the return value of the command code is "0x4B"; the index remains unchanged; DATA4 and DATA5 are the read data; and DATA6 and DATA7 are 0.

If the operation fails, the return value of the command code is "0x80"; the index remains unchanged; DATA4, DATA5, DATA6, and DATA7 are the SDO operation failure error code.

Table 4–14 SDO returned during the read operation

CAN Fr	ame	CANopen Data	Description
COB-ID	11-bit ID	0x580+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"

CAN F	rame	CANopen Data	Description
8-byte frame data	DATA0	Return value of the command code	Success: 0x4B Failure: 0x80
	DATA1	Low-order byte of index	Parameter group (0xF0 for group F0)
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Low-order byte of data
	DATA5	Data 2	High-order byte of data
	DATA6	Data 3	Success: 0
	DATA7	Data 4	Failure: SDO operation failure error code

Perform the write operation on the AC drive by using the SDO.
 The master uses the CANopen SDO to perform the write operation on the AC drive.
 The following table describes the format of data sent by the master.

CAN F	rame	CANopen Data	Description
COB-ID	11-bit ID	0x600+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Command code	0x2B
	DATA1	Low-order byte of index	Parameter group (0xF0 for group F0)
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Low-order byte of data
	DATA5	Data 2	High-order byte of data
	DATA6	Data 3	Reserved "0"
	DATA7	Data 4	Reserved "0"

Table 4–15 SDC	sent during the	write operation
----------------	-----------------	-----------------

4. The slave returns a response message. The following table describes the data format of the SDO returned by the slave during the write operation. If the operation is successful, the return value of the command code is "0x60"; the index remains unchanged; DATA4, DATA5, DATA6, and DATA7 are 0.

If the operation fails, the return value of the command code is "0x80"; the index remains unchanged; DATA4, DATA5, DATA6, and DATA7 are the SDO operation failure error code.

CAN Fra	me	CANopen Data	Description
COB-ID	11-bit ID	0x580+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Return value of the command code	Success: 0x60 Failure: 0x80
	DATA1	Low-order byte of index	Parameter group (0xF0 for group F0)
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Success: 0
	DATA5	Data 2	Failure: SDO operation
	DATA6	Data 3	failure error code
	DATA7	Data 4	Reserved "0"

5. Perform read and write operations on the AC drive.

The following takes the read and write operations on F0-02 as an example. The CANopen address of the AC drive is 0x06.

Read the AC drive command source (F0-02).

The master reads the AC drive parameter F0-02 (command source selection). The following table describes the CANopen message sent from the master when reading the AC drive parameter F0-02 (command source).

Table 4–17 Message sent from the master to read F0-02

Message ID (Hex)	RTR	Data (Hex)
0x606	0	40F020030000000

6. The AC drive returns a CANopen response message, as described in the following table.

The current value of F0-02 is 0x0002, indicating that the current command source of the AC drive is communication control.

Table 4–18 Message returned by the AC drive when reading F0-02

Message ID (Hex)	RTR	Data (Hex)
0x586	0	4BF0200302000000

7. Set the command source (F0-02) to the operating panel.

To set the command source to the operating panel, write 0 to F0-02. The master sends a CANopen message as described in the following table.

Message ID (Hex)	RTR	Data (Hex)
0x606	0	2BF020030000000

Table 4-19 Message sent from the master to write to F0-02

8. The AC drive returns a CANopen response message, as described in the following table. The value of F0-02 is changed to 0, indicating that the current command source is the operating panel.

Table 4–20 Message returned by the AC drive when writing to F0-02

Message ID (Hex)	RTR	Data (Hex)
0x586	0	60F020030000000

## 4.4.3 Operation Instance (PDO)

The AC drive supports four RPDOs (RPOD1, RPDO2, RPDO3 and RPDO4) and four TPDOs (TPOD1, TPDO2, TPDO3 and TPDO4), which can be configured as needed.

You can configure the PDO mapping for a slave by using the operating panel. You are advised to use the CANopen master to configure a mapping. PDO mapping can be configured by manually modifying parameters in group AF. The following table describes PDO mapping.

RPDO	Address of F Grou	Parameter in Jp AF	TPDO	Address of F Grou	Parameter in Jp AF
RPDO1	Sub-index 1	AF-00	TPDO1	Sub-index 1	AF-32
		AF-01			AF-33
	Sub-index 2	AF-02		Sub-index 2	AF-34
		AF-03			AF-35
	Sub-index 3	AF-04		Sub-index 3	AF-36
		AF-05			AF-37
	Sub-index 4	AF-06		Sub-index 4	AF-38
		AF-07			AF-39
RPDO2	Sub-index 1 AF-08 TPDO2 Sub-index AF-09	Sub-index 1	AF-40		
		AF-09			AF-41
	Sub-index 2	AF-10		Sub-index 2	AF-42
		AF-11			AF-43
	Sub-index 3	AF-12		Sub-index 3	AF-44
		AF-13			AF-45
	Sub-index 4	AF-14		Sub-index 4	AF-46
		AF-15			AF-47

RPDO	Address of I	Parameter in	TPDO	Address of Parameter in		
	Grou	ıp AF		Group AF		
RPDO3	Sub-index 1	AF-16	TPDO3	Sub-index 1	AF-48	
		AF-17			AF-49	
	Sub-index 2	AF-18		Sub-index 2	AF-50	
		AF-19			AF-51	
	Sub-index 3	AF-20		Sub-index 3	AF-52	
		AF-21	-		AF-53	
	Sub-index 4	AF-22		Sub-index 4	AF-54	
		AF-23			AF-55	
RPDO4	Sub-index 1	AF-24	TPDO4	Sub-index 1	AF-56	
		AF-25			AF-57	
	Sub-index 2	AF-26		Sub-index 2	AF-58	
		AF-27			AF-59	
	Sub-index 3	AF-28		Sub-index 3	AF-60	
		AF-29			AF-61	
	Sub-index 4	AF-30		Sub-index 4	AF-62	
		AF-31			AF-63	

Each PDO can be configured with four mappings. To configure one mapping, you need to operate on two parameters in group AF to implement 32-bit data, of which the high-order 16 bits (with a smaller parameter No,) are the object dictionary index, and the low-order 16 bits (with a larger parameter No.) are the object dictionary subindex and object length. The object length is calculated in bits. The mapping object format is as follows: 311615870.

Index	Sub-index	Object Length
High-order bits of the	Low-order bits of the	-
parameter in group AF	parameter in group AF	

To map a parameter to a PDO, you need only to write the object dictionary index and sub-index corresponding to the parameter as well as the data length to the parameter in group AF based on the preceding rules.

For example, to configure two mappings for RPDO1, one points to F0-01 and the other is an object dictionary object 0x6060-00, do as follows:

Assumed	Address of	Content	Remarks
Address	Parameter in		
	Group AF		
F0-01	AF-00	0x20F0	Parameter address index Equal to group No. F0 + 0x2000
	AF-01	0x0210	High-order bits (02): Parameter group No. offset + 1 Low-order bits (10): 16-bit parameter length
0x6060-00	AF-02	0x6060	Object dictionary index
	AF-03	0x0008	High-order bits (00): Object dictionary sub- index Low-order bits (08): 8-bit object length

# Note

The write operation, whether through the software tool or the operating panel, must be done before CANopen remote node is started.

# 4.5 Communication Configurations

# 4.5.1 Configuration of CANlink Communication Between AC Drive and H5U

## Software Acquisition and Hardware Connection

- 1. Log in to the official website of Inovance (https://newweb.inovance.com/hc/ serviceSupport/download) to obtain the H5U programming software.
- 2. Connect the H5U to the CN1 interface of the MD38CAN1 expansion card installed on the MD520 using twisted pair cables.



Figure 4-5 Connecting communication interfaces

## **Master-Slave Configuration**

1. Open AutoShop, click "New Project", check that "Series and models" is H5U, and click "OK" to enter the programming interface.

2. Click I CAN(CANLink) on the left, set as follows, and click "OK".

Protocol: Select CANlink.

**Station No.**: Select **Upper computer setting**. (Note that the CANlink station number of the PLC cannot be the same as that of the AC drive.)

**Baud Rate**: Select **Upper computer setting**. (The communication baud rate must be consistent with the baud rate of the AC drive.)

3. Click 🚼 CAN(CANLink), and click "AddCAN Config". CANlink Config is displayed. Double-click "CANlink Config", click "Next" on the displayed interface,

and then set as follows on the pop-up interface.

- a. Set the slave type to MD (AC drive).
- b. Set the slave number according to that defined by FD-02 of the AC drive.
- c. Set the state register and start/stop component to 7000 and 6000.
- d. Click "Add", and click "Finish".

In this way, a slave is added. If there are multiple shafts, repeat the preceding steps after clicking **"Add"**.

4. After adding the slave, select the PLC to configure the D component to write to the AC drive.

Station number	Device type
63	Host(H5U Series)
1	MD (Frequency Converter)
2	MD (Frequency Converter)

Host (63) Config

Send Config Receive Config Synchronous Write													
	NO.	Trigger Mode	Trigger	Send S	Station	Send	Register	Receiv	ver Station	Receive	Register	Length	Г
	1	Time(ms)	10	63	HOST (HEU)	0	Dec	1	MD (Frequency	1000	Hex	1	1
	2	Time(ms)	10	63	HOST (H5V)	2	Dec	1	MD (Frequency	2000	Hex	1	
	3	Time(ms)	10	63	HOST (HEU)	100	Dec	2	MD (Frequency	1000	Hex	1	
	4	Time(ms)	10	63	HOST (HEU)	102	Dec	2	MD (Frequency	2000	Hex	1	
	C C			62	UDGE (UCII)		n						

As shown in the preceding figure, assign the value of D2 to the control word address of the AC drive with the station number 1, and assign the value of D102 to the control word address of the AC drive with the station number 2. (Write to the corresponding register address as required, and make sure that the RX register address is correct and writable; otherwise the write operation will fail.)

5. Select the station (AC drive) to read to configure the D component to read the AC drive.

To read station 1, click number 1 to start configuration. To read station 2, click number 2 to start configuration. You cannot read the required value correctly if the station number is incorrect.

r Length
1
1
1
:e

As shown in the preceding figure, send the bus voltage, output voltage, and output frequency of the AC drive to D300, D302, and D304 of the PLC. Configure the TX register address and D component correctly as needed. After the read and write settings, keep clicking **"OK"** until you return to the programming interface.

#### Instances

1. Write the frequency (F0-03 is set to 9).

Data conversion: Multiply the desired frequency value a by 100, convert it to an integer, and then write it into 1000H.

The following figure shows the configuration and the program.

	63	HOST (H5U)	O De	20	1	MD (Freq	1000 <b>ju</b>	Hex		1
7	DEMUL.	D208	E100.0	D108		]				
÷	DINT	input value D108	D10	]						
L	<	D10	K10000	н	>	D10	K-10000	н	MOV	D10

2. Implement start/stop control on the AC drive (F0-02 is set to 2).

Assign a value to the D component corresponding to the station address 2000H to control forward running, reverse running, and stop of the AC drive through communication. 2000H is defined as follows:

1: Run in forward direction; 2: Run in reverse direction; 3: Jog in forward direction; 4: Jog in reverse direction; 5: Coast to stop; 6: Decelerate to stop; 7: Reset upon fault

The following figure shows the configuration and the program.



The PLC soft component address corresponding to 2000H is D2. Therefore, to control the AC drive to run in forward direction through communication, write 1 to D2. Similarly, to control the AC drive to decelerate to stop, set D2 to 6.

3. Read the bus voltage.

Convert the bus voltage address U002 to 7002 based on the conversion rule (convert U in the high-order 2 bits to 7, and convert the low-order 2 bits to a hexadecimal equivalent). The actual bus voltage is the read bus voltage a divided by 10. According to the communication configuration, the D component address of

the bus voltage is D300. Convert D300 to a floating-point number and then divide this value by 10.

The following figure shows the configuration and the program.

	1	MD	(Frequ	7002	Hex	63	HOST (HE	5V) 30	0	Dec	1	
T	-	DFLT	D30 Axi V0+	DO s 1 read O2 value	D350		]					
Ļ	-	DEDIV	D38	50	<b>E</b> 10		D500 Actual	bus volta	]			

4. Read the output voltage.

Convert the output voltage address U003 to 7003 based on the conversion rule. The read value is the actual output voltage. According to the communication configuration, you only need to move the value of D302 to another D component (or not).

The following figure shows the configuration and the program.

	1	MD	(Frequ	7003	Hex		63	HOST (H5U)	302	Dec	1
-[	:	MOV	D302 Axis V0-03	1 read value		D502 Axis 1 output	actual voltage	]			

5. Read the output current.

Convert the output current address U004 to 7004 based on the conversion rule. The actual output current is the read output current divided by 100.

1 MD (Frequ 63 HOST (H5V) 7004 Hex 304 Dec 1 D354 DFLT D304 ] Axis 1 read UO-04 value DEDIV D354 E100 D504 ] Axis 1 actual output current

The following figure shows the configuration and the program.

6. Read the AC drive state.

Read 3000H to directly obtain the current state of the AC drive (1: Running in forward direction; 2: Running in reverse direction; 3: Stopped).

The following figure shows the configuration and the program.

	1 10	) (Frequ	3000	Hex	63	HOST (H5V)	308	Dec	1	
-[	MOV	D308		D358	J					

7. Read the DI state.

Convert the DI state address U007 to 7007 based on the conversion rule, and convert the read value into a binary value. The LSB indicates DI1, the second bit indicates DI2, and so on.

The following figure shows the configuration and the program.

	1	MD (Frequ	7007	Hex	63	HOST (H5U)	310	Dec	1	
-[	моv	D310 DI statu	s	D360	]					

8. Read the fault code.

Convert the fault code address U045 to 702D and convert the fault subcode address U046 to 702E based on the conversion rule.

The following figure shows the configuration and the program.

1	MD	(Frequ	702D	Hex	63	HOST (H5U)	312	Dec	1
1	MD	(Frequ	702 <b>E</b>	Hex	63	HOST (H5U)	314	Dec	1
T	MOV	D312 Fault mast	ter code	D362	ן				
Ļ	MOV	D314 Fault subc	:ode	D364	]				

### **Common Problems and Solutions**

The must-dos are listed as follows:

- 1. Check the wiring. Check whether the wrong pins are wired as CANH and CANL to the PLC.
- 2. Check the value of FD-10. 1 indicates CANopen and 2 indicates CANlink.
- 3. Check whether the CAN communication baud rate defined by FD-00 is consistent with that of the PLC.
- 4. Check whether the CAN station number defined by FD-02 is unique to avoid conflicts with other AC drives.

Problem	Solution
Failure to write frequency	<ol> <li>Check F0-03 to confirm that the address in the configuration table is correct (when F0-03 is 0, the address is the address of F0-08; when F0-03 is 9, the address is 1000H or 7310H).</li> <li>Check whether the terminal resistor is ON. If not, switch on the terminal resistor and then power on the AC drive again.</li> </ol>
Failure to start the AC drive	<ol> <li>Check that F0-02 is set to 2 (0: Operating panel; 1: Terminal; 2: Communication).</li> <li>Check whether the terminal resistor is ON. If not, switch on the terminal resistor and then power on the AC drive again.</li> </ol>
Unstable connection	<ol> <li>Check that wiring on the PLC end is reliable. (Touch the connection cables on the PLC end to check for poor contact.)</li> <li>Check that wiring on the AC drive end is reliable, and make sure that network cables are inserted tightly.</li> <li>Check that the signal cables are far away from the power cable.</li> </ol>
Incorrect read value	<ol> <li>Check that the configuration address is correct.</li> <li>Check whether the program performs data conversion.</li> <li>Make sure that the D component is not occupied.</li> </ol>

# 4.5.2 Configuration of CANopen Communication Between AC Drive and H5U

### Software Acquisition and Hardware Connection

- 1. Log in to the official website of Inovance (https://newweb.inovance.com/hc/ serviceSupport/download) to obtain the H5U programming software and the latest EDS file.
- 2. Connect the H5U to the CN1 interface of the MD38CAN1 expansion card installed on the MD520 using twisted pair cables.



Figure 4-6 Connecting communication interfaces

## **Master-Slave Configuration**

Config".

- 1. Open AutoShop, click "New Project", check that "Series and models" is H5U, and click "OK" to enter the programming interface.
- 2. Click Reference on the left, set as follows, and click **"OK**".

Protocol: Select CANopen.

**Station No.**: Select **Upper computer setting**. (Note that the CANopen station number of the PLC cannot be the same as that of the AC drive.)

**Baud Rate**: Select **Upper computer setting**. (The communication baud rate must be consistent with the baud rate of the AC drive.)

3. Configure the master and slave. Click 😤 CAN(CANopen) , and click "AddCAN

CANOpen Config is displayed. Double-click "CANopen

**Config**", and double-click the AC drive slave in the **"CANopen Device List"** on the right.



4. Configure the receive PDOs and transmit PDOs of the slave. Double-click the slave to configure.

Receive PDO: The PDOs for writing the running frequency and control commands are added by default.

Transmit PDO: Click **Transmit PDO**, and configure the PDOs according to the following conversion rule:

Index: For groups F0 to FF, convert F in high-order bits to 0 and then add 0x2000.

For groups A0 to AF, convert A in high-order bits to 4 and then add 0x2000.

For groups U0 to UF, convert U in high-order bits to 7 and then add 0x2000.

Sub-index: For the low-order 16 bits, convert the decimal serial number into a hexadecimal equivalent and then add 1.

According to the conversion rule, the index corresponding to the bus voltage address U002 is 0x2070, and the sub-index is 03.

ave No	de Receive PDO Send PD	O Service Data	a Objects	Debug	I\O Mapping	Module information
Num	Name	Index	Subindex	Bit Len	gth	
<b>V</b> 1	1st transmit PDO	16#1800				
	Running Frequency	16#2070	16#01	16		
	Bus Voltage	16#2070	16#03	16		
	Inverter State 1	16#2070	16#3E	16		
2	2nd transmit PDO	16#1801				
	Output Voltage	16#2070	16#04	16		
	Output Current	16#2070	16#05	16		
	DI State	16#2070	16#08	16		
V 3	3rd transmit PDO	16#1802				
	Fault Maincode	16#2070	16#2E	16		
	Fault Subcode	16#2070	16#2F	16		
<b>4</b>	4th transmit PDO	16#1803				



Only four PDOs can be added to each group. As the annotation of the EDS file used during configuring the PDO may be wrong, it is recommended to check the PDOs again based on parameters after all the PDOs are added.

5. Perform I/O mapping.

This step is to map data in the PDO, that is, the value to be read or written. The D component is used as a bridge to implement data exchange between the PLC and the AC drive. The H5U high-performance small PLC of Inovance automatically performs I/O mapping based on the configured PDOs. Therefore, you only need to click I/O mapping to determine the D component to perform the read and write operations.

Variable	Mapping	Index: Subindex	Bit Length
 D7000D7001	1st receive PDO mapping	16#1600	32
D7000	Control Command	16#2073:12	16
D7001	Written Freq	16#2073:11	16
 D7424D7426	1st transmit PDO mapping	16#1A00	48
D7424	Running Frequency	16#2070:1	16
D7425	Bus Voltage	16#2070:3	16
D7426	Inverter State	16#2070:3E	16
 D7408D7410	2nd transmit PDO mapping	16#1A01	48
D7408	Output Voltage	16#2070:4	16
D7409	Output Current	16#2070:5	16
D7410	DI State	16#2070:8	16
 D7411D7412	3rd transmit PDO mapping	16#1A02	32
D7411	Fault Maincode	16#2070:2E	16
D7412	Fault Subcode	16#2070:2F	16

#### Instances

1. Write the frequency (F0-03 is set to 9).

Data conversion: Multiply the desired frequency value a by 100, convert it to an integer, and then write it into D7001.

The program is as follows:



Implement start/stop control on the AC drive (F0-02 is set to 2).
 Assign a value to the D component corresponding to the control word of the desired station to control forward running, reverse running, and stop of the AC drive through communication. The control word is defined as follows:

1: Run in forward direction; 2: Run in reverse direction; 3: Jog in forward direction; 4: Jog in reverse direction; 5: Coast to stop; 6: Decelerate to stop; 7: Reset upon fault

The program is as follows:

---[ MOV K1 D7000 ] Axis 1 control word

The PLC soft component address corresponding to the control word is D7000. Therefore, to control the AC drive to run in forward direction through communication, write 1 to D7000. Similarly, to control the AC drive to decelerate to stop, set D7000 to 6.

3. Read the bus voltage.

The actual bus voltage is the read bus voltage a divided by 10. According to the communication configuration, the D component address of the bus voltage is D7425. Convert D7425 to a floating-point number and then divide this value by 10.

FLT D7425 D350 ]
Axis 1 VO-O2
[ DEDIV D350 E10 D500 ]
Actual bus voltage

The program is as follows:

4. Read the output voltage.

According to the communication configuration, you only need to move the value of D7408 to another D component (or not).

The program is as follows:

-[	MOV	D7408	D502	]
		Axis 1 U0-03	Axis 1 Actual voltage	outpur

5. Read the output current.

According to the conversion rule, the actual output current is the read output current divided by 100.

The program is as follows:

6. Read the AC drive state.

Read D7426 to directly obtain current state of the AC drive (1: Running in forward direction; 2: Running in reverse direction; 3: Stopped).

The program is as follows:

--[ MDV D7426 D358 ] Axis 1 Inverter status

7. Read the DI state.

According to the conversion rule, the DI state maps to D7410. Convert the read value into a binary value. The LSB indicates DI1, the second bit indicates DI2, and so on.

The program is as follows:

--[ MOV D7410 D360 ] Axis 1 U0-07

8. Read the fault code.

According to the conversion rule, the fault code maps to 7411, and the fault subcode maps to 7412.

The program is as follows:



## **Common Problems and Solutions**

The must-dos are listed as follows:

- 1. Check the wiring. Check whether the wrong pins are wired as CANH and CANL to the PLC.
- 2. Check the value of FD-10. 1 indicates CANopen and 2 indicates CANlink.
- 3. Check whether the CAN communication baud rate defined by FD-00 is consistent with that of the PLC.
- 4. Check whether the CAN station number defined by FD-02 is unique to avoid conflicts with other drives.

Problem	Solution	
Failure to write frequency	<ol> <li>Check F0-03 to confirm that the D component and the address in the configuration table are correct (when F0-03 is 0, the I/O mapping is 2000sub8; when F0-03 is 9, the I/O mapping is 2073sub11).</li> <li>Check whether the terminal resistor is ON. If not, switch on the terminal resistor and then power on the AC drive again.</li> </ol>	
Failure to start the AC drive	<ol> <li>Check that F0-02 is set to 2 (0: Operating panel; 1: Terminal; 2: Communication).</li> <li>Check whether the terminal resistor is ON. If not, switch on the terminal resistor and then power on the AC drive again.</li> </ol>	

Table 4–24	Common	problems	and	solutions

Problem	Solution		
Unstable connection	<ol> <li>Check that wiring on the PLC end is reliable. (Touch the connection cables on the PLC end to check for poor contact.)</li> <li>Check that wiring on the AC drive end is reliable, and make sure that network cables are inserted tightly.</li> <li>Check that the signal cables are far away from the power cable.</li> </ol>		
Incorrect read value	<ol> <li>Check that the configuration address is correct.</li> <li>Check whether the program performs data conversion.</li> <li>Make sure that the D component is not occupied.</li> <li>Check the D component of I/O mapping.</li> </ol>		

# 4.6 Communication Faults

## 4.6.1 Emergency Message and AC Drive Faults

### **Emergency Message Data**

The following table describes the 7-byte data of the emergency message.

#### Table 4–25 Emergency message data

Emergency Error Code	Error Register	Predefined Error Code
0 to 1	2	3 to 7

# Note

- Emergency error code: For details, see relevant chapters of the DS301 documentation. 0x8100 indicates the communication error, and 0xFF00 indicates predefined errors.
- Error register: For details, see the data value in 1001H of the object dictionary in relevant chapters of the DS301 documentation. Bit0 is the error flag, bit4 is the communication error flag, and bit7 is the predefined error.
- Predefined error code: See fault codes of the AC drive.

## Fault Codes

The following table lists the standard fault codes of the MD520 series AC drive. For details, see the MD520 user guide.
AC Drive Fault Information	AC Drive Fault Information
2: Overcurrent	42: Excessive speed deviation
5: Overvoltage	43: Motor overspeed
8: Pre-charge power fault	45: Motor overtemperature
9: Undervoltage	47: STO fault
10: AC drive overload	51: Pole position auto-tuning error
11: Motor overload	55: Master-slave control fault
12: Input phase loss	56: Self-check fault 1
13: Output phase loss	57: Self-check fault 2
14: Overheat	58: Self-check fault 3
15: External fault	59: Self-check fault 4
17: Pre-charge circuit exception	61: Braking overload
18: Current sampling exception	62: Braking transistor fault
19: Motor auto-tuning exception	63: External alarm
20: Encoder/PG card exception	82: Pre-charge contactor fault
21: EEPROM fault	85: Timing fault
22: Encoder card not activated	93: Motor control exception 1
23: Output short-to-ground	94: Motor control exception 2
26: Accumulative running duration reach	159: Auto reset fault
27: User-defined fault	160: Modbus timeout
28: User-defined alarm	161: CANopen fault
29: Accumulative power-on duration reach	162: CANlink fault
30: Output load loss	164: Expansion card fault
31: PID feedback loss during running	174: Input exception protection

#### Table 4–26 Fault information

#### 4.6.2 Simple Diagnosis

#### Description

The AC drive parameter FD-17 provides the simple diagnosis function. This parameter shows the number of times that the CAN bus is off due to strong interference after power-on.

#### Diagnosis

If the value is greater than 0 but does not continue to increase, it indicates that the network has experienced strong interference for a long time. If the value is greater than 0 and increases within 5 minutes, it indicates that the network is experiencing interference or the configuration is incorrect, which requires troubleshooting.

#### Solution

Check all nodes for the same baud rate or address. Check whether the DIP switch is set correctly and in place and whether the baud rate and address of the master are set correctly.

Check whether the terminal resistor is only connected to both ends of the bus. Power off all devices and check whether the resistance between CANH and CANL of the bus is between 50  $\Omega$  and 60  $\Omega$  by using a multimeter.

Check whether CANH and CANL of a node are reversely connected and whether CGND of the bus interface is connected (typically CGND of all devices are connected together and not grounded).

# 5 **PROFINET Communication**

#### 5.1 Introduction

The MD500-PN1 card is a PROFINET fieldbus adapter card complying with the international PROFINET standard. It is installed on an MD series AC drive to improve the communication efficiency and facilitate implementation of the AC drive networking function, enabling the AC drive to be a slave controlled by the fieldbus master.

This user guide is applicable to the MD500-PN1 card with software of version 1.00 or later (you can query the version by viewing the parameter U0-67 of the MD520 after the card is installed and powered on). The corresponding GSDML file is **GSDML-V2.31-inovancemd500-20180705.xml**.

#### 5.2 Installation

The MD500-PN1 card is embedded in the MD520 series AC drive. Before installation, cut off the power supply of the AC drive and wait for about 10 minutes until the charging indicator of the AC drive becomes off. Then, insert the MD500-PN1 card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by the pulling force of the external signal cable. *"Figure 5–1 " on page 74* shows the installation.

After installing the MD500-PN1 card on the AC drive, connect the ground terminals of the MD500-PN1 card and the AC drive properly, as shown in "Figure 5-2 " on page 75.



Figure 5-1 Installation of MD500-PN1



Figure 5-2 Connecting ground terminals of the MD500-PN1 card and AC drive

## 5.3 Interface Layout and Description

The following figure shows the interface and indicator layout of the MD500-PN1 card. The pin header J1 on the back of the MD500-PN1 card is used to connect the AC drive. The MD500-PN1 card provides two network ports (J2 and J3) for communication with the PROFINET card (PLC).



Figure 5-3 Interface layout of the MD500-PN1 card

Table 5–1 Interfaces and indicators of	of the	MD500-PN1	card
--	--------	-----------	------

Symbol	Hardware Name	Function
J1	Pin header	Check whether FD-00 is set to 9 and FD- 01 is set to 3.
J2		Standard Ethernet RJ45 socket, direction-
J3	Network ports	insensitive. J3 is used to communicate with the PROFINET card (PLC).

Symbol	Hardware Name	Function
D5	Power indicator	It indicates the power status. ON indicates normal, and OFF indicates abnormal (check whether the installation is correct).
D1	Status indicator of communication with PLC (PLCLINK)	For details, see "Table 5-2" on page 77
D4	Status indicator of communication with AC drive (DSPLINK)	rol details, see Table 3-2 on page 11
S1	2-bit DIP switch	It is used for upgrade by the manufacturer only.



- After the MD500-PN1 card is installed, J2 is on the left and J3 is on the right when facing the RJ45 interface. These two ports are direction-insensitive. You can connect either one to the near PLC end.
- The Cat5e shielded twisted pair network cable is recommended to ensure stability.

Inc	dicator	State Description	Solution
	Steady green	Normal	N/A
	Steady yellow	MAC address abnormal	Replace the MD500-PN1 card.
	Blinking yellow	AC drive faulty	Clear the AC drive fault.
DSPLINK	Steady red	Abnormal communication with the AC drive	Set F0-28 to 1 and check whether the AC drive supports the MD500-PN1 card.
	Blinking red	AC drive communication timeout	Check whether the AC drive software version supports the MD500-PN1 card. Restore the AC drive software to default settings.
	Steady green	Communication normal	N/A
	Blinking green	Master not found	Check whether a device name is assigned to the slave. Check whether the corresponding PLC is connected.
	Steady yellow	Configuration error	Check whether the GSD is correct.
	Steady red	Communication with the master interrupted	Check the wiring and check whether the shield layer of the network cable is connected properly.
D1 and D4	Poth in rod	MD500-PN1 card software abnormal	Power off and then power on the equipment. Replace the MD500-PN1 card.
	both in rea	DIP switch abnormal	Check that the DIP switch S1 is OFF and re-power on the equipment.

Table 5-2	Status	indicators	of the	MD500-PN1	card
	Julus	maicutors	or the	11000011111	curc

## 5.4 Topology

PROFINET supports a variety of topologies, including bus, star, and tree topologies. Diversified networking modes can be implemented by using switches.



Figure 5-4 Bus topology



Figure 5-5 Star topology



Figure 5-6 Tree topology

## 5.5 Data Transmission Formats

The MD500-PN1 card transmits data using PZD formats with different lengths as required. You can set the functions supported by each PZD format during configuration.

The following table lists the functions supported by each data format.

Data Format	Data Length	Supported Functions
Standard telegram 1	PZD-2/2	Setting of AC drive command and frequency Reading of AC drive state and running frequency
Standard telegram 2	PZD-4/4	Setting of AC drive command and frequency Periodic writing of two function parameters Reading of AC drive state and running frequency Periodic reading of two function parameters
Standard telegram 3	PZD-6/6	Setting of AC drive command and frequency Periodic writing of four function parameters Reading of AC drive state and running frequency Periodic reading of four function parameters
Standard telegram 4	PZD-8/8	Setting of AC drive command and frequency Periodic writing of six function parameters Reading of AC drive state and running frequency Periodic reading of six function parameters
Standard telegram 5	PZD-10/10	Setting of AC drive command and frequency Periodic writing of eight function parameters Reading of AC drive state and running frequency Periodic reading of eight function parameters

Data Format	Data Length	Supported Functions
Standard telegram 6	PZD-12/12	Setting of AC drive command and frequency Periodic writing of ten function parameters Reading of AC drive state and running frequency Periodic reading of ten function parameters
Supplementary telegram	PZD-2/6	Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic reading of four function parameters

#### 5.6 PZD Data

The PZD data enables the master to modify and read AC drive data in real time and perform periodic data exchange. The data communication addresses are directly configured by the AC drive. The specific functions are as follows:

- Setting the AC drive control command and target frequency in real time
- Reading the current state and running frequency of the AC drive in real time
- Exchanging function parameter and monitoring parameter data between the AC drive and PROFINET master in real time

By default, the written PZD1 and PZD2 are mapped to U3-17 and U3-16, respectively. If a command or frequency fails to be written into the AC drive but PZD3 to PZD12 can be written and F0-02 and F0-03 are set to 2 and 9 respectively, check whether FE-00 and FE-01 are set to U3-17 and U3-16 respectively. If not, manually correct the values of FE-00 and FE-01. The read PZD1 and PZD2 are mapped to U0-68 and U0-69 respectively. If a state or running frequency fails to be read while PZD3 to PZD12 can be read, check whether FE-20 and FE-21 are set to U0-68 and U0-69 respectively. If not, manually correct the values of FE-20 and FE-21.

The following table lists the interactive data.

Master Transmit Data PZD		AC Driv	ve Response Da	ta PZD	
PZD1	PZD2	PZD3 to PZD12	PZD1	PZD2	PZD3 to PZD12
Control word (U3-17)	Frequency reference (U3-16)	AC drive parameters modified in real time	Status word (U0-68)	Running frequency (U0-69)	AC drive parameters read in real time

Master Trans	smit Data PZD	AC Drive Resp	onse Data PZD
PZD1	AC drive command word (command source set to communication, that is, F0-02 = 2) 1: Run in forward direction 2: Run in reverses direction 3: Jog in forward direction 4: Jog in reverse direction 5: Coast to stop 6: Stop according to the stop mode defined by F6-10 7: Reset upon fault	PZD1	AC drive running state, which is described as follows by bit: Bit0: 0: Stopped; 1: Running Bit1: 0: Running in forward direction; 1: Running in reverse direction Bit2: 0: Not faulty; 1: Faulty Bit3: 0: Running frequency not reached; 1: Running frequency reached Bit4 to bit7: Reserved Bit8 to bit15: AC drive fault code
PZD2	AC drive target frequency (frequency source set to communication, that is, F0-03 = 9), which ranges from the reverse frequency upper limit (negative value) to forward frequency upper limit (decimal places included, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the reference target frequency exceeds this range, the AC drive runs at the frequency upper limit.	PZD2	AC drive running frequency (unit: 0.01 Hz) The current AC drive running frequency is returned as 16-bit signed data.
PZD3 to PZD12	Parameter values modified in real time, not written into EEPROM	PZD3 to PZD12	Parameter values read in real time

Table 5–4

## 5.7 Related Parameters

#### **AC Drive PN Card Configuration**

After installation, the MD500-PN1 expansion card can communicate with the AC drive properly only after F0-28 is set to 1.

Parameter	Parameter Name	Value Range	Setpoint	Description
F0-28	Serial communication protocol	0: Modbus protocol 1: Communication card network bridge protocol	1	Select the special communication card network bridge protocol as the serial communication protocol.
F0-02	Command source	0: Operating panel 1: Terminal 2: Communication	2	Set the command source to communication.
F0-03	Main frequency reference source	0: Digital setting (non-retentive at power failure) 1: Digital setting (retentive at power failure) 2: Al1 3: Al2 4: Al3 5: Pulse reference (DI5) 6: Multi- reference 7: Simple PLC 8: PID 9: Communication	9	Set the target frequency through communication.

Parameter	Description	
U0-66	Model of communication expansion card • 100: CANopen • 200: PROFIBUS DP • 400: PROFINET • 500: EtherCAT • 600: EtherNet/IP	
U0-67	Software version of communication expansion card	

#### **Expansion Card Type Parameters**

## 5.8 Communication Configurations

#### 5.8.1 Configuring Slaves on the S7-1200 Master

Before using the PROFINET master, you need to configure the GSDML file of the slave to add the corresponding slave device to the system of the master. If the file exists, skip step 2. You can obtain the GSDML file from Inovance or its agent.

The configuration procedure is as follows:

1. Create a project and add the S7-1200 master to the project in PORTAL. To be specific, open PORTAL first. The interface as shown in the following figure is displayed.

VA Siemens				_ ¤ ×
			Τα	tally Integrated Automation PORTAL
Start			Open existing project	
Devices &	<b>•1</b>	🥚 Open existing project	Recently used	1 and a large
networks		Create new project	rioject	Lost cha
PLC programming		Migrate project		
Motion & technology	÷.			
Visualization		Welcome Tour		
Online & Diagnostics	10	First steps		
		Installed software	<[	>
		Help	Activate basic integrity check	
			Browse Remove	Open
		🚱 User interface language		
Project view				

Click Create new project, enter a project name and storage path, and click Create.

M Siemens				Totally Integrated Automa PC	tion DRTAL
Start			Create new project		
		Open existing project	Project name:	PN test	
		-	Path:	C:\Users\y0263\Documents\Automation	
		Create new project	Version:	V15	
		Migrate project	Author:	30263	
			Comments		~
		Welcome Tour			Create
Online & Diagnostics	19				
	· ·	Installed software			
		Melp			
		🛞 User interface language			
Project view					

Click **Configure a device**, as shown in the following figure.



For a new project, click **Add new device** (marked with a red circle in the following figure). For an existing project, click **Configure networks** (marked with a green circle in the following figure).



Select a PLC on the displayed page. Set the article number and firmware version of the PLC correctly to avoid download failure.



Click Add or double-click the selected master, as shown in the following figure.

<ul> <li>Show all devices</li> <li>Add new device</li> <li>Configure networks</li> <li>Help</li> </ul>	(сти 1211 С ОСОСИЯ)     (сти 1212 С СОСОКЯ)     (сти 1214 С ОСОСОС)     (сти 1214 С ОСОСОС)	CPU 1212C ACDORRY Article no.: 657 212-184-0 0X80 Version: V4.2 Description With Dis X-4002 GNK50 MCR (Do X rels y and A2 on band; 4 high-speed counters (expandable band) and 4 high-speed counters (expandable band) and 4 high-speed counters (expandable band) and 4 high-speed counters for serial communication, up to 3 light) modules for IIO expansion; 0.04 ms1000 mstructions; TROHETI Interface for programming; HM and PLC to PLC communication;
0110011	Open device view	Add

Now the master is established.

2. Install the GSDML file. (Skip this step if the GSDML file has been installed.) Choose **Options** > **Manage general station description files (GSD)**.



Select the path (English path required) for storing the GSDML file, select the GSDML file to be installed, and click **Install**.

Ma	Manage general station description files X Installed GSDs GSDs in the project							
S	Source path: E:IPNgsd							
C	Content of imported path							
	File			Version	Language	Status	Info	
	GSDML-V2.3	3-Inovance-MD500PN-2	0190405.xml	V2.33	English	Not yet installed	MD500PN	
								- 1
								- 1
								- 1
					Del	ete Install	Cance	el

Caution

The GSDML file name varies with the AC drive series. For details, see the corresponding user guide.

After the installation is successful, click **Close**.

Manage general station description files	×
Installation result	
1 Message	
<ul> <li>Installation was completed successfully.</li> </ul>	
Save log Install additional	files Close

3. Configure a slave.



Click Device configuration on the interface.

Click Network view.



Select the Ethernet interface of the PLC, and choose **Properties** > **General**.

e –	·	2m			
	PN test > Devices & network	s			_ # #×
		1	🚽 Topology view	🛔 Network view	Device view
<b>1</b>	Network Connections	MI connection	Relations		Network overvie 4 🕨
				^	Y Device
^					<ul> <li>\$7-1200 statio</li> </ul>
	PLC 1				PLC_1
=	CPU 1212C			•	
				-	
				-	
				~	
	< .	> 100%	•		<
	PROFINET interface_1 [X1 : P	N(LAN)]	<b>Properties</b>	🔰 Info 🔒 📱 Dia	agnostics 👘 🗖 🗏 🥆
	General IO tags Sy	stem constants	Texts		
~	General	Ethornot add			^
	Ethernet addresses	Ethernet add	lesses		=

Set the IP address and subnet mask of the PLC master, and click Add new subnet.

	< .	> 100%
ſ	PROFINET interface_1 [X1	: PN(LAN)] 📴 Properties 🚺 Info 🤢 🖞 Diagnostics 🗖 🖃
L	General IO tags	System constants Texts
L	General	Ethernet addresses
I.	Ethernet addresses	
I.	Time synchronization	Interface networked with
I.	Operating mode	
I.	<ul> <li>Advanced options</li> </ul>	Subnet: Not networked
I.	Web server access	Add new subnet
١		IP protocol
T.		
Ŧ.		Set IP address in the project
		IP address: 192 . 168 . 0 . 1
ł.		Subnet mask: 255 . 255 . 0
L		Use router
		Router address: 0 . 0 . 0 . 0
		<ul> <li>IP address is set directly at the device</li> </ul>

Locate MD500 under Hardware catalog on the right, and double-click MD500PN.



Click **Not assigned** to select the master system for the slave.

	📱 Topolo	gy view	晶 Network view	🚺 Dev
Network Connections	HMI connection	•		Network
PLC_1 CPU 1212C	MD500PN MD500PN Not assigned			Pevice S7 GS

Select the slave, and choose **Properties** > **General**. Then, choose **PROFINET interface [X1]** > **Ethernet addresses** and set the IP address.

PN test ► Dev	vices & netw	orks							_ # i
				21	Fopolo	ogy view	📥 Netv	vork view	🛿 Device view
Network	Connections	HMI connection	- 17 B	elations			🔍 ±		Network overvie
PLC_1 CPU 1212C	PLC_1	MDS00PN MD500PN PLC_1 PROFINET IO-Syste	ф 10 sy	ystem: P	LC_1.P	PROFINET IO	-System (1	00)	Device     S7-1200 sta     PLC_1     GSD device     MD500PF
<			> 100	0%		•		- 1	<
MD500PN [MD	500PN]				🤹 Proj	perties	🚺 Info	追 🖁 Dia	gnostics 🔹 🗖
General	IO tags	System constants	Texts						
<ul> <li>General</li> <li>PROFINET interf</li> </ul>	face [X1]	Ethernet addresses	;						
General Ethernet ad Advanced o Identification & Shared Device	dresses ptions Mainten	Interface netwo	rked with Subne	et: PN/	E_1 Add	I new subnet	:		<b>•</b>
< III	>	IP protocol	IP addres Subnet mas	is: 19 ik: 25 √ s	2 . 168 5 . 259	8.0.2 5.255.0 pnize router s	ettings wit	h 10 control	er
Devices & ne						🔝 🖌 т	he project P	N test was si	wed successf

Scroll down the screen to locate **PROFINET**. Deselect **Generate PROFINET device name automatically** and enter a name in **PROFINET device name**. (Or you can keep the option selected to allow the system to generate a device name automatically.)

MD500PN [MD500PN]		Properties	🗓 Info 📋 📱 Diagnostics	
General IO tags	System constants Texts			
<ul> <li>General</li> </ul>		Synchronize router	settings with IO controller	
▼ PROFINET interface [X1]		Use router		
General Ethernet addresses	Router address:	0.0.0.0		
Advanced options      Identification & Mainten	PROFINET			
Shared Device	$\subset$	Generate PROFINE	Idevice name automatically	
	PROFINET device name:	driver1		
	Converted name:	driver1		
	Device number:	1		-
<				

4. Configure data features of the slave.

Select the slave and switch to the **Device view** page. Locate **Module** under **Hardware catalog**, and double-click the data length for the slave as required.

PN test ► Ungroup	ed devices 🕨 MD500	PN [MD500PN]	_∎≡×	Hardware catalog 🛛 🗊 🗈 🕨
	📲 Topology view	🛔 Network view 🚽	Device view	Options
<u>å</u> ₽ <sup>▶</sup>		Device overview		
· 		Module     MDS00PN     MDS00PN     Interface     (         (		✓ Catalog     ✓ Catalog

5. Configure PZDs.

The PZD1 and PZD2 configurations are fixed and cannot be modified by users. PZD3 to PZD12 are for customized periodic data exchange. They can be set in hardware configuration.

PN test > Ungrouped de	vices + MD500PN [MD500PN]					_ # #×	Hardware catalog 🛛 🗐 🗎 🕨
		🛃 Topology view	🔥 Netwo	rk view	📑 Dev	ice view	Options
MD500PN [MD500PN]	- 🗉 🖻 🍊 🖌 🖬 🗍	Device overview					
		Y Module	Rack	Slot	l address	Q address	✓ Catalog
	A	<ul> <li>MD500PN</li> </ul>	0	0			<search> MI MI</search>
	Sta.	Interface	0	0 X1	(0. 04	C1 07 -	🗹 Filter Profile: <all> 💌 📑</all>
102	· · · · · · · · · · · · · · · · · · ·	<standard 6,="" p20<="" td="" telegram=""><td>-1 0</td><td>1</td><td>6891</td><td>648/ .</td><td>🕨 🛅 Head module</td></standard>	-1 0	1	6891	648/ .	🕨 🛅 Head module
i i i i i i i i i i i i i i i i i i i	×						✓ Im Module
< II > 100%	· · · · · · · · · ·	K II				>	Standard telegram 1, PZD-2/2
Standard telegram 6. PZC	).12/12_1 [Standard telegram 6_P	7D.12/12] C Proportion	1 Info (1)	V Diag	postice		Standard telegram 2, PZD-4/4
Standard teregram o, rec	terte_r (standard toregram of r	stropentes		Diag	nostics		Standard telegram 3, P2D-616
General IO tags	System constants Texts						Standard telegram 5, PZD-10/
▼ General	Module parameters					^	Standard telegram 6, PZD-12/
Catalog information							Supplementary telegram, P
Module parameters	General Parameter						
	PZD3(master->slave):	61452					
	PZD4(master->slave):	61448					
	PZD5(masteroslave)	64512					
	B706(mester-slave)	64613					
	<ul> <li>P2D6(masterbstave).</li> </ul>	04313					
	PZD7(master->slave):	61440					
	PZD8(master->slave):	61440					
	PZD9(master->slave):	61440					
	PZD10(master-slave):	61440				~	<
	K II					2	> Information

PZDx(master->slave) indicates the address used by the master to write to the slave, and PZDx(slave->master) indicates the address used by the master to read the slave. PZD3 to PZD12 (determined by the selected message type) are displayed in decimal and can be modified. For example, to set **PZD3(master->slaver)** to F0-12, enter **61452**.

By default, all PZDs of MD500 are set to F0-00 (61440 in decimal). For unused PZDs, modification is not required and default values can be retained. PZD mapping must be set independently for each slave as required (if the mappings of various slaves are the same, you can select a configured slave, press **Ctrl+C**, select the PROFINET bus in the configuration, press **Ctrl+V**, and modify the device name and IP address).

Switch to **Network view**. To add more stations, repeat the preceding steps. If the configuration is the same, select and copy a configured slave and modify the IP address and device name (note that the device name cannot be duplicate).

6. Download the configuration.

Save the network configuration. Set the IP address of the PC to an address in the same network segment with the PLC. (Note that the IP address of the PC must be different from the IP addresses of the slaves in the configuration. You can also allow automatic IP address allocation for the PC.) Then, start compiling, click **Load**, select the interface, and click **Start search**.

	Dening	Device trace	Class.	land and a second	A shift and	Cultures
	Device	Device type	Slot	Interface type	Address	Subnet
	PLC_1	CPU 315-2 PN/DP	2 X2	PN/IE	192.168.0.1	PN/IE_1
		Cr0 515-2 FWDF	2	IVIET	2	
		Type of the PG/PC inte	rface:	PN/IE		
		PG/PC inte	rface:	Intel(R) Ethen	net Connection (3) I2	18-LM 🔻 💎 🛛
		Connection to interface/su	ubnet:	PN/IE_1		• 🕐
	Select target de	evice:			Show all compatib	le devices
	Device	Device type	Interf	ace type Ad	dress	Target device
	PLC_1	CPU 315-2 PN/DP	PN/IE	19	2.168.0.1	PLC_1
80	-	-	PN/IE	Ac	cess address	-
_						
Flash LED						
Flash LED						<u>Start search</u>
Flash LED					_	
Flash LED	tion:				Display only erro	rmessages
Flash LED	tion: e device driver1				Display only erro	r messages
Flash LED nline status informa Found accessible Scan completed	tion: e device driver1 .1 compatible device	s of 3 accessible devices for	und.		Display only erro	r messages
Flash LED nline status informa Found accessibl Scan completed ? Retrieving device	tion: e device driver1 1 compatible device information	s of 3 accessible devices for	und.		Display only erro	r messages

7. Assign device names.

Assign device names for slaves without names. Select a slave, and choose **Online** > **Assign device name** (or right-click the slave and choose **Assign device name** in the shortcut menu).

ens - C:\Users\y0263	\Documents\Automation\PN test\PN test	
Edit View Insert	Online Options Tools Window Help	Tota
🔜 Save project 📑	💋 Go online Ctrl+K	ne 🖉 Go offline 🐰 🖪 📭 🛠 🖃 🛄 🕨
ct tree	💋 Extended go online	
	Go offline Ctrl+M	
vices	🖳 Simulation 🔸	🚽 Topology view 🚮 Networ
	Stop runtime/simulation	nnection 💌 🛺 Relations 🕎 🐫 🛄 🍳 ± 🚦
	Download to device Ctrl+L	# IO system: PLC_1.PROFINET IO-System (100)
PN test	Extended download to device	
鑙 Add new device	Download and reset PLC program	500PN
📥 Devices & networks	Download user program to Memory Card	500PN
PLC_1 [CPU 1212C /	Snapshot of the actual values	
Device configura	Load snapshots as actual values	
🙎 Online & diagno	Load start values as actual values	
Program blocks	Inload from device (coftware)	ET IO-syste
🕨 🙀 Technology obje	Upload device as new station (bardware and software)	
External source	Backup from online device	
PLC tags	Hardware detection	
PLC data types	HM Device maintenance	
Watch and force		
<ul> <li>Online backups</li> </ul>	Accessible devices Ctrl+U	
Iraces	Start CPU Ctrl+Shift+E	
<ul> <li>Link Device proxy dat</li> </ul>	T Stop CPU Ctrl+Shift+Q	
etails view	😮 Online & diagnostics Ctrl+D	> 100%
	👹 Assign device name	
	Receive alarms	Properties Info 1
	General IO tags System	n constants Texts
me	✓ PROFINET interface [X1]	

On the displayed page, devices of the same type are listed. Select the slave to be assigned with a device name based on its unique MAC address. The MAC address of the MD500-PN1 card can be found on its housing. Then, click **Assign name**.

		Configured PRO	FINET de	vice					
-		PROFINET devic	a name:	[]					
			Le manne.	driver1					
		Dev	vice type:	MD500PN				-	
		Online access							
		Type of the PG/PC i	interface:	PN/IE				-	
		PG/PC i	interface:	Intel(R) Etherne	et Connecti	on (3) I218	-LM	- •	
		Device filter							
		Only show	devices of t	the same type					
		Only show	devices wit	h bad parameter s	ettings				
		Only show	devices wit	houtnames					
	Accessible de	vices in the network:							
	IP address	MAC address	Device	PROFINET device	name	Status			_
	0.0.0.0	< /0-CA-4D-FE-03-/A	MD200	-	4	No device	name a	ssigned	
<b></b>									
Flash LED									
-									_
						en lles	-	A	-
					Opda	tenst		Assign han	e
nline status information:									
Search completed.	1 of 2 devices v	vere found.							
<									

If information similar to that shown in the following figure is displayed, the device name is assigned successfully. The displayed **PROFINET device name** must be consistent with that displayed in the preceding figure. After assigning the device name, close the window or select another device from the **PROFINET device name** drop-down list to assign device names for other stations.

Configured PROFINET device   BOFINET device name:   Device type:   Device type:   Device type:   Device time:   Configured PROFINET device   Device type:   Device time:   Configured PROFINET device   Device time:   Device time:   Only show devices of the same type   Only show devices of the same type   Only show devices with bad parameter settings   Only show devices without names   Accessible devices in the network:     Pladness   MAC address   Device   PROFINET device name   Status   DO.00   70CA4DFE037A   NDS00   divert   OK     Dotate list:		e name.					
PROFINET device name: driver1 Device type: MDSOOPN Online access Device type: PNUE PGIPC interface: PNUE PGIPC interface: PNUE PGIPC interface: Intel(R) Ethernet Connection (3) 1218-LM Only show devices of the same type Only show devices with bad parameter settings Only show devices with bad parameter settings Double settings Device PROFINET device name PROFINET device name Device PROFINET device name Device	-		Configured PRO	FINET de	vice		
Device type: ND500PN   Online access   Type of the FGIPC interface:   PUIE   PGIPC interface:   PUIE   PGIPC interface:   PUIE   PGIPC interface:   Puile:   Point Sill   Device filter   Only show devices of the same type   Only show devices with bad parameter settings   Only show devices without names   Accessible devices in the network:     IP address   MAC address   Device   PROFINET device name   Status   00.00   70CA4D+E-03-7A   MDS00   divert   OK     Image: Comparison of the same type   Only show devices without names   Accessible devices in the network:   IP address MAC address Device PROFINET device name Status Ook Occa-4D+E-03-7A MDS00 divert OK Asign pare			PROFINET devi	e name:	driver1		
Online access         Type of the RGIPC interface:         PHUE         CBIPC interface:         Immed (R) Ethernet Connection (3) 1218-LM         Only show devices of the same type         Only show devices of the same type         Only show devices with bad parameter settings         Only show devices without names         Accessible devices in the network:         IP address       Device         Plash LED			Dev	vice type:	MD500PN		
Type of the PG/PC interface: <ul> <li>PNI/E</li> <li>PG/PC interface:</li> <li>PIN/E</li> <li>PG/PC interface:</li> <li>PIN/E</li> <li>PG/PC interface:</li> <li>PIN/E</li> <li>POINT of the PG/PC interface:</li> <li>PG/PC interface:</li></ul>			Online access				
PGIPC interface: Immel(R) Ethernet Connection (3) 1218-LM			Type of the PG/PC	interface:	PN/IE		•
Device filter     Only show devices of the same type     Only show devices with bad parameter settings     Only show devices without names  Accessible devices in the network:     If address     Device     PROFINET device name     Status     OK     O			PG/PC	interface:	Intel(R) Ethernet Conne	ction (3) I218-LM	- 💎 🖪
Only show devices of the same type Only show devices with bad parameter settings Only show devices without names Accessible devices in the network: IP address MAC address Device PROFINET device name Status 0.0.0.0 70-CA+D FE:03-7A MD500 driver1 OK Flash LED K Ludate list Assign name			Device filter				
Only show devices with bad parameter settings Only show devices without names Accessible devices in the network: IP address MAC address Device PROFINET device name Status 0.0.0 70-CA+D-FE-03-7A M0500 driver1 O OK Flash LED Lodate list Assion name			🛃 Only show	devices of	the same type		
Only show devices without names  Accessible devices in the network:  IP address MAC address Device PROFINET device name Status O.0.0 TO-CA-4D-FE-03-7A MD500 driver1 OK Flash LED  Ludate list Assion name			Only show	devices w	ith bad parameter settings		
Accessible devices in the network: IP address MAC address Device PROFINET device name 0.0.0.0 70-CA-4D-FE-03-7A MD500 driver1 ♥ OK Flash LED K MAC address MAC address Device Accession and the second se			Only show	devices w	thout names		
Accessible devices in the network: IP address MAC address Device PROFINET device name Status 0.0.0.0 70-CA-4D-FE-03-7A MDS00 driver1 O OK Flash LED					and demanded		
I P address MAC address Device PROFINET device name Status 0.0.0 70-CA-4D FE:03-7A MD500 driver1 O 0K Flash LED		Accessible de	vices in the network:				
0.0.0 70-CA-4D-FE-03-7A MD500 driven     0.0.0     70-CA-4D-FE-03-7A MD500 driven     0.0.0     10-CA-4D-FE-03-7A MD500		IP address	MAC address	Device	PROFINET device name	Status	
Flash LED		0.0.0.0	70-CA-4D-FE-03-7A	MD500	driver1	🗸 ок	
Fish LED							
Image: Constraint of the second sec							
Update list Assign name	Flash LED						
	Flash LED	<			111		

The slave will save the assigned name, and the master identifies each slave based on the device name. (The MAC address is not intuitive in use. The process of assigning the device name is actually binding the device name with the MAC address.)



- Each device name can be assigned to only one slave in the network.
- After modifying the device name of a station in the configuration, device name assignment must be performed again. (For any exception, see "Troubleshooting".)
- After modifying the IP address, you only need to download the modified configuration to the PLC to validate it. Name assignment is not required.

After the preceding steps, the PROFINET slave is configured. Now, you can compile programs in the PLC to control the AC drive. Reading and writing to slaves on the PLC are similar to those of PROFIBUS DP.

To ensure normal operation of the PLC, function blocks such as OB82, 83, 86, and 122 need to be added during programming. The content of the function blocks can be compiled according to actual needs or left blank.

#### 5.8.2 MRP Function of the MD500-PN1 Card

The Media Redundancy Protocol (MRP) function is implemented by the MRP ring network in PROFINET. Only one MRP ring network is allowed in one PROFINET network.

The MD500-PN1 card with the software version of 1.04 or later supports the MRP function. (Check U0-67 on the AC drive to see the version.) To use the MRP function, the corresponding configuration is required.

#### **Configuring the MRP Function in PORTAL**

1. Configure the MRP manager.

An MRP manager is required in the MRP ring network. The MD500-PN1 card cannot be used as the manager. Generally, a PLC is used as the manager. Select the station to be used as the manager, and select **Manager (auto)** from the **Media redundancy role** drop-down list, as shown in the following figure.

2. Configure the MRP client.

Select the slave, and select **Client** from the **Media redundancy role** drop-down list, as shown in the following figure. Configure the manager before the client; otherwise, an error will be reported.

3. Download the configuration. After configuring all devices in the MRP ring network, compile and download the configuration to the PLC.

#### **Configuring the MRP Function in STEP 7**

1. Configure the MRP manager.

An MRP manager is required in the MRP ring network. The MD500-PN1 card cannot be used as the manager. Generally, a PLC is used as the manager. Double-click **PN-IO** of the PLC, click the **Media Redundancy** tab, and select **Manager (auto)** from the **Role** drop-down list, as shown in the following figure.

2. Configure the MRP client.

Select the slave, double-click **Interface**, click the **Media Redundancy** tab, and select **Client** from the **Role** drop-down list, as shown in the following figure. Configure the manager before the client; otherwise, an error will be reported.

3. Download the configuration.

After configuring all devices in the MRP ring network, compile and download the configuration to the PLC.



- Each device in the ring network must be configured as an MRP manager or client.
- Configuration of the topological structure is not required during MRP configuration. You can configure the topological structure after the MRP configuration is complete if needed.
- Do not connect devices without the MRP function configured to the ring network. Otherwise, connection failure or frequent disconnections will occur.
- In a PROFINET network configured with MRP, when a disconnection occurs in the ring network, handshaking will be performed again. In this case, the AC drive slave reports ERR164, which is cleared automatically (if the automatic clearing function is supported) after the handshaking is complete. You can also manually clear the fault. After the network recovers from the disconnection, the preceding operations are repeated.
- Even if the MRP is configured, when two disconnections occur in the network, all nodes between the two disconnected points cannot be connected normally. To avoid such problems, the star topology is recommended.

#### 5.9 Fault Diagnosis

#### 5.9.1 Communication Faults

When the communication function is configured incorrectly, both the PLC and rectifier panel will report an error. You can troubleshoot the fault based on diagnosis information on the PLC and rectifier panel.

The following table describes the fault code of the rectifier module.

Fault Code	Possible Cause	Solution
E164.1	The communication between the	Check whether the connection
	communication card and the master is	between the communication card and
	disconnected.	PLC is in poor contact. Make sure that
		they are properly connected.

Table 5–5 Fault code of the rectifier module

#### 5.9.2 Troubleshooting

The following table describes the faults that may occur during use of the MD500-PN1 card and the AC drive.

Sy	/mptom	Solution
After the AC drive is powered on, only the power indicator (D4) is on, indicating that the connection between the PN card and AC drive is not established.		<ol> <li>Check that F0-28 is set to 1.</li> <li>Check the AC drive type. This user guide only describes the usage of MD520. For other AC drive models, contact the technical engineers to obtain the correct user guide.</li> <li>Check whether the AC drive software version supports MD500-PN1.</li> </ol>
After the AC drive is powered on, the power indicator (D5) is on and the communication indicator (D4) is steady yellow.		Replace the MD500-PN1 card.
The connec tion fails	After the configuration is downloaded, D5 and D4 on the MD500-PN1 card are steady green, and D1 blinks green.	<ol> <li>Check that the cable is properly connected.</li> <li>Check that the upstream PN node works properly.</li> <li>Check whether the node is assigned with a device name through the PLC.</li> <li>Check that the GSDML file used in the configuration is correct.</li> </ol>
after the configu ration is down loaded.	After the configuration is downloaded, D5 and D4 on the MD500-PN1 card are steady on, and D1 blinks yellow.	1. Check that the GSD file used is correct. 2. Check that the PZD mapping is set correctly. Device- specific parameters in STEP 7 and PORTAL must be set in decimal format. Therefore, you need to convert the parameter numbers into decimal values when setting device- specific parameters. For example, the decimal value of FC-11 is 64523 (0xFC0B in hexadecimal format). If a parameter number that the AC drive does not support is entered, the connection fails. Note that PZD mapping does not support Modbus addresses such as H2000 and H8000.

S	ymptom	Solution
After the connec tion is success	No data can be written/read.	Check whether the operated address is correct. For example, if the I address and Q address of the station are both 520 to 531 (note that the I and Q addresses may start from different numbers), the PZD1 and PZD2 data written into the AC drive are stored in QW520 and QW522, respectively. (If the PLC is S7-300 or S7-400, PQW is required.) If SFC15 is used, check whether <b>RET_VAL</b> of the SFC15 block is <b>0</b> . If not, an invocation error exists. Eliminate this error first and invoke the block again.
ful, all indica tors on the PLC are green, but data	PZD3 or subsequent data can be written, but PZD1 or PZD2 cannot be written/read.	Check that F0-02 is set to 2 and F0-03 is set to 9. Check whether the command reference is in the range of 1 to 7 (not bit) or frequency reference is in the range of –F0-10 to +F0-10. If not, the write operation fails. Check whether FE-00 is set to U3-17 and FE-01 is set to U3-16. If not, manually correct the parameter values or restore to factory settings.
cannot be written into or read from the AC drive.	PZD1 and PZD2 can be written/ read, while PZD3 or subsequent data cannot be written/read.	Check whether the PZD is supported by the message type. Check whether <b>Device-specific parameters</b> are set correctly (check whether the mapping is correct by checking corresponding parameters in group FE).
	-	Check the logic relations. Check whether the same PZD is assigned with values for multiple times in a certain logic relation (check whether the value given by the PLC is correct under the logic relation in the monitoring table of the PLC).
After communication is established, the AC drive reports ERR164, which cannot be cleared. However, the D1 indicator on the PN card and the BF indicator on the PLC are normal.		Check whether the high-order 8 bits of the PZD1 data (QW data) written into the AC drive are 0 in the PLC program. If not, change them to 0. The PZD1 command in this user guide refers to values instead of bits. Note that this solution applies to MD520 only. For other AC drives, consult the technical personnel.



When the status word returned by the MD500-PN1 card and the AC drive during communication cannot show the fault state, you need to monitor the state by using OB82, or write a changed value to an address of the AC drive and read it back to check the state. The MD500-PN1 card can be replaced directly when the slave node is faulty (only when the MD500-PN1 card is faulty) without device configuration again.

The prerequisites for directly replacing the MD500-PN1 card are as follows:

- The alternative component and the component to be replaced are both the MD500-PN1 cards.
- The alternative MD500-PN1 card has not been assigned with a device name before.
- The topology has been configured during PLC network configuration.
- The **Support device replacement without exchangeable medium** option is selected during PLC configuration.

To directly replace the MD500-PN1 card, the corresponding configuration is required. The configuration varies in STEP 7 and PORTAL.

# Selecting the Support device replacement without exchangeable medium Option and Setting Topology in PORTAL

Open PORTAL, and select the PROFINET interface of the master in the hardware configuration. Choose **Properties** > **General**, choose **Advanced options** > **Interface options**, and select **Support device replacement without exchangeable medium**, as shown in the following figure.

PROFINET interface_1 [X2]	🔍 Properties 🚺 Info 🚯 🖞 Diagnostics 💷 🗉	
General IO tags S	ystem constants Texts	
General Ethernet addresses	Advanced options	* II
Time synchronization Operating mode	Interface options	- 4
Advanced options	Call the user program if communication errors occur	
Media redundancy Real time settings	Support device replacement without exchangeable medium>	6
<ul> <li>Port [X2 P1 R]</li> <li>Port [X2 P2 R]</li> </ul>	VI Use IEC V2.2 LLDP mode Keep-Alive connection	
Diagnostics addresses	monitoring 30 s	~

For the S7-1200 or S7-1500 PLC, the sub-option **Permit overwriting of device names of all assigned IO devices** is available. If this sub-option is selected, the second prerequisite for directly replacing the MD500-PN1 card is not required.

PLC_1 [CPU 1212C AC/	DC/	/Rly]	🔯 Properties	🔄 🗓 Info	<ol> <li>Diagnostics</li> </ol>	
General IO tags		System constants Texts				
General     PROFINET interface [X1]	^	Interface options				
General Ethernet addresses Time synchronization Operating mode Advanced options Interface options B Real time settions		Support device replacement Permit overwriting of device Use IEC V2.2 LDP mode Keep-Alive connection monitoring	without exchangeable e names of all assigne 30 s	medium d IO devices	>	
Port [X1 P1]	~					

Then, switch to **Topology view**, as shown in the following figure.



In the topology view, click and drag the interface to the interface of another device that is directly connected to this interface, and release the mouse button. Note that the preceding connection must be consistent with the actual network connection of devices. For example, if P1 of the PLC is connected to P2 of slave 1, and P1 of slave 1 is connected to another slave, the connections must be consistent in the topology. An incorrect topology will cause function failure after replacement and even communication errors. (After the MD500-PN1 card is installed, P1 is on the left and P2 is on the right when facing the RJ45 interface.)

<b>ب</b>	🍊 🗄 🛄 🛍 🚆 🙀 🌽 Goonlir	🖉 Go offline 🛛 👬 🚺	× 🗆 🗆 '	
	PN test > Devices & networks			
			🚽 Topology view	Network view
] 🛃	₩ •		-	
				^
	PLC_1 MD5 CPU 315-2 PN/DP MD5	OPN		-
_				
				• -
				~
	< .	> 100%	•	
			1000 m	

After completing the topology, start compiling and download the configuration to the PLC.

# Selecting the Support device replacement without exchangeable medium Option and Setting Topology in STEP 7

In hardware configuration, double-click PN-IO, as shown in the following figure.

🖳 HW Config	g - [SIMATIC 300(1) (Confi	guration) 1111
💵 Station	Edit Insert PLC View	Options Wind
🗅 🗃 🔓	• 🖫   5    4 🗈    1	u 🎪   📳 📼   9
🚍 (0) VR		
2	CPU 315-2 PN/DP	
E1	MPI/DP	-
II	IN-IV	
\$2 P1 R	Port 1	
<u>82 82 8</u>	Sort 2	-=
3		_
4		_
5		
<u>6</u>		-
		-
		- <b>-</b>

Click the **General** tab, select **Support device replacement without exchangeable medium**, and click **OK**, as shown in the following figure.

Media Redu General	ndancy ddworror	Time-of-Day Sy	nchronization	Options
	Addresses	TROTINET	I Device	Synchr on Fact on
Short	PN-IO			
)evice name:	PN-IO			
Use differe	nt method to ol	otain devic		
1 Summer 1	1			
<ul> <li>Support dev.</li> </ul>	ice replacement	t without exchange	able medium	
<b>T</b> . C				
Turne	Fthernet			
Dorrigo	0			
Address.	100 160 0 1			
Address:	192.166.0.1		1	
Networked:	Yes	Properties		
Comment:				
				*
				*

According to the actual network connections, double-click **Port 1** or **Port 2** of the PLC, and switch to the **Topology** tab. Select the port of the slave connected to the

PLC from the **Partner port** drop-down list (the default option is **Any partner**, which must be changed to the actual connected port), and click **OK**.

roperties - PN-IO - Port 1 (R0/S2/X2 P1 R)				
General Addresses Topology Options				
-Port Interconnection				
Local port:	SIMATIC 300(1)\PN-I0 (CPU 315-2 PN/DP)\Port 1 (RO/S2/X2 P1 R)			
Medium:	Local port: Copper Partner port:			
Cable name:	Copper			
Portpors				
Partner port: <	Any partner			
Alternating partner ports:	Any partner SIMATIC 300(1)\(1) MD500PN\Port 1 (X1 P1 R) SIMATIC 300(1)\(1) MD500PN\Port 2 (X1 P2 R)			
	Add Delete Details			
Cable Data				
Cable length:	✓ 100 m			
C Signal delay time [µs] 0.60				
OK Cancel Help				

Then click the corresponding ports of the slave to set the topology. The operations are similar to the preceding steps. After setting all connected ports, start compiling and download the configuration to the PLC.

After completing the preceding configuration, perform the following operations when a slave device needs to be replaced: 1) Disconnect the device from the network. 2) Install a new device that is not assigned with a device name before at the same position. (For S7-1200 or S7-1500, if **Permit overwriting of device names of all assigned IO devices** has been selected, a device that has been assigned with a name can be used.) 3) Connect the new device to the network using the original wiring mode. (Note that the network cable connection must be consistent with the original connection and the connection in the topology.) 4) Power on the slave station. The PLC will assign a device name to the newly connected device automatically.

# 6 EtherCAT Communication

## 6.1 Introduction

Applicable to industrial field ultra-high speed I/O network, the MD500-ECAT communication card (ECAT card for short) operates at the I/O layer and features high efficiency, flexible topology, and easy operation.

It is installed on the MD520 series AC drive to improve the communication efficiency and implement AC drive networking, enabling the AC drive to be a slave controlled by the fieldbus master. It supports a minimum synchronization cycle of 500  $\mu$ s.

This user guide is applicable to the ECAT card with software of version 1.00 or later (you can query the version by viewing the parameter U0-67 of the AC drive after the card is installed and powered on). The corresponding device profile XML file is **MD500\_1Axis\_V1.03.xml**.

## 6.2 Installation

The MD500-ECAT card is embedded in the MD520 series AC drive. Before installation, cut off the power supply of the AC drive and wait for about 10 minutes until the charging indicator of the AC drive becomes off. Then, insert the MD500-ECAT card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by the pulling force of the external signal cable. *"Figure 6–1 " on page 105* shows the installation.

After installing the MD500-ECAT card on the AC drive, connect the ground terminals of the MD500-ECAT card and the AC drive properly, as shown in *"Figure 6–2 Connecting ground terminals of the MD500-ECAT card and AC drive" on page 106.* 



Figure 6-1 Installation of MD500-ECAT



Figure 6-2 Connecting ground terminals of the MD500-ECAT card and AC drive

#### 6.3 Interface Layout and Description

The following figure shows the interface and indicator layout of the MD500-ECAT card. The pin header J7 on the back of the MD500-ECAT card is used to connect the AC drive. The MD500-ECAT card provides two network ports (J4 and J6) for communication with the master (or the upstream slave) and the downstream slave (if any).



Figure 6-3 Interface layout of the MD500-ECAT card

	Symbol	Hardware Name	Function
	J7	Pin header	It connects to the AC drive.
	J4		They use the standard Ethernet RJ45
	J6	Network ports	socket and are used for communication with the master (or the upstream slave) and the downstream slave (if any).
J1 EMC ground ter		EMC ground terminal	It connects to the EMC ground terminal of the AC drive.

Symbol	Hardware Name	Function	
D13	Power indicator (green)	It indicates the power status. ON indicates normal. OFF indicates abnormal, and you need to check whether the installation is correct.	
D1	Status indicator of communication with AC drive (green)	For details, see <i>"Table 6–2 Status</i>	
D4	EtherCAT interaction indicator (green)	indicators of the MD500-ECAT card" on page 107	
D7 ESC fault indicator (red)			



- J4 is the input port (ECAT IN) and J6 is the output port (ECAT OUT). Do not connect the input and output reversely.
- Use the Cat5e shielded twisted pair (STP) network cable to ensure stability.

Indicator		State Description	Solution			
	Steady green	Normal	N/A			
D1	Steady off	Abnormal communication with the AC drive	Set F0-28 to 1 and check whether the AC drive supports the MD500-ECAT card.			
	Steady green	Working at OP state	N/A			
D4	Blinking green	Working in PREOP/SAFEOP mode	Check the configuration. Check whether the AC drive supports the MD500-ECAT card and whether F0-28 is set to 1. Check whether the network port is connected correctly.			
	Steady off	Master disconnected or working in Initial mode	Check whether the master and upstream network port are connected correctly.			
	Steady off	Normal	N/A			
D7	Steady red	ESC internal exception	Contact Inovance for technical support.			

#### Table 6–2 Status indicators of the MD500-ECAT card
## 6.4 Topology

After enabling communication between the ECAT card and the AC drive, connecting the ECAT card to the ECAT master correctly and completing relevant communication configuration can enable the communication between the ECAT card and ECAT master and the AC drive networking function.

The ECAT card supports various topological structures including star, bus, and tree topologies and their combinations. This enables flexible and convenient equipment connection and wiring. The following figure shows the bus topology.



Figure 6-4 EtherCAT bus topology

## 6.5 PDO Data

### **PDO Data Description**

The PDO data enables the master to modify and read AC drive data in real time and perform periodic data exchange. The data communication addresses are directly configured by the AC drive. The functions of PDO data are as follows:

- 1. Setting the AC drive control command and target frequency in real time
- 2. Reading the current state and running frequency of the AC drive in real time
- 3. Exchanging function parameter and monitoring parameter data between the AC drive and EtherCAT master in real time

The PDO process data is used for periodic data exchange between the master and AC drive axes, as described in the following table.

Transmit PDO from the Master to Axis 1 (1601h)			Response PDO of AC Drive Axis 1 (1A01h)		
Fixed RPDO Variable RPDO					
AC Drive Command	AC Drive Target Frequency	AC Drive Parameters Modified in Real Time	AC Drive State AC Drive Running AC D Frequency Paramete in Real		AC Drive Parameters Read in Real Time
RPDO1	RPDO2	RPDO3 to RPDO12	TPDO1	TPDO2	TPDO3 to TPDO12

### Data Sent by the Master (RPDO)

RPDO	Description
RPDO1	AC drive command word (command source set to communication, that is, F0-02 = 2) • 1: Run in forward direction • 2: Run in reverses direction • 3: Jog in forward direction • 4: Jog in reverse direction • 5: Coast to stop • 6: Stop according to the stop mode defined by F6-10 • 7: Reset upon fault
RPDO2	AC drive target frequency (frequency source set to communication), which ranges from the reverse frequency upper limit (negative value) to forward frequency upper limit (decimal places included, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the reference target frequency exceeds this range, the AC drive runs at the frequency upper limit. For example, if the frequency upper limit is set to 50.00 Hz and the frequency reference set through communication is 6000, the AC drive will run at 50.00 Hz in the forward direction. If the frequency upper limit is set to 50.00 Hz and the frequency reference set through communication is –6000, the AC drive will run at 50.00 Hz in the reverse direction.
RPDO3 to RPDO12	Parameter values modified in real time, not written into EEPROM. FE-02 to FE-09 correspond to RPDO3 to RPDO12. For details about the configuration, see the PDO Data Configuration section.

Table 6–3	Master	transmit	data	RPDO
Tuble 0 0	master	cransninc	aaca	100

## Data Returned by the AC Drive (TPDO)

Table 6–4

TPDO	Description
TPDO1	AC drive running state • Bit0: 0: Stopped; 1: Running • Bit1: 0: Running in forward direction; 1: Running in reverse direction • Bit2: 0: Not faulty; 1: Faulty • Bit3: 0: Running frequency not reached; 1:
	Running frequency reached • Bit4 to bit7: Reserved • Bit8 to Bit15: AC drive fault code

TPDO2	AC drive running frequency (unit: 0.01 Hz) The current AC drive running frequency is returned. The returned data is 16-bit signed data and the received data is 16-bit unsigned data. Variables must be mapped to the 16-bit signed data.
TPDO3 to TPDO12	Parameter read in real time. FE-22 to FE-29 correspond to TPDO3 to TPDO12. For details about the configuration, see the PDO Data Configuration section.

## 6.6 SDO Mailbox Data

EtherCAT SDO is used to transfer non-cyclic data, such as communication parameter configuration and servo drive running parameter configuration.

The CANopen over EtherCAT (CoE) service types include: emergency message, SDO request, SDO response, TxPDO, RxPDO, remote TxPDO transmit request, remote RxPDO transmit request, and SDO information.

MD520 supports the SDO request and SDO response.

## 6.7 Related Parameters

### **AC Drive ECAT Card Configuration**

After installation, the MD500-ECAT card can communicate with the AC drive properly only after F0-28 is set to 1.

Parameter	Parameter Name	Value Range	Setpoint	Description
F0-28	Serial communication protocol	0: Modbus protocol 1: Communication card network bridge protocol	1	Select the special communication card network bridge protocol as the serial communication protocol.
F0-02	Command source	0: Operating panel 1: Terminal 2: Communication	2	Set the command source to communication.
F0-03	Main frequency reference source	0: Digital setting (non-retentive at power failure) 1: Digital setting (retentive at power failure) 2: Al1 3: Al2 4: Al3 5: Pulse reference (DI5) 6: Multi- reference 7: Simple PLC 8: PID 9: Communication	9	Set the target frequency through communication.

#### **Communication Control Parameters**

Parameter	Parameter Name	Value Range		Decimal Address
U3-16	Frequency reference	–Maximum frequency to +Maximum frequency 0.01 Hz		29456
U3-17	Control command	0000: Stop according to the stop mode defined by F6-10 0001: Run in forward direction 0002: Run in reverse direction 0003: Jog in forward direction	0004: Jog in reverse direction 0005: Coast to stop 0006: Decelerate to stop 0007: Reset upon fault	29457
U3-18	DO control	Bit0: DO1 output control Bit1: DO2 output control Bit2: Relay 1 output control Bit3: Relay 2 output control		29458
U3-19	AO1 control	0 to 7FFF, indicating 0% to 100%		29459
U3-20	AO2 control	0 to 7FFF, indicating 0% to 100%		29460
U3-21	FMP control	0 to 7FFF, indicating 0% to 100%		29461
U3-22	Reserved	Reserved		
U3-23	Speed control	Signed data, 1 RP	Signed data, 1 RPM	

Table 6–5	Communication	control	parameters

Each object within the dictionary shall be addressed uniquely by using an index and sub-index.

The index (hexadecimal) specifies the position of the same type of objects in the dictionary.

The sub-index specifies the offset of each object in the same index in hexadecimal format.

The mapping between AC drive parameters and object dictionary indexes is as follows:

Object dictionary index = 0x2000 + Parameter group number

Object dictionary sub-index = Hexadecimal value of offset in parameter group + 1

When the MD500-ECAT card is used, the written PDO1 and PDO2 are mapped to U3-17 and U3-16 respectively by default. Therefore, ensure that the first entry of RPDO is U3-

## www.PLC1.ir

17; otherwise, an operation exception will occur. Besides, if any non-zero value is written to the high-order 8 bits of U3-17, the AC drive will report the communication fault Err164.

### **Communication Monitoring Parameters**

Parameter	Parameter Name	Unit	Decimal Address
U0-00	Running frequency	0.01 Hz	28672
U0-01	Frequency reference	0.01 Hz	28673
U0-02	Bus voltage	0.1 V	28674
U0-03	Output voltage	1 V	28675
U0-04	Output current	0.1 A	28676
U0-05	Output power	0.1 kW	28677
U0-06	Output torque	0.1%	28678
U0-07	DI state	1	28679
U0-08	DO/RO state	1	28680
U0-09	AI1 voltage	0.01 V	28681
U0-10	AI2 voltage	0.01 V	28682
U0-11	AI3 voltage	0.01 V	28683
U0-12	Count value	1	28684
U0-13	Length value	1	28685
U0-14	Load speed	1	28686
U0-15	PID reference	1	28687
U0-16	PID feedback	1	28688
U0-17	PLC stage	1	28689
U0-18	Pulse input frequency	0.01 kHz	28690
U0-19	Feedback speed	0.01 Hz	28691
U0-20	Remaining running duration	0.1 min	28692
U0-21	Al1 voltage before correction	0.001 V	28693
U0-22	AI2 voltage before correction	0.001 V	28694
U0-23	AI3 voltage before correction	0.001 V	28695
U0-24	Linear speed	1 m/min	28696
U0-25	Current power-on duration	1 min	28697
U0-26	Current running duration	0.1 min	28698

Table 6–6 Communication monitoring parameters

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Parameter	Parameter Name	Unit	Decimal Address
U0-27	Pulse input frequency	1 Hz	28699
U0-28	Communication reference	0.01%	28700
U0-29	Encoder feedback speed	0.01 Hz	28701
U0-30	Main frequency X	0.01 Hz	28702
U0-31	Auxiliary frequency Y	0.01 Hz	28703
U0-32	Any memory address	1	28704
U0-33	Synchronous motor rotor position	0.1°	28705
U0-34	Motor temperature	1°C	28706
U0-35	Target torque	0.1%	28707
U0-36	Resolver position	1	28708
U0-37	Power factor angle	0.1°	28709
U0-38	ABZ position	1	28710
U0-39	V/f separation target voltage	1 V	28711
U0-40	V/f separation output voltage	1 V	28712
U0-41	DI state display	1	28713
U0-42	DO state display	1	28714
U0-43	DI state display 1	1	28715
U0-44	DI state display 2	1	28716
U0-45	Fault information	1	28717
U0-58	Z signal counter	1	28730
U0-59	Frequency reference	0.01%	28731
U0-60	Running frequency	0.01%	28732
U0-61	AC drive state	1	28733
U0-62	Current fault code	1	28734
U0-63	Data sent by master during point-point communication	0.01%	28735
U0-64	Data sent by slave during point-point communication	0.01%	28736
U0-65	Torque upper limit	0.1%	28737

Parameter	Parameter Name	Unit	Decimal Address
U0-66	Expansion card model	100: CANopen 200: PROFIBUS DP 400: PROFINET 500: EtherCAT 600: EtherNet/IP	28738
U0-67	Expansion card version	0.01	28739
U0-68	AC drive state	1	28740
U0-69	Running frequency	0.01 Hz	28741
U0-70	Motor speed	1 RMP	28742
U0-71	Output current	0.1 A	28743
U0-80	Name of EtherCAT slave	1	28752
U0-81	Alias of EtherCAT slave	1	28753
U0-82	EtherCAT ESM transmission error code	1	28754
U0-83	EtherCAT XML file version	0.01	28755
U0-84	EtherCAT synchronization loss count	1	28756
U0-85	Maximum errors and invalid frames of EtherCAT port 0 per unit time	1	28757
U0-86	Maximum errors and invalid frames of EtherCAT port 1 per unit time	1	28758
U0-87	Maximum forwarding errors of EtherCAT port per unit time	1	28759
U0-88	Maximum error count of EtherCAT data frame processing unit per unit time	1	28760
U0-89	Maximum link loss of the EtherCAT port per unit time	1	28761

When the MD500-ECAT card is used, the read PDO1 and PDO2 are mapped to U0-68 and U0-69 respectively by default. Therefore, ensure that the first entry of TPDO is U0-68; otherwise, an operation exception will occur.

## 6.8 Communication Configurations

## 6.8.1 Communication Instance of Controlling MD520 with an Omron Controller

This section takes Omron's NX701 master as an example to describe how to configure and use the MD520 series AC drives.

- 1. Create a project.
  - **Device**: Select the actual controller model.
  - Version: 1.09 or later version. NX701-1600 supports version 1.10 or later.

Sysmac Studio (32bit)				
			-	
Offline	Trease transe Author Comment Type ************************************	roperties New Project Standard Project Device Controller B24	v v v Create	

- 2. Perform communication settings.
  - a. Choose **Controller** > **Communications Setup** on the main interface to set the connection mode between the PC and controller.
  - b. Select **Direct connection via USB**, and click **USB Communications Test**. Proceed to the next step if the test is successful.



3. Import the XML configuration file.

Double-click **EtherCAT** on the left, select and right-click the master, click **Install** (File) in the **ESI Library** window, select the MD500-ECAT card XML configuration file and import it.



4. Scan for devices.

Switch the controller to the online running mode.

You can observe the controller status in the lower right corner: ONLINE, RUN mode.



Scan for devices and add slaves. Choose **Configurations and Setup** > **EtherCAT**, right-click the master device, and choose **Compare and Merge with Actual Network Configuration**. The controller automatically scans all slaves in the network (a fault will be reported if any station number is 0). After the scanning is complete, click **Apply** in the displayed **Apply actual network configuration** dialog box. The slaves are added. You can view the added slaves on the main interface.

# Note

The MD500-ECAT card allows the station alias to be modified by using the parameter FD-02 or the software tool of the master station. The modified station alias takes effect upon next power-on.





5. Set the parameters.

Switch the controller to the offline mode.

New Project - new_Controller_0	- Sysmac Stud	dio (32bit)								
File Edit View Insert Project	t Controller	Simulatio	on Tools	Window	Help		-			
	- <sup>-</sup>	20 W	E ₩	A 🖲	民	<u>a</u>	63 🛔	9 E	۹.	o ୍ଜ୍ ଜ୍
Multiview Explorer 🚽 🖣	EtherCAT	🧈 I/O M	ap 🗙			C	Offline			
new_Controller_0	Position	 ▼ § Ether(	Po CAT Netwo	ort rk Configura	tion		Descriptio	n	R/W	Data Type
Configurations and Setup	Node13	V Ino	MD500N							
▼ 潘 EtherCAT		Out	tputs_Contr	rol Comman	d_2073_12				w	UINT
∟ -□ Node13 : InoMD500I		Out	tputs_Writt	en Freq_207	3_11				w	INT
CPU/Expansion Racks		Inp	uts_Inverte	r State_2070	_45				R	UINT
J/O Map		Inp	uts_Output	Frq_2070_4	6				R	INT
Controller Setup										
▶ 樹 Motion Control Setup	l I									
Event Settings	l I									
Task Settings										
Data Trace Settings	l I									
Programming										
▼ E Programs										
V Re Program0			_	_	_	_	_	_	_	
L Section0	- Monitor type									
L SE Functions	🔵 Data type	e 🔵 Binary	🔵 Hex 🔵	Signed dea	cimal 🔵 L	Jnsigned d	lecimal			
L The Function Blocks										
	Build									

Set the PDO mapping (I/O mapping).

New Project - new_Controller_0 - Sysman	c Studio (32bit)	
File Edit View Insert Project Cont	troller Simulation Tools Window Help	
X 🕮 🖬 🖄 ဘင 🖻 🗗	▲ 影 局 間 筆 ▲ 図 ■ ★ ▲ ≫ ⊗ 秒 ♀ 言 ○ 임 ♡ □ □ ● ● 兆	
Multiview Explorer 🔹 🕈 🔠 Ether	rCAT 😒 I/O Map 🗙	- 1
new_Controller_0  Posi	ition Port Description R/W Data Type Variable Variable Comment Vari T Cher CAT Network Configuration	able
<ul> <li>Configurations and Setup</li> <li>Node</li> </ul>	le13 V InoMD500N	
▼ 7 EtherCAT	Outputs_Control_Command_2073_12 W UINT gControl_Cmd Globa	l Vari
L - Node13 : InoMD500	Outputs_Written Freq_2073_11 W INT gFrepOut Globs	l Vari
CPU/Expansion Racks	Inputs_Inverter State_2070_45 R UINT gAC_State Globa	l Vari
🖉 🦨 I/O Map	Inputs_Output Frq_2070_46 R INT gAC_Speed	
Controller Setup		
▶ 億 Motion Control Setup		
er' Cam Data Settings		
Event Settings		
Task Settings		
⊡ Data Trace Settings		
Programming		
V 🖪 POUs		
V III Programs		
V 💀 Program0		
L & Section0		
L 🕱 Functions		$ \Sigma $
L 35 Function Blocks		1 -
▶ III Data		<u> </u>
► En Tasks		
	Description Program Cocation	
El Elter	Build	

6. Edit the PLC program.



7. Download the program to the controller.

After the configuration and programming are complete, switch the controller back to the online state, and download the program to the controller.



# 6.8.2 Communication Instance of Controlling MD520 with an H5U Controller

This section takes the H5U master as an example to describe how to configure and use the MD520 series AC drives.

1. Open the software and create an H5U project

Select **H5U Series** in the **Series and models** drop-down list, as shown in the following figure.

New Project	$\times$
New Project     O Temporary Project	
Project Settings	
Project name:	
Save path: :\UMD520\	
Editor: Ladder Chart 🗸 🗸	
Project description:	
Equipment Selection	
Series and models: H5U Series $~~\sim~~$ H5U $~~\sim~~$	
(1) EtherCAT bus high performance small PLC (2) Support custom variables and FB/FC (3) Maximum support for 32-axis motion control (including EtherCAT and local pulse), support positioning, interpolation and electronic cam (4) Support 4-axis 200KHz pulse output, 4 channels 200 KHz high-speed input	
OK Cancel	

 Import the EtherCAT configuration file of MD520.
 Right-click EtherCAT Devices and choose Import Device XML. If an MD520 EtherCAT configuration file of another version exists, delete the existing configuration file before importing a new one. See the following figure.



### 3. Add an MD520 AC drive slave.

Double-click **EtherCAT** under **Config** on the left to open network configuration, and drag the device in the network device list to add the AC drive slave.

📑 AutoShop V4.4.16.5 Temp Proje	ct - [InoMD500N]				– ø ×	
File(F) Edit(E) View(V) PLC(P)	Debug(D) Tools(T) Window(W)	Help(H)				
) <b>B B B B</b>   X <b>B</b> G	이 안 한 Q 등 중 🖻	🖫 🖻 🕨 🔹 🛓 🔮 -	6 🕞 🖻 🥨 중 중 👶 🗉 🤆			
∞∎⊚≑↓⇒↓₽‡			$- +  earrow \mathbb{K} \uparrow + \mathbb{K}$ Lecal Not byged in	UP. 192. 168.0.40		
Project Manager & X				^	Toolbox 0	×
🕫 🎻 System Variable Ti 🔿	General Settings	Address	Istra		✓ Sear	dh
Global Variable	Process Data	Config Addr. 🛛	Inabling Report Sottings		EtherCAT Devices	^
G function Block	Startup Parameters	Rendated Clark			B Serve Drives B Multi_Axis Drive	
0-11 Programming 0-11 Program Block	1/0 Punctional Repping	Sync. Hole Selection Dr-Synchron	•		B Analog 30 B Pulse Output Units	
8-2 SBR_001 8-2 SBR_001 8-7 INT_001	Information	Dynal:	pai		Prequency Invester     Prequency Invester     Previews	
Function Block	State	STRC Bashles			Etheniet/P Devices     Province Devices     Other Province	
⊖-∰ <mark>5</mark> Config		Solo ant cytte	Cycle time(µs)		R-Instruction Set	
input Filtering		<ul> <li>Ther defined</li> </ul>	Offset time(µs)		Basic logic	
		Synet:			Piev control     Societa Ined	
B Motice Center		STR1 stalls			Data computation	
Axis Group Set					Dets processing     Matrix	
e- 🗮 EtherCAT		Sync. wit cycle at	4000 Cycle time(µs)		8- Strings	
		O User Defined	0 Offset time(µa)		Clock     HC axis control(EtherCAT & Pulse out)     HC axis control(CAVigoen)	
CAN(CANLink)					< >	
Ethernet					MD500_sAxis_V1.06	
		Alias Address 1	Hiss snahled	•		
· · · · · · · · · · · · · · · · ·	al MAIN IIs EtherCat.	noMD500N		6 M		

4. Set the PDO parameters.

Click **Process Data**, and click **Add** to add the TPDO mapping as required.

	Input/Ostput	Sane	Add/Edit				
Process Data	∃ 🗹 Output	Outputs	Index: Subindex	Nane	Sig	n Type	Default Value
	Output	Control Command	<sup>30</sup> 16#20F0:16#00	Standard Parameters	BD	UINT	
Startup Farameters	Output	Written Freq	<sup>™</sup> 16#20F2:16#00	Vector Ctrl Para	BD	UINT	
	🗏 🗹 Input	Inputs	16#20F3:16#00	V/F Ctrl Fara	BO	UINT	
U Functional Mapping	Input	Inverter State	16#2074:16#00	Input Terminals	BO	UINT	
	Input	Output Frq	<sup>™</sup> 16#20₱5:16#00	Output Terminals	BO	UINT	
Information			■ 16#20F6:16#00	Start/Stop Control	BO	UINT	
			16#20F8:16#00	Auxiliary Functions	BD	UINT	
State			■ 16#20F9:16#00	Fault and Frotection	BD	UINT	
			16#20FA:16#00	PID Func	BO	USINT	
			<sup>Ⅲ</sup> 16#20FB:16#00	Fixed Length and Count	BO	USINT	
			■ 16#20FC:16#00	Simple PLC Func	BO	UINT	
			B 1680040-16800	Terme Ctrl	RV	117.07	
			Sune:		Data type:	BIT	•
			Index: 16#		lit Length:		
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**NOTE: Control Command** of the RPDO and **Inverter State** of the RPDO cannot be changed and they must be set as the first entries. Otherwise, an operation exception will occur.

#### 5. Scan for the H5U PLC.

Choose **Tools** > **Communication Settings**, select a communication mode between the PC and PLC (Ethernet or USB), and scan for the PLC.

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6. Download the project to the PLC and activate and run the device. Download the compiled project file, click the run button to activate the configuration, and click the monitor button to view the motion data.

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You can view TPDO data and write RPDO data in real time through EtherCAT I/O mapping.

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## 6.8.3 Communication Instance of Controlling MD520 with an AM600 Controller

This section takes the AM600 master as an example to describe how to configure and use the MD520 series AC drives.

1. Open the software and create an AM600 project.

Select **AM600-CPU1608TP/TN** in the **Device** drop-down list, as shown in the following figure.

] New Proj	ect	
Categories	:	Templates:
	aries jects	Standard project
A project co	ntaining one device, one ap	pplication, and an empty implementation for PLC_PRG
Location	Culliners/dell/Decuments	-
		OK Cancel

Standard F	Project	23
	You are about to create a new standard project. This wizard will create the following objects within this project: - One programmable device as specified below - A program PLC_PRG in the language specified below - A cyclic task which calls PLC_PRG - A reference to the newest version of the Standard library currently installed. Device: PLO_PRG in the call are to take the calls PLC_PRG PLO_PRG in the standard library currently installed.	,
	PLC_PRG in: Structured Text (ST)	el

2. Add an MD520 AC drive slave. Open network configuration, and import the EtherCAT configuration file of MD520. If any configuration file of another version exists, delete the existing configuration file before importing a new one. Drag the device in the network device list to add the AC drive slave, as shown in the following figure.



3. Set the PDO parameters.

Right-click the position marked with a red arrow in the following figure to add the TPDO mapping as required. **Control Command** of the RPDO and **Inverter State** of the RPDO cannot be changed and they must be set as the first entries. Otherwise, an operation exception will occur.

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LocaBus Config	Online	- 10	Control Command	16#2073	16#12	2.0	UINT			
Analization		- 10	VDI2 Func Selc	16#20A1	16#02	2.0	UINT			
- V Application	CoE Online	- <b>*</b> >	VDI1 Func Selc	16#20A1	16#01	2.0	UINT			
		- **	Written Freq	16#2073	16#11	2.0	INT			
Tark Configuration	EDE Settings	😑 🔽 Inpu	t Inputs	16#1A00	16#00	8.0		Editable	3	
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	Status	- *	Running Frq	16#2070	16#01	2.0	UINT			
- Bacasc		- 10	Output Frg	16#2070	16#46	2.0	INT			
SoftMotion General Axis Paol	Information									
HIGH SPEED TO (High Speed TO Module)										

### Scan for devices.

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Download the project to the PLC.

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Library Manager		- 10	Written Freg	16#2073	16#11	2.0	INT		
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You can view TPDO data and write RPDO data in real time through EtherCAT I/O mapping.

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You can view and directly write parameter values through the online CoE.

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# 6.8.4 Communication Instance of Controlling MD520 with a Beckhoff Controller

This section takes Beckhoff's TwinCAT master as an example to describe the configuration of the MD500-ECAT card.

# www.PLC1.ir



Select a 100M Ethernet network adapter with an Intel chip. Other network adapters may not support EtherCAT.

#### 1. Install TwinCAT.

- Windows XP: tcat\_2110\_2230 is recommended.
- Windows 7 32-bit: tcat\_2110\_2248 is recommended.
- 2. Copy the EtherCAT configuration file (**MD500\_1Axis\_V1.03.xml**) of MD520 to the TwinCAT installation directory.
  - TwinCAT2 directory: TwinCAT\IO\EtherCAT
  - TwinCAT3 directory: TwinCAT\3.1\config\IO\EtherCAT

The following takes TwinCAT3 as an example. The operation steps for TwinCAT2 are similar.

#### 3. Open TwinCAT.

a. Click New Project to create a project.

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ľ	(Integrated)	Discover what's new in 2013 Shell (Integrated) You can find information about new features and enhancements in 2013 Shell (Integrated) by reviewing the following sections.	What's new on Mic	forms		
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#### b. Click **OK**.

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	Location:	C/(Users\B298	\Documents\Visual Studio 2013\Proje	cts ·	Browse		Search Error List	ρ.	
	Solution name:	TwinCAT Projec	el?		Create directory for solution OK Cancel	F. Une	Column Project		
	I							_	

4. Install the TwinCAT network adapter driver.



Choose **TWINCAT** > **Show Real Time Ethernet Compatible Devices...** In the displayed dialog box, select the local network adapter under **Incompatible devices**, and click **Install**. After installation, the installed network adapter is displayed under **Installed and ready to use devices**.



- 5. Search for devices.
  - a. Create a project, right-click **Devices**, and then click **Scan** to search for devices, as shown in the following figure.



b. Click OK.



c. Click **OK.** 



d. Click Yes.

Microsoft Visual Studio					
Scan for boxes					
Yes No	]				

e. Click **OK.** 



f. Click No. Now the device search is complete, as shown in the following figure.



- 6. Set the PDO parameters.
  - a. Configure TPDOs.

Select 0x1A00. The first two entries are default TPDOs and cannot be changed. Right-click the position marked with a red arrow in the following figure to add the TPDO mapping as required.

TwinCAT Project7 - Microsoft Visual Studio (Adm FILE EDIT VIEW PROJECT BUILD DEBUG	inistrator) TWINCAT TWINS	AFE PLC	TOOLS SCO	PE WINDOW	HELP			
0-0 18-1- 1 H H X I A 9	- C - Attach	•	- Re	ease - Ti	vinCAT RT	(x64)	•	<b>,</b>
	2 C = 0   E		U = 0 🖬 🖬	1 🔤 📚 🔨 🦉	V 🖳 🗟	< Loca	1>	• =
Solution Explorer 👻 👎 🗙	TwinCAT Project7 👳	×						
○ ○ ☆   <sup>™</sup> - <sup>™</sup> -	General EtherCAT	DC Proc	ss Data Starti	p CoE - Online	Online			
Search Solution Explorer (Ctrl+;)	Sync Manager:		PDO List:					
Solution 'TwinCAT Project7' (1 project)	SM Size Typ	e Flags	Index Si	re Name			Flags	SM
IwinCAT Project/	0 256 Mbx	Out	0x1A00 4.	) Inputs				3
P SYSTEM	1 256 Mbx	In	0x1600 4.	) Outputs				2
A MOTION	2 4 Out							
P M NC-Task 1 SAF	5 4 Inp	uts						
PLC								
SAFETY								
K C++	PDO Assignment (Or	(1012)	PDD Content ()	v1400):				
▲ <u>■ 1/0</u>	100 Hanganan (0)							
<ul> <li>"E Devices</li> </ul>	<b>W</b> OWLOOD		Index	Size Offs	Nane			Type
<ul> <li>Device 2 (EtherCAT)</li> </ul>			0x2070:45	2.0 0.0	Inverte	r State		UINT
Image			0x2010:46	2.0 2.0	Uutput	frq		UINT
Image-Info		4		, <del>.</del>				
SyncUnits	Deurland		n 1 C 1 n		$\sim$			
Inputs	RIO Anni mari		Frederined FI	U Assignment:	none)			
Outputs	The Assignment		Load PDO info	from device				
InfoData	PDU Configura	tion	Sync Unit Ass	ignnent				
<ul> <li>Drive 1 (InoMD500N)</li> </ul>								
Inputs								
Outputs	Name	Online	Туре	Size	>Add	In/Out	User	Linked to
WcState	7 Inverter State	0	UINT	2.0	71.0	Input	0	
InfoData	T Outout Fra	0	LINI	2.0	72.0	Input	0	
A Appings	- Output Frq		UIN	2.0	15.0		~	

b. Configure RPDOs.

Select 0x1600. The first two entries are default RPDOs and cannot be changed. Right-click the position marked with a red arrow in the following figure to add the RPDO mapping as required.

Ded       TwinCAT Project7 - Microsoft Visual Studio (Adr         FILE       EDIT       VIEW       PROJECT       BUILD       DEBUG         Image: Image	ninistrator) TWINCAT TWIN ▼ ♥ ▼   ► Attach ໑. ໑. ৫ ⊯ ♡   0	SAFE PLC ・	TOOLS SCOP	E WINDOW	/ HELP winCAT RT	(x64)	•	اللہ اللہ اللہ اللہ اللہ اللہ اللہ اللہ
Solution Explorer   Search Solution Explorer (Ct1+:)  Search Solution Explorer (Ct1+:)  Solution Explorer (Ct1+:)  Solution Explorer (Ct1+:)  Solution Explorer (Ct1+:)  Norticx Project7  Norticx Solution  Norticx Solution  Norticx Solution  Solut	Sync Manager:       SN Size Ty       0     256 Hb       1     258 Hb       2     4       3     4	pe Flags x0ut x1n t puts	PDO List: Index Siz Ox1400 4.0 Ox1600 4.0	CoE - Onlin e Nane Inputs Outputz	0nline		Flags	5M 3 2
	PDD Assignment () PDDx1500 Download PDD Assignme PDD Configur	hx1C12): nt ation	PDD Content (0 Index 0x2073:12 0x2073:11 Predefined PDD Load PDD info Sync Unit Assi	x1600): Sire Offr 2.0 0.0 2.0 2.0 4.0 Assignment: from device gmment	Name Control Writter (none)	Command > Freq		Type UINT INT
<ul> <li>► Computs</li> <li>► Comput</li></ul>	Name P Inverter State Output Frq	Online 0 0	Type UINT UINT	Size 2.0 2.0	>Add 71.0 73.0	In/Out Input Input	User 0 0	Linked to

c. View the SDO data list.

After the OP state is activated, you can view real-time data in the SDO data list or double-click the object dictionary to modify the SDO data.



d. Activate the configuration and switch to the running mode.

Click E. The following dialog box is displayed.

Microsoft Visual Studio	
(Old Configuration (Old Configurations will be overwritten	n!)
OK Car	icel

Click OK.



Click **OK** to enter the OP state.

🕅 TwinCAT Project7 - Microsoft Visual Studio (Administrator)								
FILE EDIT VIEW PROJECT BUILD DEBUG	TWINCAT TWI	NSAFE PLC	TOOLS SCOPE	WINDOW	V HELP			
0-0 18-1	- C - Attach.	•	- Release	- T	winCAT RT	(x64)	_	
	6. 6 0 = 0	10 10 10 10 10 10 10 10 10 10 10 10 10 1		1 1/2 6	81 🔊 🖗	L cloca	15	
	30 G G ⊂ O I		U \$ 0 <b>11 12 1</b>	10	9   💌 📲	- COCA	10	
Solution Explorer 🔹 후 부 🗙	TwinCAT Project7	* ×						
© © ☆   <sup>™</sup> ≁ <mark></mark>	General EtherCAT	I DC Proce	ss Data Startup Co	E - Onlin	e Online			
Search Solution Explorer (Ctrl+;)	State Machine							
g. Solution 'TwinCAT Project7' (1 project)	Init	Bootstrap		07		_		
TwinCAT Project7	Pre-Op	Safe-Op	Current State:	UP				
SYSTEM	00	Clear Error	Requested Stat	.e: OP				
MOTION								
NC-Task 1 SAF DI DUC	DLL Status							
	Port A: Car	rrier / Open						
SAFETT	Port B: No	Carrier / Close	ed.					
	Port C: No	Carrier / Close	2 d					
▲ <sup>4</sup> <sup>m</sup> Devices	Port D: No	Carrier / Close	1 d					
Device 2 (EtherCAT)								
🚔 Image	File Access ov	ver EtherCAT						
🛟 Image-Info	Download	Upload						
SyncUnits								
Inputs								
Outputs								
P 🖬 InfoData							_	
Outputs	Name	Online	Туре	Size	>Add	In/Out	U	
WcState	🕫 Inverter State	0	UINT	2.0	71.0	Input	0	
🕨 🛄 InfoData	🕫 Output Fra	0	UINT	2.0	73.0	Input	0	
Mappings							-	
NC-Task 1 SAF - Device 2 (EtherCAT	Error List							
INC-TASK I SAF - Device 2 (EtherCA)	T - O 0 Errors	s A 0 Warnin	as 14 Messag	es Clea	ar			
	Deserved		-   • • • • • • • • • • • • • • • • • •					
	Description	•						

e. Control the AC drive through PDO.

Write corresponding values through the configured RPDO to control the AC drive.

TwinCAT Project7 - Microsoft Visual Studio (Adn	ninistrator)
FILE EDIT VIEW PROJECT BUILD DEBUG	TWINCAT TWINSAFE PLC TOOLS SCOPE WINDOW HELP
0-0 B-1-00 X A A 9	- C - Attach Release - TwinCAT RT (x64) - 🐻
Solution Explorer 🔹 🕂 🗙	TwinCAT Project7 P ×
○ ○ ☆   `o - 司   ♪ _=	Variable Flags Online
Search Solution Explorer (Ctrl+;)	Yalue:
G Solution 'TwinCAT Project7' (1 project)	New Value: Former Release Write
<ul> <li>TwinCAT Project7</li> </ul>	AND THE ADDRESS TO A TH
SYSTEM	Connent:
MOTION	
SAFETY	
6 C++	Set Value Dialog
🔺 🖾 I/O	
<ul> <li><sup>4</sup> <sup>1</sup> Devices</li> </ul>	
<ul> <li>Device 2 (EtherCAT)</li> </ul>	Hex: DX0000 Cancel
i Image	Float:
Synclinits	
Inputs	Boot 0 1 Hex Edk
Outputs	Binary 0000 2
🕨 🝓 InfoData	
<ul> <li>Drive 1 (InoMD500N)</li> </ul>	DK 5128. 01 08 016 032 064 07
<ul> <li>Inputs</li> </ul>	
Inverter state	
Outputs	
Control Command	
Service Freq	Error List
WcState	
P 🖼 InfoData	T • U U Errors   1 U Warnings   14 Messages   Clear
<ul> <li>Mappings</li> <li>NC Task 1 SAE - Davise 3 (EtherCAT</li> </ul>	Description 🔺
INC-Task I SAF - Device 2 (EtherCAT	

# 6.9 Fault Diagnosis

### 6.9.1 ECAT Card Communication Faults

The following table describes the faults that may occur during use of the MD500-ECAT card and the AC drive.

Sym	ptom	Possible Cause	Solution
Communi		1. The AC drive does not support the MD500-ECAT card.	1. Check whether the AC drive supports the MD500-ECAT card.
failure between the MD500- ECAT	The D1 indicator on the ECAT card is steady	2. The communication configuration of the MD500-ECAT card is incorrect.	2. Set F0-28 to 1.
card and AC drive	01.	3. The MD500-ECAT card hardware is faulty.	3. Replace the MD500-ECAT card.
		1. The communication data is abnormal.	1. Check whether the EtherCAT master program is normal.
	The D1 indicator on the	2. The network cable is damaged or connected incorrectly.	2. Check whether the network cable is connected correctly. Replace the network cable if required.
Err164	is steady off.	3. The AC drive suffers external interference.	3. Use the Cat5e STP network cable as required. Check that the MD500-ECAT card is grounded correctly. Eliminate the external interference. Contact the technical support personnel if necessary.
communi cation error reported by the AC drive during	The D4 indicator on the ECAT card is blinking green.	The card works in PREOP/SAFEOP mode.	Check the configuration. Check whether the AC drive supports the MD500-ECAT card and whether F0-28 is set to 1. Check whether the network port is connected correctly.
during running	The D4 indicator on the ECAT card is steady off.	The master is not connected or the card works in initial mode.	Check whether the master and upstream network port are connected correctly.
	The D7 indicator on the ECAT card is steady red.	An ESC internal exception occurs.	Contact Inovance for technical support.

Table 6–7 Troubleshooting

The MD500-ECAT card can be replaced directly when the slave node is faulty (only when the MD500-ECAT card is faulty) without device configuration again.

The prerequisites for directly replacing the MD500-ECAT card are as follows:

# www.PLC1.ir

- 1. The wiring sequence remains unchanged before and after replacing the MD500-ECAT card.
- 2. The XML file version of the new MD500-ECAT card is the same as that of the original card.
- 3. If a station alias is used for configuring the MD500-ECAT card, the alias of the new device must be consistent with that of the original device.

# 7 PROFIBUS DP Communication

## 7.1 Introduction

As a PROFIBUS DP fieldbus adapter card that meets international PROFIBUS fieldbus standards, the MD38DP2 expansion card can improve the communication efficiency of the AC drive and implement the networking function, enabling the AC drive to be a slave controlled by the fieldbus master. Besides PROFIBUS DP communication, MD38DP2 also provides the CANlink communication interface.

This user guide is applicable to the MD38DP2 expansion card with software of version 1.09 or later (you can query the version by viewing the parameter U0-67 of the AC drive after the card is installed and powered on).

## 7.2 Installation

The MD38DP2 card is embedded in the MD520 series AC drive. Before installation, cut off the power supply of the AC drive and wait for about 10 minutes until the charging indicator of the AC drive becomes off. Then, insert the MD38DP2 card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by the pulling force of the external signal cable. *"Figure 7–1 " on page 143* shows the installation.



Figure 7-1 Installation of MD38DP2


Figure 7-2 Connecting ground terminals of the MD38DP2 card and AC drive

## 7.3 Interface Layout and Description



Figure 7-3 Interface layout of the MD38DP2 card

#### **DIP Switch**



#### MD38DP2 DIP switch description

Digit	Function	Description
1	PROFIBUS DP card type switchover	OFF: MD38DP2 (default) ON: MD38DP1
2 to 8	PROFIBUS DP communication slave address	The addresses of stations 1 to 125 can be set by the 7- digit binary DIP switch. For example: Address DIP Switch Setting (digit 8: least significant bit) 1 000 0001 7 000 0111 20 001 0100 125 111 1101



The change of digit 1 is valid upon the next power-on. The change of slave addresses takes effect immediately after setting.

MD520 only supports MD38DP2. Therefore, digit 1 of the DIP switch needs to be set to OFF.

#### **Standard 9-pin PROFIBUS Interface**

MD38DP2 is connected to the PROFIBUS master using the standard DB9 socket. The pin signal definition and pin arrangement of the standard DB9 socket are the same as those of Siemens' DB9 socket, as shown in the following figure.



Figure 7-4 DB9 terminal pins

### **Control Terminals**

Category	Symbol	Terminal Name	Function	
	1, 2, 7, and 9	NC	Unconnected internally	
PROFIBUS	3	Data line B	Positive pole of the data line	
communica	4	RTS	Request to send signal	
terminal	5	GND	Isolated 5 V power ground	
(J2)	6	+5 V	Isolated 5 V power supply	
	8	Data line A	Negative pole of the data line	
CANlink communica		Positive CAN input	Positive pole of the data line	
tion terminal (J3,	CANL	Negative CAN input	Negative pole of the data line	
J9)	GND	Power ground	Isolated 5 V power ground	
Program ming	SW1	Programming	Interface for production and commissioning. Do not use it.	
Jumper	J6	CANlink terminal resistor configuration	<ul> <li>Pins 1 and 2 shorted: resistor connected</li> <li>Pins 2 and 3 shorted: resistor disconnected</li> </ul>	

Table 7–1 Function description of control terminals

Category	Symbol	Terminal Name	Function
Indicator <sup>Note</sup>	D4 (red)	Power indicator	<ul> <li>Steady ON: The AC drive is powered on.</li> <li>OFF: The AC drive is disconnected from the power supply or the PROFIBUS DP card is installed incorrectly.</li> </ul>
	D3 (yellow)	Indicator of communication between the PROFIBUS DP card and the master	<ul> <li>Steady ON: Communication between the PROFIBUS DP card and the PROFIBUS master is normal.</li> <li>OFF: There is no communication between the PROFIBUS DP card and the PROFIBUS master (check the connection of PROFIBUS cables and the setting of the station number).</li> <li>Blinking: The master is not running or a fault occurs in communication between the PROFIBUS DP card and the master.</li> </ul>
	D2 (green)	Indicator of communication between the PROFIBUS DP card and the AC drive	<ul> <li>Steady ON: Communication between the PROFIBUS DP card and the AC drive is normal.</li> <li>OFF: Communication between the PROFIBUS DP card and the AC drive fails. (F0-28 is not set to 1 or the AC drive does not support the MD38DP2 expansion card.)</li> <li>Blinking: Interference exists in communication between the PROFIBUS DP card and the AC drive or the expansion card address is beyond the range of 1 to 125.</li> </ul>

# Note

Note: For some products, the indicator color and the terminal symbol may not match. In this case, the terminal symbol prevails. The indicators are D2, D3, and D4 from left to right. See "Figure 7–3" on page 144.

# 7.4 Topology and Transmission Distance

The following figure shows the connection between the PROFIBUS DP card and PROFIBUS master.



Figure 7-5 Connection between the PROFIBUS DP card and PROFIBUS master

Terminal resistors must be connected at both ends of the PROFIBUS bus and DIP switches must be set correctly according to the marks on the wiring terminals. After terminal resistors are connected correctly, the resistance between A1 and B1 should be 110  $\Omega$  upon power-off. For devices connected at both ends of the PROFIBUS network, the communication cables must be connected from their PROFIBUS DP terminals to the channels marked with "IN" (channels corresponding to A1/B1). Otherwise, terminal resistors cannot be connected. If any required terminal resistor is not connected, the communication quality will deteriorate.



The required length of the communication cable between the PROFIBUS DP expansion card and the PROFIBUS master varies with the baud rate of the master. It is strictly restricted according to the Siemens DB9 standard. The following table describes requirements on communication cable length based on the baud rate.

Baud Rate (kbit/s)	Maximum Length of Cable Type A (m)	Maximum Length of Cable Type B (m)
9.6	1200	1200
19.2	1200	1200
187.5	600	600
500	200	200
1500	100	70
3000	100	
6000	100	Not supported
12000	100	

The following table lists the technical specifications of the cables.

Cable Parameter	Туре А	Туре В
Impedance	135 $\Omega$ to 165 $\Omega$ (f = 3 to 20 MHz)	100 $\Omega$ to 130 $\Omega$ (f > 100 kHz)
Capacitor	< 30 pF/m	< 60 pF/m
Resistor	< 110 Ω/km	Not specified
Cross-sectional area of conductor	≥ 0.34 mm <sup>2</sup>	≥ 0.22 mm <sup>2</sup>

## 7.5 Protocol Description

#### **Data Transmission Formats**

In the PROFIdrive protocol, the PPO is used as the data transmission format. PPOs are classified into PPO1, PPO2, PPO3, PPO4, and PPO5, all of which are supported by the MD38DP2 expansion card.

The following table lists the functions supported by each data format.

Data Format	Supported Functions
PPO1	Operation on a single function parameter Setting of AC drive command and frequency Reading of AC drive state and running frequency
PPO2	Operation on a single function parameter Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic writing of four function parameters Periodic reading of four function parameters
PPO3	Setting of AC drive command and frequency Reading of AC drive state and running frequency
PPO4	Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic writing of four function parameters Periodic reading of four function parameters
PPO5	Operation on a single function parameter Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic writing of ten function parameters Periodic reading of ten function parameters

Data blocks of the PPO data are divided into two areas, PKW area (parameter value) and PZD area (process data). The following figure shows the PPO data formats supported by MD38DP2.





#### **PKW Data**

PKW data is used by the master to read/write to a single parameter of the AC drive. The communication address of the AC drive parameter is directly determined by the communication data. The functions of PKW data are as follows:

- Reading function parameters of the AC drive
- Modifying function parameters of the AC drive

#### Data format

PKW data consists of three groups of arrays, including the PKE, IND, and PWE. The lengths of PKE and IND are two bytes, and the length of PWE is four bytes. The following table describes the data format.

PKW Data Sent by the Master							
Opera tion Com mand	Paramete	er Address	Reserved			Write: para value Read: null	imeter
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE
	PKW Data Returned by the AC Drive						
Opera tion Com mand	Paramete	er Address	Reserved			Successful value Failed: erro informatio	: returned or n
PKE	PKE	IND	IND PWE PWE			PWE	PWE

#### **Data description**

PKW Data Sent by the Master		PKW Data Returned by the AC Drive	
PKE	<ul> <li>High-order 4 bits: Command code0: No request1: Read parameter data2: Modify parameter data (The preceding command code is in decimal format.)</li> <li>Low-order 4 bits: Reserved</li> <li>Low-order 8 bits: High- order bits of the parameter address</li> </ul>	PKE	<ul> <li>High-order 4 bits: Response code0: No request1: Operation succeeded7: Operation failed</li> <li>Low-order 8 bits: High-order bits of the parameter address</li> </ul>
IND	High-order 8 bits: Low-order bits of the parameter address Low-order 8 bits: Reserved	IND	High-order 8 bits: Low-order bits of the parameter address Low-order 8 bits: Reserved
PWE	High-order 16 bits: Reserved Low-order 16 bits: Parameter value (write request) or not used (read request)	PWE	<ul> <li>Request succeeded: Parameter value</li> <li>Request failed: Error code (consistent with standard Modbus)1: Invalid command2: Invalid address3: Invalid data4: Other error</li> </ul>

#### Application

The following figure shows the PKW data sent by the master and PKW response data returned by the AC drive when the master reads the AC drive parameter F0-08.



Figure 7-7 Example PKW data sent by the master when reading an AC drive parameter

The following figure shows the PKW data sent by the master and PKW response data returned by the AC drive when the master modifies the AC drive parameter F0-08.





Figure 7-8 Example PKW data sent by the master when modifying an AC drive parameter

PKW data exchange with the AC drive is performed cyclically. Continuous write command (PKE = 0x20xx) on the EEPROM will significantly shorten the service life of the AC drive's main control chip. Therefore, to modify AC drive parameters, you are advised to perform aperiodic write operations (see SFB53 described in "7.7.4 Performing Aperiodic Read/Write Operations on the AC Drive Slave" on page 173 "7.7.4 Performing Aperiodic Read/Write Operations on the AC Drive Slave" on page 173 " " on page) or write to RAM addresses in PKW. The following table lists the RAM addresses of the parameters.

Parameter Group	Address
F0 to FF	0x00 to 0x0F
A0 to AF	0x40 to 0x4F

For example, the RAM address of F0-10 is 0x000A.

#### PZD Data

The PZD data enables the master to modify and read AC drive data in real time and perform periodic data exchange. The data communication addresses are directly configured by the AC drive. The functions of PZD data are as follows:

- Setting the AC drive control command and target frequency in real time
- Reading the current state and running frequency of the AC drive in real time
- Exchanging function parameter and monitoring parameter data between the AC drive and PROFIBUS master in real time The PZD is used for periodic data exchange between the master and the AC drive, as described in the following table.

Master Transmit Data PZD				
AC Drive Command	AC Drive Target Frequency	AC Drive Parameters Modified in Real Time		
PZD1	PZD2	PZD3 to PZD12		

Master Transmit Data PZD				
AC Drive Response Data PZD				
AC Drive Command	AC Drive Running Frequency	AC Drive Parameters Read in Real Time		
PZD1	PZD2	PZD3 to PZD12		

#### Data Sent by the Master

Master Transmit Data PZD			
	AC drive command word (command source set to communication)		
PZD1	0: No command 01: Run in forward direction 02: Run in reverse direction 03: Jog in forward direction	04: Jog in reverse direction 05: Coast to stop 06: Decelerate to stop 07: Reset upon fault	
PZD2	AC drive target frequency (frequency reference source set to communication; value unit determined by the AC drive while Hz is used as an example here) The frequency reference ranges from 0 to F0-10. When F0-22 is set to 1, the frequency range is 0.0 Hz to 3200.0 Hz. When F0-22 is set to 2, the frequency range is 0.00 Hz to 320.00 Hz. When the reference target frequency exceeds F0-10, the AC drive does not respond to the frequency reference.		
PZD3 to PZD12	Function parameter values (group F and group A) modified in real time, not written into EEPROM FE-02 to FE-11 correspond to PZD3 to PZD12. For the configuration, see PZD data configuration. After communication with the PLC is established, FE-02 to FE 11 display the parameter values written into PZD3 to PZD12. Manual settings of parameters in group FE of the AC drive are invalid.		

#### Data Returned by the AC Drive

AC Drive Response Data PZD				
PZD1	AC drive running state The AC drive running state is defined by bit as follows: • Bit0: 0: Stopped; 1: Running • Bit1: 0: Running in forward direction; 1: Running in reverse direction • Bit2: 0: Not faulty; 1: Faulty • Bit3: 0: Running frequency not reached; 1: Running frequency reached			
PZD2	AC drive running frequency: The current AC drive running frequency is returned as 16-bit signed data. When F0-22 is set to 1, –32000 to +32000 correspond to the actual running frequency –3200.0 Hz to +3200.0 Hz. When F0-22 is set to 2, –32000 to +32000 correspond to the actual running frequency –320.00 Hz to +320.00 Hz.			

AC Drive Response Data PZD				
PZD3 to PZD12	Function parameter values (group F and group A) and monitoring parameter values (group U) read in real time FE-22 to FE-31 correspond to PZD3 to PZD12. For the configuration, see PZD data configuration. After communication with the PLC is established, FE-02 to FE-11 display the parameter values written into PZD3 to PZD12. Manual settings of parameters in group FE of the AC drive are invalid.			

## 7.6 Related Parameters

### 7.6.1 AC Drive Communication Card Type Setting

After powering on the AC drive, the MD38DP2 card can communicate with the AC drive properly only after F0-28 is set to 1.

Parameter	Parameter Name	Value Range	Setpoint	Description
F0-28	Serial communication protocol	0: Modbus protocol 1: Communication card network bridge protocol	1	Serial communication protocol as the serial communication protocol.
F0-02	Command source	0: Operating panel 1: Terminal 2: Communication	2	Set the command source to communication.
F0-03	Main frequency reference source	0: Digital setting (non-retentive at power failure) 1: Digital setting (retentive at power failure) 2: Al1 3: Al2 4: Al3 5: Pulse reference (DI5) 6: Multi- reference 7: Simple PLC 8: PID 9: Communication	9	Set the target frequency through communication.

## 7.6.2 Communication Control Parameters

Parameter	Parameter	Value Range	Hexadecimal	Decimal Address
	Name		Address	
U3-16	Frequency reference	–Maximum frequency to +Maximum frequency Unit: 0.01 Hz	H7310	29456
U3-17	Control command	0001: Run in forward direction 0002: Run in reverse direction 0003: Jog in forward direction 0004: Jog in reverse direction 0005: Coast to stop 0006: Decelerate to stop 0007: Reset upon fault	H7311	29457
U3-18	DO control	Bit0: DO1 output control Bit1: DO2 output control Bit2: Relay 1 output control Bit3: Relay 2 output control Bit4: FMR output control Bit5: VDO1 Bit5: VDO1 Bit6: VDO2 Bit7: VDO3 Bit8: VDO4 Bit9: VDO5	H7312	29458
U3-19	AO1 control	0 to 7FFF, indicating 0% to 100%	H7313	29459
U3-20	AO2 control	0 to 7FFF, indicating 0% to 100%	H7314	29460
U3-21	FMP control	0 to 7FFF, indicating 0% to 100%	H7315	29461
U3-23	Speed control	Signed data, 1 RPM	H7317	29463

When this expansion card is used, the written PZD1 and PZD2 are mapped to U3-17 and U3-16 respectively by default. If a command or frequency fails to be written into the AC drive but PZD3 to PZD12 can be written and F0-02 and F0-03 are set to 2 and 9 respectively, check whether FE-00 and FE-01 are set to U3-17 and U3-16 respectively. If not, manually correct the values of FE-00 and FE-01.

## 7.7 Communication Configurations

### 7.7.1 Configuring a Slave on the S7-300 Master in STEP 7 V5.4

Before using the PROFIBUS master, you need to configure the GSD file of the slave to add the corresponding slave device to the system of the master. If the file exists, skip step 2. You can obtain the GSD file from Inovance or its agent.

The configuration procedure is as follows:

1. Install the GSDML file. (Skip this step if the GSDML file has been installed.) Choose **Options > Manage general station description files (GSD)**.



 Double-click the hardware icon to access the HW Config interface, and choose Options > Install GSD File to add the MD38DP2.GSD file (English path required), as shown in the following figure.



Click **Install**. After the installation is complete, the PROFIBUS DP module MD38DP2 is displayed, as shown in the following figure.



Note: If any master or slave already exists on the **HW.config** interface, close the current interface by clicking the X button (marked with a red circle as shown in the following figure) before importing the GSD file.

RANY Config - [SIMATIC 300(1) (Configuration) Project]			-   D   ×
B Station Edit Insert PLC View Options Window Help			- 8 🕅
			-
⇒ (0) UR			크리지
	Eind:		mt mi
2	Profil	Standard	-
3	-		
	6 8 1	Additional Riald Damiana	-
6		General	
		- inovance/profibus	
8		ė- <u>e</u>	
9		HD38DP2	
		PPD-D1	
		PP0-02	
		PPD-03	
		PP0-04	
		In Prime	
		Switching Devices	
	. E	I/0	
	E	Hateway	
		PLC	-1
		L'OBBATIBLE FRIFIBIS DE SLAVES	- 1
			-2
Je Information Internation Internation International Inter	J.		Chg (

In this case, you can save the original project. If an alarm indicating that system data cannot be created is displayed, click **OK**. After closing the current configuration interface, you can install the GSD file by performing the preceding steps. After the installation is complete, click the button marked with the red circle in the following figure.



Select the original configuration project, and click **OK** to open it.

Open					×
Entry point: Project  Name: Project  V	View: Component vie Storage E:\Project	w <b>T</b>	C Onlin G Browse	0fflin	¥
🕑 🎒 Project	I SIMATIC 300	(1)			
	Object name: Object type:	SIMATIC 300(1)			
OK		Trocess all	Cance	el Hel	Lp

3. Configure the actual hardware system, as shown in the following figure.

in conrig = [Simkiit 300(1) (Conriguration) rroject]	
ung Station Edit Insert PLC View Options Window Help	
Ethernet (1): FROFINET-IO-System (100)       1       2       1 <th></th>	

In the preceding figure, station 4 is MD38DP1, which is only used as an example. For details about its usage, see the MD380 Series PROFIBUS User Guide. MD38DP1 and MD38DP2 can coexist on the same network.

4. Configure data features of the slave.



After the PPO type is added, the address assigned by the PLC to the slave is displayed, as shown in the following figure. Slot 1 marked with a red circle in the following figure indicates the PKW address (8 bytes). Slot 2 indicates the PZD address (12 bytes).

If the selected PPO type does not have a PKW area, the I address and Q address of slot 1 are blank.



5. Configure PZDs.

The PZD1 and PZD2 configurations are fixed and cannot be modified by users. PZD3 to PZD12 are for customized periodic data exchange. They can be set in hardware configuration. Double-click the MD38DP icon in **HW Config**, click **Devicespecific parameters**, and configure corresponding parameter addresses as required.

Properties - DP slave	×
General Parameter Assignment	
Parameters	Value
🖃 🔄 Station parameters	
_≝ DP Interrupt Mode	DPVO
🕂 🧰 General DP parameters	
🚊 🔄 Device-specific parameters	
- <u>⊨</u> PZD3(master->slave)	61452
_≝ PZD4 (master->slave)	61448
- <u>≡</u> PZD5 (master->slave)	64512
- <u>≡</u> PZD6 (master->slave)	64513
_≝ PZD7(master->slave)	61452
_≝ PZD8(master->slave)	61440
- <u>≡</u> PZD9(master->slave)	61440
_≝ PZD10 (master->slave)	61440
- <u>≡</u> PZD11 (master->slave)	61440
-∭ PZD12 (master->slave)	61440
-∭ PZD3(slave->master)	61440
-∭ PZD4(slave->master)	61440
P7D5 (el ava- >maetar)	61440
OK	Cancel Help

PZDx(master->slave) indicates the address used by the master to write to the slave, and PZDx(slave->master) indicates the address used by the master to read the slave. PZD3 to PZD12 are displayed in decimal and can be modified. For example, to set **PZD3(master->slaver)** to F0-12, enter **61452**.

By default, all PZDs of MD380 are set to F0-00 (61440 in decimal). For unused PZDs, modification is not required and default values can be retained. PZD mapping must be set independently for each slave as required (if the mappings of various slaves are the same, you can select a configured slave, press **Ctrl+C**, select the PROFINET bus in the configuration, press **Ctrl+V**, and modify the device name and IP address).

To enable the aperiodic parameter read and write function of DPV1, set corresponding parameters in customized indexes at the end of **Device-specific parameters** list. MD380 provides six customized indexes numbered from 0 to 5, as shown in the following figure. For example, you can set index 0 to F0-02 and index 1 to F0-08.

o <mark>perties - DP slave</mark> eneral Parameter Assignment	
Parameters	Value
-≝ PZD4(slave->master)	61440
PZD5(slave->master)	61440
_≝ PZD6(slave->master)	61440
- ≝ PZD7 (slave->master)	61440
-⊞ PZD8(slave->master)	61440
-∭ PZD9(slave->master)	61440
- ── PZD10 (slave->master)	61440
- □ PZD11 (slave->master)	61440
- ≝ PZD12(slave->master)	61440
- Function code of IndexO	61442
Function code of Index1	61448
- Function code of Index2	61440
- Function code of Index3	61440
- Function code of Index4	61440
Function code of Index5	61440
🕂 🧰 Hex parameter assignment	
<u></u>	
OK	Cancel Help

After the preceding steps, the PROFIBUS slave is configured. Now, you can compile programs in S7-300 to control the AC drive.

### 7.7.2 Configuring a Slave on the S7-1200 Master in TIA Portal V13

1. Open TIA Portal V13, create a project, and add an S7-1200 master according to actual situations.



- C:\Users\v0263\Documents\Automation\MD \_ O X nation PORTAL 🕒 🔒 Save project 🚐 🐰 🥶 🕞 🗙 🐂 🛨 (주 🗉 🔃 🛄 🔛 🖉 Go o 87 IB IB × \_ 7 = X MD500PN > PLC\_1 [CPU 1214C AC/DC/Rly] 🚰 Topology view 💧 Network view 🔐 Device view Devices Options Haro 🔲 🐋 鬜 # PLC\_1 [CPU 1214C] 💌 🖽 🖾 🚄 🛄 🍳 ± ✓ Catalog P.C.) are MD500PN ini init Add new device Profile: <All> Filter 📥 Devices & netv DI
 DQ
 DI
 DQ
 DI ▼ 🛅 PLC\_1 [CPU 1214C AC... 5 6 The Device configuration 🗓 Online & diagnostics AI 🔒 Program blocks Technology objects
 Government Source files AliAQ Communications modules PLC tags Industrial Remote Com PLC data types = Watch and force ta ▼ m PROFIBUS 2 CM 1242-5
 CM 1243-5 Conline backups 1... C Properties 🚹 Info 🔒 🎦 Diagr Traces
 Traces
 Device proxy data 6GK7 General IO tags System constants Texts Point-to-point Program info Interface options Identification systems ▼ PROFINET interface [X1] ▶ 🖬 AS interface General ✓ Information Ethernet addresses 🔽 Su Details view Device Time synchronization ting of device names of al Permit over Module Operating mode Advanced options Use IEC V2.2 LLDP mode Interface options Keep-Alive connection ing Device configuration Real time settings Port [X1 P1] 😵 Online & diagnostics CM 1243-5 Regram blocks Portal view h PLC\_1

Since the S7-1200 CPU has no PROFIBUS interface, you need to add a PROFIBUS communication module. In this example, a CM1243-5 master module is added.

After adding the PROFIBUS master module, click **Network view**. Select the communication module, click **Properties** and then **General**, and click **Add new subnet** to create a PROFIBUS network. You can modify the master number here.

MD500PN ► Devices & network	5			_ <b>=</b> =×
	6	Topology view	Metwork view	Device view
Network Connections HMI of	onnection 💌 🖪 Relations	🔛 🖷 🛄	€, ±	
-				^
Γ N				
PLC_1				
				l etw
Ų				ork d
, v				ata
				~
<		> 100	K 💌	<u></u>
CM 1243-5 [CM 1243-5]		<b>Properties</b>	🗓 Info 追 📱 Diagr	iostics 🔤 🗖 🗌 🥆
General IO tags Syste	m constants Texts			
▶ General	PROFIBUS address			^
▼ DP interface	· · · · · · · · · · ·			
PROFIBUS address	Interface networked with			
Operating mode	Subnet:	Not networked		-
-	<	Add new sub	net	
	-			
	Parameters			

To modify the PROFIBUS baud rate, select the network in the view, and choose General > Network settings on the Properties tab page, and select a proper baud rate from the Transmission speed drop-down list.

PLC_1 CPU 1214C	OFIBUS_1				
<		> 100	%	•	. 1
PROFIBUS_1 [Profibus]		🔍 Properties	🔟 Info 🔒	Diagnostics	
General IO tags Sy	stem constants Texts				
General Network settings	Network settings				
Cable configuration					
Additional network devices	Highest PROFIBUS address:	126			-
Bus parameters	<ul> <li>Transmission speed:</li> </ul>	1.5 Mbps			
	Profile :	DP		·	-

2. Install the GSD file. Skip this step if a GSD file has been installed.

If a GSD file is not installed yet, **Not yet installed** will be displayed in the **Status** column. Select the GSD file and click **Install**. (Note that an error will occur if the installation path contains Chinese characters.)



Manage general station descriptio	n files project			×
Source path: E:\MD380				
Content of imported path				
File	Version	Language	Status	Info
md38dp2.gsd		Default	Not yet installed	
<	1	1		>
			Delete	Cancel

When the interface shown in the following figure is displayed, the installation is complete. Click **Close**.

lanag	ge general station	description	files	_			_
Insta	nstallation result						
! M	lessage						
0	Installation was con	npleted succe	ssfully.				
				c)	1	cl	
	Save log		nstall additional	tiles		Close	

During installation of the GSD file, the PORTAL will automatically close the configuration interface. After the installation is complete, double-click **Devices & networks** on the left to open the original configuration interface.



Choose **Hardware catalog** > **Other field devices** > **PROFIBUS-DP** > **General**. You can find the MD38DP2 in the list, which is the same as that in STEP 7. You need to fully expand the subordinate directories as shown in the following figure.

Hardware catalog			
Options			A
			Haro
✓ Catalog			Iwar
<search></search>	litil	itit	e C
Filter Profile: <all></all>	-		đ
Controllers			ŝ
▶ 🛅 HMI			IV
Dr systems			Ų.
Drives & starters			ō
Network components			I.
Detecting & Monitoring			let
Distributed I/O			0
Power supply & distribution			S
Field devices			
Cher field devices			P
Additional Ethernet devices			as
PROFINET IO			ŝ
< TROFIBUS DP >		_	
Drives		_	μ
Encoders			ŀř
Gateways		_	ari
		_	ŝ
		_	_
		_	
MD38DP2		~	
> Information			

3. Start the configuration.

On the **Hardware catalog** tab page, double-click **MD38DP2** or drag it to **Network view** under **Devices & networks**, and click **Not assigned** under the slave to select the corresponding PROFIBUS network. Select the slave, click **Properties** and then **General**, and set the slave number. Note that the setting must be consistent with that set by the DIP switch on the MD38DP2 expansion card.



Click **General DP parameters**, and select **DPV0** from the **DP interrupt mode** dropdown list, as shown in the following figure.

	×	
< Ⅲ > 100%		< III >
Slave_1 [Module]	🖳 Properties 🚺 Info 🔒	🛛 🖳 Diagnostics 👘 🗖 🗏 🥆
General IO tags Syst	tem constants Texts	
<ul> <li>General</li> </ul>	General DP parameters	
PROFIBUS address	deneral bi parameters	
General DP parameters		
Device-specific parameters	DP interrupt mode:	DPV0
Hex parameter assignment		DPV1
Watchdog		OPV0
-		
	< IIII	\$

Click **Device view**, and select a proper PPO type under **Hardware catalog**. The addresses assigned for each segment are displayed as follows. The PKW address is marked with a red circle in the following figure. If the selected PPO has no PKW, the column is blank.

MD500	)PN ▶ Un	grouped	I devices 🔸	Slave_1					_ # #×	Hardware catalog  🖬 🛙
				📲 Topology	view	Netw	ork view	📑 Devi	ice view	Options
dt 📩			Device o	verview	Р	KW				
		^	- 11 N	lodule	Rack	Slot	l address	Q address	Туре	✓ Catalog
				Slave_1	9	0			MD38DP2	101
			$\sim$	PPO-05_2_1	0	1	6875	6471	PPO-05	
	Stave -			PPO-05_2_2	0	2	7699	7295	PPO-05	Head module
										Universal module
		•								PPO-01
										PPO-02
										PPO-03
	_									PPO-04
										PPO-05
1 1		<u> </u>						_		
	<u></u> ¥	. •	5				1	_	/	

4. Set PZD mapping.

Click **Network view** and then click **Device-specific parameters** to set the mapping for PZD3 to PZD12. Note that the PZD mappings for the PLC to read and write to the slave are set independently. For details, see " " on page "7.7.1 *Configuring a Slave on the S7-300 Master in STEP 7 V5.4*" on page 156 " " on page .

MD500PN → Devices & networks	5	_∎≡×
	🛃 Topology view 🛛 🛔 Ne	twork view
Network Connections HMI co	onnection 💌 🎽 📑	Network overview
Д Master sy	stem: PLC_1.DP-Mastersystem (1)	Device
		\$7-1200 station_1
		► CM1243-5
		<ul> <li>PLC_1</li> </ul>
Slave_1		▼ GSD device_1
MD38DP2 DP-NORM		Slave_1
CM 1243-5		
		*
< Ⅲ > 100%		
Slave 1 [Module]	Properties 1 Info	Diagnostics
Constal 10 tags Susta	m constants Toxts	
General 10 tags Syste	m constants Texts	
General	Device-specific parameters	~
General DP parameters		
Device-specific parameters	PZD3(master->slave):	61440
Hex parameter assignment	PZD4(master->slave):	61440
Watchdog	PZD5(master->slave):	61440
	PZD6(master->slave)	61440
•	PZD7/mastersalave)	61440
	rzb/(master->slave):	61440
	PZD8(master->slave):	61440
	PZD9(master->slave):	61440
	PZD10(master->slave):	61440
		>

5. Compile and download the configuration.

If the settings of multiple slaves are the same, select a configured slave, press **Ctrl** +**C** and then **Ctrl**+**V** (or right-click the configured slave and choose **Copy** and then **Paste**) to connect more slaves to the network, and then modify their station numbers.

After all slaves are configured, save the configurations, and click the compile button. After the compiling is completed successfully, click the download button.

76	涨 Siemens - C:\Users\y0263\Documents\Automation\MD500PN\MD500PN						
P	oject Edit View Insert Onlin	e Options Tools W	ndow Help				
E	🛉 🎦 🔚 Save project ا 🐰 🧾	🛅 🗙 🎝 ± (4 ± 🚽	🖥 🛄 🕼 🖳 🧖 Go	o online 📓 Go offline	🌆 🖪 🖪 🗶 🖃 💷 '		
	Project tree 🛛 🔳 🖣	MD500PN Device	s & networks				
	Devices	Compile	Downloa	d	🚰 Topology view 🔒		
S	🖼 📃 📑	Network	ections HMI connection	- Relations	🖭 🐮 🔛 🛄 🔍 ±		
L ¥				부 Master syst	em: PLC_1.DP-Mastersystem		
12	▼ MD500PN						
Ĕ	💕 Add new device						
8	📥 Devices & networks	PLC_1					
l ë	▶ 🛅 PLC_1 [CPU 1214C A	CPU 1214C					
e l	Ungrouped devices	T					
	🕨 🔚 Security settings						
	🕨 🥁 Common data		DIC 1 DD Mastersusters (				
	Documentation setti		rto_i.br-wastersystem (	0			
	Languages & resource:						

Set the interface for the PC the communicate with the PLC as required on the displayed interface. In this example, a local network port is selected. Then click **Start search** to search for the PLC.

	Device	Device type	Slot	Interface type	Address	Subne	t
	PLC_1	CPU 1214C AC/D	1 X1	PN/IE	192.168.0.1		
<b></b>	CM 1243-5	CM 1243-5	101 X1	PROFIBUS	1	PROFI	BUS_1
		Type of the PG/PC inte	rface:	PN/IE			•
		PG/PC inte	rface:	💹 Intel(R) Ether	net Connection (3) I2	18-LM	• 💎 [
		Connection to interface/su	bnet:	Direct at slot '1			- 💎
		1st gat	eway:				- 💎
	Select target dev	vice:			Show all compatib	le devices	
	Select target dev Device	vice : Device type	Interfa	ce type Ad	Show all compatibl dress	le devices Target dev	ice
	Select target dev Device 	vice: Device type 	Interfa PN/IE	ce type Ad Ac	Show all compatib dress cess address	le devices Target dev 	ice
	Select target dev Device 	vice: Device type 	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Target dev 	ice
	Select target dev Device 	vice: Device type 	Interfa PN/IE	ce type Ad Ac	Show all compatible dress comparises address	le devices Target dev —	ice
Flash LED	Select target dev Device —	/ice: Device type 	Interfa PN/IE	ce type Ad	Show all compatible dress comparises cess address cess address cess address cess address cess address cess address cess centre of the centre o	le devices Target dev 	ice
Flash LED	Select target dev Device —	/ice: Device type —	Interfa PN/IE	ce type Ad	Show all compatibi dress cess address	Ie devices Target dev 	ice
Flash LED	Select target dev Device	ice: Device type -	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Ie devices Target dev —	ice t search
Flash LED	Select target dev	itee: Device type	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Ie devices Target dev — — Star r messages	ice t search
Flash LED	Select target dev	ice: Device type	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	r messages	ice t search
Flash LED	Select target dev	ice: Device type -	Interfa PN/IE	ce type Ad	Show all compatib dress cess address Display only erro	r messages	ice t search

If no accessible device is found, the connection between the PC and PLC is faulty. Eliminate the fault first. (This problem also occurs when the PC was used for download through Ethernet in STEP 7 before. In this case, restart the PC or change the PG/PC interface to a non-Ethernet interface in STEP 7.)

Online status information:	Display only error messages
1 Found accessible device pn-io	^
😢 Scan completed. 0 compatible devices of 1 accessible devices found.	
😢 Scanning and information retrieval completed. 1 problem found.	
	×
	<u>L</u> oad <u>C</u> ancel

If the connection is normal, the **Load** button is available. You can click **Load** to start download and perform subsequent operations as prompted to download the configuration to the PLC.

### 7.7.3 Performing Periodic Read/Write Operations on the AC Drive Slave

In this example, the PLC is S7 315-2PN/DP, and the following figure shows the address assignment.

<b>(</b>	) (3)	MD38DP2				
S	DP DP	ID	Order Number / Designation	I Add	Q Address	Comment
1	4AX		PP0-02	512519	512519	
2	6A <b>F</b>		> PPO-02	520 531	520 531	

1. Directly use the MOVE command to enable the AC drive to run in forward direction at the target frequency of 30 Hz (F0-02 = 2, F0-03 = 9), as shown in the following figure.



Other data is written in a similar way. The read data can also be transmitted from the PIW register to the common Q, I, L, M, or D register using the MOVE command for parsing.

2. Use SFC14 and SFC15.



- **LADDR**: Starting address configured in the I block of the module, which must be in hexadecimal format.
- **RET\_VAL**: Return value. If an error occurs during function activation, the return value contains an error code. If no error occurs, 0 is returned.
- **RECORD**: Target area of the read user data. Its length must be consistent with the length of the module configuration selected in STEP 7. Only the byte data type is allowed.



- **LADDR**: Starting address configured in the Q block of the module, which must be in hexadecimal format.
- **RET\_VAL**: Return value. If an error occurs during function activation, the return value contains an error code. If no error occurs, 0 is returned.
- **RECORD**: Source area of the user data to be written. Its length must be consistent with the length of the module configuration selected in STEP 7. Only the byte data type is allowed.

For both SFC14 and SFC15, the addresses must be in hexadecimal format converted from the I and Q starting addresses (in this example, the address is 520, which is H208 in hexadecimal format). The length of **RECORD** must be consistent with the BYTE length of the PPO type PZD (in this example, PPO2 is used, which includes six PZDs, that is, a total of 12 bytes).

### 7.7.4 Performing Aperiodic Read/Write Operations on the AC Drive Slave

To perform aperiodic read and write operations on the AC drive PROFIBUS DP slave, Siemen's system function modules SFB52 (for reading) and SFB53 (for writing) are required. Create an organization block in the program, and add relevant function blocks and programs in the organization block.





After M0.0 is set, the function block reads F0-02 (Index 0 has been set to F0-02 before) of the AC drive No. 3 and saves it in QW6. The fields are defined as follows:

- **REQ**: Command enable. When this field is set to 1, the function block is enabled.
- ID: Logic address. To specify this field, convert any Q address of the corresponding AC drive slave to a hexadecimal value, and set bit 15 of the value to 1. For example, for Q512, the hexadecimal value is H200. After bit 15 is set to 1, H8200 is obtained.

	) (3)	MD38DP2				
S	DP DP	ID	Order Number / Designation	I Add	Q Address	Comment
1	4AX		PP0-02	512519	512519	
2	6A <b>X</b>		> PP0-02	520 531	520 531	

- **INDEX**: Index number, ranging from 0 to 5. This field can be customized to an index mapping address of a slave as required.
- MLEN: Maximum length of the data to be obtained. For MD38DP2, this field must be set to **2**.
- **RECORD**: Target area of the obtained data record. This field is used to store read data when the read operation is performed and sent data when the write operation is performed.

- VALID: New data record received and valid.
- **BUSY**: When the value is **ON**, the operation is not completed.
- ERROR: Error flag. When the value is ON, an error occurs.
- **STATUS**: Block status or error information.
- **LEN**: Length of the obtained data record.

During invocation, you can customize parameters or use some or all default parameters, as shown in the following figure.



In the preceding figure, default parameters are used on the left. In this case, parameters are set according to the information shown on the right. You can set customized or default parameters for corresponding blocks as required.

Aperiodic write operations are performed in a similar way as aperiodic read operations. The **RECORD** field stores data to be written, as shown in the following figure.



Note that before running an organization block, you need to download data blocks (above the function block, DB1 and DB2 in this example) to the PLC. Otherwise, an error indicating that the DB blocks are not loaded will be reported.

SFB53 is used to perform operations on the EEPROM. Therefore, the program is required to invoke relevant operations when required and disable relevant operations in time. As shown in the following figure, after the write operation is complete (M1.1 is set to 1), the program is invoked to reset M1.0.



When SFB52 and SFB53 are executed, relevant blocks need to be invoked for multiple times. Therefore, do not invoke them when single execution is required.

# 7.8 Fault Diagnosis

### 7.8.1 Troubleshooting

The following table describes the faults that may occur during use of the MD38DP2 expansion card and the AC drive.

Symptom	Solution
After the AC drive is powered on, only the power indicator (D4) is on, indicating that communication between the MD38DP2 expansion card and the AC drive is not established	1. Check that F0-28 is set to 1.
	2. Check the AC drive type. This user guide only describes the usage of MD520. For other AC drive models, contact the technical engineers to obtain the correct user guide.
After the AC drive is powered on, the power indicator (D4) is on and the indicator of communication with the AC drive (D2) blinks.	Set the station number correctly (within the range of 1 to 125). Note that digit 8 of the DIP switch is the least significant bit of the address.

Sy	mptom	Solution
		1. Check that the cable is properly connected.
	After the	2. Check the DIP switches on the PROFIBUS DP interfaces. The DIP switches on the PROFIBUS DP interfaces at both ends of the network must be set to ON, and the DIP switches on other PROFIBUS DP interfaces must be set to OFF.
	configuration is downloaded, indicators D2 and D4 are steady on while the yellow indicator D3 is off on the MD38DP2	3. If the AC drive is connected at the end, check that the communication cable is connected through IN of the PROFIBUS DP interface. (If the communication cable is connected through OUT, it cannot be connected to the network when the PROFIBUS DP interface is set to ON.)
	expansion card.	4. Check that the station number settings on the MD38DP2 expansion card are consistent with the configuration. Digit 8 of the DIP switch is the least significant bit of the address.
The connection		5. Check that the GSD file used in the configuration is correct.
fails after the	After the	1. Check that the GSD file used is correct.
is downloaded.	configuration is downloaded, indicators D2 and D4 are steady on while the yellow indicator D3 blinks slowly at the frequency of about 1 Hz to 2 Hz on the MD38DP2 expansion card.	2. Check that the PZD mapping is set correctly. Device-specific parameters in STEP 7 and PORTAL must be set in decimal format. Therefore, you need to convert the parameter numbers into decimal values when setting device-specific parameters. For example, the decimal value of FC-11 is 64523 (0xFC0B in hexadecimal format). If a parameter number that the AC drive does not support is entered, the connection fails. Note that PZD mapping does not support Modbus addresses such as H2000 and H8000.
	After the configuration is downloaded, the yellow indicator D3 on the MD38DP2 expansion card blinks quickly.	The PLC is not in the running status. Check the PLC status and locate the fault cause (possibly because the OB block does not exist).

Symptom		Solution	
After the connection is successful, all indicators on the PLC are green, but data cannot be written into or read from the AC drive.	No data can be written/read.	Check whether the operated address is correct. No matter whether the PPO type used contains the PKW area, the address for the read and write operations is located in the second row (also the last row). For example, if the I address and Q address in the last row of the station are both 520 to 531 (note that the I and Q addresses may start from different numbers), the PZD1 and PZD2 data written into the AC drive are stored in QW520 and QW522, respectively. (If the PLC is S7-300 or S7-400, PQW is required.) If SFC15 is used, check whether <b>RET_VAL</b> of the SFC15 block is <b>0</b> . If not, an invocation error exists. Eliminate this error first and invoke the block again. For details, see section "7.7.3 Performing Periodic Read/Write Operations on the AC Drive Slave".	
	PZD3 or subsequent data can be written, but PZD1 or PZD2 cannot be written/ read.	Check that F0-02 is set to 2 and F0-03 is set to 9. Check whether the command reference is in the range of 1 to 7 (not bit) or frequency reference is in the range of –F0-10 to +F0-10. If not, the write operation fails. Check whether FE-00 is set to U3-17 and FE-01 is set to U3-16. If not, manually correct the parameter values or restore to factory settings.	
	PZD1 and PZD2 can be written/ read, while PZD3 or subsequent data cannot be written/read.	Check whether the PPO type supports the PZD. Check whether <b>Device-specific parameters</b> are set correctly.	
	-	Check the logic relations. Check whether the same PZD is assigned with values for multiple times in a certain logic relation (check whether the value given by the PLC is correct under the logic relation in the monitoring table of the PLC).	
After communication is established, the AC drive reports ERR164, which cannot be cleared. However, the indicators on the MD38DP2 expansion card and the BF indicator on the PLC are normal.		Check whether the high-order 8 bits of the PZD1 data (QW data) written into the AC drive are 0 in the PLC program. If not, change them to 0. The PZD1 command in this user guide refers to values instead of bits. Note that this solution applies to MD520 only. For other AC drives, consult the technical personnel.	

Symptom	Solution	
After communication is established, the communication is normal when the AC drive is not	1. Disconnect the power supply, and measure the resistance between A1 and B1 of the PROFIBUS DP slave interface at the farthest end with a multimeter. The resistance should be $100\pm 20 \Omega$ .	
running. However, when one or more AC drives are running, the AC drive is disconnected randomly.	2. Check that the shield layers of cables are connected together and the shield layers are in contact with the sheet metal in the PROFIBUS DP interface. The shield layers are not required to connect with other GND.	
After the connection is established, if the AC drive reports a fault, the faulty slave cannot connect to the network when the PLC configuration is changed and downloaded or when only the AC drive is powered on again.	MD38DP2 only supports the interruption mode DPV0. If the interruption mode is set to DPV1, when a slave is faulty, the PLC master may close the PROFIBUS DP connection channel of the slave or interrupt all the PLC communication (which usually occurs on S7- 1200). When such a symptom occurs, change the PROFIBUS DP interruption mode (which is DPV0 by default in STEP 7 and DPV1 by default in PORTAL) of the slave to DPV0 under <b>General DP parameters</b> . Then, compile and download the configuration, and power on the PLC again.	

### Indicator Status and Troubleshooting

Indicator %	Status	Symptom	Solution
Red (D4)	OFF	The MD38DP2 expansion card is not powered on.	Check that connection between the MD38DP2 expansion card and the AC drive is secure.
Green (D2)	OFF	The connection between the MD38DP2 expansion card and the AC drive fails.	Check that F0-28 is set to 1 and the connection between the MD38DP2 expansion card and the AC drive is secure.
Green (D2)	Blinking at 1 Hz	The connection between the MD38DP2 expansion card and the AC drive fails.	Check that the PROFIBUS DP station number is within the range of 1 to 125.
Yellow (D3)	Blinking at 1 Hz	A configuration error occurs.	Check that the GSD file is correct.
Yellow (D3)	Blinking at 2 Hz	A parameter error occurs.	Check that all parameter addresses in <b>Device-</b> <b>specific parameters</b> are supported by the AC drive.
Indicator %	Status	Symptom	Solution
-------------	------------------	---	--
Yellow (D3)	Blinking at 5 Hz	The master is not running.	Check the master state.
Yellow (D3)	OFF	The connection between the MD38DP2 expansion card and the PROFIBUS master fails.	Check that the slave address is correct and the PROFIBUS cable is connected properly.

# Note

Note  $\approx$ : For some products, the indicator color and the terminal symbol may not match. In this case, the terminal symbol prevails. The indicators are D2, D3, and D4 from left to right. See "" on page.

### **Troubleshooting for GSD Installation Failure**

• Symptom 1: The GSD file cannot be installed or updated when STEP 7 is used, as shown in the following figure.

Install GSD Files:	
E: \MD380	Browse
File     Release     Version     Languages       MD30DF2.GSD	
An update is presently not possible. In one or more SIEP 7 applications at least one GSD file or type file is being referenced.	
MD38DP2	J
Install Show Log Select All Deselect All	
Close	Help

Possible cause: The current hardware configuration has been opened and the GSD file is being used by other components.

Solution: Close the current configuration interface by clicking the X button (marked with a red circle in the following figure). Then, install or update the GSD file and open the configuration interface again.

형 HW Config - [SIMATIC 3001]) (Configuration) Project] 행 Station Edit Insert PLC View Options Window Help D 글 알 와 열 및, 글의 원 등 1 4 4 4 10 10 10 같은 12 11	
20) UR         System (00)           1         000000000000000000000000000000000000	Ist Int Standard T Profil Stan
G)         NIGORY2           S.         [1]         PTD Order Hubber / Designation         I.Add Q.Address Connent           1         4AX         PTO-96         SI2519         *           2         AAX         =>>770-92         SI2519         *	PROFIBUS-DP slaves for SIMMIC ST, WT, and CT (distributed rack)

• Symptom 2: The file cannot be interpreted.

Install GSD Files
Install GSD Files:
E:\MD380 Browse
File Release Version Languages
MD38DP2(1).GSD Default
The file 'MD38DP2(1).GSD' cannot be interpreted.
Install Show Log Select All Deselect All
Close

Possible cause: During the GSD file transmission, the file name is changed manually or by the transmission tool. In this case, the file name fails to meet the PROFIBUS requirements.

Solution: Change the GSD file name to **MD38DP2.GSD**.

• Symptom 3: The file contains syntax errors.

nstall GSD File	5				23
Install GSD 3	Files:		from the directory	•	
E:\MD380					Browse
File	Release	Version	Languages		
MD38DP2. GSD			Default		
The file 'MI	)38DP2. GSD'	contains :	syntax errors.		
, T+-11		· · · · · · · · · · · · · · · · · · ·	S.1 411	Dec.1	
Install		NOW LOG	Select All	Deselect All	
Close					Help

Possible cause: The GSD file is modified.

Solution: Use a correct GSD file.

• Other cases

Some versions of STEP 7 and PORTAL do not support a path that contains Chinese for installing the GSD file. In this case, store the GSD file in a path that does not contain Chinese characters.

# 8 MD-SI-DP1 Communication

### 8.1 Introduction

As a PROFIBUS DP fieldbus adapter card that meets international PROFIBUS fieldbus standards, the MD-SI-DP1 expansion card can improve the communication efficiency of the AC drive and implement the networking function, enabling the AC drive to be a slave controlled by the fieldbus master. It can implement PROFIBUS DP communication.

Item	MD-SI-DP1	MD38DP2	
Diagnosis	Supported	Supported	
DPV1	Supported	Supported	
PPO4	Supported	Supported	
PPO type	Set by the Siemens software tool	Set by the Siemens software tool	
PZD mapping address	Set by the Siemens software tool	Set by the Siemens software tool	
Station number settings	Set by the DIP switch, ranging from 1 to 125	Set by the DIP switch, ranging from 1 to 125	
Master disconnection	AC drive informed by the expansion card	AC drive informed by the expansion card	
Communication rate between the expansion card and the AC drive	Constant rate	Constant rate	
Slave fault	Master informed by the expansion card	Master informed by the expansion card	
CAN communication	Not supported	Supported	

The following table lists the differences between MD-SI-DP1 and MD38DP2.

### 8.2 Installation

The MD-SI-DP1 expansion card is embedded in the MD520 series AC drive. Before installation, cut off the power supply of the AC drive and wait for about 10 minutes until the charging indicator of the AC drive becomes off. Then, insert the MD-SI-DP1 card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by the pulling force of the external signal cable. *"Figure 8–1" on page 184* shows the installation.



Figure 8-1 Installation of MD-SI-DP1



Figure 8-2 Connecting ground terminals of the MD-SI-DP1 card and AC drive



Do not install or disassemble this card with power on.



# 8.3 Interface Layout and Description

Figure 8-3 Interface layout of the MD-SI-DP1 card

### **DIP Switch**



Digit	Function			Description
1	PROFIBUS DP card type switchover	OFF: MD-SI-DP1 (default) ON: Reserved		
		The a 7-dig	ddresses o it binary D	of stations 1 to 125 can be set by the IP switch.
2 to 8	PROFIBUS DP communication slave	Ex am ple:	Address	DIP Switch Setting (digit 8: least significant bit)
	address		1	000 0001
			7	000 0111
			20	001 0100
			125	111 1101



The change of digit 1 is valid upon the next power-on. The change of slave addresses takes effect immediately after setting.

#### **Standard 9-pin PROFIBUS Interface**

The MD-SI-DP1 expansion card is connected to the PROFIBUS master using the standard DB9 socket. The pin signal definition and pin arrangement of the standard DB9 socket are the same as those of Siemens' DB9 socket, as shown in the following figure.



Figure 8-4 DB9 terminal pins

### **Control Terminals**

Category	Symbol	Terminal Name	Function
PROFI	1, 2, 7, and 9	NC	Unconnected internally
BUS3communi5cation6(J3)8	3	Data line B	Positive pole of the data line
	5	GND	Isolated 5 V power ground
	6	+5 V	Isolated 5 V power supply
	8	Data line A	Negative pole of the data line
Program ming	J4	Programming	Interface for production and commissioning. Do not use it.

Table 8–1 Function description of control terminals

Category	Symbol	Terminal Name	Function
Indica tor※	D4 (red)	Power indicator	<ul> <li>Steady ON: The AC drive is powered on.</li> <li>OFF: The AC drive is disconnected from the power supply or the PROFIBUS DP card is installed incorrectly.</li> </ul>
	D3 (yellow)	Indicator of communication between the MD-SI-DP1 expansion card and the master	<ul> <li>Steady ON: Communication between the MD-SI-DP1 card and the PROFIBUS master is normal.</li> <li>OFF: There is no communication between the MD-SI-DP1 card and the PROFIBUS master (check the connection of PROFIBUS cables and the setting of the station number).</li> <li>Blinking: The master is not running or a fault occurs in communication between the MD-SI-DP1 expansion card and the master.</li> </ul>
	D2 (green)	Indicator of communication between the MD-SI-DP1 expansion card and the AC drive	<ul> <li>Steady ON: Communication between the MD-SI-DP1 expansion card and the AC drive is normal.</li> <li>OFF: Communication between the MD-SI- DP1 card and the AC drive fails. (F0-28 is not set to 1 or the AC drive does not support the MD-SI-DP1 expansion card.)</li> <li>Blinking: Interference exists in communication between the MD-SI-DP1 expansion card and the AC drive or the expansion card address is beyond the range of 1 to 125.</li> </ul>

# 8.4 Topology and Transmission Distance

The following figure shows the connection between the PROFIBUS DP card and PROFIBUS master.



Figure 8-5 Connection between the PROFIBUS DP card and PROFIBUS master

Terminal resistors must be connected at both ends of the PROFIBUS bus and DIP switches must be set correctly according to the marks on the wiring terminals. After

terminal resistors are connected correctly, the resistance between A1 and B1 should be 110  $\Omega$  upon power-off. For devices connected at both ends of the PROFIBUS network, the communication cables must be connected from their PROFIBUS DP terminals to the channels marked with "IN" (channels corresponding to A1/B1). Otherwise, terminal resistors cannot be connected. If any required terminal resistor is not connected, the communication quality will deteriorate.



The communication cable is connected through this port on devices at both ends of the bus. This port is unconnected on devices at both ends of the bus.

The required length of the communication cable between the PROFIBUS DP expansion card and the PROFIBUS master varies with the baud rate of the master. It is strictly restricted according to the Siemens DB9 standard. The following table describes requirements on communication cable length based on the baud rate.

Paud Pata (khit/a)	Maximum Length of Cable	Maximum Length of Cable Type	
Bauu Rate (KDIL/S)	Type A (m)	B (m)	
9.6	1200	1200	
19.2	1200	1200	
187.5	600	600	
500	200	200	
1500	100	70	
3000	100		
6000	100	Not supported	
12000	100		

The following table lists the technical specifications of the cables.

Cable Parameter	Туре А	Туре В
Impedance	135 $\Omega$ to 165 $\Omega$ (f = 3 to 20 MHz)	100 $\Omega$ to 130 $\Omega$ (f > 100 kHz)
Capacitor	< 30 pF/m	< 60 pF/m
Resistor	< 110 Ω/km	Not specified
Cross-sectional area of conductor	≥ 0.34 mm <sup>2</sup>	≥ 0.22 mm <sup>2</sup>

## 8.5 Protocol Description

#### **Data Transmission Formats**

In the PROFIdrive protocol, the PPO is used as the data transmission format. PPOs are classified into PPO1, PPO2, PPO3, PPO4, and PPO5, all of which are supported by the MD38DP2 expansion card.

The following table lists the functions supported by each data format.

Data Format	Supported Functions
PPO1	Operation on a single function parameter Setting of AC drive command and frequency Reading of AC drive state and running frequency
PPO2	Operation on a single function parameter Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic writing of four function parameters Periodic reading of four function parameters
PPO3	Setting of AC drive command and frequency Reading of AC drive state and running frequency
PPO4	Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic writing of four function parameters Periodic reading of four function parameters
PPO5	Operation on a single function parameter Setting of AC drive command and frequency Reading of AC drive state and running frequency Periodic writing of ten function parameters Periodic reading of ten function parameters

Data blocks of the PPO data are divided into two areas, PKW area (parameter value) and PZD area (process data). The following figure shows the PPO data formats supported by MD38DP2.



Figure 8-6 PPO data formats

#### PKW Data

PKW data is used by the master to read/write to a single parameter of the AC drive. The communication address of the AC drive parameter is directly determined by the communication data. The functions of PKW data are as follows:

- Reading function parameters of the AC drive
- Modifying function parameters of the AC drive

#### Data format

PKW data consists of three groups of arrays, including the PKE, IND, and PWE. The lengths of PKE and IND are two bytes, and the length of PWE is four bytes. The following table describes the data format.

	PKW Data Sent by the Master						
Opera tion Com mand	Paramete	er Address	Reserved		Write: parameter value Read: null		
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE
		PKW D	ata Returne	ed by the AC	C Drive		
Opera tion Com mand	Paramete	er Address		Reserved		Successful value Failed: erro informatio	: returned or n
PKE	PKE	IND	IND	PWE	PWE	PWE	PWE

#### **Data description**

PKW Data Sent by the Master		Р	KW Data Returned by the AC Drive
PKE	<ul> <li>High-order 4 bits: Command code0: No request1: Read parameter data2: Modify parameter data (The preceding command code is in decimal format.)</li> <li>Low-order 4 bits: Reserved</li> <li>Low-order 8 bits: High- order bits of the parameter address</li> </ul>	PKE	<ul> <li>High-order 4 bits: Response code0: No request1: Operation succeeded7: Operation failed</li> <li>Low-order 8 bits: High-order bits of the parameter address</li> </ul>
IND	High-order 8 bits: Low-order bits of the parameter address Low-order 8 bits: Reserved	IND	High-order 8 bits: Low-order bits of the parameter address Low-order 8 bits: Reserved
PWE	High-order 16 bits: Reserved Low-order 16 bits: Parameter value (write request) or not used (read request)	PWE	<ul> <li>Request succeeded: Parameter value</li> <li>Request failed: Error code (consistent with standard Modbus)1: Invalid command2: Invalid address3: Invalid data4: Other error</li> </ul>

### Application

The following figure shows the PKW data sent by the master and PKW response data returned by the AC drive when the master reads the AC drive parameter F0-08.

### Master reading AC drive parameter F0-08



Figure 8-7 Example PKW data sent by the master when reading an AC drive parameter

The following figure shows the PKW data sent by the master and PKW response data returned by the AC drive when the master modifies the AC drive parameter F0-08.



Figure 8-8 Example PKW data sent by the master when modifying an AC drive parameter

PKW data exchange with the AC drive is performed cyclically. Continuous write command (PKE = 0x20xx) on the EEPROM will significantly shorten the service life of the AC drive's main control chip. Therefore, to modify AC drive parameters, you are advised to perform aperiodic write operations (see SFB53 described in "7.7.4 *Performing Aperiodic Read/Write Operations on the AC Drive Slave" on page 173 "7.7.4 Performing Aperiodic Read/Write Operations on the AC Drive Slave" on page 173 "7.7.4 Performing Aperiodic Read/Write Operations on the AC Drive Slave" on page 173 " on page*) or write to RAM addresses in PKW. The following table lists the RAM addresses of the parameters.

Parameter Group	Address
F0 to FF	0x00 to 0x0F
A0 to AF	0x40 to 0x4F

For example, the RAM address of F0-10 is 0x000A.

#### PZD Data

The PZD data enables the master to modify and read AC drive data in real time and perform periodic data exchange. The data communication addresses are directly configured by the AC drive. The functions of PZD data are as follows:

- Setting the AC drive control command and target frequency in real time
- Reading the current state and running frequency of the AC drive in real time
- Exchanging function parameter and monitoring parameter data between the AC drive and PROFIBUS master in real time The PZD is used for periodic data exchange between the master and the AC drive, as described in the following table.

Master Transmit Data PZD					
AC Drive Command	AC Drive Target Frequency	AC Drive Parameters Modified in Real Time			
PZD1 PZD2		PZD3 to PZD12			
	AC Drive Response Data PZD				
AC Drive Command	AC Drive Running Frequency	AC Drive Parameters Read in Real Time			
PZD1	PZD2	PZD3 to PZD12			

#### Data Sent by the Master

Master Transmit Data PZD				
	AC drive command word (command source set to communication)			
PZD1	0: No command 01: Run in forward direction 02: Run in reverse direction 03: Jog in forward direction	04: Jog in reverse direction 05: Coast to stop 06: Decelerate to stop 07: Reset upon fault		
PZD2	AC drive target frequency (freq communication; value unit def Hz is used as an example here) The frequency reference range When F0-22 is set to 1, the freq Hz. When F0-22 is set to 2, the freq 320.00 Hz. When the reference target freq drive does not respond to the	uency reference source set to termined by the AC drive while ) es from 0 to F0-10. quency range is 0.0 Hz to 3200.0 quency range is 0.00 Hz to quency exceeds F0-10, the AC frequency reference.		

Master Transmit Data PZD				
PZD3 to PZD12	Function parameter values (group F and group A) modified in real time, not written into EEPROM FE-02 to FE-11 correspond to PZD3 to PZD12. For the configuration, see PZD data configuration. After communication with the PLC is established, FE-02 to FE- 11 display the parameter values written into PZD3 to PZD12. Manual settings of parameters in group FE of the AC drive are invalid.			

### Data Returned by the AC Drive

	AC Drive Response Data PZD			
PZD1	AC drive running state The AC drive running state is defined by bit as follows: • Bit0: 0: Stopped; 1: Running • Bit1: 0: Running in forward direction; 1: Running in reverse direction • Bit2: 0: Not faulty; 1: Faulty • Bit3: 0: Running frequency not reached; 1: Running frequency reached			
PZD2	AC drive running frequency: The current AC drive running frequency is returned as 16-bit signed data. When F0-22 is set to 1, -32000 to +32000 correspond to the actual running frequency -3200.0 Hz to +3200.0 Hz. When F0-22 is set to 2, -32000 to +32000 correspond to the actual running frequency -320.00 Hz to +320.00 Hz.			
PZD3 to PZD12	Function parameter values (group F and group A) and monitoring parameter values (group U) read in real time FE-22 to FE-31 correspond to PZD3 to PZD12. For the configuration, see PZD data configuration. After communication with the PLC is established, FE-02 to FE-11 display the parameter values written into PZD3 to PZD12. Manual settings of parameters in group FE of the AC drive are invalid.			

## 8.6 Related Parameters

### 8.6.1 Parameters related to Communication

### AC Drive Communication Card Setting

You need to set F0-28 to 1 to select PROFIBUS DP as the serial port communication protocol of the AC drive. See the following table.

Parameter	Parameter Name	Value Range	Setpoint	Description
F0-28	Serial communication protocol	0: Modbus protocol 1: Communication card network bridge protocol	1	Select the special communication card network bridge as the serial communication protocol.

### **Communication Control Parameters**

Parameter	Parameter Name	Value Range	Hexadecimal Address	Decimal Address
U3-16	Frequency reference	-Maximum frequency to +Maximum frequency Unit: 0.01 Hz	H7310	29456
U3-17	Control command	0001: Run in forward direction 0002: Run in reverse direction 0003: Jog in forward direction 0004: Jog in reverse direction 0005: Coast to stop 0006: Decelerate to stop 0007: Reset upon fault	H7311	29457
U3-18	DO control	Bit0: DO1 output control Bit1: DO2 output control Bit2: Relay 1 output control Bit3: Relay 2 output control Bit4: FMR output control Bit5: VDO1 Bit6: VDO2 Bit7: VDO3 Bit8: VDO4 Bit9: VDO5	H7312	29458
U3-19	AO1 control	0 to 7FFF, indicating 0% to 100%	H7313	29459

Parameter	Parameter	Value Range	Hexadecimal	Decimal Address
	Name		Address	
U3-20	AO2 control	0 to 7FFF, indicating 0% to 100%	H7314	29460
U3-21	FMP control	0 to 7FFF, indicating 0% to 100%	H7315	29461
U3-23	Speed control	Signed data, 1 RPM	H7317	29463

When the MD-SI-DP1 expansion card is used, the written PZD1 and PZD2 are mapped to U3-17 and U3-16 respectively by default. If a command or frequency fails to be written into the AC drive but PZD3 to PZD12 can be written and F0-02 and F0-03 are set to 2 and 9 respectively, check whether FE-00 and FE-01 are set to U3-17 and U3-16 respectively. If not, manually correct the values of FE-00 and FE-01.

### **Communication Monitoring Parameters**

Parameter	Parameter Name	Unit	Hexadecimal	Decimal Address
			Address	
U0-00	Running frequency (Hz)	0.01 Hz	H7000	28672
U0-01	Frequency reference (Hz)	0.01 Hz	H7001	28673
U0-02	Bus voltage (V)	0.1 V	H7002	28674
U0-03	Output voltage (V)	1 V	H7003	28675
U0-04	Output current (A)	0.01 A	H7004	28676
U0-05	Output power (kW)	0.1 kW	H7005	28677
U0-06	Output torque (%)	0.1%	H7006	28678
U0-07	DI state	1	H7007	28679
U0-08	DO state	1	H7008	28680
U0-09	AI1 voltage (V)	0.01 V	H7009	28681
U0-10	AI2 voltage (V)	0.01 V	H700A	28682
U0-11	AI3 voltage (V)	0.01 V	H700B	28683
U0-12	Count value	1	H700C	28684
U0-13	Length value	1	H700D	28685
U0-14	Load speed	1	H700E	28686
U0-15	PID reference	1	H700F	28687
U0-16	PID feedback	1	H7010	28688
U0-17	PLC stage	1	H7011	28689
U0-18	Pulse input reference (Hz)	0.01 kHz	H7012	28690

Parameter	Parameter Name	Unit	Hexadecimal	Decimal Address
			Address	
U0-19	Feedback speed (Hz)	0.01 Hz	H7013	28691
U0-20	Remaining running duration	0.1 min	H7014	28692
U0-21	All voltage before correction	0.001 V	H7015	28693
U0-22	AI2 voltage before correction	0.001 V	H7016	28694
U0-23	AI3 voltage before correction	0.001 V	H7017	28695
U0-24	Linear speed	1 m/min	H7018	28696
U0-25	Current power-on duration	1 min	H7019	28697
U0-26	Current running duration	0.1 min	H701A	28698
U0-27	Pulse input frequency	1 Hz	H701B	28699
U0-28	Communication reference	0.01%	H701C	28700
U0-29	Encoder feedback speed	0.01 Hz	H701D	28701
U0-30	Main frequency X	0.01 Hz	H701E	28702
U0-31	Auxiliary frequency Y	0.01 Hz	H701F	28703
U0-32	Any memory address	1	H7020	28704
U0-33	Synchronous motor rotor position	0.1°	H7021	28705
U0-34	Motor temperature	1°C	H7022	28706
U0-35	Target torque (%)	0.1%	H7023	28707
U0-36	Resolver position	1	H7024	28708
U0-37	Power factor angle	0.1°	H7025	28709
U0-38	ABZ position	1	H7026	28710
U0-39	V/f separation target voltage	1 V	H7027	28711
U0-40	V/f separation output voltage	1 V	H7028	28712
U0-41	DI state display	1	H7029	28713
U0-42	DO state display	1	H702A	28714
U0-43	DI state display 1	1	H702B	28715

Parameter	Parameter Name	Unit	Hexadecimal Address	Decimal Address
U0-44	DI state display 2	1	H702C	28716
U0-45	Fault information	1	H702D	28717
U0-58	Z signal counter	1	H703A	28730
U0-59	Frequency reference (%)	0.01%	H703B	28731
U0-60	Running frequency (%)	0.01%	H703C	28732
U0-61	AC drive state	1	H703D	28733
U0-62	Current fault code	1	H703E	28734
U0-63	Data sent by master during point-point communication	0.01%	H703F	28735
U0-64	Data sent by slave during point-point communication	0.01%	H7040	28736
U0-65	Torque upper limit	0.1%	H7041	28737
U0-66	Expansion card model	100: CANopen 200: PROFIBUS DP 300: CANlink	H7042	28738
U0-67	Expansion card version	1	H7043	28739
U0-68	AC drive state	1	H7044	28740
U0-69	Running frequency (Hz)	0.01 Hz	H7045	28741
U0-70	Motor speed	RPM	H7046	28742
U0-71	Output current	0.1 A	H7047	28743

When the MD-SI-DP1 expansion card is used, the read PZD1 and PZD2 are mapped to U0-68 and U0-69 respectively by default. If a state or running frequency fails to be read while PZD3 to PZD12 can be read, check whether FE-20 and FE-21 are set to U0-68 and U0-69 respectively. If not, manually correct the values of FE-20 and FE-21.



If the AC drive is updated from an earlier version that supports MD38DP1 to a later version that supports MD38DP2, the preceding operations must be performed or the AC drive must be reset after the update is complete.

# 8.7 Communication Configurations

### 8.7.1 Communication Instance Description

The MD-SI-DP1 card uses the same GSD file as the MD38DP2 card, and its usage is also the same as that of the MD38DP2 card. Therefore, this chapter still uses the screenshots of the communication and configuration interfaces displaying information about the MD38DP2 card.

### 8.7.2 Configuring a Slave on the S7-300 Master in STEP 7 V5.4

Before using the PROFIBUS master, you need to configure the GSD file of the slave to add the corresponding slave device to the system of the master. If the file exists, skip step 2. You can obtain the GSD file from Inovance or its agent.

The configuration procedure is as follows:

1. Install the GSDML file. (Skip this step if the GSDML file has been installed.) Choose **Options > Manage general station description files (GSD)**.



 Double-click the hardware icon to access the HW Config interface, and choose Options > Install GSD File to add the MD38DP2.GSD file (English path required), as shown in the following figure.



Click **Install**. After the installation is complete, the PROFIBUS DP module MD38DP2 is displayed, as shown in the following figure.



Note: If any master or slave already exists on the **HW.config** interface, close the current interface by clicking the X button (marked with a red circle as shown in the following figure) before importing the GSD file.

RAN Config - [SIMATIC 300(1) (Configuration) Project]			- 🗆 ×
🕼 Station Edit Insert PLC View Options Window Help			- 18 X
			$ \circ$
			크리지
	Find:		nt ni
2	Profil	Standard	-
3	-		
	말꿈법	ROFIBUS DP	-
6		- General	
		- INOVANCE/PROFIBUS	
8		🗄 🧰 📴 🛄	
9		E m MD36DP2	
		PPD-D1	
		PP0-02	
		PP0-03	
		PP0-04	
		👔 PPU-US	
	l i	- Switching Devices	
	i i	- 🔁 I/O	
	E	- 🧰 Gateway	
×			-1
		LOBDATIBLE FRUFIDUS UF STAVES	- 1
Je Hallanana Ionan ann tao Ivanana Ivana	D		Cha

In this case, you can save the original project. If an alarm indicating that system data cannot be created is displayed, click **OK**. After closing the current configuration interface, you can install the GSD file by performing the preceding steps. After the installation is complete, click the button marked with the red circle in the following figure.



Select the original configuration project, and click **OK** to open it.

Open				×
Entry point: Project	View: Component view	× <b>•</b>	○ Onlin ⊙ Off	lin
Name: Project 💌	Storage E:\Project		Browse	
⊕ ∰ Project	SIMATIC 300	(1)		
	Object name:	SIMATIC 300(1)		
	Object type:	Process all		•
OK			Cancel	Help

3. Configure the actual hardware system, as shown in the following figure.

in conrig = [Simkiit 300(1) (Conriguration) rroject]	
ung Station Edit Insert PLC View Options Window Help	
Ethernet (1): FROFINET-IO-System (100)       1       2       1 <th></th>	

In the preceding figure, station 4 is MD38DP1, which is only used as an example. For details about its usage, see the MD380 Series PROFIBUS User Guide. MD38DP1 and MD38DP2 can coexist on the same network.

4. Configure data features of the slave.



After the PPO type is added, the address assigned by the PLC to the slave is displayed, as shown in the following figure. Slot 1 marked with a red circle in the following figure indicates the PKW address (8 bytes). Slot 2 indicates the PZD address (12 bytes).

If the selected PPO type does not have a PKW area, the I address and Q address of slot 1 are blank.



5. Configure PZDs.

The PZD1 and PZD2 configurations are fixed and cannot be modified by users. PZD3 to PZD12 are for customized periodic data exchange. They can be set in hardware configuration. Double-click the MD38DP icon in **HW Config**, click **Devicespecific parameters**, and configure corresponding parameter addresses as required.

Properties - DP slave					
General Parameter Assignment	1				
Parameters	Value				
🖃 🔄 Station parameters					
-= DP Interrupt Mode	DPVO				
🕂 🧰 General DP parameters					
🚊 🔄 Device-specific parameters					
- <u>≡</u> PZD3(master->slave)	61452				
- <u>≡</u> PZD4 (master->slave)	61448				
_≝ PZD5(master->slave)	64512				
- <u>≡</u> PZD6 (master->slave)	64513				
- <u>≡</u> PZD7 (master->slave)	61452				
- <u>≡</u> PZD8(master->slave)	61440				
_≝ PZD9(master->slave)	61440				
_≝ PZD10 (master->slave)	61440				
_≝ PZD11 (master->slave)	61440				
- <u>≡</u> PZD12 (master->slave)	61440				
_≝ PZD3(slave->master)	61440				
_≝ PZD4(slave->master)	61440				
P7D5 (clave-)macter)	61440				
OK	Cancel Help				

PZDx(master->slave) indicates the address used by the master to write to the slave, and PZDx(slave->master) indicates the address used by the master to read the slave. PZD3 to PZD12 are displayed in decimal and can be modified. For example, to set **PZD3(master->slaver)** to F0-12, enter **61452**.

By default, all PZDs of MD380 are set to F0-00 (61440 in decimal). For unused PZDs, modification is not required and default values can be retained. PZD mapping must be set independently for each slave as required (if the mappings of various slaves are the same, you can select a configured slave, press **Ctrl+C**, select the PROFINET bus in the configuration, press **Ctrl+V**, and modify the device name and IP address).

To enable the aperiodic parameter read and write function of DPV1, set corresponding parameters in customized indexes at the end of **Device-specific parameters** list. MD380 provides six customized indexes numbered from 0 to 5, as shown in the following figure. For example, you can set index 0 to F0-02 and index 1 to F0-08.

Parameters	Value	
P7D4 (s] ave= mester)	61440	
P7D5 (slave )master)	61440	
PZD6 (slave master)	61440	
PZD7 (slave->master)	61440	
PZD8(slave->master)	61440	
PZD9(slave->master)	61440	
PZD10 (slave->master)	61440	
	61440	
PZD12 (slave->master)	61440	
Function code of IndexO	61442	
Function code of Index1	61448	
- Function code of Index2	61440	
- Function code of Index3	61440	
- Function code of Index4	61440	
Function code of Index5	61440	
🕂 🦲 Hex parameter assignment		

After the preceding steps, the PROFIBUS slave is configured. Now, you can compile programs in S7-300 to control the AC drive.

### 8.7.3 Configuring a Slave on the S7-1200 Master in TIA Portal V13

1. Open TIA Portal V13, create a project, and add an S7-1200 master according to actual situations.





Since the S7-1200 CPU has no PROFIBUS interface, you need to add a PROFIBUS communication module. In this example, a CM1243-5 master module is added.

After adding the PROFIBUS master module, click **Network view**. Select the communication module, click **Properties** and then **General**, and click **Add new subnet** to create a PROFIBUS network. You can modify the master number here.

MD500PN   Devices & ne		·■■×
	🛃 Topology view 🛛 🙀 Network view 🛛 🙀 Device	e view
Network	HM connection 💌 🗛 Relations 🕎 👯 🔛 🛄 🔍 🛨	
		^
PLC_1 CPU 1214C		
		- 6
		- 11
		- 11
4		~
	100%	
CM 1243-5 [CM 1243-5]	Properties Diagnostics	
General IO tags	System constants Texts	
<ul> <li>▶ General</li> <li>▼ DP interface</li> </ul>	PROFIBUS address	
General	Interface networked with	
PROFIBUS address	Subasti Networked	
operating mode	Subiet: Not networked	
	Add new subnet	
	Parameters	

To modify the PROFIBUS baud rate, select the network in the view, and choose General > Network settings on the Properties tab page, and select a proper baud rate from the Transmission speed drop-down list.

CPU 1214C		MAMA
PROFILIE &		
PROFILOS_1		
	~	
	•	
PROFIBUS_1 [Profibus] Info 👔 🖳 Diagnostics	1	-
General IO tags System constants Texts		
General Network settings		_
Cable configuration		
Additional network devices Highest PROFIBUS address: 126	•	
Bus parameters	⊅	•
Profile: DP	•	

2. Install the GSD file. Skip this step if a GSD file has been installed.

If a GSD file is not installed yet, **Not yet installed** will be displayed in the **Status** column. Select the GSD file and click **Install**. (Note that an error will occur if the installation path contains Chinese characters.)



Manage general station description files X Installed GSDs GSDs in the project						
Source path: E:MD380						
Content of imported path						
File	Version	Language	Status	Info		
md38dp2.gsd		Default	Not yet installed			
			Delete Install	Cancel		

When the interface shown in the following figure is displayed, the installation is complete. Click **Close**.

e general station	descriptio	n files				
llation result						
essage						
Installation was co	mpleted suc	cessfully.				
Save log		Install additional	files	1000	Close	
	e general station	e general station descriptio Ilation result essage Installation was completed suc	e general station description files Ilation result essage Installation was completed successfully. Save log	e general station description files	e general station description files	e general station description files  Ilation result  essage Installation was completed successfully.  Save log Install additional files Close

During installation of the GSD file, the PORTAL will automatically close the configuration interface. After the installation is complete, double-click **Devices & networks** on the left to open the original configuration interface.



Choose **Hardware catalog** > **Other field devices** > **PROFIBUS-DP** > **General**. You can find the MD38DP2 in the list, which is the same as that in STEP 7. You need to fully expand the subordinate directories as shown in the following figure.



3. Start the configuration.

On the **Hardware catalog** tab page, double-click **MD38DP2** or drag it to **Network view** under **Devices & networks**, and click **Not assigned** under the slave to select the corresponding PROFIBUS network. Select the slave, click **Properties** and then **General**, and set the slave number. Note that the setting must be consistent with that set by the DIP switch on the MD38DP2 expansion card.

MD500PN → Devices & netw	vorks	_ # #×
6	🖥 Topology view 🛛 🛗 Netwo	ork view 🛯 🏦 Device view
Network		letwork overview
		Pevice
	=	<ul> <li>\$7-1200 station_1</li> </ul>
		CM 1243-5
CPU 1214C		PLC_1
		<ul> <li>GSD device_1</li> </ul>
		Slave_1
P	ROFIBUS_1	
	· · · · ·	
Slave_1		
MD38DP2 DP-NORN	•	
Not assigned Select master:		
PLC_1.CM 1243-5.DP interfa		
	~	
<b>&lt; III &gt;</b> 100%	▼	< III >
	×	
Slave_1		
CM 1243-5		
<u></u>		
2 III > 100%		
Slave_I [Module]	Properties 1 Info	Diagnostics
General IO tags Syst	tem constants Texts	
General	Subnet	PROFIBUS_1
PROFIBUS address		Add new subnet
Device-specific parameters		=
Hex parameter assignment	Parameters	
Watchdog	Address	2
	Address	
	Highest address	: 126
	Transmission speed	: 1.5 Mbps 🗸 🗸

Click **General DP parameters**, and select **DPV0** from the **DP interrupt mode** dropdown list, as shown in the following figure.

	<b>v</b>	
< Ⅲ > 100%		< III >
Slave_1 [Module]	🔍 Properties 🔄 🗓 Info 🔒	🛛 🔁 🗖 🖉 🤝
General IO tags Sys	stem constants Texts	
General     PROFIBUS address	General DP parameters	
General DP parameters		
Device-specific parameters	DP interrupt mode:	DPV0
Hex parameter assignment		DPV1
Watchdog		
	< III	>

Click **Device view**, and select a proper PPO type under **Hardware catalog**. The addresses assigned for each segment are displayed as follows. The PKW address is marked with a red circle in the following figure. If the selected PPO has no PKW, the column is blank.

MD500P	N ▶ Ungi	rouped	devices 🕨	Slave_1					_ # #×	Hardware catalog 🔳 🛙
				📲 Topology	view	Netw	ork view	📑 Devi	ice view	Options
dt 📩		<b>1</b>	Device of	verview	Р	KW				
		^	- *** •**	lodule	Rack	Slot	l address	Q address	Туре	✓ Catalog
				Slave_1	9	0			MD38DP2	101
			$\sim$	PPO-05_2_1	0	1	6875	6471	PPO-05	
4	Have -			PPO-05_2_2	0	2	7699	7295	PPO-05	Head module
	· ·									📗 Universal module
		•								PPO-01
										PPO-02
	_	1								PPO-03
										PPO-04
1 I										PPO-05
1 5		- 21								
		~						_		
	<u></u>	민	<				1		>	

4. Set PZD mapping.

Click **Network view** and then click **Device-specific parameters** to set the mapping for PZD3 to PZD12. Note that the PZD mappings for the PLC to read and write to the slave are set independently. For details, see " " on page "8.7.2 Configuring a Slave on the S7-300 Master in STEP 7 V5.4" on page 198 " " on page .

MD500PN → Devices & netwo	orks	_ <b>- - -</b> ×
	📲 Topology view 🛛 🛔 Ne	twork view
Network 1 Connections	VII connection 💌 🕨 📑	Network overview
<b>Д</b> Maste	r system: PLC_1.DP-Mastersystem (1)	A Pevice
		► CM 1243-5
		↓ PLC_1
Slave_1		
MD38DP2 DP-NORM		Slave_1
CM 1243-5		
		~
< III > 100%		
Slave_1 [Module]	Roperties 1 Info	🔒 🗓 Diagnostics 👘 🗖 🗖 🤝
General IO tags Sy	stem constants Texts	
> General	Device-specific parameters	^
PROFIBUS address	better spectre parameters _	
General DP parameters	P7P2(	
Hex parameter assignment	P2D3(master->slave):	61440
Watchdog	PZD4(master->slave):	61440
	<ul> <li>PZD5(master-&gt;slave):</li> </ul>	61440
	PZD6(master->slave):	61440
	PZD7(master->slave):	61440
	PZD8(master->slave):	61440
	PZD9(master->slave):	61440
	PZD10(master->slave):	61440

5. Compile and download the configuration.

If the settings of multiple slaves are the same, select a configured slave, press **Ctrl** +**C** and then **Ctrl**+**V** (or right-click the configured slave and choose **Copy** and then **Paste**) to connect more slaves to the network, and then modify their station numbers.

After all slaves are configured, save the configurations, and click the compile button. After the compiling is completed successfully, click the download button.

76	Siemens - C:\Users\y0263\Docur	nents\Automation\MD	00PN\MD500PN		
P	oject Edit View Insert Onlin	e Options Tools W	ndow Help		
E	🛉 🎦 🔚 Save project ا 🐰 🧾	🛅 🗙 🎝 ± (4 ± 🚽	🖥 🛄 🖺 🖳 💋 Go	online 🔊 Go offline	🌆 🖪 🖪 🗶 🖃 🛄 '
	Project tree 🛛 🔳 🖣	MD500PN Device	s & networks		
	Devices	Compile	Downloa	d	🚰 Topology view 🔒
s	🛍 📃 🖻	Network	ctions HMI connection	▼ 🔒 Relations	🕎 📲 📰 🛄 🍕 t
L ¥				4 Master syst	em: PLC_1.DP-Mastersystem
12	▼ MD500PN				
Ĕ	💕 Add new device				
<ul> <li>∞</li> <li>∞</li> </ul>	d Devices & networks	PLC_1			
l ä	▶ 🛅 PLC_1 [CPU 1214C A	CPU 1214C			
e l	Ungrouped devices	T			
	🕨 🔚 Security settings				
	🕨 🥁 Common data				
	Documentation setti				
	Languages & resource:				

Set the interface for the PC the communicate with the PLC as required on the displayed interface. In this example, a local network port is selected. Then click **Start search** to search for the PLC.

	Device	Device type	Slot	Interface type	Address	Subnet	
	PLC_1	CPU 1214C AC/D	1 X1	PN/IE	192.168.0.1		
-	CM 1243-5	CM 1243-5	101 X1	PROFIBUS	1	PROFIE	US_1
		Type of the PG/PC inte	rface:	PN/IE		•	•
		PG/PC inte	rface:	💹 Intel(R) Ether	net Connection (3) I2	18-LM	• 🖲 [
		Connection to interface/su	bnet:	Direct at slot '1			•
		1st gat	eway:				
	Select target dev	rice:	1		Show all compatib	le devices	
	Select target dev Device	rice : Device type	Interfa	ce type Ad	Show all compatib	le devices Target dev	ice
	Select target dev Device —	Device type	Interfa PN/IE	ce type Ad Ac	Show all compatib dress cess address	Target dev	ice
	Select target dev Device —	ice: Device type 	Interfa PN/IE	ce type Ad Ac	Show all compatib dress cess address	Target dev	ice
2 1 2	Select target dev Device —	rice: Device type —	Interfa PN/IE	ce type Ad Ac	Show all compatib dress cess address	Target dev	ice
Flash LED	Select target dev Device —	ice: Device type —	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Target dev	ice
Flash LED	Select target dev Device —	ice: Device type —	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Target dev	ice
Flash LED	Select target dev Device 	ice: Device type —	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Target dev -	search
Flash LED	Select target dev	ice: Device type -	Interfa PN/IE	ce type Ad	Show all compatible dress compatible dress company and the set of	Target dev	search
Flash LED	Select target dev	ice: Device type -	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	Target dev 	search
Flash LED	Select target dev	ice: Device type 	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	r messages	search
Flash LED	Select target dev	ice: Device type -	Interfa PN/IE	ce type Ad	Show all compatib dress cess address	r messages	search

If no accessible device is found, the connection between the PC and PLC is faulty. Eliminate the fault first. (This problem also occurs when the PC was used for download through Ethernet in STEP 7 before. In this case, restart the PC or change the PG/PC interface to a non-Ethernet interface in STEP 7.)

Online status information:	Display only error messages
🔥 Found accessible device pn-io	^
😢 Scan completed. 0 compatible devices of 1 accessible devices found.	
😢 Scanning and information retrieval completed. 1 problem found.	
	✓
	Load

If the connection is normal, the **Load** button is available. You can click **Load** to start download and perform subsequent operations as prompted to download the configuration to the PLC.

### 8.7.4 Performing Periodic Read/Write Operations on the AC Drive Slave

In this example, the PLC is S7 315-2PN/DP, and the following figure shows the address assignment.

(3) MD38DP2									
S	🚺 DP I	ID	Order Number / Designation	I Add	Q Address	Comment			
1	4AX		PP0-02	512519	512519				
2	6A <b>8</b>		> PPO-02	520 531	520 531				

1. Directly use the MOVE command to enable the AC drive to run in forward direction at the target frequency of 30 Hz (F0-02 = 2, F0-03 = 9), as shown in the following figure.



Other data is written in a similar way. The read data can also be transmitted from the PIW register to the common Q, I, L, M, or D register using the MOVE command for parsing.

2. Use SFC14 and SFC15.



- **LADDR**: Starting address configured in the I block of the module, which must be in hexadecimal format.
- **RET\_VAL**: Return value. If an error occurs during function activation, the return value contains an error code. If no error occurs, 0 is returned.
- **RECORD**: Target area of the read user data. Its length must be consistent with the length of the module configuration selected in STEP 7. Only the byte data type is allowed.



- **LADDR**: Starting address configured in the Q block of the module, which must be in hexadecimal format.
- **RET\_VAL**: Return value. If an error occurs during function activation, the return value contains an error code. If no error occurs, 0 is returned.
- **RECORD**: Source area of the user data to be written. Its length must be consistent with the length of the module configuration selected in STEP 7. Only the byte data type is allowed.

For both SFC14 and SFC15, the addresses must be in hexadecimal format converted from the I and Q starting addresses (in this example, the address is 520, which is H208 in hexadecimal format). The length of **RECORD** must be consistent with the BYTE length of the PPO type PZD (in this example, PPO2 is used, which includes six PZDs, that is, a total of 12 bytes).

### 8.7.5 Performing Aperiodic Read/Write Operations on the AC Drive Slave

To perform aperiodic read and write operations on the AC drive PROFIBUS DP slave, Siemen's system function modules SFB52 (for reading) and SFB53 (for writing) are required. Create an organization block in the program, and add relevant function blocks and programs in the organization block.




After M0.0 is set, the function block reads F0-02 (Index 0 has been set to F0-02 before) of the AC drive No. 3 and saves it in QW6. The fields are defined as follows:

- **REQ**: Command enable. When this field is set to 1, the function block is enabled.
- ID: Logic address. To specify this field, convert any Q address of the corresponding AC drive slave to a hexadecimal value, and set bit 15 of the value to 1. For example, for Q512, the hexadecimal value is H200. After bit 15 is set to 1, H8200 is obtained.

	(3)	MD38DP2				
S	DF	ID	Order Number / Designation	I Add	Q Address	Comment
1	4AX		PP0-02	512519	512519	
2	6A <b>X</b>		> PP0-02	520 531	520 531	

- **INDEX**: Index number, ranging from 0 to 5. This field can be customized to an index mapping address of a slave as required.
- MLEN: Maximum length of the data to be obtained. For MD38DP2, this field must be set to **2**.
- **RECORD**: Target area of the obtained data record. This field is used to store read data when the read operation is performed and sent data when the write operation is performed.

- VALID: New data record received and valid.
- **BUSY**: When the value is **ON**, the operation is not completed.
- ERROR: Error flag. When the value is ON, an error occurs.
- **STATUS**: Block status or error information.
- LEN: Length of the obtained data record.

During invocation, you can customize parameters or use some or all default parameters, as shown in the following figure.



In the preceding figure, default parameters are used on the left. In this case, parameters are set according to the information shown on the right. You can set customized or default parameters for corresponding blocks as required.

Aperiodic write operations are performed in a similar way as aperiodic read operations. The **RECORD** field stores data to be written, as shown in the following figure.



Note that before running an organization block, you need to download data blocks (above the function block, DB1 and DB2 in this example) to the PLC. Otherwise, an error indicating that the DB blocks are not loaded will be reported.

SFB53 is used to perform operations on the EEPROM. Therefore, the program is required to invoke relevant operations when required and disable relevant operations in time. As shown in the following figure, after the write operation is complete (M1.1 is set to 1), the program is invoked to reset M1.0.



When SFB52 and SFB53 are executed, relevant blocks need to be invoked for multiple times. Therefore, do not invoke them when single execution is required.

#### 8.7.6 Diagnosis

You can use SFC13 in the program to obtain specific diagnosis information of each slave, as shown in the following figure.



- **REQ**: Command enable. When this field is set to **ON**, diagnosis information reading is initiated.
- LADDR: Configured diagnosis address of the PROFIBUS DP slave. The following figure shows the actual value. For SFC13, the address must be specified in hexadecimal.

Properties - DP slave		×
General Parameter	Assignment	
Module Order number: Family: DP slave type: Designation:	General MD38DP2	GSD file (type file): MD38DP2.GSD
Addresses — Diagnostic	16377	Node/Master System PROFIBUS 3 DP master system (1)
SYNC/FREEZE Capa	bilities	
SYNC SYNC	<b>F</b> REEZE	✓ Watchdog
Comment:		
		*
OK		Cancel Help

- **RET\_VAL**: Error code (negative) when an invocation error occurs or actual length of transmitted data (positive) when no error occurs.
- **RECORD**: Target area of the read diagnosis data. The value must be 9 bytes. Otherwise, an error is reported during invocation. The 9 bytes are defined as follows:

Bytes 0–2: Station status

Byte 3: Master number

Byte 4: Supplier ID (high-order byte)

Byte 5: Supplier ID (low-order byte)

Byte 6: Dedicated device diagnosis length (fixed to 3)

Byte 7: Dedicated device diagnosis (high-order byte)

Byte 8: Dedicated device diagnosis (low-order byte)

• **BUSY**: When this field is **1**, reading is not complete. Device-specific diagnosis provides relevant AC drive fault information, which is consistent with the value of U0-62. When the communication between the MD-SI-DP1 expansion card and AC drive is interrupted, 0x34 is returned.

### 8.8 Fault Diagnosis

### 8.8.1 Troubleshooting

The following table describes the faults that may occur during use of the MD-SI-DP1 expansion card and the AC drive.

Symptom	Solution
After the AC drive is powered on, only the power indicator (D4) is on, indicating that communication between the MD-SI-DP1 expansion	<ol> <li>Check that F0-28 is set to 1.</li> <li>Check the AC drive type. This user guide only describes the usage of MD520. For other AC drive models, contact the technical engineers to obtain the correct user guide.</li> </ol>
card and the AC drive is not established.	3. Check whether the AC drive software version supports the MD-SI-DP1 card.
After the AC drive is powered on, the power indicator (D4) is on and the indicator of communication with the AC drive (D2) blinks.	Set the station number correctly (within the range of 1 to 125). Note that digit 8 of the DIP switch is the least significant bit of the address.

Symptom		Solution
		1. Check that the cable is properly connected.
	After the configuration is downloaded, indicators D2 and D4 are steady on while the yellow indicator D3 is off on the MD-SI-DP1 expansion card.	2. Check the DIP switches on the PROFIBUS DP interfaces. The DIP switches on the PROFIBUS DP interfaces at both ends of the network must be set to ON, and the DIP switches on other PROFIBUS DP interfaces must be set to OFF.
		3. If the AC drive is connected at the end, check that the communication cable is connected through IN of the PROFIBUS DP interface. (If the communication cable is connected through OUT, it cannot be connected to the network when the PROFIBUS DP interface is set to ON.)
		4. Check that the station number settings on the MD- SI-DP1 expansion card are consistent with the configuration. Digit 8 of the DIP switch is the least significant bit of the address.
The connection		5. Check that the GSD file used in the configuration is correct.
tails after the	After the	1. Check that the GSD file used is correct.
is downloaded.	configuration is downloaded, indicators D2 and D4 are steady on while the yellow indicator D3 blinks slowly at the frequency of about 1 Hz to 2 Hz on the MD-SI-DP1 expansion card.	2. Check that the PZD mapping is set correctly. Device-specific parameters in STEP 7 and PORTAL must be set in decimal format. Therefore, you need to convert the parameter numbers into decimal values when setting device-specific parameters. For example, the decimal value of FC-11 is 64523 (0xFC0B in hexadecimal format). If a parameter number that the AC drive does not support is entered, the connection fails. Note that PZD mapping does not support Modbus addresses such as H2000 and H8000.
	After the configuration is downloaded, the yellow indicator D3 on the MD-SI- DP1 expansion card blinks quickly.	The PLC is not in the running status. Check the PLC status and locate the fault cause (possibly because the OB block does not exist).

Symptom		Solution
After the connection is successful, all	No data can be written/read.	Check whether the operated address is correct. No matter whether the PPO type used contains the PKW area, the address for the read and write operations is located in the second row (also the last row). For example, if the I address and Q address in the last row of the station are both 520 to 531 (note that the I and Q addresses may start from different numbers), the PZD1 and PZD2 data written into the AC drive are stored in QW520 and QW522, respectively. (If the PLC is S7-300 or S7-400, PQW is required.) If SFC15 is used, check whether <b>RET_VAL</b> of the SFC15 block is <b>0</b> . If not, an invocation error exists. Eliminate this error first and invoke the block again. For details, see section "8.7.4 Performing Periodic Read/Write Operations on the AC Drive Slave".
the PLC are green, but data cannot be written into or read from the AC drive.	PZD3 or subsequent data can be written, but PZD1 or PZD2 cannot be written/ read.	Check that F0-02 is set to 2 and F0-03 is set to 9. Check whether the command reference is in the range of 1 to 7 (not bit) or frequency reference is in the range of –F0-10 to +F0-10. If not, the write operation fails. Check whether FE-00 is set to U3-17 and FE-01 is set to U3-16. If not, manually correct the parameter values or restore to factory settings.
	PZD1 and PZD2 can be written/ read, while PZD3 or subsequent data cannot be written/read.	Check whether the PPO type supports the PZD. Check whether <b>Device-specific parameters</b> are set correctly.
	-	Check the logic relations. Check whether the same PZD is assigned with values for multiple times in a certain logic relation (check whether the value given by the PLC is correct under the logic relation in the monitoring table of the PLC).
After communication is established, the AC drive reports ERR164, which cannot be cleared. However, the indicators on the MD-SI-DP1 expansion card and the BF indicator on the PLC are normal.		Check whether the high-order 8 bits of the PZD1 data (QW data) written into the AC drive are 0 in the PLC program. If not, change them to 0. The PZD1 command in this user guide refers to values instead of bits. Note that this solution applies to MD520 only. For other AC drives, consult the technical personnel.

Symptom	Solution
After communication is established, the communication is normal when the AC drive is not	1. Disconnect the power supply, and measure the resistance between A1 and B1 of the PROFIBUS DP slave interface at the farthest end with a multimeter. The resistance should be $100\pm 20 \Omega$ .
running. However, when one or more AC drives are running, the AC drive is disconnected randomly.	2. Check that the shield layers of cables are connected together and the shield layers are in contact with the sheet metal in the PROFIBUS DP interface. The shield layers are not required to connect with other GND.
After the connection is established, if the AC drive reports a fault, the faulty slave cannot connect to the network when the PLC configuration is changed and downloaded or when only the AC drive is powered on again.	MD-SI-DP1 only supports the interruption mode DPV0. If the interruption mode is set to DPV1, when a slave is faulty, the PLC master may close the PROFIBUS DP connection channel of the slave or interrupt all the PLC communication (which usually occurs on S7-1200). When such a symptom occurs, change the PROFIBUS DP interruption mode (which is DPV0 by default in STEP 7 and DPV1 by default in PORTAL) of the slave to DPV0 under <b>General DP</b> <b>parameters</b> . Then, compile and download the configuration, and power on the PLC again.

### Indicator Status and Troubleshooting

Indicator ※	Status	Symptom	Solution
Red (D4)	OFF	The MD-SI-DP1 expansion card is not powered on.	Check that connection between the MD-SI-DP1 expansion card and the AC drive is secure.
Green (D2)	OFF	The connection between the MD-SI-DP1 expansion card and the AC drive fails.	Check that F0-28 is set to 1 and the connection between the MD-SI-DP1 expansion card and the AC drive is secure.
Green (D2)	Blinking at 1 Hz	The connection between the MD-SI-DP1 expansion card and the AC drive fails.	Check that the PROFIBUS DP station number is within the range of 1 to 125.
Yellow (D3)	Blinking at 1 Hz	A configuration error occurs.	Check that the GSD file is correct.
Yellow (D3)	Blinking at 2 Hz	A parameter error occurs.	Check that all parameter addresses in <b>Device</b> - <b>specific parameters</b> are supported by the AC drive.

#### Table 8–2

Indicator %	Status	Symptom	Solution
Yellow (D3)	Blinking at 5 Hz	The master is not running.	Check the master state.
Yellow (D3)	OFF	The connection between the MD-SI-DP1 expansion card and the PROFIBUS master fails.	Check that the slave address is correct and the PROFIBUS cable is connected properly.

### Note

Note  $\approx$ : For some products, the indicator color and the terminal symbol may not match. In this case, the terminal symbol prevails. The indicators are D2, D3, and D4 from left to right. See "" on page.

#### **Troubleshooting for GSD Installation Failure**

• Symptom 1: The GSD file cannot be installed or updated when STEP 7 is used, as shown in the following figure.

Install GSD Files:	
E: \MD380	Browse
File     Release     Version     Languages       MD30DF2.GSD	
An update is presently not possible. In one or more SIEP 7 applications at least one GSD file or type file is being referenced.	
MD38DP2	J
Install Show Log Select All Deselect All	
Close	Help

Possible cause: The current hardware configuration has been opened and the GSD file is being used by other components.

Solution: Close the current configuration interface by clicking the X button (marked with a red circle in the following figure). Then, install or update the GSD file and open the configuration interface again.

C # 2+ 0         %: 6         %: 6         %: 7         2         2         2         1	时 HW Config - ISIMATIC 300(1) (Configuration) Project] 時 Station Edit Insert PLC View Options Window Help	
(i) MD08DP2	2     0     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0       1     1     0     0	Eind     nejai       Pofil     Standard       B     Brozzensor       B     Brozensor       B     Brozensor
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★	THE PROFIBUS-OF slaves for ts (distributed rack)

• Symptom 2: The file cannot be interpreted.

Install GSD Files	×
Install GSD Files:	
E:\MD380	Browse
File Release Version Languages	
MD38DP2(1).GSD Default	
The file 'MD38DP2(1).GSD' cannot be interpreted.	
Install Show Log Select All Deselect All	
Close	Help

Possible cause: During the GSD file transmission, the file name is changed manually or by the transmission tool. In this case, the file name fails to meet the PROFIBUS requirements.

Solution: Change the GSD file name to **MD38DP2.GSD**.

• Symptom 3: The file contains syntax errors.

Install GSD File	s			23			
Install GSD 1	Install GSD Files: from the directory						
E:\MD380				Browse			
File	Release	Version	Languages				
MD38DP2.GSD			Default				
The file 'MI	38DP2. GSD'	contains	syntax errors.				
Install		Show Log	Select All Deselect All				
Close				Help			

Possible cause: The GSD file is modified.

Solution: Use a correct GSD file.

• Other cases

Some versions of STEP 7 and PORTAL do not support a path that contains Chinese for installing the GSD file. In this case, store the GSD file in a path that does not contain Chinese characters.

# 9 EtherNet/IP Communication

### 9.1 Introduction

As an EtherNet/IP fieldbus adapter that complies with international EtherNet/IP bus standards, the MD520 series EtherNet/IP communication expansion card (MD500-EN1 card for short) features high efficiency, flexible topology, and easy operation. It is installed on an MD series AC drive to improve the communication efficiency and facilitate implementation of the AC drive networking function, enabling the AC drive to be a slave controlled by the fieldbus master.

This user guide is applicable to the MD500-EN1 card with software of version 1.00 or later (you can query the version by viewing the parameter U0-67 of the AC drive after the card is installed and powered on). The corresponding EDS file is **MD500P\_EIP\_V1.00.eds**.

### 9.2 Installation

The MD500-EN1 card is embedded in the MD520 series AC drive. Before installation, cut off the power supply of the AC drive and wait for about 10 minutes until the charging indicator of the AC drive becomes off. Then, insert the MD500-EN1 card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by the pulling force of the external signal cable. *"Figure 9–1" on page 227* shows the installation.

After installing the MD500-EN1 card on the AC drive, connect the ground terminals of the MD500-EN1 card and the AC drive properly, as shown in *"Figure 9–2 Connecting ground terminals of the MD500-EN1 card and AC drive" on page 228*.



Figure 9-1 Installation of MD500-EN1



Figure 9-2 Connecting ground terminals of the MD500-EN1 card and AC drive

### 9.3 Interface Layout and Description

"Table 9–1" on page 229 shows the hardware layout of the MD500-EN1 card. The pin header J7 on the back of the MD500-EN1 card is used to connect the AC drive. The MD500-EN1 card provides two network ports (J4 and J6) for communication with the EtherNet/IP master (or other slaves). For details about the hardware, see "Table 9–1" on page 229.



Figure 9-3 Interface layout of the MD500-EN1 card

Symbol	Hardware Name	Function
J7	Pin header	It connects to the AC drive.
J4 J6	Network ports	The MD500-EN1 card is connected to the EtherNet/IP master using the standard Ethernet RJ45 socket (direction-insensitive). The pin signal definitions are the same as those of the standard Ethernet pins. They support both cross-connected lines or direct-connected lines.
J1	EMC ground terminal	It connects to the EMC ground terminal of the AC drive.
D13	Power indicator (green)	It indicates the power status. ON indicates normal. OFF indicates abnormal, and you need to check whether the installation is correct.
D1	Status indicator of communication with the AC drive (green)	For details, see "Table 9-2 Indicators
D4	Ethernet/IP RUN indicator (green)	of the MD500-EN1 card" on page 229
D7	Ethernet/IP fault indicator (red)	

Table 9–1 Hardware description of the MD500-EN	1 card
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- After the MD500-PN1 card is installed, J2 is on the left and J3 is on the right when facing the RJ45 interface. These two ports are direction-insensitive. You can connect either one to the near PLC end.
- The Cat5e shielded twisted pair network cable is recommended to ensure stability.

Indicator	State Description	Solution
D1 steady green	Normal	N/A
D1 is steady off.	Abnormal communication with the AC drive	Check whether FD-00 is set to 9 and FD-01 is set to 3.
D4 is steady off, and D7 is steady red.	Faulty	See the following AC drive fault codes and troubleshooting.

Table 9–2 Indicators of	the MD500-EN1 card
	CHE HIDSOU LIVE CUIU

Indicator	State Description	Solution
D4 is steady off, and D7 is blinking red.	Waiting for obtaining IP address	The expansion card is in DHCP mode. Assign an IP address to the device by using BOOTP or DHCP.
D4 is blinking green, and D7 is blinking red.	Connection disconnected or timed out	Check whether the network cable is disconnected and whether the master is running.
D4 is blinking green, and D7 is steady off.	Waiting for connecting to the master	Check whether the network cable is properly connected and whether the master is running.
D4 is steady green, and D7 is steady off.	Normal	N/A

### 9.4 Topology

EtherNet/IP supports a variety of topologies, including bus, star, and tree topologies. Diversified networking modes can be implemented by using switches.



Figure 9-4 Bus topology



Figure 9-5 Star topology

### 9.5 Protocol Description

#### 9.5.1 I/O Messages

The MD500-EN1 expansion card supports 24 I/O messages for data transmission, of which 12 are master-to-slave messages and 12 are slave-to-master messages.

The I/O messages enable the master to modify and read AC drive data in real time and perform periodic data exchange. The data communication addresses are directly configured by the AC drive. The specific functions are as follows:

- Setting the AC drive control command and target frequency in real time
- Reading the current state and running frequency of the AC drive in real time
- Exchanging function parameter and monitoring parameter data between the AC drive and EtherNet/IP master in real time

The I/O message data is used for periodic data exchange between the master and the AC drive, as described in the following table.

I/O Messages (O->T) Sent by Master			
AC Drive Command AC Drive Target Frequency AC Drive Parameters Modified in Real Time			
Output I/O Messages[0]	Output I/O Messages[1]	Output I/O Messages[2–11]	
I/O Messages (T->T) Returned by AC Drive			

AC Drive State	AC Drive Running Frequency	AC Drive Parameters Read in Real Time
Input I/O Messages[0]	Input I/O Messages[1]	Input I/O Messages[2–11]

### 9.5.2 Data Sent by the Master

The following table describes the data sent by the master.

I/O Message Data Sent by the Master			
	AC drive command word (command source set to communication)		
I/O Messages 0	00: Stop according to the stop mode defined by F6-10 01: Run in forward direction 02: Run in reverse direction 03: Jog in forward direction	04: Jog in reverse direction 05: Coast to stop 06: Stop according to the stop mode defined by F6-10 07: Reset upon fault	
I/O Messages 1	AC drive target frequency (frequency reference source set to communication), which ranges from the reverse frequency upper limit (negative value) to forward frequency upper limit (decimal places included, for example, 2000 corresponds to 20.00 Hz on the AC drive). When the reference target frequency exceeds this range, the AC drive runs at the frequency upper limit.		
I/O Messages 2 to I/O Messages 11	Function parameter values (group F and group A) modified in real time, not written into EEPROM. FE-02 to FE-11 correspond to I/O Messages 2 to I/O Messages 11. For details about the configuration, see the I/O message data configuration.		

#### 9.5.3 Data Returned by the AC Drive

The following table describes the data returned by the AC drive.

I/O Message Data Returned by the AC Drive		
I/O Messages 0	AC drive running state, which is described as follows by bit: Bit0: 0: Stopped; 1: Running Bit1: 0: Running in forward direction; 1: Running in reverse direction Bit2: 0: Not faulty; 1: Faulty Bit3: 0: Running frequency not reached; 1: Running frequency reached Bit4 to Bit7: Reserved Bit8 to bit15: AC drive fault code	
I/O Messages 1	AC drive running frequency (unit: 0.01 Hz) The current AC drive running frequency is returned as 16-bit signed data.	
I/O Messages 2 to I/O Messages 11	Function parameter values (group F and group A) and monitoring parameter values (group U) read in real time. FE-22 to FE-31 correspond to I/O Messages 2 to I/O Messages 11. For details about the configuration, see the I/O message data configuration.	

### 9.6 Related Parameters

#### 9.6.1 AC Drive Communication Card Type Setting

After powering on the AC drive, the MD500-EN1 card can communicate with the AC drive properly only after F0-28 is set to 1.

Parameter	Parameter Name	Value Range	Setpoint	Description
F0-28	Serial communication protocol	0: Modbus protocol 1: Communication card network bridge protocol	1	Select the special communication card network bridge protocol as the serial communication protocol.
F0-02	Command source	0: Operating panel 1: Terminal 2: Communication	2	Set the command source to communication.
F0-03	Main frequency reference source	0: Digital setting (non-retentive at power failure) 1: Digital setting (retentive at power failure) 2: Al1 3: Al2 4: Al3 5: Pulse reference (DI5) 6: Multi- reference 7: Simple PLC 8: PID 9: Communication	9	Set the target frequency through communication.

### 9.6.2 MD500-EN1 Card IP Address Configuration

The following table describes the communication card configuration parameters of the AC drive.

Parameter No.	Parameter Name	Value Range	Description
FD-37	DHCP function	0: Disabled 1: Enabled	Defines the DHCP function of the EtherNet/IP expansion card. After the DHCP function is enabled, the following IP address configuration parameters are invalid.
FD-38 to FD-41	Expansion card IP address	0–255	Defines the IP address of the EtherNet/IP expansion card.
FD-42 to FD-45	Expansion card subnet mask	0–255	Defines the subnet mask of the EtherNet/IP expansion card.
FD-46 to FD-49	Expansion card gateway address	0–255	Defines the gateway address of the EtherNet/IP expansion card.

The IP address can be a static IP address or DHCP dynamic IP address. The IP mode is defined by FD-37. The static IP address is set by FD-37 to FD-39. For example, if the static IP address is 192.168.0.6, the subnet mask is 255.255.255.0, and the gateway is 192.168.0.1, set as follows:

Parameter	Function	Setpoint
FD-37	DHCP function	0
FD-38	Most significant byte of the IP address	192
FD-39	Second most significant byte of the IP address	168
FD-40	Third byte of the IP address	0
FD-41	Least significant byte of the IP address	6
FD-42	Most significant byte of the subnet mask	255
FD-43	Second most significant byte of the subnet mask	255
FD-44	Third byte of the subnet mask	255
FD-45	Least significant byte of the subnet mask	0

Parameter	Function	Setpoint
FD-46	Most significant byte of the gateway	192
FD-47	Second most significant byte of the gateway	168
FD-48	Third byte of the gateway	0
FD-49	Least significant byte of the gateway	1

When the DHCP or BOOTP function is used, the MAC address of the expansion card is required. You can obtain the MAC address by checking the label on the expansion card, or viewing the related parameter of the AC drive.

The MD500-EN1 expansion card also supports the IP address conflict detection function. When the IP address of this card is the same as that of another device in the network, the red indicator D7 becomes steady on, and bit2 of FD-58 changes to 1.

No.	Scenario	Symptom	Solution
1	Both devices support IP address conflict detection. The two devices are powered on at different time.	The device powered on first keeps the IP address and continues to run, and the other device enters conflict mode.	
2	Both devices support IP address conflict detection. The two devices are powered on at almost the same time.	Both devices enter IP address conflict mode.	Check device IP addresses and change duplicate
3	One device supports IP address conflict detection while the other does not.	The device that does not support IP address conflict detection occupies the IP address no matter whether it is powered on first. The device that supports IP address conflict detection enters conflict mode.	addresses.

There are three IP address conflict situations, as described in the following table.

# Note

- The expansion card implements active conflict detection upon power-on and DHCP IP address assignment, and it implements passive detection at other times. If the same dynamic (static) IP address is separately assigned to two devices, which are then connected to a network, neither of the two expansion cards will report an IP address conflict.
- IP address assignment by using the DHCP function will fail if an assignment conflict occurs during the process.

### 9.6.3 Parameters Related to AC Drive Communication Card

Parameter No.	Parameter Name	Unit	Description
FD-61	First two bytes of the expansion card MAC address	1	MAC address of the expansion card
FD-62	Middle two bytes of the expansion card MAC address	1	MAC address of the expansion card
FD-63	Last two bytes of the expansion card MAC address	1	MAC address of the expansion card
FD-58	Expansion card error code	1	Error code of the expansion card

#### 9.6.4 Communication Control Parameters

Parameter No.	Parameter	Value	Range	Decimal Address
	Name			
U3-16	Frequency	–Maximum freque	ency to	29456
	reference	+Maximum freque	ency	
		0.01 Hz		
U3-17	Control	0000: Stop	0004: Jog in	29457
	command	according to the	reverse	
		stop mode	direction	
		defined by F6-10	0005: Coast to	
		0001: Run in	stop	
		forward	0006: Decelerate	
		direction	to stop	
		0002: Run in	0007: Reset	
		reverse	upon fault	
		direction		
		0003: Jog in		
		forward		
		direction		

Parameter No.	Parameter	Value Range	Decimal Address
	Name		
U3-18	DO control	Bit0: DO1 output control	29458
		Bit1: DO2 output control	
		Bit2: Relay 1 output control	
		Bit3: Relay 2 output control	
U3-19	AO1 control	0 to 7FFF, indicating 0% to 100%	29459
U3-20	AO2 control	0 to 7FFF, indicating 0% to 100%	29460
U3-21	FMP control	0 to 7FFF, indicating 0% to 100%	29461
U3-22	Reserved	Reserved	
U3-23	Speed control	Signed data, 1 RPM	29463

When the MD500-EN1 expansion card is used, the written I/O Messages 0 and I/O Messages 1 are mapped to U3-17 and U3-16 respectively by default. If a command or frequency fails to be written into the AC drive but I/O Messages 2 to I/O Messages 11 can be written and F0-02 and F0-03 are set to 2 and 9 respectively, check whether FE-00 and FE-01 are set to U3-17 and U3-16 respectively. If not, manually correct the values of FE-00 and FE-01.

#### 9.6.5 Communication Monitoring Parameters

Parameter	Parameter Name	Unit	Decimal Address
U0-00	Running frequency	0.01 Hz	28672
U0-01	Frequency reference	0.01 Hz	28673
U0-02	Bus voltage	0.1 V	28674
U0-03	Output voltage	1 V	28675
U0-04	Output current	0.1 A	28676
U0-05	Output power	0.1 kW	28677
U0-06	Output torque	0.1%	28678
U0-07	DI state	1	28679
U0-08	DO/RO state	1	28680
U0-09	AI1 voltage	0.01 V	28681
U0-10	AI2 voltage	0.01 V	28682
U0-11	AI3 voltage	0.01 V	28683
U0-12	Count value	1	28684
U0-13	Length value	1	28685
U0-14	Load speed	1	28686
U0-15	PID reference	1	28687
U0-16	PID feedback	1	28688
U0-17	PLC stage	1	28689

Table 9–3 Communication monitoring parameters

Parameter	Parameter Name	Unit	Decimal Address
U0-18	Pulse input frequency	0.01 kHz	28690
U0-19	Feedback speed	0.01 Hz	28691
U0-20	Remaining running duration	0.1 min	28692
U0-21	Al1 voltage before correction	0.001 V	28693
U0-22	AI2 voltage before correction	0.001 V	28694
U0-23	AI3 voltage before correction	0.001 V	28695
U0-24	Linear speed	1 m/min	28696
U0-25	Current power-on duration	1 min	28697
U0-26	Current running duration	0.1 min	28698
U0-27	Pulse input frequency	1 Hz	28699
U0-28	Communication reference	0.01%	28700
U0-29	Encoder feedback speed	0.01 Hz	28701
U0-30	Main frequency X	0.01 Hz	28702
U0-31	Auxiliary frequency Y	0.01 Hz	28703
U0-32	Any memory address	1	28704
U0-33	Synchronous motor rotor position	0.1°	28705
U0-34	Motor temperature	1°C	28706
U0-35	Target torque	0.1%	28707
U0-36	Resolver position	1	28708
U0-37	Power factor angle	0.1°	28709
U0-38	ABZ position	1	28710
U0-39	V/f separation target voltage	1 V	28711
U0-40	V/f separation output voltage	1 V	28712
U0-41	DI state display	1	28713
U0-42	DO state display	1	28714
U0-43	DI state display 1	1	28715
U0-44	DI state display 2	1	28716
U0-45	Fault information	1	28717

Parameter	Parameter Name	Unit	Decimal Address
U0-58	Z signal counter	1	28730
U0-59	Frequency reference	0.01%	28731
U0-60	Running frequency	0.01%	28732
U0-61	AC drive state	1	28733
U0-62	Current fault code	1	28734
U0-63	Data sent by master during point-point communication	0.01%	28735
U0-64	Data sent by slave during point-point communication	0.01%	28736
U0-65	Torque upper limit	0.1%	28737
U0-66	Expansion card model	100: CANopen 200: PROFIBUS DP 400: PROFINET 500: EtherCAT 600: EtherNet/IP	28738
U0-67	Expansion card version	0.01	28739
U0-68	AC drive state	1	28740
U0-69	Running frequency	0.01 Hz	28741
U0-70	Motor speed	1 RMP	28742
U0-71	Output current	0.1 A	28743
U0-80	Name of EtherCAT slave	1	28752
U0-81	Alias of EtherCAT slave	1	28753
U0-82	EtherCAT ESM transmission error code	1	28754
U0-83	EtherCAT XML file version	0.01	28755
U0-84	EtherCAT synchronization loss count	1	28756
U0-85	Maximum errors and invalid frames of EtherCAT port 0 per unit time	1	28757
U0-86	Maximum errors and invalid frames of EtherCAT port 1 per unit time	1	28758

Parameter	Parameter Name	Unit	Decimal Address
U0-87	Maximum forwarding errors of EtherCAT port per unit time	1	28759
U0-88	Maximum error count of EtherCAT data frame processing unit per unit time	1	28760
U0-89	Maximum link loss of the EtherCAT port per unit time	1	28761

### 9.7 Communication Configurations

### 9.7.1 Using an MD500-EN1 Expansion Card on an Allen-Bradley L16ER Master

In this example, Studio5000 version 32.00.00 is used, the master is 1769-L16ER-BB1B, and the IP address and other information have been configured in advance according to the guide. Both network ports on the expansion card are available. To use the expansion card, set F0-02 to 2, F0-03 to 9, FD-00 to 9, and FD-01 to 3 on the AC drive.



Step 1: Create a project.

Open Studio 5000 and create a project. Select **1769-L16ER-BB1B** under **CompactLogix 5370 Controller** as the controller model.

😚 New Project	:	×
Project Types	Search	×
J Logix	<ul> <li>Compact GuardLogix® 5370 Safety Controller</li> <li>Compact GuardLogix® 5380 Safety Controller</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L16ER-8B18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L18ERM-BB18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L19ER-8B18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L24ER-QB18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L24ER-QBFC18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L24ER-QBFC18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L24ER-QBFC18</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L30ER</li> <li>CompactLogix® 5370 Controller</li> <li>1769-L30ER</li> </ul>	+
	Location: E:\	se
	Cancel Back Next Fini	sh

#### Step 2: Import the EDS file.

#### 52.11 TOOLS WINDOW HELP ATIONS Options... **\*** i 🖓 🖓 Volts l l'A Security ► Documentation Languages... ē Favo Import ۲ Export ۲ EDS Hardware Installation Tool Motion ► Monitor Equipment Phases Plug-In Manager... Custom Tools... ControlFLASH ControlFLASH Plus

#### Choose Tools > EDS Hardware Installation Tool.

Click Next, and select Register an EDS file(s).

<b>Options</b> What tank do you want to complete?	¥,
<sup>(7)</sup> Register an EDS file(s). This option will add a device(s) to our database.	
C Unregister a device. This option will remove a device that has been registered by an EDS file from our database.	
Create an EDS file. This option creates a new EDS file that allows our software to recognize your device.	
C Upload EDS file(s) from the device. This option uploads and registers the EDS file(s) stored in the device.	

Select the EDS file in your computer and click Next.

Rockwell Automation's EDS Wizard	$\times$
Registration Bectronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications.	J.
(	
C Register a directory of EDS files 🔲 Look in subfolders	
Named:	
D:\MD500P_EIP_V1.00.eds Browse	
• If there is an icon file (ico) with the same name as the file(s) you are registering then this image will be associated with the device. To perform an installation test on the file(s), click Next	
Next >	Cancel

Then keep clicking **Next** until the **Finish** button appears, click **Finish**.

Step 3: Set the IP address for the expansion card. Take a static IP address as an example.

Set the AC drive parameters FD-37 to FD-49 to disable the DHCP function, set the IP address to 192.168.0.6, set the subnet mask to 255.255.255.0, and set the gateway address to 192.168.0.1.

Step 4: Configure the Studio 5000 project.

Click **Ethernet** on the left and choose **New Module**.

0] 1 💭 [0] 1 🖌 🖉 [0] 1 🖉 [0] 1	<ul> <li>[0] 1769-L16ER-BB1B MD500_EIP_Card</li> <li>Embedded I/O</li> <li>[1] Embedded Discrete_IO</li> <li>Expansion I/O, 0 Modules</li> </ul>					
🔷 🔺 Ethernet	t					
1769		New Module				
	đ	Import Module Discover Modules Paste	Ctrl+V			
		Properties Alt+ Print	Enter			

#### Locate EIP\_Card and click Create.

Enter Search Text for Module Ty	Clear Filters			3	lide Filters🛠
Module Type Category	7 Filters	<u>^</u>	Iodule Type Vendor Filters		
<ul> <li>✓ Analog</li> <li>✓ Communication</li> <li>✓ Communications</li> </ul>		Ad Di Er	dvanced Energy Industries, Inc. ialight ndresstHauser www.common.com		
Consumications Adapts	IF	- V F/	ANC CONFORMION ANUC Robotics America		-
Catalog Number	Description	Vendor	Category		-
CNB	FLOWSERVE IPS - 400/480V	Rockwell Au	DPI to EtherNet/IP		
CNB	FLOWSERVE IPS - 208/240V	Rockwell Au	DPI to EtherNet/IP		
CNB	FLOWSERVE IPS - 600V	Rockwell Au	DPI to EtherNet/IP		
DACS EtherNet/IP A	Dialight EtherNet/IP Adapter	Dialight	Communication		
DACS EtherNet/IP A	Dialight EtherNet/IP Adapter, 2-Port	Dialight	Communication		
Drivelogix5730 Eth	10/100 Mbps Ethernet Port on DriveLogix5730	Rockwell Au	Communication		
E1 Plus	Electronic Overload Relay Communications	Rockwell Au	Communication		
E121	Flowserve 208Vac/240Vac/325Vdc	Rockwell Au	DPI to EtherNet/IP		
E141	Flowserve 400Vac/480Vac/650Vdc	Rockwell Au	DPI to EtherNet/IP		
E151	Flowserve 600Vac/810Vdc	Rockwell Au	DPI to EtherNet/IP		
EA3600 EtherNet/IP	EA3600 Network Connect	Zebra Techn	Communication		
EIP_Card	EIP_Coard	Inovance	Frequency converter to Et		
EtherNet/IP	SoftLogix5800 EtherNet/IP	Rockwell Au	Communication		
ETHERNET-BRIDGE	Generic EtherNet/IP CIP Bridge	Rockwell Au	Communication		
ETHERNET-MODULE	Generic Ethernet Module	Rockwell Au	Communication		
ETHERNET-PANEL/TEN	EtherNet/TP Panelview	Rockwell An	HNT		
532 of 532 Module Types Fo	und			Add	to Favorites

On the displayed configuration interface, enter the configured IP address and specify the name.

General* Ge	neral				
Module Info T Internet Protocol V Port Configuration V	ype: 'endor:	MD500_EtherNetIP_Card MD500_Ether Inovance	NetIP_Card		
	dienit.	Luca		Discount Address	
N	lame:	MUSUU			100 100 1
D	lescription:		*	Private Network:	192.168.1.
				IP Address:	192 . 168 . 0 . 6
				Host Name:	
			-		
	Module Defini	ition			
	Revision:	1.001			
	Electronic Ke	eying: Compatible Module			
	Connections	RT Connection Point			
			Change		
Status: Offline				OK Cancel	Apply Help

Click **Change**, select **INT** from the **SINT** drop-down list on the right, click **OK**, ignore the warning and click **Yes**.

Module Definition*					×
Revision: 1 • 001	-				
Electronic Keying: Compatible Module		•	]		
Connections:					
Name		Size			
PT Connection Point	Input:		24	SINT	
	Output:		24		•
				SINT	
				DINT	
				REAL	
_					
	ОК		Cancel		Help

Choose LOGIC > Monitor Tags.



Unfold MD500:C.Data, and select Hex in the Style column.

Name	-8 +	Value +	Force Mask 🔷	Style	Data Type	Description
Local:1:C		{]	{}		AB:Embedded_Discre	
Local:1:1		{]	{}		AB:Embedded_Discre	
Local:1:0		{]	{}		AB:Embedded_Discre	
▲ MD500:C		{]	{}		_3039:MD500_EtherN	
▲ MD500:C.Data		{]	{	Hex 🗸	SINT[48]	
MD500:C.Data[0]		16#44		Hex	SINT	
MD500:C.Data[1]		16#70		Hex	SINT	
MD500:C.Data[2]		16#45		Hex	SINT	
MD500:C.Data[3]		16#70		Hex	SINT	
<ul> <li>MD500:C.Data[4]</li> </ul>		16#00		Hex	SINT	
MD500:C.Data[5]		16#f0		Hex	SINT	
<ul> <li>MD500:C.Data[6]</li> </ul>		16#00		Hex	SINT	
<ul> <li>MD500:C.Data[7]</li> </ul>		16#f0		Hex	SINT	
MD500:C.Data[8]		16#00		Hex	SINT	
MD500:C.Data[9]		16#f0		Hex	SINT	
MD500:C.Data[10]		16#00		Hex	SINT	
MD500:C.Data[11]		16#f0		Hex	SINT	
<ul> <li>MD500:C.Data[12]</li> </ul>		16#00		Hex	SINT	

The parameters under **MD500:C.Data** are related to PDO mapping. Every two parameters form a group. 0–23 are I/O Messages Mapping(T->O), and 24–27 are I/O Messages Mapping(O->T). As shown in the figure, Data[0] is 0x44, and Data[1] is 0x70, indicating that TPDO1 is mapped to U0-68.

By default, I/O Messages Mapping(T->O)[0] is U0-68, I/O Messages Mapping(T->O)[1] is U0-69, I/O Messages Mapping(O->T)[0] is U3-17, and I/O Messages Mapping(O->T)[1] is U3-16. These four entries cannot be modified. Otherwise, a fault will occur. Other entries can be customized.

MD500:I.Data and MD500:O.Data are I/O data during transmission. Values written to O.Data are actually written into the corresponding parameters according to the configured mapping. The parameter configured in I/O Messages Mapping(T->O)[0] is uploaded to I.Data regularly.

After the configuration is complete, click the button marked with the red square in the figure below to search for the device.



In this example, USB is used to connect the device. Select the device and click **Download** to download the code to the PLC.



Step 5: Transmit data using explicit messages.

Open the program compiling part in the PLC, and click **MSG** under **Input/Output**.

	MSG		
-	Message Control	?	-(EN)
			-(ER)

Enter a name at the question mark (?), right-click the name, and choose New "Read".

	MSC		•
		New "Read"	
l	ж	Cut Instruction	Ctrl+X
	ŋ	Copy Instruction	Ctrl+C
	đ	Paste	Ctrl+V
		Delete Instruction	Delete
		Add Ladder Element	Alt+Insert
		Edit Main Operand Description	Ctrl+D
		Save Instruction Defaults	
		Clear Instruction Defaults	

Click Create.

New Tag			×
Name:	Read		Create 🛛 🔻
Description:		*	Cancel Help
		~	
Usage:	<controller></controller>	T	
Туре:	Base 🔹	Connection	
Alias For:		Ŧ	
Data Type:	MESSAGE		
Parameter Connection:		-	
Scope:	D500_EIP_Card	•	
External Access:	Read/Write	•	
Style:			
Constant			
Sequencing	l		
Open MESS	SAGE Configuration		
Open Param	neter Connections		

Click ... on the right under **MSG**.

MSG		
Message Control	Reac 🛄	Ř

Set the parameters according to the following figure.

Set **Service Type** to **Get Attribute Single** for reading parameters or **Set Attribute Single** for writing to parameters. **Class** is fixed to 0x93, **Attribute** is fixed to 0x9, and **Instance** is the decimal value converted from the parameter to be read. For example, FD-13, that is, FD0D, needs to be converted to the decimal value 64781, as shown in the preceding figure.

Select a position for storing the parameter from the **Destination Element** drop-down list on the right. You can also click **New Tag** to create a variable.

	•	
•	Source Element:	
(Law)	Source Length:	0 (Bytes)
(nex)	Destination Element:	EIP_Read 🗸
(Hex)		New Tag

Click the **Communication** tab to select the AC drive.

Click **OK**. The master will read the parameter and store the data to the selected variable. You can choose **LOGIC** > **Monitor Tags** to view the value of the variable.

MD500:1	{}	{}		_3039:MD500_EtherN	
MD500:O	()	<b>{}</b>		_3039:MD500_EtherN	
Read	{}	{}		MESSAGE	
EIP_Read	1		Decimal	DINT	
key	0		Decimal	BOOL	

To write to a parameter, set the parameters according to the following figure.

Step 6: Set the DHCP function.

Note: IP addresses assigned by using the DHCP function are not retained upon power failure.
Set FD-37 to 1 to enable the DHCP function, power on the AC drive again, and connect the PC and AC drive to the same network.

Choose **BootP-DHCP Tool** from the start menu, and select the network adapter.

After power-on, you can find the device request in the BootP DHCP EtherNet/IP Commissioning Tool.

BootP DHCP EtherNet/IP Co	mmissio	ning Tool		1	1.1	
File Tools Help						
Add Relation	Discovery History Clear History					
Ethernet Address (MAC)	Туре	(hr:min:sec)	#	IP Address	Hostna	ime
00:10:4D:FE:70:CA	DHCP	17:01:20	4			
	, Entered Relations					
Ethernet Address (MAC)	Туре	IP Address		Hostname	Description	
Errors and warnings						
Unable to service DHCP request from 00:10:4D:FE:70:CA.						0 of 256

Right-click the request and choose **Add Relation**.

	Discovery History			cicar mixery		
rnet Address (MAC)	Туре	(hr:min:sec)	#	IP Address	Hostnar	ne
0:4D:FE:70:CA	DHCP	17:02:20	10	Add Relation Clear History		
Entered Relations						
rnet Address (MAC)	Туре	IP Address		Hostname	Description	

Set the IP address and click **OK**.

ſ	New Entry	x
	Server IP Address: 169.254.120.72	
	Client Address (MAC): 00:10:4D:FE:70:CA	
	Client IP Address: 192 . 168 . 0 . 6	
	Hostname:	
	Description:	
	OK Cancel	

The IP address is written to the device.

Delete Relation	Entered Relations	Enable BOOTP/DHCP	Disable BOOTP/DHCP	
Ethernet Address (MAC) Ty	ype IP Address	Hostname Descrip	otion	
00:10:4D:FE:70:CA D	HCP 192.168.0.6			
Errors and warnings			Relations	
Sent 192.168.0.6 to Ethernet address 00:10:4D:FE:70:CA 1 of 256				

### 9.7.2 Using an MD500-EN1 Expansion Card on an Inovance AM600 Master

In this example, InoProShop V1.5.2 is used, the master is AM600, and the IP address and other information have been configured in advance according to the guide. You can use either network port on the expansion card. To use the expansion card, set F0-02 to 2, F0-03 to 9, FD-00 to 9, and FD-01 to 3 on the AC drive.



Step 1: Create a project.

Open InoProShop and create a project. Select the device model AM600-CPU1608TP/ TN.

Step 2: Import the EDS file and add a slave.

Click **Network Configuration** on the left, click the PLC, select **EtherNet/IP Master**, and click **Import EDS File** to import the EDS file for the EtherNet/IP expansion card. Import the device in the **Network Device List** on the right.

Step 3: Configure parameters for the slave.

Configure an IP address for the slave.

Click **Connections** on the left to configure the implicit message mapping. **Input I/O Messages Mapping(T->O)**[*x*] is the mapping of data sent from the slave to the master, and **Output I/O Messages Mapping (O->T)**[*x*] is the mapping of data sent from the master to the slave. Each entry can be configured with up to 12 mappings. By default, **Input I/O Messages Mapping(T->O)**[**0**] is mapped to U0-68 (28740 in decimal), **Input I/O Messages Mapping(T->O)**[**1**] is mapped to U0-69 (28741 in decimal); **Output I/O Messages Mapping(O->T)**[**0**] is mapped to U3-17 (29457 in decimal), and **Output I/O Messages Mapping(O->T)**[**1**] is mapped to U3-16 (29456 in decimal). Do not change these four default mappings. Other mappings are set to F0-00 (61440 in decimal) by default. You can modify the mappings as required here.

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Convert the parameter address into a decimal value and enter the value. For example, for F0-12, enter 61452. Retain the default values for unneeded mappings.

Step 4: Configure the IP address for the master.

Scan the network for the master to be configured.

Assign an IP address to the network port of the master.

Download the project to the PLC.

You can view the I/O Messages(O->T) and I/O Messages(T->O) data based on the EtherNet/IP I/O mapping.

### 9.8 Fault Diagnosis

### 9.8.1 Troubleshooting

The following table describes the faults that may occur during use of the MD500-EN1 card and the AC drive.

Symptom	Possible Cause	Solution
Communication failure between the MD500-EN1 card and AC drive	1. The AC drive does not support EtherNet/IP communication. 2. The communication configuration of the MD500- EN1 card is incorrect. 3. The MD500-EN1 card hardware is faulty.	1. Check that the AC drive supports EtherNet/IP communication. 2. Set the MD500-EN1 communication parameters correctly. 3. Replace the MD500-EN1 card.
Err164 communication error reported by the AC drive during running	1. The communication data is abnormal. 2. The network cable is damaged or connected incorrectly. 3. External interference exists.	1. Check that the EtherNet/ IP master program is normal. 2. Check that the network cable is connected properly, and replace the cable if necessary. 3. Use the Cat5e shielded twisted pair network cable as required. Check that the MD500-EN1 card is grounded correctly. Eliminate the external interference. Contact the technical support personnel if necessary.

Table 9–4 Fault analysis and solutions

A fault code is an 8-bit binary integer, of which each bit indicates a different fault. To obtain the fault code, read the value of FD-58 of the AC drive, and convert it into an 8-bit binary number. For example, if the read value of FD-58 is 3, its binary equivalent is

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0000 0011, then the fault code is bit 0 and bit 1. The following table describes the corresponding fault description and troubleshooting.

Fault Code	Description	Solution	
Bit7	None	None	
Bit6	Communication with the AC drive fails, or the AC drive version is incorrect.	Upgrade the AC drive software to the version that supports EtherNet/IP.	
Bit5	The I/O Messages mapping configuration is incorrect.	Check the PLC configurations.	
Bit4	Connection times out.	Check the connections and whether the master is running properly.	
Bit3	Link loss occurs.	Check the wiring.	
Bit2	An IP conflict occurs.	Check whether there is another device with the same IP address as this device.	
Bit1	The MAC address is lost or not programed.	Contact Inovance for technical support.	
Bit0	An Ethernet hardware error occurs.	Contact Inovance for technical support.	

Note: A fault code may be a combination of multiple faults.

If the fault code is 0, the green indicator D4 is steady off, and the red indicator D7 is steady on, the troubleshooting is the same as that of bit6.



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