

SOURCETRONIC - Quality electronics for service, lab and production

Installation and Setup Guide

Ethernet based communication extension cards





No.	Change description	Version	Release date
1	First release	V1.0	October 2020
2			



Safety precautions

The extension card can be installed and operated only by people who have taken part in professional training on electrical operation and safety knowledge, obtained the certification, and been familiar with all steps and requirements for installing, performing commissioning on, operating, and maintaining the device, and are capable of preventing all kinds of emergencies.

Before installing, removing, or operating the communication card, read the safety precautions described in this manual and the variable-frequency drive (VFD) operation manual carefully to ensure safe operation.

For any physical injuries or damage to the device caused due to your neglect of the safety precautions described in this manual and the VFD operation manual, our company shall not be held liable.

- You need to open the housing of the VFD when installing or removing the communication card. Therefore, you must disconnect all power supplies of the VFD and ensure that the voltage inside the VFD is safe. For details, see the description in the VFD operation manual. Severe physical injuries or even death may be caused if you do not follow the instructions.
- Store the communication card in a place that is dustproof and dampproof without electric shocks or mechanical pressure.
- The communication card is electrostatic sensitive. Take measurements to prevent electrostatic discharge when performing operations involving it.
- Tighten the screws up when installing the communication card. Ensure that it is firmly fixed and properly grounded.

Terminology, abbreviations, and acronyms

CAN	Controller Area Network						
СОВ	Communication object, a transmitted unit on a CAN network.						
	Communication objects (COBs) carry data and can be transmitted through						
	the whole network. A COB is part of a CAN message frame.						
	Electronic data sheet (EDS), an ASCII file for node configuration, required						
EDS	when a CANopen network is configured. An EDS file contains general						
	information about nodes and their dictionary objects (parameters).						
	Network management, one of the CAN application-layer service elements in						
NMT	the CAN reference model. It is used for the initialization, configuration, and						
	fault handling of a CAN network.						
Object	Stores information about all COBs identified by a device						
dictionary							
PDO	Process data object, a type of COBs, used to transmit process data, such as						
	control command, set values, status values, and actual values.						
PDOn Tx	PDO command transmitted by a slave station to the master station, where n						
	refers to 1, 2, 3, 4.						
PDOn Rx	PDO command transmitted by the master station and received by a slave						
1 Bonna	station, where n refers to 1, 2, 3, 4.						
SDO	Service data object, a type of COB, used to transmit non-time key data, such						
02.0	as parameter values.						
RO	Indicates read-only access.						
RW	Indicates the read and write access.						
SYNC	Indicates synchronous transmission.						
Node-ID	Node ID, that is, address of a communication card.						
0×	Indicates that a number with this prefix is a hexadecimal value, for example,						
UX	0x10 indicates the decimal value 16						

Contents

Contents	iii
1 Product confirmation	1
2 PROFINET communication card	2
2.1 Overview	2
2.2 Features	2
2.3 Electrical wiring	4
2.4 Communication	5
2.4.1 Packet format	5
2.4.2 PROFINET I/O communication	6
2.5 Example of PLC communication	15
2.5.1 Parameter configuration	15
2.5.2 Create a new project	18
2.5.3 Add GSD files	19
2.5.4 Configure the basic information of the project	20
2.5.5 Assign the device name of the IO device (Sourcetronic communication	n card)25
2.5.6 Save, compile, and download	26
2.5.7 VFD parameter watching	29
3 Ethernet IP communication card	31
3.1 Overview	31
3.2 Features	31
3.3 Electrical wiring	33
3.4 Communication	34
3.4.1 Communication settings	34
3.4.2 Packet format	35
3.4.3 Ethernet IP communication	35
3.5 Example 1 of PLC communication (communicate with Allen-Bradley PLC)	45
3.5.1 Create a new project	45
3.5.2 Import an EDS file	46
3.5.3 Create a new device object	49
3.5.4 Use of Rslinx Classic	53
3.5.5 Writing PLC programs	54
3.5.6 PC connection and program download	56
3.5.7 Configuring PLC IP Addresses through the studio5000 V31 software .	57
3.5.8 DLR Ring Network Configuration	58
3.6 Example 2 of PLC communication (communicate with ORMON PLC)	60
3.6.1 Hardware connections	60
3.6.2 Network Configurator software setting	61
3.6.3 Sysmac Studio software settings	67

3.6.4 Import and export data tags	72
3.6.5 PLC program downloading and online monitoring	74
4 EtherCAT communication card	81
4.1 Overview	81
4.2 Features	81
4.3 Electrical wiring	83
4.4 Communication	84
4.4.1 CoE reference model	84
4.4.2 EtherCAT slave station information	85
4.4.3 EtherCAT state machine	85
4.4.4 PDO mapping	86
4.4.5 DC-based network synchronization	88
4.5 CiA402 device protocol	
4.5.1 CoE state machine	89
4.5.2 Device running mode	92
4.6 Function code modification	94
4.7 Example of TwinCAT2 application	95
5 Modbus TCP communication card	101
5.1 Overview	101
5.2 Features	101
5.3 Electrical wiring	103
5.4 Communication	104
5.4.1 Communication settings	104
5.4.2 Packet format	104
5.4.3 Modbus TCP communication	105
5.4.4 Data address definition	107
5.4.5 Fieldbus scale	112
5.4.6 Error message response	113
5.5 Example of PLC communication	114
Appendix A EtherCAT object dictionary	123
Appendix B Related function codes	130

1 Product confirmation

Check the following after receiving a communication extension card product:

- Whether the communication card is damaged.
- Whether the received communication card is the one you purchase according to the bar code label on the PCB.
- Whether all the following items are contained in the product package:
- One communication card, one tie wrap, one tie, one M3 screw, and one manual
- If the communication card is damaged, a wrong model is delivered, or some items are missing, contact the supplier in a timely manner.
- Obtain the ESD file of the communication card from Sourcetronic. The file is named communication card model.eds.
- Confirm the environmental requirements for application.

Item	Requirement
Operation temperature	-10-+50°C
Storage temperature	-20–+60°C
Relative humidity	5%–95%
Other weather	No condensation, ice, rain, snow, or hail;
conditions	solar radiation < 700 W/m ²
Air pressure	70–106 kPa
Vibration and impact	5.9m/s ² (0.6g) at the sine vibration of 9 Hz to 200 Hz

Table 1-1 Environmental requirements

2 PROFINET communication card

2.1 Overview

- Thanks for choosing Sourcetronic PROFINET communication cards. This manual describes the function specifications, installation, basic operation and settings, and information about the network protocol. To ensure that you install and operate the product properly, read this manual and the communication protocol section in the VFD operation manual carefully before you use the product.
- This manual only describes how to operate the PROFINET communication card and the related commands but does not provide details about the PROFINET protocol. For more information about the PROFINET protocol, read the related specialized articles or books.
- This communication card is defined as a PROFINET slave station communication card and is used on a VFD that supports PROFINET communication.
- The communication card supports the linear network topology and star-shaped network topology.
- The communication card supports 32 inputs/outputs to read and write process data, read state data, and read and write function parameters of a VFD.

2.2 Features

1. Supported functions

- Supports the PROFINET protocol, and supports PROFINET I/O devices
- Provides two PROFINET I/O ports and supports the 100 M full-duplex operation
- Supports the linear network topology and star-shaped network topology.

2. Supported communication types

Standard Ethernet channels:

Standard Ethernet channels are non-realtime communication channels that use the TCP/IP protocol, and are mainly used for device parameterization and configuration and to read diagnosis data.

Real-time (RT) communication channels:

RT channels are optimized channels for real-time communication. They take precedence over TCP (UDP)/IP, which ensures that various stations on a network perform data transmission with high time requirements at a certain interval. The bus period may reach the precision of millisecond. These channels are used to transmit data such as process data and alarm data.

Isochronous real-time (IRT) communication channels

IRT channels are implemented through the built-in Switch-ASIC IRT chip. IRT communication can further shorten the processing time of the communication stack software, synchronizing data transmission of the program and device. The transmission delay is less than 1 ms, and the jitter is less than 1 μ s. The typical application is motion control.

3. Communication ports

Standard RJ45 ports are used in PROFINET communication. The communication card provides two RJ45 ports with no transmission direction defined, and therefore you can insert a cable into the port without regard to its direction. Figure 2-1 shows the ports, and Table 2-1 describes the functions of the ports.



Figure 2-1 Two standard RJ45 ports

Table 2-1	Standard	RJ45	port	pins
-----------	----------	------	------	------

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

4. State indicators

PROFINET communication card provides nine LED indicators to indicate its states. Table 2-2 describes the state indicators.

LED	Color	State	Description				
LED1	Green		3.3 V power indicator				
	Red	On	Not connected through a network cable				
(Bup state indicator)		Blinking	Connected to the PROFINET controller				
(Bus state indicator)			through a network cable, but no				

Table 2-2 Stat	e indicators
----------------	--------------

LED	Color	State	Description				
			communication established				
		Off	Communication established with the PROFINET controller				
LED3		On	PROFINET diagnosis enabled				
(System fault indicator)	Red	Off	PROFINET diagnosis disabled				
		On	TPS-1 communication stack started				
(Slove ready indicator)	Green	Blinking	TPS-1 waits for the initialization of MCU				
(Slave ready mulcator)		Off	TPS-1 communication stack not started				
LED5 (Maintenance state indicator)	LED5 Maintenance state Green On the characterist						
LED6/7 (Network port state	Green	On	PROFINET communication card connected to the PC/PLC through a network cable				
indicator)		Off	PROFINET communication card not connected to the PC/PLC				
LED8/9 (Network port		On	PROFINET communication card communicating with the PC/PLC				
communication indicator)	Green	Off	PROFINET communication card not communicating with the PC/PLC				

2.3 Electrical wiring

PROFINET communication card provides standard RJ45 ports and supports the linear and star topologies. Figure 2-2 and Figure 2-3 show the electrical wiring diagrams for different topologies.

Use CAT5, CAT5e, and CAT6 network cables for electrical wiring. When the communication distance is greater than 50 meters, use high-quality network cables that meet the national standards.



Figure 2-2 Electrical wiring diagram for a linear topology

Note: For the star-shaped network topology, you need to use a PROFINET switch.



Figure 2-3 Electrical wiring diagram for a star topology

2.4 Communication

2.4.1 Packet format

Table 2-3 describes the structure of an RT frame (non-synchronous).

Table 2-3	Structure	of a	an RT	frame
-----------	-----------	------	-------	-------

Data header	Ether typ	rnet De	VLAN	Ethern type	net 9	Frame identifier	RT user data	Perio counte	d Data er state	Transmission state	FCS
	2 hv	tes	2	2 hvte	20	2 hvtes	36–1440	2 hvte	<mark>ر</mark> 1	1 hvte	4
	2.59	.00	bytes	2 bytes		2 byte5	bytes	2 0 9 10	byte	T byte	bytes
	0x81	100		0x889	92						
	VL	_AN 1	flag						APDI	J state	
						Data h	neader				
7-by pream	te ble	sync inf	1-byte hroniza formatio	ation 6 on	δ-by	rte source l	MAC addr	ess	6-byte	e destination MA address	C

Table 2-4 describes the structure of the IRT frame (synchronous).

Table 2-4 Structure of an IRT frame

Data header			Etherne t type	VLA N	Etherne t type	Frame identifie r	IRT user data	FCS	
7-byte preambl e	1-byte synchronizatio n	6-byte source MAC addres s	6-byte destinatio n MAC address	2 bytes	2 bytes	2 bytes	2 bytes	36–144 0 bytes	4 byte s

2.4.2 PROFINET I/O communication

The PROFINET communication card supports 16-word input/output. Figure 2-4 shows the packet format for transmitting data with a VFD.

Parameter identification (PKW)				Fixed -	P	rocess d (PZD) Distributa	ata	
PKW1	PKW2	PKW3	PKW4	CW SW	PZD2 PZD2	PZD3 PZD3		PZD12 PZD12

Figure 2-4 Packet structure

By using the 32 inputs/outputs, you can set the reference parameters of the VFD, monitor the status values, transmit control commands, monitor the running state, and read/write the function parameters of the VFD. For specific operations, see the following description.

Parameter zone:

PKW1—Parameter identification

PKW2—Array index number

PKW3—Parameter value 1

PKW4—Parameter value 2

Process data:

CW-Control word (transmitted from the master to a slave. For description, see

Table 2-5)

SW-Status word (transmitted from a slave to the master. For description, see Table 2-7.)

PZD-Process data (defined by users)

(When the process data is output by the master to a slave, it is a reference value; and when the process data is input by a slave to the master, it is an actual value.)

PZD zone (process data zone): The PZD zone in a communication packet is designed for controlling and monitoring a VFD. The master and slave stations always process the received PZD with the highest priority. The processing of PZD takes priority over that of PKW, and the master and slave stations always transmit the latest valid data on the interfaces.

CWs and SWs

Using CWs is the basic method of the fieldbus system to control VFDs. A CW is transmitted by

the fieldbus master station to a VFD device. In this case, the adapter module functions as a gateway. The VFD device responds to the bit code information of the CW and feeds state information back to the master through an SW.

Reference value: A VFD device may receive control information in multiple channels, including analog and digital input terminals, VFD control panel, and communication modules (such as RS485 and CH-PA01 adapter modules). To enable the control over VFD devices through PROFINET, you need to set the communication module as the controller of the VFD device.

Actual value: An actual value is a 16-bit word that includes information about VFD device operation. The monitoring function is defined through VFD parameters. The conversion scale of an integer transmitted as an actual value from the VFD device to the master depends on the set function. For more description, see the related VFD operation manual.

Note: A VFD device always checks the bytes of a CW and reference value.

Task packet (master station -> VFD)

CW: The first word in a PZD task packet is a VFD CW. You can select the expression method according to P15.43. Table 2.5 and Table 2.6 describe the control words (CWs) of the ST600 series VFD. Table 2.5 and Table 2.6 describe the control words (CWs) of the ST600 series VFD.

Bit	Name	Value	Description
		1	Forward running
		2	Reverse running
		3	Forward jogging
		4	Reverse jogging
0–7	communication-based	5	Stop
	control command	6	Coast to stop (emergency stop)
		7	Fault reset
		8	Jogging to stop
		9	Decelerate to stop
8	Enable writing	1	Enable reading and writing (PKW1-PKW4)
0.40	Mater mere action	00	Motor 1
9-10	wotor group setting	01	Motor 2
44	Control mode evitabies	1	Enable torque/speed control switching
11	Control mode switching	0	Disable switching
12	Reset power consumption	1	Enable
12	to zero	0	Disable

Table 2-5 ST600 series VFD CWs expressed in decimal format

Bit	Name	Value	Description
40	Des susitation	1	Enable
13	Pre-excitation	0	Disable
14	DC broking	1	Enable
14	DC blaking	0	Disable
45		1	Enable
15	Heartbeat reference	0	Disable

Table 2-6 ST600 series VFD CWs expressed in binary format

Bit	Name	Description	Priority
0	Forward running	0: Decelerate to stop 1: Forward running	1
1	Reverse running	0: Decelerate to stop 1: Reverse running	2
2	Fault reset	0: Disable 1: Enable	3
3	Coast to stop	0: Disable 1: Enable	4
4	Forward jogging	0: Disable 1: Enable	5
5	Reverse jogging	0: Disable 1: Enable	6
6	Jogging to stop	0: Disable 1: Enable	7
7	/	Reserved	
8	Enable reading and writing (PKW1-PKW4)	0: Disable 1: Enable	
9	/	Reserved	
10	Decelerate to stop	0: Disable 1: Enable	0: Top priority
11 - 15	/	Reserved	

Reference value (REF): The second to twelfth words in a PZD task packet are the main settings. The main frequency settings are provided by the main setting signal source. Table 2-7 describes the settings of ST600 series VFD.

Table 2-7	Settings	of ST600	series	VFD
-----------	----------	----------	--------	-----

Function code	Word	Value range	Default value
P16.32	Received	0: Invalid	0
	PZDZ	1: Set frequency (0–Fmax, unit: 0.01 Hz)	
P16 33	Received	2: PID reference (0-1000, in which 1000 corresponds to	0
1 10.55	PZD3	100.0%)	0
D16.24	Received	3: PID feedback (0-1000, in which 1000 corresponds to	0
F 10.34	PZD4	100.0%)	0

Function code	Word	Value range	Default value
P16.35	Received PZD5	4: Torque setting (-3000-+3000, in which 1000 corresponds to 100.0% of the rated current of the motor)	0
P16.36	Received PZD6	5: Setting of the upper limit of forward running frequency (0-Fmax, unit: 0.01 Hz)	0
P16.37	Received PZD7	6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz)	0
P16.38	Received PZD8	7: Upper limit of the electromotive torque (0-3000, in which 1000 corresponds to 100.0% of the rated current of	0
P16.39	Received PZD9	the motor) 8: Upper limit of the brake torque (0–3000, in which 1000	0
P16.40	Received PZD10	 corresponds to 100.0% of the rated current of the motor) 9: Virtual input terminal command, 0x000–0x3FF 	0
P16.41	Received PZD11	(corresponding to S8, S7, S6, S5, HDIB, HDIA, S4, S3, S2, and S1 in sequence)	0
P16.42	Received PZD12	 10: Virtual output terminial command, 0x00–0x0F (corresponding to RO2, RO1, HDO, and Y1 in sequence) 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: AO output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed number) 15: LSB of position reference (unsigned number) 16: MSB of position feedback (signed number) 17: LSB of position feedback (setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 	0

Response packet (VFD -> master station)

SW: The first word in a PZD response packet is a VFD SW. You can select the expression method according to P15.43.

Table 2.8 and Table 2.9 describe the control words (CWs) of the ST600 series VFD.

Table 2-8 ST600 series VFD SWs expressed in decimal format

Bit	Name	Value	Description
		1	Forward running
		2	Reverse running
0–7	Running state	3	Stopped
		4	Faulty
		5	POFF
0	Due veltere established	1	Ready to run
8	Bus voltage established	0	Not ready to run
0.40	Materia and a fact that a	0	Motor 1
9–10	Motor group feedback	1	Motor 2
44	Mater ture feedback	1	Synchronous motor
11	Motor type reedback	0	Asynchronous motor
40		1	Overload pre-alarm generated
12	Overload pre-alarm feedback	0	No overload pre-alarm generated
		0	Keypad-based control
10 11	Due (Otan made	1	Terminal-based control
13 - 14	Run/Stop mode	2	Communication-based control
		3	Reserved
45		1	Heartbeat feedback
15	Hearibeat feedback	0	No heartbeat feedback

Table 2-9 ST600 series VFD SWs expressed in binary format

Bit	Name	Description	Priority
0	Forward running	0: Disable 1: Enable	1
1	Reverse running	0: Disable 1: Enable	2
2	Stopped	0: Disable 1: Enable	3
3	Fault	0: Disable 1: Enable	4
4	POFF	0: Disable 1: Enable	5
5	Pre-excited	0: Disable 1: Enable	6
6 - 15	/	Reserved	

Actual value (ACT): The second to twelfth words in a PZD task packet are the main actual values. The main actual frequency values are provided by the main actual value signal source. Table 2.10 lists the actual status values of the ST600 series VFD.

Table 2-10 Actual status va	lues of ST600 series VFD
-----------------------------	--------------------------

Function code	Word	Value range	Default value
P16.43	Transmitted PZD2	0: Invalid	0
P16.44	Transmitted PZD3	1: Running frequency (×100, Hz)	0
P16.45	Transmitted PZD4	2: Set frequency (×100, Hz)	0
P16.46	Transmitted PZD5	3: Bus voltage (×10, V)	0
P16.47	Transmitted PZD6	4: Output voltage (×1, V)	0
P16.48	Transmitted PZD7	5: Output current (×10, A)	0
P16.49	Transmitted PZD8	6: Actual output torque (×10, %)	0
P16.50	Transmitted PZD9	7: Actual output power (×10, %)	0
P16.51	Transmitted	8: Rotating speed of the running (x1, RPM) 9: Linear speed of the running (x1, m/s)	0
P16.52	Transmitted PZD10	10: Ramp frequency reference 11: Fault code	0
P16.53	Transmitted PZD12	 13: Al2 value (x100, V) 13: Al2 value (x100, V) 14: Al3 value (x100, V) 15: HDIA frequency (x100, kHz) 16: Terminal input state 17: Terminal output state 18: PID reference (x100, %) 19: PID feedback (x100, %) 20: Rated torque of the motor 21: MSB of position reference (unsigned number) 22: LSB of position feedback (signed number) 23: MSB of position feedback (unsigned number) 24: LSB of position feedback (unsigned number) 25: Status word 26: HDIB frequency value (x100, kHz) 	0

PKW zone

PKW zone (parameter identification flag PKW1—numerical zone): The PKW zone describes the processing mode of the parameter identification interface. A PKW interface is not a physical interface but a mechanism that defines the transmission mode (such reading and writing a parameter value) of arameter between two communication ends.

- ide	Parame entification	eter n (PKW)		Proces	ss data	
PKW1	PKW2	PKW3	PKW4	CW SW	PZD2 PZD2	
Request No. Response No.	Parameter address	Parameter value error No.	Parameter value			

Figure 2-5 Parameter identification zone

In the periodic communication, the PKW zone consists of four 16-bit words. The following table describes the definition of each word.

First word PKW1 (16 bits)										
Bits 15-00	Bits 15–00 Task or response identification flag 0–7									
	Second word PKW2 (16 bits)									
Bits 15-00	Basic parameter address	0–247								
	Third word PKW3 (16 bits)									
Bits 15-00	Value (most significant word) of a parameter or	00								
Dits 15-00	error code of the returned value	00								
	Fourth word PKW4 (16 bits)									
Bits 15-00	Value (least significant word) of a parameter	0-65535								

Note: If the master station requests the value of a parameter, the values in PKW3 and PKW4 of the packet that the master station transmits to the VFD are no longer valid.

Task request and response: When transmitting data to a slave, the master uses a request number, and the slave uses a response number to accept or reject the request.

	Request No. (from the master to a slave)	Respons	se signal
Request No.	Function	Acceptance	Rejection
0	No task	0	_
1	Requesting the value of a parameter	1, 2	3
2	Modifying a parameter value (one word) [modifying the value only on RAM]	1	3 or 4
3	Modifying a parameter value (two words) [modifying the value only on RAM]	2	3 or 4
4	Modifying a parameter value (one word) [modifying the value on both RAM and EEPROM]	1	3 or 4
5	Modifying a parameter value (two words) [modifying the value on both RAM and EEPROM]	2	3 or 4

Table 2-11 Task identification flag PKW1

Note: The requests #2, #3, and #5 are not supported currently.

Response No. (from a slave to the master)										
Response No.	Function									
0	No response									
1	Transmitting the value of a parameter (one word)									
2	Transmitting the value of a parameter (two words)									
	The task cannot be executed and one of the following error number									
	is returned:									
	1: Invalid command									
	2: Invalid data address									
	3: Invalid data value									
3	4: Operation failure									
	5: Password error									
	6: Data frame error									
	7: Parameter read only									
	8: Parameter cannot be modified during VFD running									
	9: Password protection									

Table	2-12	Response	identification	flag	PKW1

PKW examples

Example 1: Reading the value of a parameter

You can set PKW1 to 1 and PKW2 to 0A to read a frequency set through keypad (the address of the frequency set through keypad is 10), and the value is returned in PKW4. The following data is in hexadecimal format.

Request (master station -> VFD)

	PKW1		PKW2		PKW3		PKW4		C	W	ΡZ	D2	ΡZ	D3	 PZI	012
Request	00	01	00	0A	00	00	00	00	xx	xx	xx	хх	хх	xx	 xx	хх
	~		<u> </u>		, 	010:	Parar Requ	neter est fc	addre or read	ess ding p	param	ieter v	values	8		

Response (VFD -> master station)



Example 2: Modifying the value of a parameter (on both RAM and EEPROM)

You can set PKW1 to 4 and PKW2 to 0A to modify a frequency set through keypad (the address of the frequency set through keypad is 10), and the value to be modified (50.00) is in PKW4.

Request (master station -> VFD)

	PKW1		PK	PKW2 PKW		W3	PKW4		cw		PZD2		PZD3			PZI	012
Request	00	04	00	0A	00	00	13	88	xx	xx	хх	хх	xx	xx		хх	xx
		ىـــ				0004	· Para			1388: 19 to k	Para	mete	r valu	e in a	ddres	s 10	

Response (VFD-> master station)

	PK	W1	РК	W2	PK	W3	PK	W4	C	W	PZ	D2	PZ	D3	 PZI	012
Response	00	01	00	0A	00	00	13	88	xx	хх	xx	xx	xx	xx	 xx	xx
	<u> </u>					0001	: Res	pons	е (ра	ramet	ter va	lue ur	odate	d)		

PZD examples: The transmission of the PZD zone is implemented through VFD function code settings. For the function codes, see the related Sourcetronic VFD operation manual.

Example 1: Reading the process data of a VFD

In this example, PZD3 is set to "8: Rotating speed of the running" through the VFD parameter P15.14. This operation sets the parameter forcibly. The setting remains until the parameter is set to another option.

Response (VFD -> master station)

	PK	W1	PK	W2	PK	W3	PK\	N4	C١	N	PZ	D2	PZ	D3	 PZ	D12
Resp onse	xx	хх	xx	xx	xx	хх	хх	xx	хх	xx	хх	xx	00	0A	 хх	хх

Example 2: Writing process data to a VFD device

In this example, PZD3 is set to "2: PID reference" through the VFD parameter P15.03. The parameter specified in each request frame is updated with the information contained in PZD3 until another parameter is specified.

Request (master station -> VFD)

	PK	W1	PK	W2	PK	W3	PK\	N4	C١	V	PZI	D2	PZ	D3	 PZI	D12
Resp onse	xx	xx	хх	xx	xx	xx	00	00	 хх	xx						

Subsequently, the information contained in PZD3 is used as tractive force reference in each request frame until another parameter is specified.

2.5 Example of PLC communication

This example shows how to use a Siemens S7-1200 series PLC to communicate with the PROFINET adapter module (through using the TIA Portal V13 PC software as the configuration tool).

2.5.1 Parameter configuration

Connect the PLC to the PC with a standard network cable, and set the computer IP (e.g. 192.168.0.100) in the PC network settings. Set the IP and name of the PLC.

1) Open the "TIA PORTAL V13" software, and click "Online & Diagnostics" --> "Accessible Devices" on the left. Select "PN/IE" in the drop-down list of "Type of the PG/PC interface", select the Ethernet port in the "PG/PC Interface", and finally click "Refresh" to scan the connected PLC devices, as shown in the following figure.

§ Siemens								
							Totall	y Integrated Automation PORT/
			Accessible desices	_		_	_	
					Type of the PGIPC inter PGIPC inter	tos: Ero	i InGAT-Intel PO Etherner, A	e fester (Sabit) 🔹 🖲 🔍
				income being and				
				Device PLC 1	Oevice type CPU 1215C DOD	Type mile	Address 192.168.0.23	MAC editress AC-64-17-13-97-07
		Accemible devices	.					
Online & Diagnostics	/		Field					
			Online status informati	on: ion retrieval comple	sed.			- Britton
			Display only proble	m reports		_	E	grow grocel

2) If the connection between the PLC and PC is normal, after scanning is completed, the PLC device will appear in the device bar, as shown in the red box of the following figure. The device bar displays the device, device type and device MAC address. Then click the "Show" button in the lower right corner to enter the device settings.

Accessible devices					×
	_Accessible nodes	Type of the PGIPC interfa PGIPC interfa of the selected interface:	ce: Levi	E ICAT-Intel PCI Ethernet Ad	apter (Gigabit) 💌 🖲
	Device	Device type	Туре	Address	MAC address
	PLC_1	CPU 1215C DC/D	PN/IE	192.168.0.23	AC-64-17-13-9F-DF
Flash LED					
Online status informa	tion:				Befresh
Scan and inform	ation retrieval complete lem reports	d.			*
					<u>Show</u>

3) Click "Online & Diagnostics" in the device tree, click "Assign IP Address" under the "Functions" on the right of the menu bar, and set the IP address and subnet mask of the PLC shown in the red box marked ③, to ensure that the IP address of the PC and the IP address of the PLC are in the same network segment, as shown in the following figure.

			Online access TwinCAT-In		
	Devices				
Online & Diagnostics	Devices		Diagnostics Prunctions Prunctions Receipt IP address Set time Firmware update Assign name Reset to factory settings	Aciego P addess Accessible devicesAccessible devices	_
	Intel(R) Dual Band Wreless-AC 7 Tale Senice [Automatic protoc Details view	>			

4) Set the IP address of the PLC to "192.168.0.1" and subnet mask to "255.255.255.0" (you can check "Use router", that is, the router assigns IP). Click the "Assign IP address" button after the setting is completed, as shown in the following figure.

Diagnostics	Assign IP address
 Functions 	Posigina dedicos
Assign IP address	
Set time	
Firmware update	MAC address: AC -64 -17 -13 -9F -DF Accessible devices
Assign name	
Reset to factory settings	IP address: 192.168.0.1
	Subnet mask: 255 . 255 . 0
	Use router Router address: 0 0 0 0
	Assign IP address

5) Click "Assign Name", and mark the PLC name in the position shown in the red box marked ②, such as "PLC1215C". Click the "Assign Device Name" button, as shown in the following figure.

Disportion		CON	igurea PROFINET a	evice		
✓ Functions			PROFINET device name:	PLC1215C		
Assign IP address		Ľ	Time:	\$7,1200		-
Set time			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	57-1200		
Firmware update						-
Assign name						
Reset to factory settings						
		Devi	ce filter			
				the same type		
			Only show devices w	ith bad parameter set	ttings	
	1		Only show devices w			
	are Teilne	hmer im Netzwerk:				
	is	MAC address	Туре	Name	Status	
		- CLED	flashes	Update	Assign name	
	1					

2.5.2 Create a new project

Double click the TIA PORTAL V13 icon to open the TIA PORTAL V13 project tool. Click the "Create new project" button to create a new project, add project name, project storage path, author, comment and other related information, and click the "Create" button to create a new project, as shown in the following figure.

Sort 1	\$	Create new project
	Open existing project	Polyectnesse: Polyect Putt: Different V13/V15_sockspace
	Create new project	Author: Administrator
	🔅 One project	Contra Co
	🚺 💿 Welcome Tour	
	n First steps	
	Installed software	
	• Help	

After creating a new project, double click "Open the project view", as shown in the following figure.

				Totally Integrated Automation PORTAL
Start			First steps	
	10 ¹⁰		Project: "Project?" was opened successfully. Please select the next step:	
	-	Create new poject Migrate project	···	
	٠			
	1	Wakenes Tool	Configure a device	
	1	Int steps	-> Michaeler Withe RC program	
			Configure technology objects	
		 Matched address Holp 	-> Configure as Hill screen	
			Open the project sleev	
Project view		Opened posiect D1Publ V1%V	5 werksoare/Project1/Project1	

2.5.3 Add GSD files

In the project view, click "Options" on the toolbar, select the "Manage general station description files (GSD)" option from the drop-down list, and a box pops up, as shown in the following figure. Enter the file directory where the Sourcetronic GSD file is located in the source path, select the GSD file, and click the "Install" button to start the installation.

Ins	tall genera	al station description file				×						
s	ource path:	h: C:lUsers lAdministratorlDesktop										
Content of imported path												
LE	File		Version	Language	Status							
	GSDML-V2	.32-INVT-TPS1-Extended-20171110.xml	11/10/2017	English	Not yet installed							
	¢	1	1			>						
				Г	Install	ncel						
					Cal	incer .						

After the installation was completedly successfully, a prompt pops up, indicating that the GSDML file has been installed successfully, as shown in the following figure.

Install general station description file	×
Installation result	
1 Message	
 Installation was completed successfully. 	

2.5.4 Configure the basic information of the project

1) Enter the "Devices & networks" view interface

In the project view, select and double click "Devices & networks" in the project tree on the left to enter the "Network overview" view interface, as shown in the following figure.

Siemens - Project1		_ # X
Project Edit View Insert Online Options	Tools Window Help	Totally Integrated Automation
Seve project 💩 🕺 🗄 🗶 🖏) t (* t 🙀 🖞 🗓 🔟 📓 🕼 🖉 Goothre 🦉 Goothre 🥻 🕅 🕼 🗶 🗖 🛄	PORTAL
Project tree U 4	Project1 + Devices & networks	X Hardware catalog V U F
Devices	🦉 Topology view 📥 Network view 👔	Device view Options
200 2	💦 Network 🖞 Connections MM connection 🔹 🖏 🔛 🔍 🛓 100% 💌 📑 Network	vork overvit 🗧 🕨 🛄 ฐ
5		Catalog S
Project1		dearcho Mi Mi
Add new device		Fiber 8
dis services a networks		Controllers
		* 🔄 HUB
Languages & resources		Image: Second
- 🔛 Online access		 Drives & starters
Y Display/hide interfaces		Network components
 Use [\$7Use] 		Detecting & Monitoring
PLCSIMVS.x[PNR] 20		• Distributed I/O
 TwinCATintel PO Ethemet Adapt 		Peter Devices
Dpdate accessible devices		CONTINUE CONTENT
▼ ■ PLC 1 [192.168.0.23]	-	5
at Details sizes		all
· Details view		
- 1		
Name		5
		a
		2
	N	
	Properties Sinfo & Diagnost	Information
Portal view Dverview	A Devices & ne	Project Project1 created.

2) Add Project device and PROFINET network

1) Add PLC S7-1215C to the "Devices & networks" view

In the "Hardware catalog" on the right sidebar, select "Controller" \rightarrow "SIMATIC S7-1200" \rightarrow "CPU" \rightarrow "CPU 1215C AC/DC/Rly" \rightarrow "6ES7 215-1BG40-0XB0", and double click the "6ES7 215-1BG40-0XB0" icon or drag it to the project, as shown in the following figure.

Instanti Connectione Instanti Connect	Project1 > Devices & networks			_##X	Hardware catalog	
		Topology view	A Network view	Device view	Options	
K.C. Winter V. Catalog Virging Vi	Network 🚼 Connections HMI connection 💌	💐 🔛 🔍 ± '		Network overvie + >		
C - La Contractione Productione Productina Productione Productione Productione Productione Produc			^	V Device	✓ Catalog	
MC_1 C / more than C C / more than C MC_1101C C / more than C / more than C / more than C / more than MC_1101C C / more than				 \$7-1200 station. 	-Seatch-	80 BT
	810.1			+ R.C.1	Tilter	
C C C	CPU 1215C				Controllers	~
C I III CONTRACTOR IN CONTR					 SIMATIC 57-1200 	
					- 🧃 CPU	
					CPU 1211C ACIDCRIy	
					CPU 1211C DC/DC/DC	
Image: Section of the sectio					CPU 1211C DODORY	
					CPU 1212C ACIDCRIy	
					CPU 1212C DC/DC/DC	
Image: State Control Image: State Contro Image: State Control Image: Sta					Dev 1212C DC/DC/Ry	
			2		CPU 1214C AC/DC/R/y	
C = C =					CPU 1214C DC/DC/DC	
 ■ @ 1155 c.RCB(%) ■ @ 1155 c.RCB(%)					CPU 1214C DC/DC/Rly	
					CPU 1215C AC/DCRIy	
c a b c a					CPU 1215C DC/DC/DC	
					6657 215-1AG31-0X8	10
					6ES7 215-1AG40-008	10
					CPU 1215C DODORIy	
• () • () <td< td=""><td></td><td></td><td></td><td></td><td> CPU 1217C DO/DO/DC </td><td></td></td<>					 CPU 1217C DO/DO/DC 	
C = C =					Unspecified CPU 1200	
					Communications modules	
					 SIMATIC \$7-1500 	
			~		SIMATIC \$7-300	
Conception Theorem (1) Proceeding (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	< II		> 🕤	K II	SIMATIC \$7-400	
		d Properties	Dillete (D) Disc	martine in a	Information	1.0

(2) Add the Sourcetronic communication card to the "Devices & networks" view

In the "Hardware Catalog", click "Other field devices" \rightarrow "Profinet IO" \rightarrow "I/O" \rightarrow "Sourcetronic" \rightarrow "Sourcetronic Profinet Adapter" \rightarrow "Sourcetronic Profinet Adapter V1.0", and double click the "Sourcetronic Profinet Adapter V1.0" icon or drag it to the view of "Devices & networks". The communication card is displayed as "Not assigned", as shown in the following figure.

74 56	emens - Project1							- 6	×
							Totally integrated Automy	ation	
90	🖹 🔜 Save project 🚠 🐰 🦄 🕞 🗙	೧೭೧೭ 🌆 ಹಿ	E 🗄 🖩 🗳 🖉 Courtine 🚽	Goottine 🏠 🖪 🕼 🗶			P	ORTAL	
		Project1 + De	rvices & networks			_@=×	Hardware catalog		
10	Devices			Topology view	A Network view	Device view	Options		
E.	0.0	C Network 17	Connections IBM connection		- B [[Network compile () h	-		Ŧ
4 H							Y Catalon		ş.
į .	Project1	~				Y Device	- Controly		ā.
8	Add new device					 BC1 	Contract		£
8	devices & networks	PLC_1 CPU 1215C	IPS-1 IN/T Patient A	20.0000		- GSD device_1	Priner		ž.
ě	Image: March [OPU 1215C DODODC]		Not essigned			► TP5-1		(
8 -	Unassigned devices						 Im PC systems 	- 1	÷
	Common data						Drives & starters	_	8
							Network components		르
	Coline arrest						Detecting & Manitoring		8
11	Y Disalauhida interfaren						Distributed I/O		Ξ.
	Chara (crural)						Field devices		ē.
	 Ten consult - imaini 						 Other Seld devices 		4
	Thin (Atintal IN) Ethemat idant	~					 Improvementio 		8
					-		Drives		e.
	Details view	-					Encoders		a.
							Gateway		
							- (m) 10		
	harre						TVNI 📷 INVT		s
							👻 🌉 INVT Profinet Adapter		2
							NVT Profinet Adapte	er V1.0	ā
							 Denc systems 	1	
							Employees		
							 PROFIBUS OP 		
					~				
		< =			> 🛃	K II >	1		
				S Properties	🚺 Info 🔒 🖳 Diaj	gnostics 👘 👘 🔺	> Information		1
	Portal view E Overview	- Devices & ne					Project Project constact		

Click the "Not assigned" option of " Sourcetronic Profinet Adapter V1.0" and select the IO controller " PLC_1. PROFINET IO-System", then CPU and Sourcetronic Profinet in the network view are connected to the same Profinet subnet, as shown in the following figure.

28 Siemens	- Project1										E
									Totally Integrated Auto	mation	
🕒 🕒 🖬 🖻	nveproject 📓 🐰 🗵 🕞	XS	± (24 ± 🖬	3 🖪 🕼 🖉 🐺 🎜 Go onli	se 🖉 Go offine	🏠 🖪 🖉 🗡	= I			PORTAL	
			Project1 +	Devices & networks					Hardware catalog		
Device					2	Topology view	A Network view	W Device view	Options		
1300		12	Network	Connections DIM connection	- 12	E 0.±*		Network overvisi 1			ł
÷					0.10 system:	PLC 1.PROFINET I	-System (100)	10.0	✓ Catalog		ŝ
🗧 🖝 🚺 Proje	ct1	^						# \$7,1200 station	Geanho	100.000	ē
1 PA	id new device		BC 1	105.1			- 1	+ RC1	G Filter		8
	nices & networks		OPU 1215C	INVT Profe	et A 09-ac			 GSD device_1 	Controllers		£
	mmin fata			NC.1				▶ 1954	▶ → HM		
· • •	cumentation settings								PC systems		31
 La	nguages & resources			DIC 1 PROPINET IO SH	de la				Drives & starters		9
🕶 🖬 Orie	e access								 Network components 	_	F
1 Di	splayhide interlaces								Detecting & Monitoring	_	ŝ.
• 🛄 us	a (\$7U\$8)	100							Distributed to		ē.
	CSIM V5.x(PNIE)	20							Heid devices	_	
• 🛄 Ta	inCAT-intel PCI Ethernet Adapt	- 100								-	ē.
A>	Update accessible devices										H
×		/					1		a forefern		į,
V Detail	s view	_							b Gateway		a.
									- III 10		m
Name		_							- 100 INVT	-	Ē
									💌 🌆 INUT Profeset Adapte	er i	a
									IN/T Profinet Ada	pter V1.0	æ
							_		Ident Systems		
							-		Employed Sensors		
									PROFIBUS OF		
										_	
							~			_	
			< =				> 🛃	K =			
						Properties	📜 Info 🔒 🔛 Di	agnostics	> Information		
Portal	I vlew 🗄 Overview	-	Devices & n	e					Project Project1 created.		F
		_									-

3) Add the Sourcetronic I/O sub-module to the project

Double click the "Sourcetronic Profinet Adapter V1.0" icon in the "Devices & Networks" view to enter the "Device view" interface, as shown in the following figure.



Click the "Hardware Catalog" on the right \rightarrow "Module", double click the "32 Byte IN/OUT" module or drag it to the blank space in the "Device view", and the "32 Byte IN/OUT" module is added to the project, as shown in the following figure.

31 Siemens - Project1							_ # X
Project Edit Wew Insert Online Options	Tools Window Help			-1		Totally Integrated /	Automation
🕒 🕒 🔚 Save project 🏭 🐰 🗐 🕞 🗙 🕷	아= (== 대 소 대 표 별	📓 🖉 Go online 🧬 Go offine	17 IB L	7 × 🗆 🗌			PORTAL
Project tree II 4	PLC_1 [CPU 1215C DOD	C/DC] Distributed I/O F	ROFINET	IO-System (100): PNiTE_1 +	TPS-1 _ 🗗	X Hardware catalog	
Devices		a de la companya de l	Topolog	y view 📥 Network view	Y Device view	Options	1
900 1	at 175-1	🖃 🖬 🍕 🖽 🔍 ± '	8 III	Device overview			_ _
			^	V Module	- Reck Sk	✓ Catalog	1
Project1	S			 TFS-1 	0 0	«Search»	HI HT
Add new device				 PN40 	0 0:	(1 Siter	ata
B DEVICES & RETWONS	l de la companya de l			Port 1 - RU45	0 0:	11 > 📺 Head module	2
Common data	1 i		- 12	Port 7 - \$145		- Module	
Documentation settings				32 Eye HOULT	0 1	- Can INOUT	34
Languages & resources						2 Byte INCUT	8
Online access		DP NORM				B Byte INICUT	ne l
ISB IS7US81						12 Byte INIOUT	teo
PLCSIMVSx[PNIE]						16 Byte INIOUT	-
 TwinCATentel PCI Ethernet Adapt 						24 Byte INIOUT	10
Ap Update accessible devices			- 1			32 Byte INIOUT	1
<	-						ask
· Details view							
1							
Name							÷
							Tari
							8
			~				
	< =		> 🕘 👘	< II		2	
			9 Prope	rties 🛛 🚺 Info 💶 🔀 Diag	mostics -	> Information	
Portal view Dverview	tPS-1					Project Project1 created.	

(4) Simple configuration of S7-1215C and Sourcetronic Profinet parameters

<1>Configure parameters of PLC S7-1215C

Double click the "Devices & Networks" option to enter the view interface of "Devices & Networks".

Double click the "PLC S7-1215C" icon in the interface to enter the "Device view" interface of the PLC.

Double click the network interface position in the PLC icon to enter the properties editing interface bar of "PROFINET interface_1".

Click the "Ethernet addresses" option in the "General" list to set the PLC address and name (In this example, IP address of the PLC is 192.168.0.1 and PLC name is PLC1215C).

Operations are shown in the following figure.

M Siemens - Project1		_ 0 1
	Tools Window Help Tool	ally Integrated Automation
📑 🛅 🖬 Save project 📓 🐰 🗉 🕞 🗙 崎	1 (# 1 😨 🖫 🗉 🔛 🔛 🖉 Goonline 🖉 Goottline 🍶 🖪 🕼 🗶 🖃 🛄	PORTAL
Project tree 🛛 🕄 🕯		Hardw # II)
Devices	🛃 Topology view 🛛 🛓 Network view 🚺 Devic	ce view Options
1900 at	# RC1 P = 4 = 0, ± 100% P = Device overview	
5	1 2 3 4 5 6 7 A Y Module	slet V Catalog
• Projecti	Reck_0 A2/AD2_1	12 A deartho Mg MT
Add new device		13 Filter
Devices & networks	103 HSC_1	11
Common data	- P ^a that 1 HSC.2	1 3 > Signal boards
Documentation settings	101 MILE 3	Communic
Languages & resources		Battery bo
• 🕞 Online access	HIC 6	12 4
Y Displayhide interfaces	K III S K III	2 0000
US8 [\$7U\$8]	PROFINET interface_1 [Module] Properties 1 Infe	
PLCSMVS.x[PNE]	General 10 true Sustem constants Texts	AQ
Indexe arrestible desires	Consult to tags System constants Texts	AliAQ 3
< = >	University of the second	👘 🕨 🧊 Communic
✓ Details view	Time synchronization	🕨 🏣 Technology 👌
	Operating mode Subnetmask: 255 . 255 . 255 . 0	
Name	Advanced options	
	Hardware identifier Router address: 0 . 0 . 0 . 0	
	 IP address is set directly at the device 	
	PROFINET	
-	FROFRET device name is set directly at the device	
	Generate PROFINET device name automatically	
	PROFINET device name PLC1215C	
	Converted name: pic1215c	- D Information
A Restal science The Description	Lara di Industria	

<2> Configure parameters of the Sourcetronic Profinet communication card

Double click the "Devices & Networks" option to enter the view interface of "Devices & Networks".

Double click the "Sourcetronic Profinet Adapter V1.0" icon in the interface to enter the "Device view" interface of the communication card.

Double click the network interface position in the Sourcetronic Profinet communication card icon to enter the properties editing interface bar of PROFINET interface.

Click the "PROFINET interface [X1]" option in the "General" list, and click the "Ethernet addresses" option. Configure parameters of the Sourcetronic PROFINET communication card according to the parameters shown in the following figure such as IP address and device name of the communication card (in this example, IP address of the communication card is 192.168.0.2 and the name is sourcetronic1).

Operations are shown in the following figure.

34 Siemens - Project1					_ # ×
	Tools Window Help			Totally inter	rated Automation
🕒 🛅 🖬 Save project 🔠 🐰 🖄 🗟 🗙 崎	2 (~ : 🖬 🖏 🗄 🖬 및 🗣	🖉 Go online 🧬 Go offine 🛛 🛔	UR 🛪 🖃 🛄		PORTAL
Project tree 🛛 🕄 🕯	Project1 + PLC_1 (OPU 1215C				K Hardw # ID 🕨 👘
Devices			a Topology view	📥 Network view 📑 Device view	Options 🛃
B 0 0 2	dr 1954	• 🔡 💰 🖽 🔍 ± 100%	• •	Device overview	
Ingenti Ingentingenti Ingenti Ingenti Ingenti Ingenti Ingenti	TISS Under TISS Under Manuel - Same - Sa	Eren constants Tants	Constraints and end of the second secon	V tota • F51 • F52 · F55 ·	C B C C B C C B C C B C C B C C B C C
					> Information
Portal view Direview	1195-1			Project Project1 created	

2.5.5 Assign the device name of the IO device (Sourcetronic communication card)

After the CPU and Sourcetronic Profinet communication card are successfully connected to the PC through the network cable, click "Online access" on the left to find the network card corresponding to the PC that is connected to the PLC and communication card.

In all displayed devices, find the Sourcetronic communication card device and click it, such as emc (192.168.0.2) device, as shown in the following figure (**Note:** When the communication card is used for the first time, there is no device name, and only the default IP can be scanned).

Double click "Online & Diagnostics" to enter the online diagnostics state.

Click "Functions" → "Assign name" to enter the "Assign name" interface.

Enter the communication card name in "PROFINET device name", and click "Assign Name" in the lower right corner to confirm.

Note: The name of the PROFINET communication card set online must be consistent with that set in the configuration project, otherwise PROFINET communication cannot be carried out between the devices.

The operation steps are shown in the following figure.

Angen Die Vereinert Onter Contro Salts Charliert Inser Periodent Inser Periodent Per	: Window Herb 生 論 弘 臣 臣 聖 章 が Online access ・ TwinCAT-Intel	io online 🝠 Go offine 👔				Totally Integra	ted Automation PORTAL
See project Joint See Project Joint See	11 14 15 13 14 18 14 20 10 Inline access + TwinCAT-Intel	Goonline 🥁 Gooffine PCI Ethernet Adapter (C		1			PORTAL
Project two II 4 0	Online access + TwinCAT-Intel						
Devices C C C 2 · · · · · · · · · · · · · · · ·						_#=X	Online # D >
Constant Project Project Project							Options
Troject1 Add new device	Diagnostics		,	RORNET device name	inv101		
Image: Conversion Image: Conversion Image: Conversion Image: Conversion <td>General Diagnoticit timus • PROINCT interface Fundion Accign P address Accign P address Acc</td> <td></td> <td>Devic</td> <td>te filter Only show devices o Only show devices o Only show devices o</td> <td>frhe same type ith bad parameter setti ithout names</td> <td>nga</td> <td>V CPU operator</td>	General Diagnoticit timus • PROINCT interface Fundion Accign P address Accign P address Acc		Devic	te filter Only show devices o Only show devices o Only show devices o	frhe same type ith bad parameter setti ithout names	nga	V CPU operator
 TwinCATentel PCI Ethernet Adapter (Gig) 		Emeichbare Teilne	hmer im Netzoerk:				at Carlo Sano
A Update access de devices Centre & Erios Ade devices Centre & Erios		₽ address	MAC address	Type factor	Name	Status	Net supported
Name				C Properties	Ninte Nilling	Postice	
					Contraction of the second		
	General Cross-recerences	Compile					> Memory
Portal view Portal view	5-1 📡 Online & dia					Scanning for desires card	pleted for int

2.5.6 Save, compile, and download

Download the project configuration information to the PLC S7-1215C after the entire project configuration is completed.

Click "Save Project" to save the entire project.

Right click "PLC_1 [CPU 1215C AC/DC/Rly]" \rightarrow left click "Compile" \rightarrow "Hardware and software (change only)" to compile the entire project.

Click the "Download to device" icon to download the project configuration to the PLC controller.

Operations are shown in the following figure.

jjec trans	0 C Pro	dect1 +	Devices & netw	rorks							_ # = ×	Hardw 🔊 🛙
Devices						2	Topology view	A Ne	twork wie	w 🕅 0	evice view	Options
00	2 6	Network	Connections			8. ± 100%			- BI (Network	koven/k ()	
						3 10 system	PLC. 1. PROFINET	O-System	1000	-		✓ Catalog
Project1	~								-			dearte Ha
Add new device										-	 B(C 1) 	
- Devices & networks		UC_1		TP5-1					- 11		COD device 1	Filter
PLC_1 (CPU 1215C DC/DC/DC)		PU 1215C		INVE PROVIDES	A CP. MCCOM				- 11		1 75.1	 Controller
Device configuration				MAC 1								• 🔄 HLA
S Online & diagnostics												PC system
Program blocks			BC 1	PROFINET ID-Syste					- 8			Drives & s
Technology objects									- 12			P Detacre c
External source files									_			Perecang
FLC tags									- 8			Distribute.
FLC date types									- 8			· · · · · · · · · · · · · · · · · · ·
Image: Watch and force tables									- 11			- Conternete
Taces 2									- 10			- I Photos
Program info									*			
	<								> 🔁			1000
 Bevice providata 							d Doparties	1 Inte	< (Q) n	Lamontica		
Text Bats								1.0	1.12	- agriciture	1 martine from	
Bevice providata Text lists Text lists Local modules												
Device proy data Text Sets Lecal modules Distibuted IIO		jeneral	Cross-refere	nces Compi	1e							
Gevice provydata Text Ext: Gevice provydata Text Ext: Gevice provydata Text Ext: Git Statuted IIO Gormenn data	0	Seneral smpiling co	Cross-refere	nces Compl (warnings:1)	le							- 0
Bevice proyidata Device proyidata Device provides Device imposite Device imposite Distributed I/O Common data Discumentation settings	(() ()	Seneral smpiling.co Path	Cross-refere	nces Compl (warnings:1) Description	ie		Go to	2	Enon	Warrings	Time	- California
Borrice programs Device programs Device programs Device programs Device stars Device stars Common deta Common deta Documentation settings Details view	v	General smpiling co Path	Cross-refere ompleted (errors: 0 • RLC_1	nces Compl (warnings:1) (Description	le		Go to	2	Errors 0	Warnings 1	Time 10 02 30 AM #	+ California
Dervice providats Dervice providats Text State Device modules Doutermon data Doutmentation settings Details view		General ompiling co Path	Cross-refere ompleted (errors: 0 # RLC_1 # MOPINE	nces Compl Courrings: 1) Description	le		Go to	2	Erron 0 0	Wernings 1 1	Time 10.02.30 AM = 10.02.30 AM	Inden Inden Inden Inden Inden Inden Inden
Bend Errory data Bend Errory data Bend Error Local modules Bed Error data Common data Documentation settings Details view		General propiling co Path	Cross-refere ompleted (errors: 0 • R.C.,1 • Morrise	nces Compi (warnings: 1) Description ET inte The device	le replacement aithou	texchargeable me	Go to	, 7	Enon 0 0 0	Warrings 1 1	Time 10.02.30 AM + 10.02.30 AM 10.02.30 AM	• California •
Broke providata Too loss Too loss Too loss Too loss Connect of too Connect Connect of too Connect of tooo		Seneral propiling co Path • Pr	Cross-refere ompleted (error: 0 • PLC_1 • PROFile regram blocks	ncos Compi Cuarrings: 1) Description ET inte The device	ne	texchangeable me	Go to clium functio.	, 7	Emons 0 0 0	Marnings 1 1 1 0	Time 10.02.30 AM = 10.02.30 AM 10.02.30 AM 10.02.30 AM	• Californi • Californi • Californi • Californi • Californi
Benick providate Technick providate Technick providate Technick provides Schuld Kongen Document date Document date Document date	×	Seneral propiling co Path • Pr	Cross-refere ompleted (errors: C * PLC_1 * PROFile regram blocks	nces Compi (warrings: 1) Description ET inte The device No block v	neplacement without as compiled. All bloc	t exchangeable me ki are up to-date.	Go to	7	Emons 0 0 0 0 0	Wernings 1 1 1 0 0	Time 10.02.30 AM = 10.02.30 AM 10.02.30 AM 10.02.30 AM	• California • California • California • California • California

In the download dialog box, search for the connected PLC device, as shown in the following figure.

Select the "PN/ IE_1" option in the drop-down list of "Connection to interface/subnet".

Click the "Start search" button in the lower right corner to start scanning and detecting PLC devices in the subnet.

	Device	Device type	Slot	Type	Address	Subnet
	PLC 1	CPU 1215C DCID	1 11	PN/IF	192 168 0 1	PNIE 1
	rec.	0.012130000	1.41	TTON.	192.100.0.1	THE T
		Type of the PG/PC inte	rface:	PN/IE		•
		PG/PC inte	rface:	TwinCA	T-Intel PCI Ethernet Ad	lapter (Gigahit) 💌 🖲
		Connection to interface/su	bnet:	PN/IE_1		
		Istuat	eway.	_		
	Compatible	devices in target subget:			SI SI	now all compatible devic
	Device	Device type	Туре		Address	Target device
-	Device —	Device type -	Type PN/IE		Address Access address	Target device
er en l	Device 	Device type —	Type PN/IE		Address Access address	Target device
	Device 	Device type —	Type PN/IE		Address Access address	Target device —
Mar and a	—	Device type —	Type PN/IE		Address Access address	Target device
Flash LED	Device -	Device type —	Type PN/IE		Address Access address	Target device
Flash LED		Device type —	Type PN/IE		Address Access address	Target device
Flash LED	-	Device type —	Type PN/IE		Address Access address	Target device
Flash LED		Device type	Type PN/IE		Address Access address	Target device
Flash LED	Device -	Device type	Type PN/IE		Address Access address	Target device
Plash LED	Device -	Device type	Type PN/IE		Address Access address	Target device
Flash LED	Device -	Device type	Type PN/IE		Address Access address	Target device
Flash LED	Device 	Divice type	Type PN/IE		Address Access address	Target device
Plash LED	Device 	Device type	Type PN/IE		Address Access address	Target device

After searching is completed, the PLC S7-1215C that is connected to the PC will be displayed in the list of "Compatible devices in target subnet", as shown in the following figure.

Select the PLC to be downloaded in the following figure, and click the "Download" button to download the configuration information and PLC program to the selected PLC.

	Configured acce	ess nodes of "PLC_1"					
	Device	Device type	Slot	Туре	Address		Subnet
	PLC_1	CPU 1215C DC/D	1 X1	PN/IE	192.168.0.1		PNIE_1
		Type of the PG/PC inte PG/PC inte Connection to interface/s	erface: erface: ubnet:	PN/IE_1	Intel PCI Ethernet Ad	dapter (Gigal	bit) V V
					_		
	Compatible dev	ices in target subnet:	2.00		S ddeere	how all com	patible devices
	Compatible dev	ices in target subnet: Device type CPU 1215C DC/D.	Type PN/IE		Address 192.168.0.1	how all com Target d PLC_1	patible devices
80 - 80 8 - 10 8	Compatible dev Device PLC_1	ices in target subnet: Device type CPU 1215C DCID.	Type PN/IE PN/IE		Address 192.168.0.1 Access address	how all com Target d PLC_1	patible devices
e Flesh LED	Compatible dev Ooviee PLC_1	ices in target subnet: Device type CPU 1215C DCID.	Type PN/IE PN/IE		Address 192.168.0.1 Access address	how all com Target d PLC_1	patible devices
Flash LED	Compatible dev	ices in target subnet: On-ise type CPU 1215C DCD	Type PN/IE CN/IE		Vision Contraction	how all com Target d PLC_1	patible devices levice
Flesh LED	Compatible dev Devise PLC_1 tion:	ices in target subnet: Orvice type CPU 121SC DCID.	Type PN/IE PN/IE		192.168.0.1	how all com	patible devices evice

2.5.7 VFD parameter watching

Click "Watch and force tables" in the left menu bar, and double click "Add new watch table" in the drop-down menu, as shown in the following figure.

		- 1
		Totally Integrated Automation
(*1) ± (* ± 🖫 신 旧 田 田 国 과 & coonine 과 Cooniine 🏰 徳 郎 弟 🖃 🗉		PORTAL
II € Project1 + Devices & networks.		Hardware catalog 🛛 🗊 🗊 🕨
🖉 Topology view 👗 Network view 👔 Devi	ce view	Options
😭 📢 lietuot 🖞 Connectors Hit connectors 🔹 💐 🔡 🔭 🕞 Network overview		
0 10 system PLC 1 PROFINET IO-System (100)		v Catalog
	1000	dearby Marine
	CR0120010	
RC1 TES1	CTO desine	W fiber
OU 1215C INVT Protect A BP ASSNE	ALC Derive	Controllers
		• 🔄 +8.8
		 PC systems
a had a second to four her		Dives & states
POLITIKE TO SYME.		Network components
		Detecting & Manitoring
		Distributed ID
		 Field devices
		 Other field devices
		· Cal MONNETIO
		+ 🧃 Drives
		Encoders
		 Gateway
S Properties Line Diagnostics	1.101	* 📺 40
General Cossumferances Compile		- (m 10/T
		 Itti/Thro&set Adapter
a beaution and a second s		INVTPrefinet Adapt
V Message		🕨 🎯 Ident Systems
	-	Sensors
the Partsware computers in the been loaded, because it is up-to-size.		RORBUS DP
The London mail not been roaded, because it is up-to-bern.		
Scanning to devices compared as manage watching in compare pagano, none a service; an of a		
Consult conductor lice consultante al		< = >
		> Information
	Constructions of norms of the second se	Construction of a constru

Create target watch variables—PZD, PKW, control word and status word variables of the VFD in the newly created watch table, as shown in the following figure.

2% Siemens - Project1										
									Totally Integrated Autom	ation
📑 🛅 🖬 Save project 📓 📈 Jij 🕞	X 5: C*: 🖬	5 IE IE E E F	Go online 🧬 Go offi	ne 🛵 🖪 💷	× 🗉 🛛				P	ORTAL
Project tree	1 Project1	PLC_1 [CPU 1215C 0	OC/DC/DC] • Watch	and force table	s + Watch tabl	e_1	- * *	X		1111
Devices									Options	3
1900	2 2 3	1 2 2 2 2 7								
	100	Address	Display format	Monitor value	Modify value	2	Comment	- 1	CPU operator panel	
* [1 Priert]	0.1	9/0//2	Hex				PKU/1(PLC send)			-
and new desire	2	50/04	Hex				PKN2(PLC send)		No online connection	
Devices & networks	3	5,016	Mex				PKHD(PLC send)			
PLC. 1 [OPU 1215C DODCOC]	4	%Q//8	Hex				PKINE(PLC send)			
Device configuration	5	%QW10	Hex				CW			
Coline & disgnostics	6	5/QW12	Mex				F2D2(FLC send)			- H
Program blocks	= 7	%QW14	Hex				P2D3(PLC send)			- F
Technology objects	8	%QW16	Hex				P2D4(PLC send)			
External source files	9	500/18	Hex				F205(FLC send)			
PLC tags	10	%QV/Q0	Hex				P2D6(PLC send)			
PLC data types	11	%QV/22	Hex				P2D7(PLC send)			- L
 Watch and force tables 	- 12	5Q824	Hex				F2DB(FLC send)			
Add new watch table	12	%QV/26	Hex				P2D9(PLC send)			
Force table	14	%QV/28	Hex				P2D10(PLC send)			
Wetch table_1	15	501/00	Hex				F2D11(FLC send)			
Tieves	16	%QV/02	Hex				P2D12(PLC send)			
Program info	17									
Device proxy data	18	3								
Text lists	19					0				
Local modules	~ 20	<rul> dd new> </rul>								
✓ Details view										
				line of		(11)				
Name	_				ierties 3 Inf	o 131	Diagnostics			
	General	Cross-references	Compile							
	I Messes	e					Gato	1		
						_		1		
Portal view E Overview	Force table	U Watch table_1						🖌 Proj	ect Project1 opened.	

iemens - Project1											
									Totally inter	rated Automat	tion
🕒 😡 Save project 👗 🐰 🖄 🖓	X 520	24 🖬 🖏 🖪 🖬 🕯	🛛 📮 🖉 Goorline	💕 Go offine 🔥	. III 🚺 🗶 🖃					PC	DRTA
	14	Project1 + PLC_1 (CP						_ # = ×	Testing		11
Devices									Options		_
100		1 10 10 10 10 1 1	5. 57 99 99								
		Liferer	Nicelay fromat	Monitorvalue	Lines and		Terrando	_	AL COLL AND ALL	and a	-
Company of the second		8000	bigging romat	1640000	inverg new	-	Extended (monium)	_	· cro operato	paner	
Add new device	•	2000	Hex	1640000			PENDIPLC receive)		PLC_1 (OPU 1215	[DCIDCIDC]	
A Devicer & networks		9/26	Here	1640000			PKUB(PLC receive)		RUN / STOP	BUN	
• M BC 1 [CBI 1215C DCDCDC]		5//0	Hex	1640000			PROVERIPLIC receive)		1000	1708	
Device cardouration		1/w/10	Hex	16#0004			SW		Linkow	2101	
Coline & diagonstics		5/012	Hex	1640000			P2D2IPLC receive)		MAINT	ARES	
Program blocks		5/014	Hex	16+0000			PZD3(PLC receive)				
Technology objects	-	5/016	Hex	1680000			P2D4(PLC receive)				
External source files		5/018	Hex	1640000			#2D5(#LC receive)				
PLC tegs	•	0 1///20	Hex	16#0000			P2D6(PLC receive)				
Call PLC data types		1 9///22	Hex	1680000			F2D7(PLC receive)				
 Watch and force tables 	1.11	2 %///24	Hex	1640000			#2DB(#LC receive)				
Add new watch table		3 %//26	Hex	16#0000			P2D9(PLC receive)		1		
Force table		4 %/#28	Hex	1640000			P2D10(PLC receive)				
Watch table_1		5 %///30	Hex	1640000			P2D11(PLC receive)				
Watch to ble_2		6 9///32	Hex	16#0000			P2D12(PLC receive)		1		
Taces		2 3									
Program info		8 oldd nevo									
Device proxy data											
M Text lists	~										
Data Bardan	-										
Details view	_	6						>	1		
					Properties	Unfo	Diagnostics				
Name		Daulas information	Connection in		Name of contrasts						
		verve aromation	Commection in	internation 1	sam uspay						

After the watch variables are created, click the "Watch all" button in the watch table to monitor the values of all variables, and click the "Modify parameters" button in the watch table to modify the parameters of the target variable, so as to watch the VFD through the PLC.
3 Ethernet IP communication card

3.1 Overview

- Thanks for choosing Sourcetronic Ethernet IP communication cards. This manual describes the function specifications, installation, basic operation and settings, and information about the network protocol. To ensure that you install and operate the product properly, read this manual and the communication protocol section in the VFD operation manual carefully before you use the product.
- This manual only describes how to operate the Ethernet IP communication card and the related commands but does not provide details about the EtherNet/IP protocol. For more information about the Ethernet IP protocol, read the related specialized articles or books.
- This communication card is defined as an Ethernet IP slave station communication card and is used on a VFD that supports EtherNet/IP communication.
- 4. The communication card supports the star, linear, and ring topologies.
- The communication card supports 32 inputs/outputs to read and write process data, read state data, and read and write function parameters of a VFD.

3.2 Features

1. Supported functions

- > Supports the EtherNet/IP protocol, and supports EtherNet/IP devices.
- Provides two EtherNet/IP ports and supports the 10/100M full-duplex/half-duplex operation.
- > Supports the star, linear, and ring topologies (but does not support ring-network monitoring).

2. Supported communication types

EtherNet/IP adopts the application layer protocol CIP, which is also used by DeviceNet and ControlNet. Therefore, they use the same object library and consistent industrial specifications.

CIP uses non-connected UDP/IP and connection-based TCP/IP for information control and transmission over the Ethernet, allowing the sending of explicit and implicit packets. Implicit packets are time-critical control messages and transmitted using UDP/IP. Explicit packets are point-to-point messages that are not time critical and transmitted using TCP/IP. Explicit packets are used for configuration, download, and fault diagnosis, while implicit packets are used for real-time I/O data transmission.

3. Communication ports

Standard RJ45 ports are used in EtherNet/IP communication. The communication card provides two RJ45 ports with no transmission direction defined, and therefore you can insert a cable into either port without regard to its direction. Figure 3-1 shows the ports, and Table 3-1 describes the port pins.



Figure 3-1 Two standard RJ45 ports

Table 3-1	Standard	RJ45	port	pins
-----------	----------	-------------	------	------

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

4. State indicators

The EtherNet/IP communication card provides four LED indicators and four net port indicators to indicate its states. Table 3-2 describes the state indicators.

Table 3-2 State	indicators
-----------------	------------

LED	Color	State	Description
		On	Indicating that the card and VFD identify each
		0	other.
	C	Blinking (1Hz)	Indicating that the card and VFD communicate
LED1	Green		normally.
		0"	Indicating that the card and VFD communicate
		Οπ	improperly.
			Indicating that communication between the card
LED2	Green	On	and PLC is online and data interchange is
			allowed.

LED	Color	State	Description
		Blinking (1Hz)	Indicating IP address conflict between the card and PLC.
		Off	Indicating that communication between the card and PLC is offline.
		On	Failed to set up I/O between the card and PLC.
		Blinking (1Hz)	Incorrect PLC configuration.
LED3 Red	Blinking (2Hz)	The card failed to send data to the PLC.	
	Reu	Blinking (4Hz)	The connection between the card and PLC timed out.
		Off	No fault
LED4	Red	On	3.3V power indicator
Net port	Vollow	On	Link indicator, indicating successful Ethernet connection.
indicator	Yellow	Off	Link indicator, indicating that Ethernet connection is not established.
Net port	Creat	On	ACK indicator, indicating that data interchange being performed.
indicator	Green	Off	ACK indicator, indicating that data interchange is not be performed.

3.3 Electrical wiring

The Ethernet IP communication card provides standard RJ45 ports and supports the linear, star, and ring topologies. Figure 3-2, Figure 3-3, and Figure 3-4 show the electrical wiring diagrams for different topologies.

Use CAT5, CAT5e, and CAT6 network cables for electrical wiring. When the communication distance is greater than 50 meters, use high-quality network cables that meet the national standards.



Figure 3-2 Electrical wiring diagram for a linear topology





Note: An Ethernet switch must be available when the star topology is used.



Figure 3-4 Electrical wiring diagram for a ring network

3.4 Communication

3.4.1 Communication settings

The EtherNet/IP communication card can function as only the EtherNet/IP slave station. Before communication, set ST600 function codes, including:

IP address and subnet mask for the card

The default IP address and subnet mask for each communication card are 192.168.0.1 and 255.255.255.0. You can change them to the address of a network segment.

Control mode

If you want to control the VFD with the communication card, set the control mode to EtherNet/IP communication control. To be specific, set P00.01=2 (communication as the running command channel) and set P00.02=3 (EtherNet/IP communication channel) to control VFD start and stop. If you want to set a value through EtherNet/IP communication, change the control way of corresponding function codes to EtherNet/IP communication. Appendix B lists related function codes. Note: After the setting, the card can communicate normally. If you want to control the VFD with the card, set related function codes to enable EtherNet/IP communication control.

3.4.2 Packet format

Table 3-3 describes the structure of a TCP communication packet.

Table 3-3 Structure of a TCP communication packet

MAC-layer packet header	IP-layer packet header	TCP-layer packet header	Valid data	Packet trailer
14 bytes	20 bytes	20 bytes	0–1488 bytes	4 bytes

Table 3-4 describes the structure of a UDP communication packet.

Table 3-4 Structure of a UDP communication packet

MAC-layer packet header	IP-layer packet header	UDP-layer packet header	Valid data	Packet trailer
14 bytes	20 bytes	20 bytes	0-1488 bytes	4 bytes

3.4.3 Ethernet IP communication

The EtherNet/IP communication card supports 16-word input/output. Figure 3-5 shows the packet format for transmitting data with a VFD.

Parameter identification (PKW)			Fixed zone	_ P	rocess d (PZD) Distributa	lata		
PKW1	PKW2	PKW3	PKW4	CW SW	PZD2 PZD2	PZD3 PZD3		PZD12 PZD12

Figure 3-5 Packet structure

By using the 32 inputs/outputs, you can set the reference parameters of the VFD, monitor the status values, transmit control commands, monitor the running state, and read/write the function parameters of the VFD. For specific operations, see the following description.

Parameter zone:

PKW1—Parameter identification

PKW2—Array index number

PKW3—Parameter value 1

PKW4—Parameter value 2

Process data:

CW—Control word (transmitted from the master to a slave. For description, see Table 3-5.)

SW—Status word (transmitted from a slave to the master. For description, see Table 3-8.)

PZD-Process data (user defined)

(The process data output from the master to a slave is a reference value, and the process data input from a slave to the master is an actual value.)

PZD zone (process data zone): The PZD zone in a communication packet is designed for controlling and monitoring a VFD. The master and slave stations always process the received PZD with the highest priority. The processing of PZD takes priority over that of PKW, and the master and slave stations always transmit the latest valid data on the interfaces.

CWs and SWs

Using CWs is the basic method of the fieldbus system to control VFDs. A CW is transmitted by the fieldbus master station to a VFD device. In this case, the adapter module functions as a gateway. The VFD device responds to the bit code information of the CW and feeds state information back to the master through an SW.

Reference value: A VFD device may receive control information in multiple channels, including analog and digital input terminals, VFD control panel, and communication modules (such as RS485 and CH-PA01 adapter modules). To enable the control over VFD devices through EtherNet/IP, you need to set the communication module as the controller of the VFD device.

Actual value: An actual value is a 16-bit word that includes information about VFD device operation. The monitoring function is defined through VFD parameters. The conversion scale of an integer transmitted as an actual value from the VFD device to the master depends on the set function. For more description, see the related VFD operation manual.

Note: A VFD device always checks the bytes of a CW and reference value.

Task packet (master station -> VFD)

CW: The first word in a PZD task packet is a VFD CW.

When P15.43=0, EtherNet IP control words are defined by byte. Table 3-5 describes ST600 series VFD CWs defined by byte.

Bit	Name	Value	Description
		1	Forward running
		2	Reverse running
		3	Forward jogging
	Communication board	4	Reverse jogging
0–7	communication-based	5	Stop
	control command	6	Coast to stop (emergency stop)
		7	Fault reset
		8	Jogging to stop
		9	Decelerate to stop
0	0 Fachling writing	1	Enable writing (mainly through PKW1 to
0	Enabling writing	I	PKW4)
0.40	Motor group cotting	00	Motor 1
9-10	9–10 Motor group setting	01	Motor 2
11	Control mode owitching	1	Enable torque/speed control switching
11	Control mode switching	0	Disable switching
10	Resetting power	1	Enable
12	consumption to zero	0	Disable
10	Dre eveitetien	1	Enable
13	Pre-excitation	0	Disable
4.4	DC healing	1	Enable
14	DC braking	0	Disable
45		1	Enable
15	Heartbeat reference	0	Disable

Table 3-5 ST600 series VFD CWs expressed in decimal format

When P16.56=1, EtherNetIP control words are defined by bit. Table 3-6 describes ST600 series VFD CWs defined by bit.

Table 3-6 ST600 series	VFD CWs expressed	l in binary format
------------------------	-------------------	--------------------

Bit	Name	Description	Priority
0	Forward running	0: Decelerate to stop 1: Forward running	1
1	Reverse running	0: Decelerate to stop 1: Reverse running	2
2	Fault reset	0: Disable 1: Enable	3
3	Coast to stop	0: Disable 1: Enable	4
4	Forward jogging	0: Disable 1: Enable	5
5	Reverse jogging	0: Disable 1: Enable	6
6	Jogging to stop	0: Disable 1: Enable	7

Bit	Name	Name Description	
7	/	Reserved	
8	Enable reading and writing (PKW1-PKW4)	0: Disable 1: Enable	
9	/	Reserved	
10	Decelerate to stop	0: Disable 1: Enable	0: Top priority
11 - 15	/	Reserved	

Reference value (REF): The second to twelfth words in a PZD task packet are the main settings. The main frequency settings are provided by the main setting signal source. Table 3-7 describes the settings of ST600 series VFD.

Table 3-7 Settings of ST600 series VFD

Function code	Word	Value range	
P16.32	Received PZD2	0: Invalid 1: Set frequency (0–Fmax, unit: 0.01 Hz)	0
P16.33	Received PZD3	2: PID reference (0–1000, in which 1000 corresponds to 100.0%)	0
P16.34	Received PZD4	3: PID feedback (0–1000, in which 1000 corresponds to 100.0%)	
P16.35	Received PZD5	4: Torque setting (-3000-+3000, in which 1000 corresponds to 100.0% of the rated current of the motor)	0
P16.36	Received PZD6	5: Setting of the upper limit of forward running frequency (0-Fmax, unit: 0.01 Hz)	0
P16.37	Received PZD7	 6: Setting of the upper limit of reverse running frequency (0-Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0-3000, in which 1000 corresponds to 100.0% of the rated current of 	
P16.38	Received PZD8		
P16.39	Received PZD9	the motor) 8: Upper limit of the brake torque (0–3000, in which 1000	0
P16.40	Received PZD10	 Corresponds to 100.0% of the rated current of the motor) Virtual input terminal command, 0x000–0x3FF (corresponding to S8, S7, S6, S5, HDIB, HDIA, S4, S3, S2, and S1 in sequence) Virtual cutput terminal command, 0x00, 0x0E 	
P16.41	Received PZD11		
P16.42	Received PZD12	(corresponding to RO2, RO1, HDO, and Y1 in sequence) 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor)	0

Function code	Word	Value range	
		12: AO output setting 1 (-1000-+1000, in which 1000 corresponds to 100.0%)	
		13: AO output setting 2 (-1000-+1000, in which 1000 corresponds to 100.0%)	
		14: MSB of position reference (signed number)	
		15: LSB of position reference (unsigned number)	
		16: MSB of position feedback (signed number)	
		17: LSB of position feedback (unsigned number)	
		18: Position feedback setting flag (position feedback can	
		be set only after this flag is set to 1 and then to 0)	

Response packet (VFD -> master station)

Status word (SW): The first word in a PZD response packet is a VFD SW.

P15.43=0 (SWs are defined in decimal format), and the VFD SWs are defined as follows.

Table 3-8 ST600 series VFD SWs expressed in decimal format

Bit	Name	Value	Description
		1	Forward running
		2	Reverse running
0–7	Running state	3	Stopped
		4	Faulty
		5	POFF
	Rus voltogo ostablishod	1	Ready to run
0	Bus voltage established	0	Not ready to run
0.10	Motor group foodbook	0	Motor 1
9-10	Motor group reedback	1	Motor 2
11	Motor type feedback	1	Synchronous motor
11	Motor type reedback	0	Asynchronous motor
10	Overlead pro alarm foodback	1	Overload pre-alarm generated
12	Overload pre-alarm leedback	0	No overload pre-alarm generated
		0	Keypad-based control
10 14	Bun/Stop mode	1	Terminal-based control
13 - 14	Run/Stop mode	2	Communication-based control
		3	Reserved
15	Hearthaat foodbaak	1	Heartbeat feedback
15	Healibeat leeuback	0	No heartbeat feedback

P15.43=1 (SWs are defined in binary format), and the VFD SWs are defined as follows.

Table 3-9 ST600 series	VFD SWs	expressed in	binary format
------------------------	---------	--------------	---------------

Bit	Name	Description	Priority
0	Forward running	0: Disable 1: Enable	1
1	Reverse running	0: Disable 1: Enable	2
2	Stopped	0: Disable 1: Enable	3
3	Fault	0: Disable 1: Enable	4
4	POFF	0: Disable 1: Enable	5
5	Pre-excited	0: Disable 1: Enable	6
6 - 15	/	Reserved	

Actual value (ACT): The second to twelfth words in a PZD task packet are the main actual values. The main actual frequency values are provided by the main actual value signal source.

Function code	Word	Value range	Default value
P16.43	Transmitted PZD2	0: Invalid	0
P16.44	Transmitted PZD3	1: Running frequency (x100, Hz)	0
P16.45	Transmitted PZD4	2: Set frequency (×100, Hz)	0
P16.46	Transmitted PZD5	3: Bus voltage (×10, V)	0
P16.47	Transmitted PZD6	4: Output voltage (x1, V)	0
P16.48	Transmitted PZD7	5: Output current (×10, A)	0
P16.49	Transmitted PZD8	6: Actual output torque (×10, %)	0
P16.50	Transmitted PZD9	7: Actual output power (×10, %)	0
P16.51	Transmitted PZD10	8: Rotating speed of the running (×1, RPM) 9: Linear speed of the running (×1, m/s)	0
P16.52	Transmitted PZD11	10: Ramp frequency reference 11: Fault code	0
P16.53	Transmitted PZD12	 12: All Value (x100, V) 13: Al2 value (x100, V) 14: Al3 value (x100, V) 15: HDIA frequency (x100, kHz) 16: Terminal input state 17: Terminal output state 18: PID reference (x100, %) 19: PID feedback (x100, %) 20: Rated torque of the motor 21: MSB of position reference (signed number) 	0

Table 3-10 Actual status values of ST600 series VFD

Function code	Word	Value range	Default value
		 22: LSB of position reference (unsigned number) 23: MSB of position feedback (signed number) 24: LSB of position feedback (unsigned number) 25: Status word 26: HDIB frequency value (x100, kHz) 	

PKW zone

PKW zone (parameter identification flag PKW1—numerical zone): The PKW zone describes the processing mode of the parameter identification interface. A PKW interface is not a physical interface but a mechanism that defines the transmission mode (such reading and writing a parameter value) of arameter between two communication ends.



Figure 3-6 Parameter identification zone
--

In the periodic communication, the PKW zone consists of four 16-bit words. The following table describes the definition of each word.

First word PKW1 (16 bits)			
Bits 15–00 Task or response identification flag 0 - 7			
Second word PKW2 (16 bits)			
Bits 15-00	Bits 15–00 Basic parameter address 0 - 247		
Third word PKW3 (16 bits)			
Bits 15-00	Value (most significant word) of a parameter or	00	
	error code of the returned value		
Fourth word PKW4 (16 bits)			
Bits 15-00	Value (least significant word) of a parameter	0 - 65535	

Note: If the master station requests the value of a parameter, the values in PKW3 and PKW4 of the packet that the master station transmits to the VFD are no longer valid.

Task request and response: When transmitting data to a slave, the master uses a request number, and the slave uses a response number to accept or reject the request.

	Request No. (from the master to a slave)	Response signal	
Request No.	Function	Acceptance	Rejection
0	No task	0	_
1	Requesting the value of a parameter	1, 2	3
2	Modifying a parameter value (one word) [modifying the value only on RAM]	1	3 or 4
3	Modifying a parameter value (two words) [modifying the value only on RAM]	2	3 or 4
4	Modifying a parameter value (one word) [modifying the value on both RAM and EEPROM]	1	3 or 4
5	Modifying a parameter value (two words) [modifying the value on both RAM and EEPROM]	2	3 or 4

Table 3-11 Task identification flag PKV	N1
---	----

Note: The requests #2, #3, and #5 are not supported currently.

Table 3-12 Response identification flag PKW1

Response No. (from a slave to the master)		
Response No.	Function	
0	No response	
1	Transmitting the value of a parameter (one word)	
2	Transmitting the value of a parameter (two words)	
3	The task cannot be executed and one of the following error number is returned: 1: Invalid command 2: Invalid data address 3: Invalid data value 4: Operation failure 5: Password error 6: Data frame error 7: Parameter read only 8: Parameter cannot be modified during VFD running 9: Password protection	

Model specified in the standard ODVA agreement

The standard ODVA protocol specifies the data transmission format and CWs/SWs definitions, and the packet format for data transmission with the VFD is shown in Table 3.13. Table 3.13 Transmission modes specified in standard ODVA protocol

No.	Input/Output	Data length (bytes)	Format (word)
2	70/20	4	CW1/SW1 + Speed_ref/act
3	71/21	4	CW2/SW2 + Speed_ref/act
4	70/00	6	CW1/SW1 + Speed_ref/act +
4	12/22		Torque_ref/act
5	73/23	6	CW2/SW2 + Speed_ref/act +
5			Torque_ref/act

In which, CW1/SW1 and CW2/SW2 are defined as shown in Tables 3.14, 3.15, 3.16 and 3.17.

Table 3.14 CW1 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Forward rupping	0	Disable
	Forward running	1	Enable
1	Reserved	/	/
2	Fault reset	0	Disable
		1	Enable
3–15	Reserved	/	/

Table 3.15 SW1 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Foult state	0	No fault
	Fault state	1	Fault
1	Reserved	/	/
2	Running state	0	Not forward running
		1	Forward running
3–15	Reserved	/	/

Table 3.16 CW2 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Forward rupping	0	Disable
	Forward running	1	Enable
1	Reverse running	0	Disable
1		1	Enable
2	Foult report	0	Disable
2	Fault reset	1	Enable

Bit	Name	Value	Description
3–4	Reserved	/	/
5	Control reference course	0	Local control (keypad)
5	Control reference source	1	Remote control (Ethernet IP communication)
6	Fragueney reference	0	Local reference (keypad)
	source	1	Remote reference (Ethernet IP
			communication)
7–15	Reserved	/	/

Table 3.17 SW2 specified in standard ODVA protocol

Bit	Name	Value	Description
0	Foult	0	No fault
0	Fault	1	Fault
1	Overload prealarm	0	No overload
1	feedback	1	Overload prealarm
2	Bunning state 1	0	Stopped
2	Running state 1	1	Forward running
2	Bunning state 2	0	Stopped
3	Running state 2	1	Reverse running
4	Pue veltage established	0	Ready to run
4	bus voltage established	1	Not ready to run
F	Control reference course	0	Local control (keypad)
5	Control reference source	1	Remote control (not keypad)
6	Frequency/torque	0	Local control (keypad)
0	reference source	1	Remote control (not keypad)
7	Beference reached	0	Not reached
1	Reference reactied	1	Reached
8–15	Reserved	/	/

Sourcetronic extended data model based on the ODVA Protocol

Based on the ODVA protocol provisions, these four modes are combined with PZD process data defined by Sourcetronic, and the packet format for data transmission with the VFD is shown in Table 3.18.

Table 3.18 Sourcetronic extended	data model based	on the ODVA protocol
----------------------------------	------------------	----------------------

No.	Input/Output	Data length (bytes)	Format (word)
6	74/24	24	CW1/SW1 + Speed_ref/act + Null +PZD4-12

No.	Input/Output	Data length (bytes)	Format (word)
7	75/25	24	CW2/SW2 + Speed_ref/act + Null +PZD4-12
8	76/26	24	CW1/SW1 + Speed_ref/act + Torque_ref/act + PZD4–12
9	77/27	24	CW2/SW2 + Speed_ref/act + Torque_ref/act + PZD4–12

In these four modes, definitions of CWs and SWs are consistent with that of "Model specified in the standard ODVA agreement", and definitions of PZD4–12 are consistent with that of "Sourcetronic self-defined mode".

3.5 Example 1 of PLC communication (communicate with Allen-Bradley PLC)

This example shows how to use an Allen-Bradley PLC (model: 1769_L36ERMS) to communicate with an Ethernet IP adapter module (through using the Studio 5000 software as the configuration tool).

3.5.1 Create a new project

Connect the PC to the PLC with a printer cable or network cable. Open



and click "New Project".

Rockwell Software [®] Studio 5000 [°]						
	Create	Open	Explore			
	New Project	Existing Project	<u>H</u> elp			
	From Import	Sample Project	About			
Recent Projects	From Sample Project	Erom Upload				
S EDS_TEST_0419						

Select the correct PLC model, fill in the project name, click "Next", and click "Finish".

A New Destant						
o New Project					?	×
Project Types			Search			×
Logix	Compact GuardLo T769-L30ERMS T769-L30ERMS T769-L30ERMS T769-L37ERMS T769-L37ERMS T769-L37ERMS Compact GuardLo Compact GuardLo CompactLogix** 5 CompactLogix** Name: GD_350_EF	egix® 5370 Compa Compa Compa Compa Compa Compa Compa Compa Compa S Compa Co	Safety Controll ct GuardLogix® ct GuardLogix® ct GuardLogix® ct GuardLogix® Safety Controlle Iller Siller SDVA_049	er 5370 Safety C 5370 Safety C 5370 Safety C 5370 Safety C 5370 Safety C 5370 Safety C 5370 Safety C er	iontroller iontroller iontroller iontroller	
	Location: C:\Users\A	dministrate	or\Documents\9	itudio 500(v	Browse	ə
		Cancel	Back	Next	Finis	h
		cuncer	Duck	Hen	<u>T</u> unio	
🔕 New Project					2	~
						~
1769-L36ERMS Co GD_350_EthernetIP_OD	mpact GuardLogix® 5 VA_049	370 Safet	ty Controller		:	~
1769-L36ERMS Co GD_350_EthernetIP_OD Re <u>v</u> ision:	mpact GuardLogix® 5 VA_049 31 v	370 Safet	ty Controller		:	~
1769-L36ERMS Co GD_350_EthernettP_OD Revision: Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_049 31 V No Protection	370 Safet	ty Controller	v	:	~
1769-L36ERMS Co GD_350_EthernetIP_OD Revision: Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_049 31 Y No Protection Use only the selected Sr authorization	370 Safet	ty Controller	v ntication and	-	~
1769-L36ERMS Co GD_350_EthernetIP_OD Regision: Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_049 31 V No Protection Use only the selected So authorization Logical Name <controll Deprinsion Set</controll 	ecurity Aut	ty Controller	v ntication and v		~
1769-L36ERMS Co GD_350_EthernetIP_00 Regision: Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_049 31 V No Protection Use only the selected S authorization Cogical Name <controll Opermission Set</controll 	ecurity Aut	ty Controller	v ntication and v		~
1769-L36ERMS Co GD_350_EthemetIP_00 Regision: Security <u>A</u> uthority: Secure With:	mpact GuardLogix® 5 VA_049 31 V No Protection Use only the selected S authorization Cogical Name <controll Dermission Set</controll 	ecurity Aut	ty Controller	v ntication and v		~
1769-L36ERMS Co GD_350_EthernetIP_0D Regision: Security <u>A</u> uthority: Secure With:	mpact GuardLogix® 5 VA_049 31 V No Protection Use only the selected S authorization Cogical Name <controll Deprmission Set</controll 	370 Safet ecurity Autl	ty Controller	v ntication and		~
1769-L36ERMS Co GD_350 EthernetIP_0D Registion: Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_0x9 31 V Wo Protection Use only the selected St authorization Logical Name <controll Permission Set</controll 	ecurity Auti	ty Controller	v ntication and v		~
1769-L36ERMS Co GD_350 EthernetIP_OD Registion: Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_0x9 31 V No Protection Use only the selected St authorization Logical Name <controll Permission Set</controll 	ecurity Aut	ty Controller	v ntication and		~
1769-L36ERMS Co GD_350_EthernetIP_OD Security <u>A</u> uthority:	mpact GuardLogix® 5 VA_0x9 31 V No Protection Use only the selected S authorization Cogical Name <controll Permission Set</controll 	ecurity Aut	ty Controller	v ntication and		~

3.5.2 Import an EDS file

The EDS file is used to specify device attributes for Ethernet IP client. The client identifies the device through product code, device type, and major version attributes.

You can obtain the EDS file of the communication card from the vendor, or downloaded it (file name: ST600_EthernetIP_V1.01.eds) from the Sourcetronic website at www.sourcetronic.com.

Right click "TOOLS", and select "EDS Hardware Installation Tool".



Click "Next".

Rockwell Automation's EDS Wiz	ard	\times
	Welcome to Rockwell Automation's EDS Wizard	
	The EDS Wizard allows you to:	
	- register EDS-based devices.	
	- unregister a device.	
	 change the graphic images associated with a device. 	
	- create an EDS file from an unknown device.	
	- upload EDS file(s) stored in a device.	
	To continue click Next	
	下	

Select the option as shown in the following figure, and click "Next".



Click "Browse" to select the EDS file that you want to download, and then click "Next".

Rockwell Automation's EDS Wizard	×
Registration Electronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications.	U.
Register a gingle file C Register a girectory of EDS files Look in subfolders	
Named:	
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	
< 上一步(L) 下一步(L) >	R:H

Continue to click "Next".

Rockwell Automation's EDS Wizard	×
EDS File Installation Test Results This test evaluates each EDS file for errors in the EDS file. This test does not guarant	ee EDS file validity.
E Installation Test Results	
e:\ invt_gd350_ethernetip_v1.20.eds	
1	

Click "Next" again, and the installation is successful.

Rockwell Automatio	n's EDS Wizard	×
Change Graphic You can chang	: Inage ge the graphic image that is associated with a device.	
	Product	
Change icon	Generic Device(deprecited for new devices)	
	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	取消

3.5.3 Create a new device object

Select "I/O Configuration"-->"Ethernet item" on the left, and right click "New Module".



Select "ST600_EthernetIP_MODULE", and click "Create".

Catalog Manher	Benription	Tendor	Category	^
EE260-SER2	Ethernet Valve Manifold SIV	SMC Corporation	Communication	
EED60-SERO	Ithernet Valve Manifold SIV	INC Corporation.	Commication	
EE200-SEN4	Ethernet Valve Manifold SIV	32C Corporation	Communication	
EISOD-GERI	Ethernet Gateway	INC Corporation.	Commination	
FARE CRC	EtherHet/IF CHC	FAMIC CORPORATION	Specialty	
PARTS: Robert	EtherHet/IF Robert	FAIRUE Robotics America	Spacialty	
FAMPE Robert B3018 Flux	EtharHot/IP Robert \$3018 Flux	FASTC Robotics Associes	Specialty	
05000_2therest2f_BCOULE	18Vf	ANG Industrial Betworks AB	Contrin Baving Ideptorated	
1012) - 234(292) - D	Cilcinet to Rolling Linking Device	180 Industrial Setrophy AD	Communication	
HED-RHOPD-R	Ethernet to Frofibus Linking Device	MMS Industrial Matworks AB	Communication	
HRE-EN2LE-R	Etharnet to Serial Linking Device	MES Industrial Hetworks AB	Commination	
18-801	2 Zane Controller (Stundard)	Itoh Danki Co., Ltd.	Commination	
18-8038	2 Zane Controller (Standard)	Insh Beshi Co. , Ltd.	Communication	
18-8047	2 Zene Controller (Stundard)	Itah Banki Co., Ltd.	Communication	
ISD131 Ethernet/IF	Scale Terminal	Mattler-Teledo	Commination	
ISDS40 Ethernet/27	Scale Terminal	Mattler-Teledo	Commication	
ISDS70 Ethernet/IP	Scale Terminal	Mattler-Tolado	Communication.	
ISD/00 Etheract/27	Scale Terminal	Mattler-Tolado	Commination	
In-Sight 1700 Series	Vision System	Cognon Corporation.	Communication	
In-Sight 3400 Series	Vision System	Cognes Corporation	Communication	
In-Sight 5000 Series	Vision System	Cogness Corporation.	Communication	
In-Sight Micro Series	Winion System	Cognes Corporation	Commication	
Link_03_Printer	Link-OS Printer	Zahra Tachnalogian	Communication	
Ligailine_CABOocs	EtherHet/IF Analysis	Indroux Mauser	Special tr	

Fill in the module name, and set the IP address of the module. The IP address must be consistent with P16.02–P16.05 on the ST600 Ethernet IP communication card, otherwise communication fails.

Generali Connection Module Info Internet Protocol Pot Configuration Network Type: G0350_EhemetiP_MODULE INVT Vendor: HMS Industrial Networks AB Parent: Local Name: Ehemet Address Description:	📧 New Module	×
Module Definition Pervision: 1013 Bectronic Keyling: Compatible Module Connections: Exclusive Owner	General® Connection Module Info Internet Protocol Port Configuration Network Type: G0350_EthernetIP_MODULE INVT Vendo: HMS Industral Networks A8 Parent: Local Name: OPrivate Network: 192:158.1. 0 Host Name: Internet]
	Module Definition Revision: 1.013 Electronic Keying: Compatible Module Connections: Exclusive Owner	

Click the "Change" option to select the protocol type used by the module. Each type differs in IO format, so you need to select the corresponding IO format based on the protocol type, as shown in the following table. Take "Exclusive Owner" as an example.

Beneral* Conr	le nection Module Info Internet Protocoll Port Configuration Network	×
Type: Vendor:	Module Definition* X	
Parent:	Revision: 1 V 013 🜩	
Name:	Bectronic Keying: Compatible Module ~	
Description:	Connections:	
	Name Size Tag Suffix 1 . 3]
	Exclusive Owner Injut 16 NT 1 test_0429_3:11 Optput 16 NT 1 test_0429_3:01 1	
Module Defir Revision: Electronic K Connections	Exclusive Owner 2070 Basic speed control 2171 Extended speed oc 2272 Basic Speed NVT 2474 Basic Speed Nut 2474 Basic Speed <	
	Cildige	
Status: Creating	OK Cancel Heip	>

Name	Size	Format
Exclusive Owner	16	INT
20/70 Basic speed control	2	INT
21/71 Extended speed control	2	INT
22/72 Basic Speed and Torque control	3	INT
23/73 Extended Speed and Torque control	3	INT
Sourcetronic 24/74 Basic Speed Control plus Drive Parameters	12	INT
Sourcetronic 25/75 Enhanced Speed Control plus Drive Parameters	12	INT
Sourcetronic 26/76 Basic Speed and torque Control plus Drive Parameters	12	INT
Sourcetronic 27/77 Enhanced Speed and torque Control plus Drive Parameters	12	INT

Click "OK", "Yes", "OK", "OK", "OK", and "OK" in turn.

Type: Vendor:	Module Info	Internet Protocol Port Configuration Network	×
Parent:	Revision:	1 ~ 013 +	
logix Designe			×
Data Verify	will be set to defai module propertie	It values unless it can be recovered from the s before Applying changes.	existing module properties.
Revision:	ge module definitio	Yes No	
Revision:	ge module definitio	Ves No	

Once the module has been created successfully, you can see it under "Ethernet" item under "I/O Configuration" on the left, and click it to check the device information.

Logix Designer - GD_353_DthemetiP_COVA_048 [1768-L368]	IMS 31.112*	
FILE EDIT VIEW SEARCH LOGIC COMMUNICATION	IS TOOLS WINDOW HELP	
5 🖆 🖶 🗶 🖉 G 🗇 😋		
= N/N The second		
Energy Strage Officer I In Proces	b mention 2 sufety blocked \$3 () favorites Add-On Safety Alarms 58 TimerCounter Input	
Controlar Opposite	T Madda Respective Land MD150 Blansett M005311410	
4.12		
	General Connection Module Info Internet Protocol Part Configuration Network	
A Controler GD_IOU_InternetP_ODWLORP	Tax 0000 Demail W000 EW/T	
Control or Tage		
Revenue le Manifer	Nerdor: Miko Indulate Nervoka Ad	
4 STain	Parent: Local	
4 () MainTask	Name: Inst \$429.3 Ethernet Address	
b 5 MainProgram	Doute National 102 102 1 2 0	
# 🕒 SafetyTask	Desotgion:	
SafetyProgram	O/P ASSess:	
Unscheduled		
# 🖳 Metion Groups	O Bot Nane:	
Chiproped Anes	N N	
 Alisti Alisti 	No.4 in Defection	
S copical second		
A CO Companyon	Pierteen 1.013	
Rental 1769-136FRMS GD 350 Ethermetik ODVA GAS	Bectronic Keying: Compatible Module	
4 & Ethernet	Connections: Exclusive Owner	
1789-L36ERMS GD_350_EthemetiP_ODVA_048		
60350_EthernetIP_MCDULE test_0429_3		
	Overge	~
	Errors	
	O Olivers A O'Warrings O O'Messages	
		THE PERSON NEW YORK
De Controller Organizer	😹 Search Results 👼 Histoh 📮 Errors	
Ready		ommunication Software: #SLinx Classic 🖉 -
		_

3.5.4 Use of Rslinx Classic

Rslinx Classic is used to connect the PC to the PLC. Open the "Rslinx Classic" software.

Click the "S" icon, and a window of "Configure Drivers" pops up. Select "Ethernet/IP Driver" in the drop-down menu of "Available Driver Types", click "Add New", a window of "Add New RSLinx Classic Driver" pops up, and click "OK".

🎨 RSLinx Classic Gateway		-	\Box \times
File Edit View Communications Station DDE/OPC Security Window	v Help		
Configure Drivers		? ×	
Available Driver Type:: T944200HP for DH+ devices R5:220F1 devices T944220F1 devices T94447X10(PFLMK K6 DH+/014455 devices DH PAling Nature Dh+/014455 dev	Status Running	Dose Help Configure Statup Stat Stop Delote	
For Help, press F1	CAP	04/29/20	10:44 AM

🇞 RSLinx Classic	Gateway				-		×
File Edit View	Communications 9	tation DDE/OPC	Security Window	/ Help			
🗃 🍰 🎜 🖉							
C	onfigure Drivers				? ×		
1	Available Driver Types:				Class		
	EtherNet/IP Driver		-	Add New	Help		
ſ	Configured Drivers:						
	Name and Description	Add New RSLinx Cl	assic Driver	×			
	AB_VBP-1 RUN	Choose a name for the	e new driver.	ок	Configure		
		(10 characters maximu	mj	Cancel	Startup		
		AB_ETHIP-1			Start		
					Stop		
					3102		
					Delete		
	1						
For Help, press F1				CAP	04/29/20	0 10:44	AM //

In the "Configure driver" window that pops up, select your computer's network card and click "OK".

RSLinx Classic Lite - RSWho - 1			X
File View Communications Station DDE/OPC Security Window Help			
1 S 0			
RSWho - 1 Configure driver: AB_ETHIP-2			
Autobrowse Bafrash EtherNet/IP Settings			
Burgeringen Bereinigen Berei			
For Help, press F1	NUM 11/12/1	18 03:47 6	PM

3.5.5 Writing PLC programs

Click on "Tasks"-->"MainTask"-->"MainProgram"--> on the left. Right click on "MainProgram" and "Parameters and Local Tag" above "MainRoutine" to create global variables. Right click "Parameters and Local Tag" above "MainProgram" to create global variables.

Cogix Designer - GD_350_EthemetP_ODVA_049 (1768-L368)	RMS 31.11/P	- 8 ×
5 6 8 8 8 x 7 8 9 9 9		
Energy Storage CK Energy Storage CK Energy Storage CK Program Energy Storage CK Program Energy Storage CK	No. 201 Image: State	
Controller Organizer w # 3	🗴 🕴 Module Properties: Local (\$0000 EthemetiP MODULE 1010) 📄 MeinPregnen - MeinReatine* 😒	
er 11	C.11.15.15.15.15.15.15.15.15.15.15.15.15.	
Controller CD (35) Different P(CDVA),049 Controller Tags Controller Tags Controller Fault Handler Tosts Controller Fault Handler Tosts Controller Sait Handler	WV More Conj More R00, 000 Door wulket, 00, 00 Seeng Door wulket, 00, 00 Seeng Door wulket, 00, 00 Seeng WW WW WW	Â
Construction C		, v
	Erron	• * ×
	O Erron 🛦 O Warnings 0 39 Messages	
te Controller Organizer	🕱 Search Results 👼 Walch 🥫 Errors	
Ready	Communication Software: REvine Classic Rung 1 of 2 ADP VER	48

New Parame	eter or Tag		×
<u>N</u> ame:	cw		Create 🗸 🗸
Description:		^	Cancel
			Help
		~	c
<u>U</u> sage:	Input Parameter	\sim	-
Typ <u>e</u> :	Base ~ Connectio	n	
Alias <u>F</u> or:		~	_
Data <u>T</u> ype:	INT		
Parameter Connection:		~	-
<u>S</u> cope:	🔓 MainProgram	~	-
Class:	Standard	\sim	
External Access:	Read/Write	\sim	
St <u>y</u> le:	Decimal	\sim	
Constant			
Seguencing	1		
Open Confi	guration		
Open Paran	neter Connections		

d Logix Designer - GD 350 (thematif ODVA 049 (1789-LS688)	MS 31,710							- 0 ×
FLE EDIT VIEW SEARCH LOGIC COMMUNICATION	TOOLS WINDOW	HELP						
54 H # 100 000	- 23	ASSIS	NORT	10.02				
Rus Mole Greeder DK III Dregs Storage DK Tech USEUD* Tech USEUD* Tech USEUD* Tech USEUD*	2 Section	a talat inista	A 8 1	and the second	and the lot war not	t Separcir		
Controller Organizer • • ×	Module Propertie	e: Local (GD950_EH	wmwEP_MODULE 1	.011) MainProgram -	Manfloutine 0 Prop	um Parameters and	Local Taga - MainProgram 📯	
(877)	Scare L Marcho	an v Dor	AL Tage			- T	e film.	×
Control 2010 (Second 2010) (Second 2010) Control 2010 (Second 2010) (Second 2	Name > CW > SW > PZD2,SIME > PZD2,REC	12) - Usage Input Local Input Input	Video	Force Mask 1	Style Decimal Hes Decimal Decimal	Data Type BT BT BT BT BT	Insertion B (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	* 3
G0350_BtherretP_MODULI test_9429_1	I Monitor	Taxe (Edit	Taxa /		_			
	Errors							• 7 X
	0 0	iron 🔺	0 Warman 0	39 Menadera				
	-							
De Controller Organizer	Gal Gearch Results	Wester Ca Erro	12			Cor	setunication Software, ISLinx Classic -	a 0

3.5.6 PC connection and program download

Click on "COMMUNICATIONS" under "Who Active", and in the pop-up screen, click on PLC Project under the "USB" option. "Dowmload". **Note:** The PLC dial code cannot be "RUN" at this time.

Logix Designer - GD_350_EthernetIP_ODVA_049 [1]	769-L36ERM5 31.11]
FILE EDIT VIEW SEARCH LOGIC COMMUN	NICATIONS TOOLS WINDOW HELP
15 🖆 🖨 🗶 🗗 조 🤊 연 👬 Who	a Active 🗾 🔎 📴 ኬ 🕒 🖪 📩 😳 🛍 😳 🖓
RUN OK OK OK OK OK OK Offine Offine	et Recent Path et Communication Software At Communication Software Safety Uniced 29 () Favorites AdS-On Safety Airms Bt Time/Counter Input
Controller Organizer Unio	es: Local (GD350 EthernetiP MODULE 1.013) ×
d ^e eiii Dow	vnlaad
Gontroller GD_330_EthemetiP_ODW Ontroller Tags Controller Tags Controller Fault Handler Proper-Up Handler Tests OMainTask	pan Mode pro Mode HP Termer Hotos (Pd Configuration Reinold Mode S1050; (Dennere J) MODULE NVT Mode S15 Industrial Network AB Controller cold S1 Between Address
A 5 MainProgram Clear	r Faults
	Strauht S
	Errors



3.5.7 Configuring PLC IP Addresses through the studio5000 V31 software

Make sure that the PLC is in REM or PROG mode, click "1769-L36ERMS" at the bottom left to enter the "Controller Properties" interface, and then click "Internet Protocol" to change the IP address of the PLC.

D Bloccall Main CO and Diversity Conversal Line-Trailver.		
FLE EDIT VEW SEARCH LOGIC COMMUNICATIONS	TOOLS WINDOW HELP	
	Controller Properties - GD 100 EthernetiP COVA 048	
B Regres Hole ' Fash USEUS' B Careole Di B Dorgy Seran GR Program SC se Forces P	Port Configuration Network Security Alam Log F	
Controller Organizer + # K	Project Safety Norvolatile Memory Capacity Internet Protocol	
6.11		
Control (20, 10) (Interest), 20(0), 00 Control (10) Control (# Sincut antisan Zushigi C/C P Address 100:00 T 100 Schurt Max. 50:00 C 00 C P Address 100:00 T 100 Schurt Max. 50:00 C 00 C C Charge Team Schurt Max. 50:00 C 00 0:00 C 00 C C C Upg Name Schurt Max. Schurt Max. Schurt Max. C <td></td>	
4 1709 Bus D 101 1769-L368 PMS GD, 350_Ethemed P, 00%A, 549		
Chenet Color 1360 1360 Chematil 0004,040 Color 1360 Chematil 0004,040 Color 1360 Chematil 000000 Chematil 0000000 Chematil 000000000000000000000000000000000000		
		x
	MAR ROM SEMICUL MAR	
Te Controller Organizer Sty Kopical Organizer	a leant feulti 🚡 Watth 🕝 Den	
Ready	Communication Software History Classic	

3.5.8 DLR Ring Network Configuration

(1) Using Logix Designer for setup

Open the Studio 5000 software and use an Allen-Bradley CompactLogix PLC with ring networking capability, which requires at least two ST600 Ethernet IP communication cards. More ST600 Ethernet IP communication cards can be added, but it is recommended that the maximum number of nodes used on the DLR ring network shall not exceed 32. The connection method is shown in the following figure.



Note: An EDS file must be added.

(2) Add an Ethernet IP communication card to the Studio 5000 software

The method of addition is the same as that of the linear star connection.

🗿 Logix Designer - IFW75 (1769-L968NMS 31.11)*	- 0 ×
11 m H + × 2 0 2 で ・ × 5 M 5 h + 5 h 2 G H G G	
FILE EDIT VEW SEARCH LOGIC COMMUNICATIONS TOOLS WINDOW HELP	
In the second se	*
Elipo deser presente e a presente e antiportecemente en eliportecemente en eliportecement	
# 1	
()a Controller Organiser	
Ersen Beerch Results B Welch	
Parts	Connected and Advance Million Phone A

(3) Enabling PLC ring network monitor function

Double click "1769-L36ERMS SourcetronicS" under the "I/O Configuration" folder, as shown in the following figure.



Enter "Network" under the "Controller Properties" option and select "Enable Supervisor Mode".

🗳 Controller Properties - IN	NVTS						×
General Major Faults	Minor Faults	Date/Time	Advanced	SFC Ex	ecution	Project	Safety
Nonvolatile Memory Lapac	ity internet r	rotoco1 for	t configura	tion Me	CNOLK	Security	Alarm Log
Network Topology:	Linear/Star				[Advanced	
Network Status:	Nomai						
Active Hing Supervisor: Active Supervisor Precedence:							
Enable Supervisor Mode							
Ring Faults Detected:		Reset Coun	ter 🗧				
Supervisor Status:							
		2		前消	िका	BAI	夷Pah

Note: The ring network monitor function is enabled only when the PLC is in programming mode.

(4) Return to Logix Designer and make sure that none of the communication cards has encountered the following fault.



(5) Download the project to the PLC, bring the PLC online, and put it in programming mode.

3.6 Example 2 of PLC communication (communicate with ORMON PLC)

This example shows how to use an ORMON PLC (model: NX1P2-9024DT) to communicate with an Ethernet IP adapter module (through using the Sysmac Studio software as the configuration tool).

3.6.1 Hardware connections

The NX1P2-9024DT is not configured with a USB download port, and communication and

download between the PC and PLC is conducted through the built-in Ethernet IP port. In this case, a switch is needed in the experiment, and the connection method is as follows.



3.6.2 Network Configurator software setting

3.6.2.1 Launch Network Configurator software



Start the Network Configurator software

as an administrator in the following

directory: "C:\Program Files

(x86)\OMRON\CX-One\NetworkConfigurator\Program\NetConfigurator.exe".

3.6.2.2 Load the EDS file

Select "EDS File"->"Install", and add EDS file: Sourcetronic_ST600_EthernetIP_V1.01. Click "Open", "Yes", and then click "Cancel".

□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
Image: Section of the sectio
Image: Section 2016 and Section 20
Image: Constraint of
Image: Second and Sec
I de l'andre en la contra en la
g Gowin clean Nations - Gowin (Constraints) - Gowing (DS Notes) -
a dana da
(8) 💑 Press Supple Derive (8) 💆 Thereod Could it in Built or ing Der
is a marved could be maintering be
Trace of Device Juddidth
Tend .
Wessage Code June Jecorolption
Lifebrahard Talabaran Jata S German Annual (1976) 141 162 165 16665 (Annual Annual C

Untitled - Network Configurator	Tank Ontine Hall	🖏 Install EDS	Fle			×	- σ ×
□ # ■ ■ 초 관 법 적 월 월 4	1 @ X & B	意味で高い	NetConfigurator workspace	- 😳 💋	• 🖬		
S = 9 9 + + 2 = 1 1 1	R	an		修改日期		85	
town Casil groats	C [the:Net/1P_1	INVT_GD3	50_E8emmetP_V101ED5	2020/4/29 11	57	EDS 🗴	
	Dange of Device Data	٤				,	
*		文件名(1):	INVT_GD350_EthemetiP_V1.01.ED	\$	打开	(Q)	
Rezzape Code Jato Jo	swiption	文件关系已	Electronic Data Sheet(".eds)	~	R	4	
		Device Informat Vandor Device Type Product Name Revision	ion HWS industrial Networks AB Genetic Device BV/T 1.13				
Ready		_	Statement Contractor				219-LM 192.168.250.5 1000M (2) Off-line
Untitled - Network Configurator File Edit View Network Device EDS File 1	ools Option Help						- σ ×
□ # ₩ ♬ 듯 장 성 작 당 당 4	1011082	< 🌆 55 m	■ 9-9-				
	F 🛛 🖉 🗄 🖬 🖄	A 12					
the contract of the contr	EtherNet/IP_1	(81	Network Configurator (2) Invatil the Issan	é INVT? ŠINO			
< >	Jetail						
X Terrage Colo Date De	neripti 43.						

Add "NX1P2" and "Sourcetronic" in the following location to the Ethernet IP bus. After these two device are added successfully, the bus shows two devices. The default IP addresses are "192.168. 250.1" and "192.168.250.2", and ST600 function codes P16.02–P16.05 are changed into 192, 168, 250 and 2 respectively.



3.6.2.3 Connection setting

Click "Option" → "Select Interface", and select "Ethernet I/F".

Untitled - Network Configurator			- 0 ×
File Edit View Network Device EDS File	a Toole Option Help		
D # B 토 친 친 성 적 월 월	🥔 👸 Select Interface	CJ2 USB/Serial Port	
(5) 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日 日	Edit Configuration File	CS/CJ1 Serial Port -> EIP Unit I/F	
	Setup Monitor Refresh Timer	Ethernet -> CS/CI1 ETN-EIP Unit I/F	
Fatwork Configurator ThereFat/17 Eardware Wadar Wadar	Install Bugin Module Install Interface Module	NU/NX/NY Series Ethernet Direct U/F NU/NX Series USB Port 1752 SmartQuard USB Port	
Generic Derice 32011 10 - 28 0000 Corporation.	² Update Parameter gutomatically, when Configuration was changed Update Device Status automatically, when it was connected on Network		
Barra Birran System Las. Brind System Las. Brind System Las. Gamming Annual System Las.			
	thus of Jerice Judeidth		
٢	Betuil		
*			
Channel Color State	President in		
	LEtherNet/IP T/Unknown Intel(%) E0	hemet Connection (4) 1219-EM 192.168.250.5 1000M @ Off-line	

Click the "Connect" icon to select the corresponding network port, and click "OK".

SD350 EthernetiP text - Network Configurato		- a ×
File Edit View Network Device EDS File	Tools Option Help	
□ ☞ ■ ■ 분 분 환 성 적 월 월 :	4 ● と 市 市 × 14 田 田 市 市	
K = 44 + 2 = X =	8 8 9 1 8 8 7 8 8 7 8 8 8 8 9 1 8 8 8 9 1 8 8 8 9 1 8 1 8 1	
Alternative Constraints	Version of the second s	9
	Unap of Device Emoleich. Tereil	
6 >		
Constant Internal Int	Annalasta	
Ready	LEtherNet/P TrLinknown Intel/R) Ethernet Connection (4) (219-LM 192.168.250.5 1000M (3)	Off-line

Select "TCP:2", and click "OK".

GD350 EthernetiP text - Network Configurator	- 0 ×
File Edit View Network Device EDS File Tools Option Help	
D @ @ 】 ● 员 句 (包括) 發展 # (●) 人物的× (●) 甘香物	
(5)日日日本中区(第)公司(公司)(1)日	
Control of the river of th	
With and a start is a start of a start is a start of a start of a start is a start of a start is a start of a start is a start	3
Top of Reise Taskilli	
Name 1	
<	
Kana Ada - Nandada	
beady LEBterNet/IP TURknown Intel/RJ: Effernet Connection (4) (219-LM 192.168.250.5 1000M	3 Off-line

Select "Use the existing network" \rightarrow "EtherNet/IP_1", click "OK", and the PLC is connected successfully.

After the PLC is connected successfully, the blue indicator above the PLC device icon is on.

Sci GD150. Ethernet IP. test - Network Configurator	0	\times
File Edit View Network Device EDS File Tools Option Help		
日本目目を向ける。今年にの時人には日前の後		
K □ 19 9 + + Ø 0 0 X 0 0 X 0 X 0 X 0 X 0 X 0 X 0 X 0		
Weine Harden Ferner Image: Section of the section o		7
< >> Priil.		
Ranna Pub. Ran Randala		
Rendy I OtherNat/ID Trisknown Intel® Ethernet Connection (# 1216-14) 192146 2905 10004 (0 Office		

Click the "Device Property" icon, and the "Controller Information" tab pops up. You can switch the PLC status between "Program" and "Run" in the tab.

GD350_EthernetIP_test - Network Configurator Ela Edit View Network Davida EDS Ela Tanla Ontion Halo		- a ×
D # 2 5 5 4 5 5 4 5 4 5 5 5 5 5 5 5 5 5 5 5	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	
Compared and a service an	NV020 reprove General Controller Monaution Controller Monaution Controll	
Image Image Description 346 Description Description 2000/00/11 (2:20) Description Description 2000/00/11 (2:20) Description	One	
Ready	LittherNet/IP TritherNet/IP Intel(K) Ethernet Connection (4) 1219-LM 192.168.250.5 1000M @ On-line	

3.6.2.4 Modify IP address

Right click the device icon and select "Change Node Address" to change the PLC IP address.

File Edit View Network Device EDS File Tools	Option Help				
D## # # # # 10 10 10 10 10 10 10 10 10 10 10 10 10	X Ra m				
8 B 8 8 + + 2 B 2 B 2 B	28 (G) 5	AIR			
*	Other	Nat/0P 1			
Inner Ladgever Control Research Control Research	Parameter	,	1		
	No.101	N Meritor			
		lleset			
		Distance Information.			
		Register to other Device			
		External Data	,	•	
		X Cut Re Drey			
	Ι.	× Delete	_		
		Change Node Address	_		
lines a	lings of Der	Change Device Opminent.			
	Tatal.	22 Edit I/O Comment			
		Synchrionize (dentity			
Ressage Code Date Description	il su	Change Device Type			
		AP Broperty			
Annet Langever Oriente Contervente Oriente Oriente Contervente Oriente Oriente Contervente () Oriente Contervente ()	Image: Solution of the soluti				
---	---	--			
	Tatul.				

3.6.3 Sysmac Studio software settings

3.6.3.1 Create a new project

Double click the



icon to open the software, select "New Project", enter "Project name",

select the device type, and click "Create".

Sysmac Studio (32bit)					0 0 2
				_	_
Offline				_	
New Project	💼 Project F	roperties			
Conse Depinet	Project name	GD350_EthenetIP_test			
á ^p Import	Author	Administrator			
ିଲ୍ଲ Export	Comment				
Online					
4 Connect to Device	Туре	Standard Project			
Version Control					
🕀 Version Control Explorer	Til Select	Device			
License		Controller			
🖬 License	Device	NXLP2	 9024DT 		
Trial Version	Version	140			
Remaining dates 30					
				2	

After a new project is created completely, you can enter the following interface. Right click the device icon and select "Rename" to change the device name (you can choose not to change it).



3.6.3.2 Connection setting

Click "Controller" in the menu bar, and select "Communications setup".

GD350_EthenetIP_test - NX1P2 -	Sysmac Studio (32bit)			- C ×
File Edit View Insert Project	Controller Simulation Tools	Window Help		
X • • • • • • • •	Communications Setup		* # # * * 0 0 2 2 H 0 0	
Maria da como de la com	Change Device	Child	· · · ·	
Muteriew Explorer	Offline	Ctrl+Shift+W		Control of the second s
NX1PZ V	Synchronize	Ctrl+M		Andrea Communica
Configurations and Setup	Transfer	•		Analog Conversion
V II POUs	Mode	•		- BLD Committee
▼ 3€ Programs	Monitor Stop Monitoring			Bit string Processing
V 🖂 Program0	Sat/Reset			Communications
L (1) Functions	Forced Refreshing			Comparison
L (0) Function Blocks	MC Test Run	•		Conversion
► Deta	MC Monitor Table			Counter
	CNC Coordinate System Moni	tor Table		Data Movement
	Controller Clock			Data Type Conversion
	Release Access Right			► FCS
	Update CPU Unit Name			Ladder Tools
	Security	•		- ∓ x ► Math
	Clear All Memory			Motion Control
	Reset Consolien.		Location I	► Other
				Program Control
🖬 filter 🕑	🖨 Output 📈 Build			

Select "Ethernet-Hub Connection" as the connection method, enter the remote IP address "192.168.250.1", and click "Ethernet communication test". Click "OK" when the status bar shows "Test succeeded".

3.6.3.3 Set data labels

Select "Programming" \rightarrow "Data" \rightarrow "Global Variables" in the left menu bar, and add global

variables as needed. Note that you shall select "WORD" in the "Data Type" column and select "Input/Output" in the "Network Publish" column. Take "ODVA Basic speed control assembly" as an example, and create four global variables.

File Edit View Insert Project	Controller Simulation	Tools Window	Help		_					
X @ @ @ 5 < Ø	- 	8 # A 9	R 🛕 🔌				щαе			
- Multiview Explorer 🔹 🔍	Global Variables X								- Toolbox	. 1
new_Controller_0 •	Name	Data Type	Initial Value	AT	Retain	Constant N	ietwork Publish	Comment	<search></search>	
Configurations and Setup	CW PZD.OUT	WORD	16#0			0ut	put v put v			
V d POIR	SW SW	WORD	16#0				t v			
▼3€ Programs ▼ ⊟ Program0	P20,1N	WORD	1040				a ·			
L @ Section0										
L 35 Function Blocks									Ĩ	
USE Data										
Global Variables										
	Build	-						- 1	×	
	I I Desc	iption I							2	
										2
🖪 Filter 🖉	ቭ Output 🖌 Build									

Click "Tools" in the top menu bar, and select "EtherNet/IP Connection Settings".



Double click "Built-in EtherNet/IP Port Settings".

File Edit View Insert Project Controlle	er Simulation Tools Window	Help				
X 40 40 10 10 10 10 10 10 10 10		R 🔺 🔌 😂 🖗	∿ ¶ O 2 2 I			
Multiview Explorer • 0 Int Global Vi	ariables EtherNet/IP Device List X				Toolbox	• •
new_Controller_0 +	ode Address	Device I	Description		<search></search>	
Configurations and Setup	168.250.1 Built-in EtherNet/IP Por	1 Settings	NX1P2			~
Programming						
V @ POUs						
▼ 3E Programs						
V 🖂 Program0						
L & Section0						
L 30 Functions						
T III Data						
U.54 Data Types						
Global Variables						
► Etti Tasks						
0.74						
S 100 000				•••		
1 1	Description	Program I Locatio	n I			
						2
El Filter 💽 ቭ Output	K Build					

Right click the blank area under "Tag Set", and select "Create New Tag Set".

File Edit View Insert Project Controller Simulation Tools Window Help	
「 デ のの江 いいひき チャネスダ マ 日本 花目目 非正式 目目 かん 雪 雪 キャ	
Multiview Explorer • 9 batt Clobal Variables EtherNet/P Device Lat Built-in EtherNet/Pection Sex	Toolbax 🔹 🖗
Multice for a set of the set of t	Toolbox v P Target Device Variable Name 1 Size (Byte)
Byper at ing sets Delet Al Douod Eng Sets 11 Fiber 21 Al Doubs - Build	

The input tag set is named "INPUT", right click "INPUT" to select "Create New Tag", and add the input global variables to the "INPUT" tag set. Pay attention to the order of the data sequence.



Repeat above steps for "OUTPUT" tag set and "OUTPUT" tag.

File Edit View Insert Proje	xt Controller Simulation Tools Window Help	
X 0 0 0 0 0 0	■ 「中人影目目後を回った」 ▲ ★ おちゃまつかね 耳ののよ	
Multiview Explorer 🔹 🖣	1	oolbax 🔹 🖡
new_Controller_0 Configurations and Setup	II- Tag Set	arget Device
The CPU/Expansion Racks	Device Information	
at UO Map	II-18 ▼ 1ag Sets	
Controller Setup	Tag Sets/Max: 2 / 32 Tags/Max: 4 / 256 Registration All Import Export	
Mation Control Setup	anyat decrea	N - U
6' Cam Data Settings	I Tag Set Name I Bit Selection I Size (Byte) I Size (Bit) I Instance ID I Controller Status IOut	Variable Name I Cas (Date)
Event Settings	▼ OUTPUT 4 Auto Not included	variable Name 1 aste (byte)
B Task Settings	CW 2 0 Clear	
En Lata Trace Settings	PZD_OUT 2 0 Clear	
V II POLK		
▼ 2€ Programs		
V 🖂 Program0	No.	
L @ Section0	Restart Return All to Default	
L 38 Functions		
L 37 Function Blocks	Transfer to Controller Transfer from Controller Compare	
V = Data		
L 25 Data types	5.7 X	
E I Tark	Statement (Avenue)	
P DI 18545	I I Description I Program I Location I	
🖬 filter 🕑	📇 Output 🧭 Build	Import Tag Set

3.6.4 Import and export data tags

3.6.4.1 Export data tags from Sysmac Studio

After data tags are set completely, click "Export" to export the data tag to a local folder, and save it as "ST600_test.csv" format.

File Edit View Insert Proje	ect Controller Simulation Tools Window Help	
X ● & ● うぐ	■ 中人教員問題本書目 査 ▲ ★ 8 半 4 手 言 つ い 2 三 日 魚 点 人	
Multiview Explorer 🔹 🔻	Int Global Variables EtherNet/IP Device List Ruit-in EtherNet/IPection Se ×	Toolbox 🔹 🔻
new_Controller_0 Configurations and Setup Conf	Tag Set	arget Device
Controller Setup In Motion Control Setup	Inst Distant	N - N
er' Cam Data Settings	Tag Set Name Bit Selection Size (Byte) Size (Bit) Instance ID Controller Status (Out)	
Event Settings	OUTPUT 4 Auto Not included	Variable Name Size (Byte)
Task Settings	CW 2 0 Clear	
El: Data Trace Settings	PZD_OUT 2 0 Clear	
Programming POUs S: Programs Figure Pous		
L d: Section0	Restart Return All to Default	i i
L 36 Functions L 36 Function Blocks V III Data	Townler is Controller	
L 3% Data Types	suid v # x	
► Ptt Tasks	L Description Description	
	· · Leturgation · Program · Location ·	
E Filter 🖌	A Build	Import Tag Set

3.6.4.2 Import data tags into Network Configurator

In the "Network Configurator" software, double click the PLC device icon, click "To/From File" in the lower right corner, and select "Import from File...".

🙀 Untitled - Network Configurator	- 00 SS
File Edit View Network Device EDS/File Tools Option Help	
□ 字目 ▲ ● ● (14 A) ● ● (1 B) ▲ ● (1 B) ▲ ● (1 B) ▲ ■ ■ ● (1 B) ▲ ■ ● (1 B) ▲ ■ ■ ■ ■ ● (1 B) ▲ ■ ■ ■ ■ ■ ● (1 B) ▲ ■ ■ ■ ■ ■ ● (1 B) ▲ ■ ■ ■ ■ ■ ● (1 B) ▲ ■ ■ ■ ■ ■ ■ ● (1 B) ▲ ■ ■ ■ ■ ■ ■ ■ ■ ● (1 B) ▲ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	
(5) (2) <td></td>	
Provide Figure 2	a
Bit = 1 Image: State 1	
Bernet Bernet	
Figure 100 Detail. Detail. Detail. Detail. Detail. Detail. Detail. Detail. Detail.	
Boot to Fie.	
Bate Second II 2: 2: 7: 10: 10: 10: 10: 10: 10: 10: 10: 10: 10	
Ready LEtherNet/IP TEtherNet/IP TwinCAT-Intel PCI Ethernet Adapter (Gigabit) 1923/88250.4 1000M @ On-line	NUM

Select the file "ST600_test.csv" exported from Sysmac Studio, and click "Open".

GD350_EthernetIP_test - Network Configurator	Edit Device Param	Import Connection Configuration		× >	- a ×
File Edit View Network Device EDS File Tools Option Hel	Connections V	and the second second second	0 4 mm		
🗅 📽 🖬 토 토 🕹 🕹 (김 씨 🗟 😵 🖉 🖉 👗 🖄 📾	Connections 1	童珍白色的(1); sysmac studio workspace			
5 9 2 2 4 + 7 0 2 2 2 2 2 2 2 2 2	Unregister De	88 ^	(#20日) 2 (201		
X CetherNet/P		GD350_test.csv	2020/5/15 15:46 N	licrose	
Instantion and instantial former instantial instantinstantial instantial instantial instantial instantial instantial	Convertions : Register Devi Product Nar	Co150,mtory	2020/5/15 15:48 N		
Osege al Device Bar		<		-	
< >	New	文件編(N): GD350_test.csv	打开(C) From File	
anna an Anna Anna Anna Anna Anna Anna A		文师简显(T): CSV Format File (*.csv)			
Ready				Rin Din	On-line

3.6.4.3 Data tag corresponding connection

Select the device "192.168.250.2" under the "Connections" tab, and click the Move Down button.

Untitled - Network Configurator	
File Edit View Network Device EDS File Tools Option Help	
□ ☞ ■ 표 표 ● → (本 和) ● ● ≠ ■ ◎ × ■ ◎ × ■ Ⅲ ∰ ∰ % %	
Image: Source Construction State (State State Sta	
Image: Start of a start of	
Biter	
Restage Cole Date Description	
PERCENSE DOCUMENTER 17:22-07 102-108-250 Theory or write particular to the second	
VIDV. 3000 2000/09/10 11.23.11 3499 TLA #45 Complexits.	

Double click the device "192.168.250.2", set the data input/output tags, and click "Regist".

EtherNet/IP	dit Device Parameters : 192.168.250.90 NX1P.	2	8
	Connections Tag Sats		
	Veregister Device List	192.168.250.2 INVT Edit Connection	×
192.168.250.90 NDC1P2		It will add a connection configuration to originator Please configure the Tag Set each of originator devi-	r device. ice and target
- I		Originator Device	Target Device
		Node Address 192.168.250.90	Node Address 192.158.250.2
		Comment : MX1P2	Comment : INVT
	Begister Device List	Input Tag Set dit Tag Set:	Output Tag Set
	Product Hama 192.168.250.9	Connection Bulti-cast connection *	E> Izput_TO - [48yte] •
		Output Tag Set dit Tag Set:	Input Tag Set
		Connection Type: Point to Point connection -	Ostput_20 - [43yte] -
		Show Datail	Regist Close
Usage of Device Ba	L. L		
Detail	Fev Edit Delete Edit :	All Dange Target Node ID To/From File	
Description			

3.6.5 PLC program downloading and online monitoring

3.6.5.1 Sysamc Studio downloading

Click the Online button (If the device name has been changed, the following interface will pop up, and you can click "No").



Click "Transfer to Controller" under the "Built-in EtherNet/IP Port Settings" tab.

ą	🖭 Global Va	riable	s EtherNet/IP Device List	Built-in EtherNet/IPecti	on Se >	<					
ļ	0-	1	🖬 Tag Set								
	o.‡8	►I V1	levice Information ag Sets		_	_	_	_	_	_	-
	40		ag Sets/Max: 2 / 32 Tags	Max: 4 / 256				Registration All	Import	Export	
		Inp	ut Output								
			Tag Set Name	Bit Selection	Size	(Byte)	Size (Bit)	Instance ID	Controller Status	Output at Fatal Er	1
		Ľ	CW		4		0	Auto	Not included	Cleared	
			PZD OUT		2	-	0			Cleared	
Ξ			-								
											_
			Restart						L	Return All to Defau	ult
						Tran	sfer to Controller	Transfer from	1 Controller	Compare	
										oongare	
	Build										, ‡ ×
1	😒 0 Errors	1	Warnings								

Click "Yes".

🗺 Global Var	iables EtherNet/IP Device Lis	Built-in EtherNet/IPection Se ×
۵.	💶 Tag Set	
	Device Information	
a48	▼ Tag Sets	
40	Tag Sets/Maxc 2 / 32	Tags/Max: 4 / 256 Registration All Import Export
	Input Output	
	I Tag Set Name	Transfer to Controller Controller Controller Status (Output at Fatal Err)
		Not included
	PZD_OUT	Are you sure you want to execute the transfer to the Controller?
		Caution: Connection will stop during the transfer.
		The Unit will be restarted after the transfer.
	Restart	Return All to Default
		Transfer to Controller Transfer from Controller Compare
0.11		
	A 0 Warnings	÷ * *
1 1	Description	Program I Location I

Click the "Sync" function button.

<i>ð</i> 4	. X	5. F2	👬 🖊 🖳	R 🔺 🔌 63	😫 🐤 🕯	0 <u>8</u> 2	n o' o'	2		
별 Global Va	ariable	s EtherNet	/IP Device List	Built-in EtherNet/IPecti	ion Se ×					4
0+	1	🕞 Tag S								
¤€₿	▶ [▼ 1 1 Inp	Device Informa ag Sets ag Sets/Max ut <mark>Output</mark>	tion 2/32 Ta	gs/Max: 4 / 256			Registration A	ll Import	Export	
	Ē	<u>і т</u>	ag Set Name	Bit Selection	Size (Byte)	I Size (Bit)	Instance ID	Controller Status	Output at Fatal Err	
	•	OUTPUT			4		Auto	Not included		
		CW			2	0			Cleared	
		PZD_OUT			2	0			Cleared	
		Restart			Т	ransfer to Controli	er Transfer from	n Controller	Return All to Default Compare	
uild				_	_			_	- 0	×

Select the device "NX1P2", and click "Transfer To Controller".

Synch	Synchronization						
	Computer. Data Name	Computer: Update Date	Controller: Update Date	Controller: Data Name	Compare		
₩ 0	- N01P2	2020/9/18 18:08:59	2020/6/24 11:28:15	·· N01P2			
1							
Legend:	Synchronized						
Clear	the present values of variables with Retain	attribute (Valid for Transfe	er to Controller).				
Do n	ot transfer the POU program source (Valid	for Transfer to Controller).	All data will be re-transfe	red when this option is changed.			
Do n	ot transfer the following. (All items are no Unit application data on the CDLL Pack an	t transferred.) d Ethor (AT, claus, backup, i	osramaterr				
- Uni	t operation settings and NX Unit application	data on Slave Terminals.					
🗹 Don	ot transfer the EtherNet/IP connection setting						
🖲 All	All data will be transferred because the projects in the computer and the controller are different.						
		ransfer To Controller	ransfer From Controller	Recompare Close			

Click "Yes".

🗺 Global Variable	s EtherNet/IP Device List Built-	n EtherNet/IPection Se $ imes$			-
0- 0	🕞 Tag Set				
	Device Information				
n.∔8 ▼1	ag Sets				
	'ag Sets/Max: 2 / 32 Tags/Max:			Registration All Impo	ert Export
Inp	ut Output				
	Sysmac Studio				out at Fatal Erri
	Confirm that there The operating more refreshing will be Are you sure that	e is no problem if the controlle de will be changed to PROGR/ cancelled. you want to execute the transl	r operation is stopped. M mode. Then, EtherC ier?(Y/N) No	AT slaves will be reset and for	ed ced
	Restart				Return All to Default
					Compare
				· · ·	
Output					~ û X

Click "Close" when the "Controller" status in the lower right corner is two green lights.

Syr	chronization						
	Computer: Data Name	Computer: Update Date	Controller: Update Date	Controller: Data Name	Compare	_	
	->ND3192	2020/9/18 18:08:59	2020/9/18 18:08:59	►NICIP2			
							Toolbax 👻 🔻
							Target Device
						Export	
						at Fatal Ent	
Legen							
= 0							
• N							
🖬 De	not transfer the following. (All items are no	t transferred.)					
	VX Unit application data on the CPU Rack an Init operation settings and NX Unit application	nd EtherCAT slave backup n data on Slave Terminals	parameters.				
2 0x	not transfer the EtherNet/IP connection setti	ngs (i.e., tag data link settin				1 to Default	
	he Surchmaintains nurses surgestfully Eaith	ed.					Controller Status - #
						pare	Ex.
							ONLINE 9 192.168.250.1
						- 9 ×	ERR/ALM PROGRAM mx
						 L	
		Transfer To Controller	ransfer From Controller	Recompare Cose			
		_					

3.6.5.2 Network Configurator downloading

Click the icon of "Download to Device", and click "Yes".

■ 20150 (Bernard) tet. Notex Configurate — 0 目: [di yee yetex A configurate C0] [H: 2016: 20160: 20160: 2016 □ (ag) 日: 名 [20] (b, 20] (b, 2016) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b	×
Constrained active to the state of the	
Instance Calls Non- Non-	
Ready LEtherNet/IP TEtherNet/IP TEtherNet/IP Intel® Ethernet Connection (4) (219-141 192-168-250.5 1000M @ On-line	

Click the icon of "Download to Network", and click "Yes".

GD350_EthernetIP_test - Network Config	gurator	- 0 X
elle Edit View Network Device EDS	i File Tools Option Help	
🗅 🚅 🖬 🛎 💐 🖓 🖄 씨는 🎙	▶ # # 3 % @ × 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
K 0 1 1 1 4 + V 0 1 1	F F S F F F	
	* A BharNeal P 1	
Itered Cadjuster Itered Cadjuster	ITE VIGOR VESSOR ITE VIGOR ITE VIGOR ITE VIGOR ITE VIGOR ITE VIGOR Ite offers to malite rate configuration, downloading parameters GO	;
	Vsape of Device Daubilit (0)	
	Densil	
	,	
Ressage Cole 341e 0 406-0000 2020/05/16 16:10:37 0 405-0000 2020/05/15 16:10:06	Description 1 - Dendard dé deries promotie eux amplitud 6 - Dealard dé deries promotie aux amplitud.	
anti	I-FiburNatilD T-FiburNatilD Intel®) Ethernal Connection (#1019-108-250-5-1000M @ On-Sna	

3.6.5.3 Sysamc Studio online monitoring

Click the "Run" icon, turn the PLC to "Run Mode", and click "Yes".

Projet	ect Controller Simulation Tools Window Help	
c 6	Ø ♂ ∧ ※ ज़ ज़ ☆ ∧ ◎ ▼ ▲ ∧ ≫ ↔ ♥ ♥ ♥ ♥ № ♥ № ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ♥	
• 9	Net Global Variables EtherNet/IP Device List Built-in EtherNet/IP. ection Se ×	-
	Tag Set	
acks	Christ Information T fig Set T as set-Max: 2 / 32 Test/Max: 4 / 256 Regulation All Import Expert T Tag Set-Max: 2 / 32 Test/Max: 4 / 256 Regulation All Import Expert	1 1 1
etup	Input (Output)	1
s 35	Eng Set Name El BL Sección Sore (949) Sore (940) Instance ID Controler Souto, Outpoint al faita En CV CV P20_OUT Make sure a Controller startup vill cause no problem. De you samt to chunge to RUM Mode? (7/N) Test No	
ks	Return All to Default	ſ
les -	Transfer to Controller Transfer from Controller Compare	
	Output • 9	с.

Click "View" on the top menu bar, and select "Watch Tab Page".



Enter the variable name in the "Watch Tab Page" to monitor the value of the variable, and change the value in real time in the "Modify" box.

			7			- ù
l Name	Online value	Modify	Comment	Data type	I AT	
CW	0001	1		WORD		- I
PZD_OUT	1388	1388		WORD		
SW	0004			WORD		
PZD_IN	1388			WORD		

4 EtherCAT communication card

4.1 Overview

- Thanks for choosing Sourcetronic EC-TX508 communication cards. This manual describes the function specifications, installation, basic operation and settings, and information about the EtherCAT protocol. To ensure that you install and operate the product properly, read this manual and the communication protocol section in the VFD operation manual carefully before you use the product.
- This manual only describes how to operate the EC-TX508 communication card and the related commands but does not provide details about the EtherCAT protocol. For more information about the EtherCAT protocol, read the related specialized articles or books.
- 3. EC-TX508 communication card is defined as an EtherCAT slave station communication card and is used on a VFD that supports EtherCAT communication.
- 4. The EtherCAT communication of this communication card supports two types of process data for reading data from and writing data to VFDs. They are PDOs (process data objects) and SDOs (service data objects) for reading data from and writing data to the object dictionary defined by the manufacturer.

4.2 Features

1. Supported functions

- Supports the EtherCAT COE 402 protocol.
- Supports automatic network address setting
- 2. Supported services
- Supports the PDO service
- Supports the SDO service
- Supports the object dictionary defined by the manufacturer
- Allowing SDOs to read data from and write data to VFD function codes

3. Supported EtherCAT synchronization cycle

Table 4-1 Supported synchronization cycle

Item	Supported specification
Supervision evalu	250us
Synchronization cycle	500us

Item	Supported specification
	1ms
	2ms

4. Communication ports

Standard RJ45 ports are used in EtherCAT communication. The communication card provides two RJ45 ports with transmission direction defined. Figure 4-1 shows the ports. IN (indicating input) and OUT (indicating ouput) are EtherCAT wiring network ports. Table 4-2 describes the port pins.



Figure 4-1 RJ45 ports

Table 4-2 RJ45 port pins

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

5. State indicators

The EtherCAT communication card provides four LED indicators and four net port indicators to indicate its states. Table 4-3 describes the state indicators.

Item	Color	Function description
	Green	The green indicator indicates EtherCAT running state.
		Init state: It remains off.
RUN		Pre-OP state: It blinks off 0.2s and on 0.2s.
		Safe-OP state: It blinks off 1s and on 0.2s.
		OP state: It remains on.
ALM	Red	The red indicator indicates EtherCAT fault state.
		No fault: It remains off.

Table 4-3 State indicators

Item	Color	Function description			
		Init or Pre-OP state: It blinks off 0.2s and on 0.2s.			
		Safe-OP fault state: It blinks off 1s and on 0.2s.			
		OP fault state: It remains on.			
PWR	Red	3.3V power indicator			
		Off: Indicates that Ethernet connection is not established.			
Network	Yellow	On: Indicates that Ethernet connection is established			
Net port		successfully.			
Indicator	Green	Off: Without connection			
(11)		On: Wilth connection but inactive			
		Blinks: With connection and active			
		Off: Indicates that Ethernet connection is not established.			
Network	Yellow	On: Indicates that Ethernet connection is established			
Net port indicator (OUT)		successfully.			
		Off: Without connection			
	Green	On: Wilth connection but inactive			
		Blinks: With connection and active			

4.3 Electrical wiring

The EtherCAT network usually consists of a master station (PLC) and several slave stations (drives or bus extension terminals). Each EtherCAT slave station are configured with two standard Ethernet interfaces, and the electrical wiring diagram is shown in Figure 4-2.



Figure 4-2 Electrical wiring diagram for a linear topology

4.4 Communication

4.4.1 CoE reference model



Figure 4-3 CoE reference model

CoE network reference model consists of the data link layer and application layer. The data link layer is responsible for EtherCAT communication protocol. CANopen drive Profile (DS402) communication rules are embedded in the application layer. The object dictionary in CoE includes the parameters, application data, and PDO mapping configuration information.

PDOs are composed of the objects (in the object dictionary) that can perform PDO mapping. The content in PDO data is defined by PDO mapping. PDO data is periodically read and written, which does not require searching the object dictionary. Mail box communication (SDO) is not periodic, which requires searching the object dictionary.

Note: To parse SDO and PDO data correctly on the EtherCAT data link layer, it is necessary to configure FMMU and Sync Manager (SM).

Synchronization management	Configuration	Size	Start address
Sync Manager 0	Assigned to receive SDO	512byte	0x1000
Sync Manager 1	Assigned to send SDO	512byte	0x1400
Sync Manager 2	Assigned to receive PDO	128byte	0x1800

Table 4-4 EtherCAT Sync Manager configuration

Synchronization management	Configuration	Size	Start address	
Sync Manager 3	Assigned to send PDO	128byte	0x1C00	

4.4.2 EtherCAT slave station information

EtherCAT slave station information file (.xml) is read by the master station to construct the master and slave station configuration. This file contains mandatory information about EtherCAT communication settings. Sourcetronic provides this file EC-TX508_100.xml.

4.4.3 EtherCAT state machine

EtherCAT state machine is used to describe the states and state change of slave station applications. Generally, the master station sends a state change request, while the slave station responds. The state change flow is shown in the following figure.



Figure 4-4 EtherCAT state machine flowchart

Table 4-5 Ethe	rCAT state	machine	description
----------------	------------	---------	-------------

State	Description			
Init	Both SDO and PDO communication are unavailable.			
Init to Pre-Op	The master station configures the data link layer address and SM channel for SDO communication. The master station initializes DC synchronization information. The master station requests the jump to the Pre-Op state. The master station configures the application layer control register. The slave station checks whether the mailbox is initialized properly.			

State	Description				
Pre-Op	SDO communication is available but PDO is unavailable.				
Pre-Op to Safe-Op	The master station configures the SM and FMMU channels for PDO communication. The main station configures PDO mapping through SDO communication. The master station requests the jump to the Safe-Op state. The slave station checks whether the PDO and DC are configured				
Safe-Op	SDO communication is available. Communication of receiving PDOs is available, but that of sending PDOs is unavailable, in the Safe state.				
Safe-Op to Op	The master station requests the jump to the Op state.				
Ор	Both SDO and PDO communication are available.				

4.4.4 PDO mapping

The process data of an EtherCAT slave station is composed of SM channel objects. Each SM channel object describes the consistent area of the EtherCAT process data and includes multiple PDOs. An EtherCAT slave station with the application control function shall support PDO mapping and reading of SM PDO assigned objects.

The master station can select objects from the object dictionary to perform PDO mapping. PDO mapping configuration is located in the range of 1600h–1603h (RxPDOs: receiving PDOs) and range of 1A00h–1A03h (TxPDOs: sending PDOs) in the object dictionary. The PDO mapping method is shown in the following figure.

Object dictionary				
Index	Sub- index	Object content	h	6064 indicates index 00h indicates sub-index 20h indicates parameter bit length
1A00h	0	0x03		
1A00h	1	0x60410010		
1A00h	2	0x60640020		
1A00h	3	0x60B90010		
Index	Sub- index	Object content	Bits	1A00h(PDO-1) Object Object Object B E G
6040h	0	Object A	10h	
6041h	0	Object B	10h	
6042h	0	Object C	10h	
6060h	0	Object D	8h	
6064h	0	Object E	20h	
60D8h	0	Object F	10h	
60B9	0	Object G	10h	

Figure 4-5 PDO mapping method

In addition to PDO mapping, EtherCAT process data switching needs to assign PDOs to SM channels. The relationship between PDOs and SM channels is established through SM PDO assigned objects (1C12h and 1C13h). The mapping between SM channels and PDOs is shown in the following figure.

Object dictionary						
Index	Sub- index	Object content	\vdash			
1C13h	0	0x02				
1C13h	1	0x1A00				
1C13h	2	0x1A01] [1C13h	PDO 1	PDO 2
		1				
Index	ndex Object content					
1A00h		PDO_1				
1A01h		PDO_2				
1A02h	1	PDO_3	1			
1A03h		PDO_4]			



Default PDO mapping (Position, Velocity, Torque, Torque limit, Touch probe):

RxPDO (0x1600)	Control word (0x6040)	Target Position (0x607A)	Target Velocity (0x60FF)	Target Torque (0x6071)	Max. Torque (0x6072)	Mode of Operation (0x6060)	Profile velocity (0x6081)	Touch Probe Function (0x60B8)
TxPDO (0x1A00)	Statusw ord (0x6041)	Position Actual Value (0x6064)	Speed Actual Value (0x606C)	Torque Actual Value (0x6077)	Following Error Actual Value (0x60F4)	Mode of Operation Display (0x6061)	Error Code (0x603F)	Touch Probe Value (0x60BA)

4.4.5 DC-based network synchronization

The DC (distributed clock) can enable all EtherCAT devices to use the same system time so as to control the synchronous execution of all device tasks. In the EtherCAT network, the clock with the DC function of the first slave station connected to the master station is used as the reference clock across the network. The other slave stations and master station use this reference clock for synchronization.

Free-Run: The running cycle and communication cycle of each servo drive are not related to the communication cycle of the master station.

DC Mode: The servo drive performs synchronization through Sync0 of the master station.

4.5 CiA402 device protocol

The master station controls the drive through the control word (0x6040) and obtains the current state of the drive by reading the status word (0x6041). The servo drive implements motor control based on master station control commands.

4.5.1 CoE state machine



Figure 4-7 CANopen over EtherCAT state machine

Status	Description
Not Ready to Switch On	The drive is in the initialization process.
Switch On Disabled	Drive initialization completes.
Ready to Switch On	The drive is preparing to enter the Switch On state, but the motor is not excited.
Switched On	The drive is in the ready state, and the main circuit power supply is normal.
Operation Enable	The drive is enabled and controls the motor based on the control mode.
Quick Stop Active	The drive stops in the set manner.
Fault Reaction Active	When detecting an alarm, the drive stops in the set manner, but the motor still has the exciting signal.
Fault	The drive is in the faulty state, and the motor has no exciting signal.

6040h control word includes:

- 1. Bit for status control;
- 2. Bit related to control mode;
- 3. Factory-defined control bit.

15 1	1	10	9	8	7	6	4	3	2	1	0
Factor define	y	Rese	rved	Suspend	Fault reset	Ope m	ration ode	Servo running	Quick stop	Switch on main circuit	Servo being running
0		С)	0	М		0	М	М	М	М
MSB					LSB						

The bits of 6040h are described as follows.

BITS 0-3 AND 7 (used for status control):

Command	Fault reset	Enable operation Quick stop		Enable voltage	Switch on	Transitions
Shutdown	0	Х	1	1	0	2,6,8
Switch on	0	0	1	1	1	3*
Switch on	0	1	1	1	1	3**
Disable voltage	0	Х	Х	0	Х	7,9,10,12
Quick stop	0	Х	0	1	Х	7,10,11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4,16
Fault reset	0-1	Х	Х	Х	Х	15

BITS 4, 5, 6 AND 8 (related to control mode)

	Operation mode						
Bit	Profile position mode	Profile velocity mode	Homing mode				
4	New set-point	Reserved	Homing operation start				
5	Change set immediately	Reserved	Reserved				
6	Abs/rel	Reserved	Reserved				
8	Halt	Halt	Halt				

Control word is set to 0x0F for enabling the drive. Otherwise, the drive will stop. When a fault occurs, if bit 7 of the control word is set to 1, the reset command is enabled.

6041h status word includes:

- 1. Current status bit of drive;
- 2. Status bit related to control mode;
- 3. Factory-defined status bit.

The bits of 6041h are described as follows:

Bit	Bit Description	
0	Ready to switch on	М
1	Switched on	М
2	Operation enabled	М
3	fault	М
4	Voltage enable	М
5	Quick stop	М
6	Switch on disabled	М
7	Warning	0
8	Manufacture specific	0
9	Remote	М
10	Target reached	М
11	Internal limit active	М
12-13	Operation mode specific	0
14-15	Manufacturer specific	0

BIT0-3, 5, AND6:

Value(binary)	State
xxxx xxxx x0xx 0000	Not ready to switch on
xxxx xxxx x1xx 0000	Switch on disabled
xxxx xxxx x01x 0001	Ready to switch on
xxxx xxxx x01x 0011	Switched on
xxxx xxxx x01x 0111	Operation enabled
xxxx xxxx x00x 0111	Quick stop active
xxxx xxxx x0xx 1111	Fault reaction active
xxxx xxxx x0xx 1000	Fault

BIT4: Voltage enable, when this bit is 1, it indicates that the main circuit power supply is normal.

BIT9: Remote, when this bit is 1, it indicates that the slave station is in the OP state, and the master station can control the drive through PDO.

BIT10: Target reached, this bit differs in meaning under different control modes. When this bit is 1, in cyclic synchronous position mode, it indicates that target position is reached, while in cyclic synchronous velocity mode, it indicates that reference speed is reached; in homing mode, it indicates that homing is completed.

BIT14: When this bit is 1, it indicates motor zero-speed state.

BIT7-8, BIT11-13, and BIT15: Reserved.

4.5.2 Device running mode

Set P00.01=2 (command running channel), P00.02=3 (EtherCAT communication channel), and P16.18 Communication timeout. Position mode and homing mode are achieved only when the drive is in the closed-loop mode.

6.5.2.1 Cyclic Synchronous Position Mode

1. Set 【6060h: Mode of operations】 to 8 (Cyclic synchronous position mode).

2. Set [6040h: Control word] to enable the drive (set it to 0x0F for enabling).

3. Set 【607Ah: Target position】 to the target position (unit: user unit).

4. Query for 【6064h: Position actual value】 to obtain actual position feedback of the motor.

5. Query for 【6041h: Status word】 to obtain the status feedback of the drive (following error, target reached and internal limit active).

6. For function details, see function parameters in group P21 in ST600 and the specific function commissioning instructions in the basic operations in the manual.

6.5.2.2 Profile Position Mode

1. Set 【6060h: Mode of operations】 to 1 (Profile Position Mode).

2. Set tens of P21.00 (Position command source) to 1 (Digital position), and set P21.16 (Digital positioning mode).

3. Set 【6040h: Control word】 to enable the drive (set it to 0x0F for enabling).

4. Set 【607Ah: Target position】 to the target position (unit: user unit).

5. Query for 【6064h: Position actual value】 to obtain actual position feedback of the motor.

6. Query for 【6041h: Status word】 to obtain the status feedback of the drive (following error, target reached and internal limit active).

7. For function details, see function parameters in group P21 in ST600 and the specific function commissioning instructions in the basic operations in the manual.

6.5.2.3 Homing Mode

1. Set **[**6060h: Mode of operations **]** to 6 (homing mode).

2. Set P22.00.Bit0=1 to enable the spindle positioning, and set P22.03-P22.06.

3. Set 【6040h: Control word】 to enable the drive (set it to 0x0F for enabling). Homing operation start (Bit4) changes from 0 to 1 (Control word Bit4 is set to 1). However, the change from 1 to 0 will terminate Homing.

4. The motor queries the limit switch and Home switch to complete Homing.

5. Query 【6041h: Status word】 to obtain the status feedback of the drive (Homing error, Homing attained, and Target reached).

6. For function details, see function parameters in group P22 in ST600 and the specific function commissioning instructions in the basic operations in the manual.

6.5.2.4 Cyclic Synchronous Velocity Mode

1. Set 【6060h: Mode of operations】 to 9 (Cyclic synchronous velocity mode).

2. Set 【6040h: Control word】 to enable the drive (set it to 0x0F for enabling) and start the motor for running.

 Set 【60FFh: Target velocity】 to set the target rotation speed (unit: rpm), which corresponds to P00.10 (a positive value indicates forward rotation and a negative value indicates reverse rotation).

4. Query 【6041h: Status word】 to obtain the status feedback of the drive (Speed zero, Max slippage error, Target reached, and Internal limit active).

6.5.2.5 Cyclic Synchronous torque Mode

1. Set 【6060h: Mode of operations】 to 10 (Cyclic synchronous torque mode).

2. Set the VFD to torque control (P03.32=1).

3. Set 【6040h: Control word】 to enable the drive (set it to 0x0F for enabling) and start the motor for running.

4. Set 【6071h: Target torque】 to set the target torque.

5. Query [6041h: Status word] to obtain the status feedback of the drive (Speed zero, Max slippage error, Target reached, and Internal limit active).

4.6 Function code modification

Index	Sub-index	Description	Permission	Data type	Default				
2000h	0	Read function codes	RW	UINT32	0				
Bits 16-31:	Bits 16–31: Read function code addresses								
Bits 00-15:	No function								
Example of	read operation	n: Read the keyp	ad-set frequenc	y (value of P00.	10)				
SDO opera	ates 2000h to	write 0x00A00	000. View the	response value	of 2001h read				
operation.		Deed							
2001h	0	response	RO	UINT32	0				
Bits 16-31:	0x0001 read s	success							
Bits 00-15:	Parameter va	lue read by 2000)h						
Bits 16-31:	0x0003 read e	error							
Bits 00-15:	Error codes								
	0x0002 illegal	data address							
	0x0009 passw	ord protection							
00001	2	Write			0				
2002n	0	function	RW	UINT32	0				
Bits 16_31	Write function	codes							
Bits 00–15:	Written data	00000							
Write opera	ation example:	Modify the value	of P00.10 to 50	.00.					
SDO opera	tes 2002h to w	rite 0x000A1388	3. View the respo	onse value of 20	03h write				
operation.									
2003h	0	Write	RO	LIINT32	0				
200011	0	response	Ro	ONTIOL	Ŭ				
Bits 16-31:	Bits 16–31: 0x0001 write success								
Bits 00–15: Parameter value written by 2002h									
BITS 16-31: UXUUU3 Write error Pite 00, 15: Error codes									
רי-טי גוום אין									
0x0003 illegal data value									
0x0007 read-only parameter									
0	x0008 the para	ameter is unchar	ngeable during r	unning					
Bits 16–31: Write function codes Bits 00–15: Written data Write operation example: Modify the value of P00.10 to 50.00. SDO operates 2002h to write 0x000A1388. View the response value of 2003h write operation. 2003h 0 Write response RO UINT32 0 Bits 16–31: 0x0001 write success Bits 16–31: 0x0003 write error Bits 16–31: 0x0003 write error Bits 00–15: Parameter value written by 2002h Bits 10–15: Error codes 0x0002 illegal data address 0x0007 read-only parameter 0x0007 read-only parameter 0x0007 read-only parameter									

4.7 Example of TwinCAT2 application

This example shows how to use TwinCAT2 as the main station to communicate with the EtherCAT module of the VFD.

1. Install TwinCAT2 software

2. Copy the EtherCAT configuration file (EC-TX508_100.xml) of ST600 to the installation directory of TwinCAT2 ("C:\TwinCAT\lo\EtherCAT").

3. Open TwinCAT2



4. Install the network card drive

👼 Untitled - TwinCAT S	ystem Manager - "CX-26ABBE"		
File Edit Actions View	Options Help		
🗅 🚅 📽 🖬 🚳	Language	- 🐘 🔍 @ 🗣 🔍 🚜 &# 🔍 🕵 🕲 🖇</th><th></th></tr><tr><th>B (B) <u>CYTER-L Carvay</u> Her PCC - Configuration B (B) 10 - Configuration B (</th><th>Ad gradeh Trans. Derike Vinder Trans. Sereiher Trans. Cord (Jer Trans.) Cord (Jer Trans.) Cord (Jer Trans.) Serein Law Arthough Serein Law Arthough Serein Law Arthough Sector Law Daniel Sector Law Daniel Sector</th><th>(Haget) Kost Setting (Haget) System Manager At 2234 T PLC Build 2239 BECKHOFF # 1955/201 mi.lenb.Mf.com</th><th></th></tr><tr><th></th><th>Show Real Time Ethernet Compatible Devices Change PCM/254 Ease Address</th><th>an Beckleff Automation</th><th></th></tr><tr><th></th><td>Update EtherGAT Device Descriptions Edit Terminel Types</td><td>Beckhoff Automation GmbH OF68-48EC-D001-1DDF</td><td></td></tr></tbody></table>	

Open the menu as shown in the above figure, select "Show Realtime Ethernet Compatible Devices...", pop up a dialog box as shown in the following figure, select the local area network card, and click "Install". After the network card is installed successfully, it will shown under the menu "Installed and ready to use devices". (Note: Please choose the network cards configured with Intel chips)



5. Set TwinCAT2 to be in the configuration mode



6. Scan device

Select "I/O Devices" menu, and right-click to select "Scan Devices..." to scan the device.



Pop up the following dialog box, and select "OK".



Pop up the following dialog box, and select "OK".

new I/O devices found		×
Device 1 (EtherCAT) Device 2 (RT-Ethernet) Device 3 (RT-Ethernet)	[PCI\Tcl8254x2] [PCI\Tcl8254x1]	OK Cancel
		Select All Unselect All

Pop up the following dialog box, and select "Yes".



Pop up the following dialog box, and select "Yes". Then the device enters the free running mode.



The following figure shows "Box3" which is the slave device scanned, and view that the device enters the "OP" state.



7. Process data input and output

Select "DO Outputs" menu, and there are data sent from the master station to the VFD, which can be used to set commands and rotation speed.

🖶 Untitled - TwinCAT System Manager - 'CX-27EDA8'								
File Edit Actions View Options Help								
000000000000000000000000000000000000000	i 📾 🗸 🍠 强 🧕	🐮 🖄 🛞 😵 🖹	Q #2	es 🍡 💇	1 🖉	•		
SYSTEM - Configuration	Norse	Online	Type	Site	>Addr	Inflout	Use	r ID Linked to
- Disconfiguration	 Control Word 	0x000F (15)	LONT	2.0	71.0	Output	0	
- PLC - Configuration	 Target Position 	0:00000000 (0)	DINT	4.0	73.0	Output	0	2.
- 💯 Can - Configuration	 Target Velocity 	0x000005DC (1500)	DINT	4.0	77.0	Output	0	
🖻 🛒 1/0 - Configuration	 Target Torque 	0x0000 (0)	INT	2.0	81.0	Output	0	
E 10 Devices	 Max Torque 	0x0000 (0)	DNT	2.0	83.0	Output	0	
E Device 1 (EtherCAT)	 Mode of Operation 	0x09 (9)	SINT	1.0	85.0	Output	0	
	 Profile Velocity 	0:00000000 (0)	DBNT	4.0	86.0	Output	0	
- Device 1-Image-Info	S Touch Probe Con	0:0000 (0)	UDVT	2.0	90.0	Output	0	
H- Incuts							_	
R- Qutputs								
🕀 🔒 InfoData								
E Term 1 (E(1200)								
B- (0 Boy 3 (INIT ECAT 100)								
H- N DI Innuts								
a di Colonta 1.								
AL Control Mond								
Turnet Dockion								
Target Polician								
Target Peloty								
 Target Torque 								
Made of Constitution								
Pice or Operation								
Prome Vescery								
the Webcate								
(a) Unrociata								
- B Mappings								

Select "DI Intputs" menu, and there are data sent from the VFD to the master station, which can be used to return the statuses and and rotation speed.

stitled - TwinCAT System Manager - 'CX-27EDAB'								-
Call Actors Yew Options Help		••• •• •• •• ••	0.20		A 19 1	,		
SYSTEM - Configuration	Name	Online	Type	3/20	>A69	35/04	User 10	Unked
NC - Configuration	Section Work	0.00007 (1809)	11007	2.0	71.0	Instant	0 0	
PLC - Configuration	Position Actual V	0+00000000 (0)	OBVE	4.0	73.0	Incast	0	
Can - Configuration	S Velocity Actual V	0x0000000F (15)	DINT	4.0	77.0	Input	0	
tio - Configuration	 Torque Actual Value 	0+0000 (0)	INT	2.0	81.0	Input	0	
10 Devices	Following Error A	0x00000000 (0)	OINT	4.0	83.0	Input	0	
ID THE Device 1 (EtherCAT)	Mode of operatio	0×09 (9)	SANT	1.0	87.0	Input	0	
Device 1-Image	C Error code	0×0000 (0)	UBNT	2.0	85.0	Input	0	
Device 1-Image-Info	 Touch probe pisiti 	0.00000000 (0)	OINT	4.0	90.0	Input	0	
(A) and Impute								
(ii) Outputs								
🕀 💼 InfoData	1							
Term 1 (E)(1290)	1							
Box 2 (INVT_ECAT_190)	1							
H-STOLINGERS 1.	1							
Status Word	1							
Position Actual Value	1							
 Of Weinelity Articul Volum 								
Tongue Actual Value								
Pollowing Error Actual Value	1							
• Mode of operation deplay	1							
Error code	1							
Touch probe pisition 1 positive value	1							
E-B DO Outputs								
 Control Word 	1							
Target Position	1							
 Target Velocity 	1							
Target Torque	1							
Max Torout								
 Mode of Operation 	1							
Evolis Velocity	1							
 Touch Probe Control 	1							
WrState								
10 b InfoData								
AR Mannings	1							
	1							
	1							
	1							
	•						_	

8. SDO data operation

Select "CoE–Online" menu, as shown in the figure below. Read the VFD function code parameters through index 0x2000, and double click 0x2000 to pop up a dialog box. Write the parameter address in the dialog box, and click "OK". The returned results are stored in index 0x2001. Similarly, Write the VFD function code parameters through index 0x2002, and the written results are stored in index 0x2003.

Untitled - TwinCAT System Manager - "CX-27EDA8"						_ 0
e Edit Actions View Options Help						
🗅 😂 🖬 🗃 💽 者 🖻 📾 的 🦉	💼 🗸 🚿 👧 🧕	🕭 🗞 🔨 🛞 🖗 🖹	Q al 66 🔍 🞗	* 🛷 🕑 📍 👘		
SYSTEM - Configuration	in star and	ten for alle	2	- 1		
MC - Configuration	General EtherCAT	DC Process Data St	atup Lot Drana D	ine		
- 🙀 PLC - Configuration	Destate 15a	1 =	E			
- 🕎 Cam - Configuration	Update List	Auto Update	I Single Update I	Show Uttime Data		
- 🛃 IJO - Configuration	Advanced					
			-	C Deep la		
Device 1 (EtherCAT)	Add to Startup	Online Data	Module UD (A	ie Poilt 10		
	L		10	Lucz.		1 1
	Index	Narie	Flags	Value		-
e Inputs	+ 1A020	ULTXPDU-Map2	HW	>2<		
B Quiputs	100000	UT THE DUM ADJ	PIW DD	225		
🛞 😫 InfoData	10000	sync manager type	NU	245		
Term 1 (EX1200)	A 10120	TyPDD assign	Piw/	217		
Box 3 (INVI_ECAT_200)	10220	SM output parameter	DW	227		_
B - B Inputs	10330	SM input parameter	BD	> 32 < 3		
- 💜 Status Word	2000	Parameter lead	RW	0+0000000000000		
 On Position Actual Value 	2001	Parameter read display	RD	0+00000000 (0)		- 11
- I Velocity Actual Value	- 2002	Parameter veite	RW	0x00000000 (0)		_
	- 2003	Parameter write display	RD	0x00000000 (0)		
Following Error Actual Value	- 603F	Error code	RD	0x0000 (0)		
— Q [*] Mode of operation display	6040	Control word	M RW	0x000F (15)		
- I Error code	6041	Status word	M RO	0x4637 (17975)		
 Structure Touch probe pisition 1 positive value 	- 6050	Hait option code	RW/	0		
(i) \$ DO Outputs	- 6060	Mode of operation	M RW	9		
Control Word	- 6061	Mode of operation display	RD	9		
Target Position	6062	Position demand value	RD	0		
Target Velocity	- 6063	Postion actual value*	HU	U		
- I Target Torque	0.04	Position actual value	MHU	0-00000000000		
Max Torque	0000	Following end window	Fiw Fiw	0.0000000000000000000000000000000000000		-
	1 1 1 1 1		Prev			_
Profile Velocity						
Touch Probe Control			1- I-			
H WcState	Nerre	Online	Type Size	>Addr In/Ou	User ID	Linked to
InfoData	Status word	01:4637 (17975)	0041 2.0	71.0 Inp.x	0	
- B Mappings	Violante Actual V	0-0000000000000000000000000000000000000	0.0	73.0 Input	č	
	Corpus Actual Value	0x0000000000000000000000000000000000000	DUN 4.0	01.0 Input	ő	
	St Enloying From A	0+00000000 (0)	DINT 4.0	83.0 Input	ŏ	
	Mode of operatio	0-09 (9)	SINT 1.0	87.0 Input	0	
	AT				-	
	•					
dy .				CK-27ED48 (5.39.23)	(168.1.1)	Confrig Mo

Set Value Dia	log	×
Dec:	65536	2. OK
Hex:	0x00010000 1.	Cancel
Float:	65536	
Bool:	0 1	Hex Edit
Binary:	00 00 01 00	4
Bit Size:	○1 ○8 ○16 ● 32 ○ 64	I 🔿 ?

5 Modbus TCP communication card

5.1 Overview

- Thanks for choosing Sourcetronic Modbus TCP communication cards. This manual describes the function specifications, installation, basic operation and settings, and information about the network protocol. To ensure that you install and operate the product properly, read this manual and the communication protocol section in the VFD operation manual carefully before you use the product.
- This manual only describes how to operate the Modbus TCP communication card and the related commands but does not provide details about the Modbus TCP protocol. For more information about the Modbus TCP protocol, read the related specialized articles or books.
- This communication card is defined as a Modbus TCP slave station communication card and is used on a VFD that supports Modbus TCP communication.
- The communication card supports the star-shaped network topology and linear network topology.
- The communication card supports 32 inputs/outputs to read and write process data, read state data, and read and write function parameters of a VFD.

5.2 Features

1. Supported functions

- > Supports the Modbus TCP protocol and Modbus TCP slave stations.
- Provides two Modbus TCP ports and supports the 10/100M full/half-duplex operation
- Supports the star-shaped network topology and linear network topology.

2. Supported communication types

Modbus TCP uses TCP/IP for information control and transmission over the Ethernet, allowing the sending of explicit packets, namely, point-to-point messages that are not time critical. The Modbus TCP application layer adopts the Modbus protocol, which is also used by Modbus RTU.

Same as Modbus RTU, Modbus TCP requires the PLC/PC to send the read or write commands, and the communication card returns the operation result after data forwarding to complete the data transmission.

3. Communication ports

Standard RJ45 ports are used in Modbus TCP communication. The communication card provides two RJ45 ports with no transmission direction defined, and therefore you can insert a cable into the port without regard to its direction. Figure 5-1 shows the ports, and Table 5-1 describes the functions of the ports.



Figure 5-1 Two standard RJ45 ports

Table 5-1 Standard RJ45 port pins

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

4. State indicators

The Modbus TCP communication card provides4 LED indicators and 4 network port indicators to indicate its states. Table 5-2 describes the state indicators.

Table 5-2 State in	ndicators
--------------------	-----------

LED	Color	State	Description
LED1	Green	On	Indicating that the card and VFD identify each
			other.
		Blinking (1Hz)	Indicating that the card and VFD
			communicate normally.
		Off	Indicating that the card and VFD
			communicate improperly.
LED2	Green	On	The communication between the card and
			PLC is online and data interchange is
			allowed.
LED	Color	State	Description
-------------------	--------	----------------	---
		Blinking (1Hz)	Indicating IP address conflict between the card and PLC.
		Off	Indicating that communication between the card and PLC is offline.
		On	Modbus TCP has not received valid data.
LED3	Red	Blinking (1Hz)	Indicating that the packet address is unused or undefined.
		Blinking (8Hz)	Indicating incorrect packet address.
		Off	No fault
LED4	Red	On	3.3V power indicator
Network	Vellow	On	Link indicator, indicating successful Ethernet connection.
indicator	Tellow	Off	Link indicator, indicating that Ethernet connection is not established.
Network	Groop	On	ACK indicator, indicating that data interchange being performed.
port indicator	Green	Off	ACK indicator, indicating that data interchange is not be performed.

5.3 Electrical wiring

The Modbus TCP communication card provides standard RJ45 ports and supports the linear and star topologies. Figure 5-2 and Figure 5-3 show the electrical wiring diagrams for different topologies.

Use CAT5, CAT5e, and CAT6 network cables for electrical wiring. When the communication distance is greater than 50 meters, use high-quality network cables that meet the national standards.



Figure 5-2 Electrical wiring diagram for a linear topology





Note: An Ethernet switch must be available when the star topology is used.

5.4 Communication

5.4.1 Communication settings

The Modbus TCP communication card can function as only the Modbus TCP slave station. Before communication, set ST600 function codes, including:

1. Communication station address, IP address and subnet mask for the card

The default station address, IP address, and subnet mask for each communication card are 1, 192.168.0.1, and 255.255.255.0 respectively. You can change them to the address of a network segment.

Control mode

If you want to control the VFD with the communication card, set the control mode to Modbus TCP communication control. To be specific, set P00.01=2 (communication as the running command channel) and set P00.02=0 (Modbus TCP communication channel) to control VFD start and stop. If you want to set a value through Modbus TCP communication, change the control way of corresponding function codes to Modbus TCP communication. Appendix B lists related function codes.

Note: After the setting, the card can communicate normally. If you want to control the VFD with the card, set related function codes to enable Modbus TCP communication control.

5.4.2 Packet format

Table 5-3 describes the structure of a TCP communication packet.

MAC-layer	IP-layer	TCP-layer						
packet packet		packet	Valid data	Packet trailer				
header	header	header						
14 bytes	20 bytes	20 bytes	0-1488 bytes	4 bytes				

Table 5-3 Structure of a TCP communication packet

5.4.3 Modbus TCP communication

The application layer of the Modbus TCP communication card supports the Modbus protocol. The Modbus TCP protocol packet is located in the valid data area of the TCP communication packet. It consists of two parts. The first part is MBAP (packet header, occupying 7 bytes), and the second part is PDU (protocol data unit whose length is variable), as shown in Table 5.4.

Table 5-4 Modbus TCP protocol packet

	PDU				
Transaction identifier	Protocol identifier	Length field	Unit identifier	Function Code	Data
2 bytes	2 bytes	2 bytes	1 byte	1 byte	n bytes
Sequence number of packets, incremented by 1 after each communication for distinguishing between different packets	0000=Modbu s-TCP protocol	Data length	Device address (station number)	Modbus function code	Includes VFD function codes and data, and the length is variable.

Through the above packets, you can set the VFD reference parameters, monitor the status value, send control commands, monitor the running status of the VFD, and read and write the VFD function codes. For specific operations, see the follow-up.

Parameter description:

Unit identifier: Slave station number (1-247).

Function code: Modbus function codes, as shown in Table 5.5.

Table 5-5 Modbus function codes

Function code	Description
0x01	Read coils
0x05	Write single coil
0x0F	Write multiple coils
0x02	Read discrete quantity
0x04	Read input register

Function code	Description
0x03	Read holding register
0x06	Write single holding register
0x10	Write multiple holding registers

Data: The data of the first word is the address of the VFD function code, for example, P00.00 corresponds to the address of 0000h, and the subsequent data is the value to be read and written.

Packet examples:

(1) Command code 03H, reading N words (continuously up to 16 words)

The command code 03H is used by the master to read data from the VFD. The count of data to be read depends on the "data count" in the command. A maximum of 16 pieces of data can be read. The addresses of the read parameters must be contiguous. Each piece of data occupies 2 bytes, that is, one word. The command format is presented using the hexadecimal system (a number followed by "H" indicates a hexadecimal value). One hexadecimal value occupies one byte.

The command is used to read parameters and operation status of the VFD.

For example, starting from the data address of 0004H, to read two contiguous pieces of data (that is, to read content from the data addresses 0004H and 0005H) of the VFD whose address is 01H, the frame structures are described in the following.

Example	Request	0001	0000	0006	01	03	0004	0004
	Meaning		MBA	νP		Function code	Write address	Number of bytes
	Response	0001	0000	0007	01	03	04	1388 0000
	Meaning		MBA	νP		Function code	Number of bytes	Data

From the response, the data in 0004H is 1388H (50.00Hz), and that in 0005H is 0000H (00.00Hz).

(2) Command code 06H, writing one word

This command is used by the master to write data to the VFD. One command can be used to write only one piece of data. It is used to modify the parameters and running mode of the VFD.

For example, to write 5000 (1388H) to 0004H of the VFD whose address is 02H, the frame structures are described in the following.

Example	Request	0001	0000	0006	02	06	0004	1388
	Meaning		MBAR	>		Function code	Write address	Data
	Response	0001 0000 0006 02			02	06	0004	1388
	Meaning		MBAR	2		Function code	Write address	Data

(3) Command code 10H, continuous writing

The command code 10H is used by the master to write data to the VFD. The quantity of data to be written is determined by "Data count", and a maximum of 16 pieces of data can be written.

For example, to write 5000 (1388H) and 50 (0032H) respectively to 0004H and 0005H of the VFD whose slave address is 02H, the frame structures are described in the following.

	Request	0001	0000	000B	02	10	0004	0002	04	1388 0032
Exa	Meaning		MBA	٩P		Function code	Write address	Number of registers	Number of bytes	Data
mple	Response	0001	0000	0006	02	10	0004	0002		
	Meaning	MBAP				Function code	Write address	Number of registers		

5.4.4 Data address definition

This section describes the address definition of communication data. The addresses are used for controlling the running, obtaining the status information, and setting function parameters of the VFD.

The address of a function code consists of two bytes, with the high-order bit on the left and low-order bit on the right. The high-order bit ranges from 00 to ffH, and the low-order bit also ranges from 00 to ffH. The high-order bit is the hexadecimal form of the group number before the dot mark, and low-order bit is that of the number behind the dot mark. Take P14.00 as an example: The group number is 14, that is, the high-order bit of the parameter address is the hexadecimal form of 0E; and the number behind the dot mark is 00, that is, the low-order bit is the hexadecimal form of 0D. Therefore, the function code address is 0E00H in the hexadecimal form. For example, the parameter address of P14.03 is 0E03H.

Function code	Name	Parameter description	Setting range	Default value
P14.00	Local communication	1–247	1–247	1
	address			

Function code	Name	Parameter description	Setting range	Default value
P14.03	Communication response delay	0–200ms	0–200	5

Note:

- The parameters in the P99 group are set by the manufacturer and cannot be read or modified. Some parameters cannot be modified when the VFD is running; some cannot be modified regardless of the VFD status. Pay attention to the setting range, unit, and description of a parameter when modifying it.
- The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. Some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the MSB of the corresponding function code address from 0 to 1. For example, if P00.07 is not to be stored in the EEPROM, you need only to modify the value in the RAM, that is, set the address to 8007H. The address can be used only for writing data to the on-chip RAM, and it is invalid when used for reading data.

Description of other function addresses

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as starting and stopping it, and monitoring the operation status of the VFD. The following table describes other function parameters.

Function	Address	Data description	R/W	
		0001H: Forward running		
		0002H: Reverse running		
		0003H: Forward jogging		
Communication-	200011	0004H: Reverse jogging	DAA	
command	2000H	0005H: Stop	R/VV	
		0006H: Coast to stop (emergency stop)		
		0007H: Fault reset		
		0008H: Jogging to stop		
	2001	Communication-based frequency setting	DAV	
Communication	2001H	(0–Fmax, unit: 0.01 Hz)	R/VV	
based value setting	2002H	PID setting, range (0-1000, 1000	D/M	
	2002H	corresponding to 100.0%)	rt/ VV	
	20021	PID feedback, range (0-1000, 1000	D AA/	
	20030	corresponding to 100.0%)	rv/W	

Function	Address	Data description	R/W
	2004H	Torque setting (-3000-+3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2005H	Setting of the upper limit of the forward running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2006H	Setting of the upper limit of the reverse running frequency (0–Fmax, unit: 0.01 Hz)	R/W
	2007H	Upper limit of the electromotion torque (0–3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2008H	Upper limit of the brake torque (0–3000, 1000 corresponding to 100.0% of the motor rated current)	R/W
	2009H	Special control command word: Bit0-1: =00: Motor 1 =01: Motor 2 Bit2: =1 Enable speed/torque control switchover =0: Disable speed/torque control switchover Bit3: =1 Clear electricity consumption =0: Not clear electricity consumption Bit4: =1 Pre-excitation; =0: Disable pre-excitation Bit5: =1 DC brake =0: Disable DC brake	R/W
	200AH	Virtual input terminal command, range: 0x000–0x3FF Corresponding to S8/S7/S6/S5/HDIB/HDIA/S4/ S3/ S2/S1	R/W
	200BH	Virtual output terminal command, range: 0x00–0x0F Corresponding to local RO2/RO1/HDO/Y1	R/W
	200CH	Voltage setting (used for V/F separation) (0–1000, 1000 corresponding to 100.0% of the motor rated voltage)	R/W
	200DH	AO output setting 1 (-1000-+1000, 1000 corresponding to 100.0%)	R/W
	200EH	AO output setting 2 (-1000–+1000, 1000 corresponding to 100.0%)	R/W

Function	Address	Data descriptio	on	R/W	
		0001H: Forward running			
		0002H: Reverse running			
VFD status word	2100	0003H: Stopped		Б	
1	2100H	0004H: Faulty		ĸ	
		0005H: POFF			
		0006H: Pre-excited			
VFD status word 2	2101H	Bit0: =0: Not ready to run =1 Bit1-2: =00: Motor 1 =01: M Bit3: =0: Asynchronous Synchronous motor Bit4: =0: No overload alarm alarm Bit5-Bit6: =00: Keypad-based Terminal-based control =10: Communication-based c Bit7: Reserved Bit8: =0: Speed control =1: ^ Bit9: =0: Non position control =1: Position control Bit1-Bit10: =0: Vector 0 =1 =2: Closed-loop v =3: Space voltage vector	I: Ready to run Motor 2 motor 2=1: n =1: Overload d control =01: ontrol Torque control I: Vector 1 vector	R	
VFD fault code	2102H	See the description of fault type	pes.	R	
VFD identification code	2103H	ST6000x01A0		R	
Running frequency	3000H	0–Fmax (Unit: 0.01Hz)		R	
Set frequency	3001H	0–Fmax (Unit: 0.01Hz)	Compatible	R	
Bus voltage	3002H	0.0-2000.0V (Unit: 0.1V)	with	R	
Output voltage	3003H	0–1200V (Unit: 1V)	CHF100A	R	
Output current	3004H	0.0-3000.0A (Unit: 0.1A)	and CHV100	R	
Rotating speed	3005H	0-65535 (Unit: 1RPM)	communicati	R	
Output power	3006H	-300.0-300.0% (Unit: 0.1%)	on	R	
Output torque	3007H	-250.0-250.0% (Unit: 0.1%)	addresses	R	
Closed-loop setting	3008H	-100.0–100.0% (Unit: 0.1%)		R	

Function	Address	Data descriptio	n	R/W
Closed-loop feedback	3009H	-100.0–100.0% (Unit: 0.1%)		R
Input state	300AH	000–3F Corresponding to the local HDIB/ HDIA/S4/S3/S2/S1		R
Output state	300BH	000–0F Corresponding to the local RO2/RO1/HDO/Y1		R
Analog input 1	300CH	0.00-10.00V (Unit: 0.01V)		R
Analog input 2	300DH	0.00-10.00V (Unit: 0.01V)		R
Analog input 3	300EH	-10.00–10.00V (Unit: 0.01V)		R
Analog input 4	300FH			R
Read input of HDIA high-speed pulse	3010H	0.00–50.00kHz (Unit: 0.01Hz)		R
Read input of HDIB high-speed pulse	3011H			R
Read current step of multi-step speed	3012H	0–15		R
External length	3013H	0–65535		R
External count value	3014H	0–65535		R
Torque setting	3015H	-300.0-300.0% (Unit: 0.1%)		R
Identification code	3016H			R
Fault code	5000H			R

The Read/Write (R/W) characteristics indicate whether a function can be read and written. For example, "Communication-based control command" can be written, and therefore the command code 6H is used to control the VFD. The R characteristic indicates that a function can only be read, and W indicates that a function can only be written.

Note: Some parameters in the preceding table are valid only after they are enabled. Take the running and stop operations as examples, you need to set "Running command channel" (P00.01) to "Communication", and set "Communication running command channel" (P00.02) to the Modbus communication channel. For another example, when modifying "PID setting",

you need to set "PID reference source" (P09.00) to Modbus communication.

The following table describes the encoding rules of device codes (corresponding to the identification code 2103H of the VFD).

Eight high-order bits of code	Meaning	Eight low-order bits of code	Meaning
	VFD series	0x08	ST35 vector VFD
		0x09	ST35-H1 vector VFD
01		0x0a	ST300 vector VFD
01		0xa0	ST600 vector VFD
		0xa1	ST600-UL vector VFD
		0xa2	ST600A vector VFD

5.4.5 Fieldbus scale

In practical applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. For example, 50.12 Hz cannot be represented in the hexadecimal form. In such cases, we can multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H (5012 in the decimal form) in the hexadecimal form.

In the process of multiplying a non-integer by a multiple to obtain an integer, the multiple is referred to as a fieldbus scale.

The fieldbus scale depends on the number of decimals in the value specified in "Detailed parameter description" or "Default value". If there are *n* decimals in the value, the fieldbus scale m is the n^{th} -power of 10. Take the following table as an example, m is 10.

Function code	Name	Description	Setting range	Default
P01.20	Wake-up-from-sl eep delay	0.0–3600.0s (valid when P01.15 is 2)	0.00 - 3600.0	0.0s
P01.21	Restart after power failure	0: Disable 1: Enable	0 - 1	0

The value specified in "Setting range" or "Default" contains one decimal, so the fieldbus scale is 10. If the value received by the upper computer is 50, the value of "Wake-up-from-sleep delay" of the VFD is 5.0 (5.0=50/10).

To set the "Wake-up-from-sleep delay" to 5.0s through Modbus communication, you need first to multiply 5.0 by 10 according to the scale to obtain an integer 50, that is, 32H in the hexadecimal form.

After receiving the command, the VFD converts 50 into 5.0 based on the fieldbus scale, and then sets "Wake-up-from-sleep delay" to 5.0s.

5.4.6 Error message response

Operation errors may occur in communication-based control. For example, some parameters can only be read, but a write command is transmitted. In this case, the VFD returns an error message response.

Error message responses are sent from the VFD to the master. The following table describes the codes and definitions of the error message responses.

Code	Name	Description
01H	Invalid command	 The command code received by the upper computer is not allowed to be executed. The possible causes are as follows: The function code is applicable only on new devices and is not implemented on this device. The slave is in the faulty state when processing this request.
02H	Invalid data address	For the VFD, the data address in the request of the upper computer is not allowed. In particular, the combination of the register address and the number of the to-be-transmitted bytes is invalid.
03H	Invalid data value	The received data domain contains a value that is not allowed. The value indicates the error of the remaining structure in the combined request. Note: It does not mean that the data item submitted for storage in the register includes a value unexpected by the program.
04H	Operation failure	The parameter is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Password error	The password entered in the password verification address is different from that set in P07.00.
06H	Data frame error	The length of the data frame transmitted by the upper computer is incorrect, or in the RTU format, the value of the CRC check bit is inconsistent with the CRC value calculated by the lower computer.
07H	Parameter read-only	The parameter to be modified in the write operation of the upper computer is a read-only parameter.

Code	Name	Description					
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the upper computer cannot be modified during the running of the VFD.					
09H	Password protection	A user password is set, and the upper computer does not provide the password to unlock the system when performing a read or write operation. The error of "system locked" is reported.					

When returning a response, the slave device uses a function code domain and fault address to indicate whether it is a normal response (no error) or exception response (some errors occur). In a normal response, the device returns the corresponding function code and data address or sub-function code. In an exception response, the device returns a code that is equal to a normal code, but the first bit is logic 1.

For example, if the master device transmits a request message to a slave device for reading a group of function code address data, the code is generated as follows:

0 0 0 0 0 0 1 1 (03H in the hexadecimal form)

For an exception response, the following code is returned:

```
1 0 0 0 0 1 1 (83H in the hexadecimal form)
```

In addition to the modification of the code, the slave device returns a byte of exception code that describes the cause of the exception. After receiving the exception response, the typical processing of the master device is to transmit the request message again or modify the command based on the fault information.

5.5 Example of PLC communication

This example shows how to use SIEMENS PLC (S7-1200) to communicate with Modbus TCP communication extension card (through the TIA Portal V13 software), and Modbus TCP is not configured with device description file.

Use TIA Portal V13 software to add a Modbus TCP block.

Open TIA Portal V13, and create a new project as shown in the following figure.

Create new project	
Project name:	ModbusTCP_BookletDemoProject_s1200
Path:	D:IProtal V13IV15_workspace
Author:	Administrator
Comment:	A
	×
	Create

After a new project is created, click "Project view" in the lower left corner, and double click "Add new device" in the interface, as shown in the following figure.

Project tree	
Devices	
00	
 ModbusTCP_BookletDemoProject_S1200)
Add new device	
🚠 Devices & networks	
PLC_1 [CPU 1215C DC/DC/DC]	
🕨 🙀 Common data	
Documentation settings	
🕨 🐻 Languages & resources	

Select the correct PLC model, and click "OK" (PLC models used by our company are shown in the following figure).

Add new device			×
Device name:			
PLC_1			
Controllers HM PC systems	 Controllers City SIMATIC S7-1200 CPU CPU CPU 1211C ACDC/Rky CPU 1211C CODC/RC CPU 1211C CODC/Rky CPU 1212C CODC/Rky CPU 1212C CODC/Rky CPU 1212C CODC/Rky CPU 1212C CODC/Rky CPU 1214C CODC/Rky CPU 1215C CDC/Rky CPU 1215C CDC/Rky CPU 1215C CDC/Rky CPU 1215C CDC/Rky	Device: Order no.: Version: Description: Work memory D14 x 24VDC A12 and A2 and a pulse o expands onb M14 and PLCe	CPU 1215C DC/DC/DC GES7 215-1AG40 0X80 V4.0
Open device view			OK Cancel
Construction and the second			

Click "Program blocks", and double click "Main[OB1]" to open the programming interface, as shown in the following figure.

Devices					
900	말	ನ ನ 🤿 🕆 🍉 🔚 🚍	🗩 😹 ± 😹 😫 🔛	e° 6₀ e≣ 9	비 약 입 부 및 이 약 및
		Main			
PLC_1 [CPU 1215C DC/DC/DC]	^	Name	Data type	Default value	Comment
T Device configuration		1 💶 🕶 Input			
😼 Online & diagnostics		2 💶 🔹 Initial_Call	Bool	1	Initial call of this OB
🕶 😹 Program blocks		3 💶 🖷 Remanence	Bool		=True, if remanent data are available
Add new block				town to be	eq.
Main (OB1)	=				
Technology objects		- Dischalder and a	(* 1.)*		
External source files		 Block title: "Main Program Sw 	eep (Cycle).		
PLC tags		Comment			
PLC data types		 Network 1: 			
Watch and force tables					
Marces 🗠 🗠		Comment			
Program info					
Device proxy data	~				
Details view					

Select "Others" under the "Communication" bar on the right, then select "MODBUS TCP" \rightarrow "MB_CLIENT", as shown in the following figure.



Add 2 data blocks in "Add new block" under "Program blocks", namely "MB_CLIENT_TCON" and "MB_Client_Data", as shown in the following figure.



Set the variables of these two data blocks respectively, as shown in the following figure.

(1) MB_CLIENT_TCON data block

	MB_CLIENT_TCON									
		Na	me			Data type	Start value			
1		•	St	atic						
2		•	•	TCON	4	TCON_IP_v4				
з			•	In	terfaceId	HW_ANY	64			
4			•	ID)	CONN_OUC	2			
5			•	C	onnectionType	Byte	16#0B			
6			•	A	ctiveEstablished	Bool	1			
7			•	👻 R	emoteAddress	IP_V4				
8				• •	ADDR	Array[14] of Byte				
9					ADDR[1]	Byte	192			
10	-00				ADDR[2]	Byte	168			
11	-00				ADDR[3]	Byte	0			
12	-00				ADDR[4]	Byte	2			
13			•	R	emotePort	UInt	502			
14	-		•	L	ocalPort	UInt	0			

(2) MB_Client_Data data block

	MB_Client_Data								
		Nam	e	Data type	Start value				
1	-	👻 S	tatic						
2	-	• •	data	Array[09] of Int					
З	-		data[0]	Int	0				
4		•	data[1]	Int	0				
5	-00		data[2]	Int	0				
6	-		data[3]	Int	0				
7		•	data[4]	Int	0				
8	-00		data[5]	Int	0				
9	-00		data[6]	Int	0				
10	-00		data[7]	Int	0				
11	-		data[8]	Int	0				
12	-		data[9]	Int	0				

Uncheck the "Optimized block access" of the block, as shown in the following figure.

MB_Client_Data [DB3]	
General	
General	A ++
Information	Attributes
Time stamps	
Compilation	Only store in load memory
Protection	Data block write-protected in the device
Attributes	
Download with	Optimized block access

Double click "Show all" under "PLC tags", and create variables, as shown in the following figure.

Р	PLC tags								
		Name	Tag table	Data type	Address				
1	-	MB_Client_REQ	Default tag table	Bool	%M10.0				
2	-	MB_Client_DISCONNET	Default tag table	Bool	%M10.1				
З	-	MB_Client_MODE	Default tag table	USInt	%MB20				
4	-	MB_Client_ADDR	Default tag table	Word	%MW100				
5	-	MB_Client_LEN	Default tag table	UInt	%MW102				
6	-00	MB_Client_DONE	Default tag table	Bool	%M10.2				
7	-00	MB_Client_BUSY	Default tag table	Bool	%M10.3				
8	-00	MB_Client_ERROR	Default tag table	Bool	%M10.4				
9	-00	MB_Client_STATUS	Default tag table	Word	%MW104				
10	-00	AUTO_RUN	Default tag table	Bool	%M0.0				
11	-00	RUN_TERM	Default tag table	Bool	%10.0				

Configure the Modbus TCP block as shown in the following figure.



Double click "Device configuration", right click the network port to select "Properties", set the following parameters in the pop-up interface, and modify the local Ethernet network segment to be the same as the following network segment.

									a To	pology	view	di Ne	etwor	k view	/ Device vie
dt	PLC_1]	4	•	100%		-			E	1	Device overview
			101			1		2	3	4	5	6	7	^	Module
		Rack_0	103	50005]]]]											PROFINI
			101	Ē										~	
<				-	_		_			_	_	(***	>	U	< 11
PRO	FINET int	terface,	_1 [M	lodule					3	Proper	ties	1 Info	•	🕲 Dia	ignostics
Ge	eneral	IO ta	gs	Syst	em co	nstants		Texts							
Ge	eneral hemet add	resses			Ethe	met ad	dress	es							
Tin	ne synchro	nization			In	terface	netwo	orked wi	th						
op	perating m	ode							E					1	
Ad	lvanced op	tions						Su	ibnet:	PN/IE_1			_		•
ria i	roware loe	nuner							L	A	dd new s	subnet			
					IP	protoco	1								
									(Set I	Paddre	ss in the p	roject		
											IPadd	ress: 1	92.1	68.0	. 23
										s	ubnet m	ask: 2	55 2	55 2	55.0
									F	Usen	outer				

Write the PLC program as follows.







Download the PLC program to the PLC after the program has been written completely. Set VFD function codes such as P00.01=2, P00.02=0, P00.06=8, P14.00=2, P16.02–P16.05= 192.168.0.2, and keep default values of P16.06–P16.13. Then, you can use the I0.0 input terminal to control the VFD to start and stop at 50.00Hz through ModbusTCP protocol.

Appendix A EtherCAT object dictionary

Index	Subindex	Description	Access permission	Data type	Default value
1000h	0	Device type	RO	UINT32	0x00000192
1001h	0	Error register	RO	UINT8	0
1008h	0	Factory device name	RO	String	Sourcetronic-EtherCAT
1009h	0	Factory hardware version	RO	String	Hardware version dependant
100Ah	0	Factory software version	RO	String	Software version dependant
			ID object		
	0	Included max. sub-index	RO	UINT8	4
1018h	1	Supplier ID	RO	UINT32	0x000004D8
	2	Product code	RO	UINT32	0x00009252
	3	Revision number	RO	UINT32	0x0000001
	4	Serial number	RO	UINT32	0x0000001
		RX PE	001 mapping p	parameter	
	0	Number of supported mapping objects	RW	UINT8	8
	1	First mapping object	RW	UINT32	0x60400010
	2	Second mapping object	RW	UINT32	0x607A0020
1600h	3	Third mapping object	RW	UINT32	0x60FF0020
	4	Fourth mapping object	RW	UINT32	0x60710010
	5	Fifth mapping object	RW	UINT32	0x60720010
	6	Sixth mapping object	RW	UINT32	0x60600008
	7	Seventh mapping	RW	UINT32	0x60810020
	8	Eighth mapping object	RW	UINT32	0x60B80010

Index	Subindex	Subindex Description		Data type	Default value			
		RX PC	002 mapping p	parameter				
10041	0	Number of supported mapping objects	RW	UINT8	2			
1601h	1	First mapping object	RW	UINT32	0x60400010			
	2	Second mapping object	RW	UINT32	0x607A0020			
		RX PD	003 mapping	parameter				
1602b	0	Number of supported mapping objects	RW	UINT8	2			
1602h	1	First mapping object	RW	UINT32	0x60400010			
	2	Second mapping object	RW	UINT32	0x607A0020			
	RX PDO4 mapping parameter							
40001	0	Number of supported mapping objects	RW	UINT8	2			
16030	1	First mapping object	RW	UINT32	0x60400010			
	2	Second mapping object	RW	UINT32	0x607A0020			
		TX PC	001 mapping p	parameter				
	0	Number of supported mapping objects	RW	UINT8	8			
	1	First mapping object	RW	UINT32	0x60410010			
1A00h	2	Second mapping object	RW	UINT32	0x60640020			
	3	Third mapping object	RW	UINT32	0x606C0020			
	4	Fourth mapping object	RW	UINT32	0x60770010			
	5	Fifth mapping	RW	UINT32	0x60F40020			

Index	Subindex	Description	Access permission	Data type	Default value	
		object				
	6	Sixth mapping object	RW	UINT32	0x60610008	
	7	Seventh mapping object	RW	UINT32	0x60B90010	
	8	Eighth mapping object	RW	UINT32	0x60BA0020	
		TX PC	002 mapping p	parameter		
14041	0	Number of supported mapping objects	RW	UINT8	8	
1A01h	1	First mapping object	RW	UINT32	0x60410010	
	2	Second mapping object	RW	UINT32	0x60640020	
		TX PC	003 mapping parameter			
	0	Number of supported mapping objects	RW	UINT8	8	
1A02h	1	First mapping object	RW	UINT32	0x60410010	
	2	Second mapping object	RW	UINT32	0x60640020	
		TX PC	PDO4 mapping parameter			
(0	Number of supported mapping objects	RW	UINT8	8	
1A03h	1	First mapping object	RW	UINT32	0x60410010	
	2	Second mapping object	RW	UINT32	0x60640020	
		SM	communicatio	on type		
	0	Max. sub-index	RO	UINT8	4	
1C00h	1	SM0 communication type	RO	UINT8	0x01	
	2	SM1	RO	UINT8	0x02	

Index	Subindex	Description	Access permission	Data type	Default value			
		communication type						
	3	SM2 communication type	RO	UINT8	0x03			
	4	SM3 communication type	RO	UINT8	0x04			
		F	xPDO assign	ment				
40405	0	Max. sub-index	RW	UINT8	1			
1012n	1	RxPDO assigned object index	RW	UINT16	0x1600			
		I	xPDO assigni	ment				
40405	0	Max. sub-index	RW	UINT8	1			
1C13h	1	TxPDO assigned object index	RW	UINT16	0x1A00			
	SM synchronization output parameter							
	0x00	Max. sub-index	RO	UINT8	0x20			
	0x01	Synchronization mode	RW	UINT16	0x02			
	0x02	Cycle time	RO	UINT32	0			
	0x03	Switching time	RO	UINT32	0			
	0x04	Supported synchronization type	RO	UINT16	0x4006			
	0x05	Min. periodic time	RO	UINT32	0x0003D090			
1C32h	0x06	Calculation and replication time	RO	UINT32	0			
	0x07	Reserved	RW	UINT32	0			
	0x08	Obtained periodic time	RW	UINT16	0			
	0x09	Delay time	RO	UINT32	0			
	0x0A	Sync0 time	RW	UINT32	-			
	0x0B	SM event loss counter	RO	UINT32	0			
	0x0C	Circulation timeout counter	RO	UINT32	0			

Index	Subindex	Description	Access permission	Data type	Default value
	0x0D	Counter of too short switching	RO	UINT32	0
	0x20	Synchronization error	RO	UINT8	0
		SM synch	ronization inp	out paramete	er
	0x00	Max. sub-index	RO	UINT8	0x20
	0x01	Synchronization mode	RW	UINT16	0x02
	0x02	Cycle time	RO	UINT32	0
	0x03	Switching time	RO	UINT32	0
	0x04	Supported synchronization type	RO	UINT16	0x4006
	0x05	Min. periodic time	RO	UINT32	0x0003D090
	0x06 Calculation and replication time		RO	UINT32	0
1C33h	0x07	Reserved	RW	UINT32	0
	0x08	Obtained periodic time	RW	UINT16	0
	0x09	Delay time	RO	UINT32	0
	0x0A	Sync0 time	RW	UINT32	-
	0x0B	SM event loss counter	RO	UINT32	0
	0x0C	Circulation timeout counter	RO	UINT32	0
	0x0D	Counter of too short switching	RO	UINT32	0
	0x20	Synchronization error	RO	UINT8	0
2000h	0	Read function codes	RW	UINT32	0
2001h	0	Read response	RO	UINT32	0
2002h	0	Write function codes	RW	UINT32	0
2003h	0	Write response	RO	UINT32	0
603Fh	0	Error code	RO	UINT16	0
6040h	0	Control word	RW	UINT16	0

Index	Subindex	Description	Access permission	Data type	Default value
6041h	0	Status word	RO	UINT16	0
605Dh	0	Suspension mode	RW	INT16	0
6060h	0	Operation mode	RW	UINT16	0
6061h	0	Operation mode display	RO	UINT16	0
6062h	0	Position command	RO	DINT32	0
6063h	0	Position feedback	RO	DINT32	0
6064h	0	Position feedback	RO	DINT32	0
6065h	0	Position deviation range	RW	UDINT32	0
6066h	0	Too-large position deviation timeout	RW	UINT16	0
6067h	0	Position pulse range	RW	UDINT32	0
606Ch	0	Actual speed	RW	DINT32	0
6071h	0	Target torque	RW	INT16	0
6072h	0	Max. torque	RW	UINT16	0
6073h	0	Max. current	RO	UINT16	0
6075h	0	Motor rated current	RO	UDINT32	0
6076h	0	Motor rated torque	RO	UDINT32	0
6077h	0	Actual torque	RO	INT16	0
6078h	0	Actual current	RO	INT16	0
6079h	0	Bus voltage	RO	UDINT32	0
607Ah	0	Target position	RW	INT16	0
		F	osition range	limit	
	0	Number of sub-indexes	RW	UINT8	2
607Bh	1	Min. position range limit	RW	INT32	0
	2	Max. position range limit	RW	INT32	0
607Ch	0	Coordinate deviation	RW	DINT32	0
6081h	0	Speed in industrial regulations	RW	UDINT32	0

Index	Subindex	Description	Access permission	Data type	Default value		
6083h	0	ACC in industrial regulations	RW	UDINT32	0		
6084h	0	DEC in industrial regulations	RW	UDINT32	0		
			Gear ratio				
6001h	0	Number of sub-indexes	RW	UINT8	2		
609111	1	Motor resolution	RW	UINT32	0x00000001		
	2	Bearing axle resolution	RW	UINT32	0x0000001		
			Position fact	or			
6093h	0	Number of sub-indexes	RW	UINT8	2		
	1	Molecule	RW	UINT32	0x00000001		
	2	Set constant	RW	UINT32	0x00000001		
6098h	0	Zeroing mode	RW	INT16	0		
		Zeroing speed					
	0	Number of sub-indexes	RW	UINT8	2		
6099h	1	Search limit switch speed	RW	UINT32	0		
	2	Search zero-phase speed	RW	UINT32	0		
60B8h	0	Probe control	RW	UINT16	0		
60B9h	0	Probe status	RO	UINT16	0		
60BAh	0	Probe position rising edge	RO	INT32	0		
60F4h	0	Position deviation	RO	INT32	0		
60FDh	0	Digital input	RO	UINT32	0		
60FEh	0	Digital output	RO	INT32	0		
60FFh	0	Target speed	RW	INT32	0		
6502h	0	Drive mode	RO	UINT32	0x000003A5		

Appendix B Related function codes

Function code	Name	Parameter description	Setting range	Default value
P00.01	Channel of running commands	0: Keypad 1: Terminal 2: Communication	0–2	0
P00.02	Communication channel of running commands	0: Modbus RTU/Modbus TCP communication 1: PROFIBUS/CANopen/DeviceNet communication 2: Ethernet communication 3: EtherCAT/PROFINET/EtherNet IP communication 4: PLC programmable extension card 5: Wireless communication card Note: Channels 1, 2, 3, 4, and 5 are extension functions that require corresponding extension cards.	0–5	0
P00.06	Frequency A command setting mode	0: Keypad 1–7: Reserved 8: Modbus RTU/Modbus TCP	0–15	0
P00.07	Frequency B command setting mode	communication 9: PROFIBUS/CANopen/DeviceNet communication 10: Ethernet communication 11–12: Reserved 13: EtherCAT/PROFINET/EtherNet IP communication 14–15: Reserved	0–15	2
P03.11	Torque setting mode	0–1: Keypad 2–6: Reserved 7: Modbus RTU/Modbus TCP communication 8: PROFIBUS/CANopen/DeviceNet communication 9: Ethernet communication 10: Reserved 11: EtherCAT/PROFINET/EtherNet IP communication	0–12	0

Function	Name	Parameter description	Setting	Default
code			range	value
		12: Reserved		
		0: Keypad (P03.16)		
		1–5: Reserved		
		6: Modbus RTU/Modbus TCP		
	Setting mode of	communication		
	upper frequency	7: PROFIBUS/CANopen/DeviceNet		
P03.14	limit of forward	communication	0–12	0
	running in torque	8: Ethernet communication		
	control	9: Reserved		
		10: EtherCAT/PROFINET/EtherNet IP		
		communication		
		11–12: Reserved		
		0: Keypad (P03.17)		
		1–5: Reserved		
P03.15		6: Modbus RTU/Modbus TCP		
	Setting mode of	communication		
	upper frequency	7: PROFIBUS/CANopen/DeviceNet		
	limit of reverse	communication	0–12	0
	running in torque	8: Ethernet communication		
	control	9: Reserved		
		10: EtherCAT/PROFINET/EtherNet IP		
		communication		
		11–12: Reserved		
		0: Keypad (P03.20)		
		1–4: Reserved		
		5: Modbus RTU/Modbus TCP		
	Catting made of	communication		
	Setting mode of	6: PROFIBUS/CANopen/DeviceNet		
P03.18	upper innit of	communication	0–11	0
	electromotive	7: Ethernet communication		
	torque	8: Reserved		
		9: EtherCAT/PROFINET/EtherNet IP		
		communication		
		10–11: Reserved		
	Cotting mode of	0: Keypad (P03.21)		
D02.40	Setting mode of	1–4: Reserved	0.44	0
P03.19	upper limit of	5: Modbus RTU/Modbus TCP	0-11	U
	brake torque	communication		

Function code	Name	Parameter description	Setting range	Default value
		6: PROFIBUS/CANopen/DeviceNet		
		communication		
		7: Ethernet communication		
		8: Reserved		
		9: EtherCAT/PROFINET/EtherNet IP		
		communication		
		10–11: Reserved		
		0: Keypad (P04.28)		
		1–6: Reserved		
		7: Modbus RTU/Modbus TCP		
		communication		
		8: PROFIBUS/CANopen/DeviceNet		
P04.27	Voltage setting	communication	0–13	0
	channei	9: Ethernet communication		
		10: Reserved		
		11: EtherCAT/PROFINET/EtherNet IP		
		communication		
		12–13: Reserved		
P06.01	Y1 output	0: Invalid	0–63	0
P06.02	HDO output	1–22: Reserved	0–63	0
D 00.00	Relay output	23: Modbus RTU/Modbus TCP	0.00	
P06.03	RO1	communication virtual terminal output	0-63	1
		24: PROFIBUS/CANopen/DeviceNet		
		communication virtual terminal output		
		Ethernet communication virtual		
D06.04	Relay output RO2	terminal output	0.62	F
P06.04		26–33: Reserved	0-03	5
		34: EtherCAT/PROFINET/EtherNet IP		
		communication virtual terminal output		
		35–63: Reserved		
P06 14	Analog output	0: Running frequency	0-47	0
1 00.14	AO1	1–13: Reserved	0-47	0
		14: Modbus RTU/Modbus TCP		
		communication setting 1		
P06 16	HDO high-speed	15: Modbus RTU/Modbus TCP	0–47	0
P06.16	pulse output	communication setting 2		U
		16: PROFIBUS/CANopen/DeviceNet		
		communication setting 1		

Function code	Name	Parameter description	Setting range	Default value
0040		17: PROFIBIUS/CANopen/DeviceNet	range	Value
		communication setting 2		
		18: Ethernet communication setting 1		
		10: Ethernet communication setting 2		
		20: Reserved		
		21: EtherCAT/PROFINET/EtherNet IP		
		communication setting 1		
		22_26 [·] Reserved		
		27: EtherCAT/PROFINET/EtherNet IP		
		communication setting 2		
		28_47 [·] Reserved		
		0: No fault		
		18: 485/Modbus TCP communication		
		fault (CE)		
		29: PROFIBUS communication fault		
		(F-DP)		
		30: Ethernet communication fault		
		(E-NET)		
		31: CANopen communication fault		
	Type of current fault	(E-CAN)		
		57: PROFINET communication timeout		
		fault (E-PN)		
		58: CAN communication timeout fault		
		(ESCAN)		
P07.27		60: Card identification failure in slot 1	/	/
		(F1-Er)		
		61: Card identification failure in slot 2		
		(F2-Er)		
		62: Card identification failure in slot 3		
		(F3-Er)		
		63: Card communication failure in slot 1		
		(C1-Er)		
		64: Card communication failure in slot 2		
		(C2-Er)		
		65: Card communication failure in slot 3		
		(C3-Er)		
		66: EtherCAT communication fault		
		(E-CAT)		

Function code	Name	Parameter description	Setting range	Default value
Dozoo	T. (1. ()	67: BACnet communication fault (E-BAC) 68: DeviceNet communication fault (E-DEV) 69: CAN slave fault in master/slave synchronous communication (S-Err) 70: EtherNet IP communication timeout (E-EIP)	, in the second se	.,
P07.28 P07.29	Type of 2nd-last fault	/	/	/
P07.30	Type of 3rd-last fault	/	/	/
P07.31	Type of 4th-last fault	/	/	/
P07.32	Type of 5th-last fault	/	/	/
P08.31	Motor 1 and motor 2 switching channel	0x00–0x14 LED ones place: Switching channel 0: Terminal 1: Modbus RTU/Modbus TCP communication 2: PROFIBUS/CANopen/DeviceNet communication 3: Ethernet communication 4: EtherCAT/PROFINET/EtherNet IP communication LED tens place: Switching in running 0: Disabled 1: Enabled	00–14	0x00
P09.00	PID reference source	0: Keypad (P09.01) 1–5: Reserved 6: Modbus RTU/Modbus TCP communication 7: PROFIBUS/CANopen/DeviceNet communication 8: Ethernet communication 9: Reserved	0–12	0

Function code	Name	Parameter description	Setting range	Default value
		10: EtherCAT/PROFINET/EtherNet IP communication 11–12: Reserved		
P09.02	PID feedback source	0: Al1 1–3: Reserved 4: Modbus RTU/Modbus TCP communication 5: PROFIBUS/CANopen/DeviceNet communication 6: Ethernet communication 7: Reserved 8: EtherCAT/PROFINET/EtherNet IP communication 9–10: Reserved	0–10	0
P14.00	Local communication address	1–247	1–247	1
P14.03	Communication response delay	1–200ms	1–200	5
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	1–3	0
P14.06	Communication processing action	0x00–0x11 Ones place: 0: Respond to write operations 1: Not respond to write operations Tens place: Communication encrypting 0: Disable 1: Enable Hundreds place: Self-define the communication command address 0: Disable	0x000–0x 111	0x000

Function code	Name	Parameter description	Setting range	Default value
		1: Enable		
	Modbus-TCP			
P14.09	communication	0.0 (invalid)–60.0s	0.0–60.0	0.0s
	timeout time		-	
P15.01	Module address	0–127	0–127	2
P15.02	Received PZD2	0: Invalid	0–31	0
P15.03	Received PZD3	1: Set frequency (0–Fmax, unit: 0.01	0–31	0
P15.04	Received PZD4	Hz)	0–31	0
P15.05	Received PZD5	2: PID reference (0–1000, in which	0–31	0
P15.06	Received PZD6	1000 corresponds to 100.0%)	0–31	0
P15.07	Received PZD7	3: PID feedback (0–1000, in which 1000	0–31	0
P15.08	Received PZD8	corresponds to 100.0%)	0–31	0
P15.09	Received PZD9	4: Torque setting (-3000-+3000, in	0–31	0
P15.10	Received PZD10	which 1000 corresponds to 100.0% of	0–31	0
P15.11	Received PZD11	the rated current of the motor)	0–31	0
P15.12	Received PZD12	running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 8: Upper limit of the brake torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 9: Virtual input terminal command, 0x000–0x3FF (corresponding to S8, S7, S6, S5, HDIB, HDIA, S4, S3, S2, and S1 in sequence) 10: Virtual output terminal command, 0x00–0x0F (corresponding to RO2, RO1, HDO, and V1 in sequence)	0–31	0

Function code	Name	Parameter description	Setting range	Default value
		 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: AO output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed number) 15: LSB of position reference (unsigned number) 16: MSB of position feedback (signed number) 17: LSB of position feedback (unsigned number) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19–31: Reserved 		
P15.13	Transmitted PZD2	0: Invalid 1: Running frequency (×100, Hz)	0–31	0
P15.14	Transmitted PZD3	2: Set frequency (×100, Hz) 3: Bus voltage (×10, V)	0–31	0
P15.15	Transmitted PZD4	4: Output voltage (×1, V) 5: Output current (×10, A)	0–31	0
P15.16	Transmitted PZD5	6: Actual output torque (×10, %) 7: Actual output power (×10, %)	0–31	0
P15.17	Transmitted PZD6	8: Rotating speed of the running (×1, RPM)	0–31	0
P15.18	Transmitted PZD7	9: Linear speed of the running (x1, m/s) 10: Ramp frequency reference	0–31	0
P15.19	Transmitted PZD8	11: Fault code 12: Al1 value (×100, V)	0–31	0
P15.20	Transmitted PZD9	13: Al2 value (×100, V) 14: Al3 value (×100, V)	0–31	0
P15.21	Transmitted PZD10	15: HDIA frequency (×100, kHz) 16: Terminal input state	0–31	0

Function code	Name	Parameter description	Setting range	Default value
P15.22	Transmitted	17: Terminal output state	0–31	0
P15.23	Transmitted PZD12	 10: FID feedback (x100, %) 19: FID feedback (x100, %) 20: Rated torque of the motor 21: MSB of position reference (signed number) 22: LSB of position feedback (signed number) 23: MSB of position feedback (unsigned number) 24: LSB of position feedback (unsigned number) 25: Status word 26: HDIB frequency value (x100, kHz) 27–31: Reserved 	0–31	0
P15.24	Temporary variable 1 used for transmitted PZD	0–65535	0–65535	0
P15.25	DP communication timeout time	0.0 (invalid)–300.0s	0.0–300. 0	0.0s
P15.26	CANopen communication timeout time	0.0 (invalid)–300.0s	0.0–300. 0	0.0s
P15.27	CANopen communication baud rate	0: 1000 kbps 1: 800 kbps 2: 500 kbps 3: 250 kbps 4: 125 kbps 5: 100 kbps 6: 50 kbps 7: 20 kbps	0–7	0
P15.28	CAN communication address	0–127	0–127	1
P15.29	CAN baud rate setting	0: 50Kbps 1: 125Kbps	0–4	1
Function code	Name	Parameter description	Setting range	Default value
---------------	-------------------------------	---	---------------	------------------
		2: 250Kbps		
		3: 500Kbps		
		4: 1M bps		
	CAN		0 0 200	
P15.30	communication	0.0 (invalid)–300.0s	0.0-300.	0.0s
	timeout time		0	
	DeviceNet		0.0–300.	0.0s
P15.31	communication	0.0 (invalid)–300.0s		
	timeout time		0	
P15.32	Displayed node baud rate	0	0	0
P15.33	Enable polling	0–1	0–1	1
P15.34	Output instance in polling	 Sourcetronic self-defined output ODVA basic speed control output ODVA extended speed control output ODVA extended speed control output ODVA speed and torque control output ODVA extended speed and torque control output Sourcetronic basic speed control output Sourcetronic extended speed control output Sourcetronic speed and torque control output Sourcetronic speed and torque control output Sourcetronic speed and torque control output 	19–27	19
P15.35	Input instance in polling	69: Sourcetronic self-defined input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: Sourcetronic basic speed control input 75: Sourcetronic extended speed	69–77	69

Function code	Name	Parameter description	Setting range	Default value
		control input 76: Sourcetronic speed and torque control input 77: Sourcetronic extended speed and torque control input		
P15.36	Enable state change/period	0–1	0–1	0
P15.37	Output instance in state change/period	 Sourcetronic self-defined output ODVA basic speed control output ODVA extended speed control output ODVA extended speed and torque control output ODVA extended speed and torque control output Sourcetronic basic speed control output Sourcetronic speed and torque control output 	19–27	19
P15.38	Input instance in state change/period	 69: Sourcetronic self-defined input 70: ODVA basic speed control input 71: ODVA extended speed control input 72: ODVA speed and torque control input 73: ODVA extended speed and torque control input 74: Sourcetronic basic speed control input 75: Sourcetronic extended speed control input 76: Sourcetronic speed and torque control input 77: Sourcetronic extended speed and torque control input 	69–77	69

Function code	Name	Parameter description	Setting range	Default value
P15.39	Output length of component 19	8–32	8–32	32
P15.40	Input length of component 69	8–32	8–32	32
P15.41	BACnet communication mode setting	0: Enable P16.22 (I-Am service) 1: Enable P15.42 (Baud rate of BACnet_MSTP)	0–1	0
P15.42	Baud rate of BACnet_MSTP	0–5	0–5	0
P15.43	Communication control word/status word expression method	0: In decimal format 1: In binary format	0–1	0
P15.44– P15.69	Reserved			
P16.01	Ethernet communication rate setting	0: Self-adaption 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0–4	0
P16.02	IP address 1	0–255	0-255	192
P16.03	IP address 2	0–255	0-255	168
P16.04	IP address 3	0–255	0–255	0
P16.05	IP address 4	0–255	0–255	1
P16.06	Subnet mask 1	0–255	0–255	255
P16.07	Subnet mask 2	0–255	0–255	255
P16.08	Subnet mask 3	0–255	0–255	255
P16.09	Subnet mask 4	0–255	0–255	0
P16.10	Gateway 1	0–255	0–255	192
P16.11	Gateway 2	0–255	0–255	168
P16.12	Gateway 3	0–255	0–255	1
P16.13	Gateway 4	0–255	0–255	1
P16.14	Ethernet monitoring variable address 1	0x0000-0xFFF	0000–FF FF	0x0000

Function code	Name	Parameter description	Setting range	Default value
P16.15	Ethernet monitoring variable address 2	0x0000–0xFFFF	0000–FF FF	0x0000
P16.16	Ethernet monitoring variable address 3	0x0000–0xFFFF	0000–FF FF	0x0000
P16.17	Ethernet monitoring variable address 4	0x0000–0xFFFF	0000–FF FF	0x0000
P16.18	EtherCAT communication timeout time	0.0s (invalid)–300.0s	0.0–300. 0	0.5s
P16.19	Reserved			
P16.20	MSD of BACnet device number	Independent code of BACnet device (0-4194303)	0–4194	0
P16.21	LSD of BACnet device number		0–999	1
P16.22	BACnet "I-Am" service setting	0: Transmission at power-on 1: Continuous transmission	0–1	0
P16.23	BACnet communication timeout time	0.0 (invalid)–300.0s	0.0–300. 0	0.0s
P16.24	Extension card identification time of slot 1	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600. 00	0.0
P16.25	Extension card identification time of slot 2	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600. 00	0.0
P16.26	Extension card identification time of slot 3	0.0–600.0s When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600. 00	0.0
P16.27	Extension card	0.0-600.0s	0.0-600.	0.0

Function code	Name	Parameter description	Setting range	Default value
	communication timeout time of slot 1	When this parameter is set to 0.0, disconnection fault detection is not performed.	00	
	Extension card	0.0–600.0s		
P16.28	communication timeout time of slot 2	When this parameter is set to 0.0, disconnection fault detection is not performed.	0.0–600. 00	0.0
	Extension card	0.0–600.0s		
D16 20	communication	When this parameter is set to 0.0,	0.0–600.	0.0
P 10.29	timeout time of slot 3	disconnection fault detection is not performed.	00	0.0
P16.30	Reserved			
	PROFINET			
P16.31	communication	0.0 (invalid)–300.0s	0.0–300.	0.0s
D40.00	Uneout une	O. Invalid	0.04	0
P10.32	Received PZD2	1: Set frequency (0. Emox. unit: 0.01	0 21	0
P16.24	Received PZD3		0 21	0
P16.25	Received PZD4	2: PID reference (0-1000 in which	0 21	0
P16.35	Received PZD5	1000 corresponds to 100 0%)	0-31	0
P16.37	Received PZD7	3. PID feedback (0–1000, in which 1000	0-31	0
P16 38	Received PZD8	corresponds to 100.0%)	0_31	0
P16.39	Received PZD9	4: Torque setting (-3000-+3000, in	0-31	0
P16.40	Received PZD10	which 1000 corresponds to 100.0% of	0-31	0
P16 41	Received PZD11	the rated current of the motor)	0-31	0
P16.42	Received PZD12	 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01 Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01 Hz) 7: Upper limit of the electromotive torque (0–3000, in which 1000 corresponds to 100.0% of the rated current of the motor) 8: Upper limit of the brake torque (0–3000, in which 1000 corresponds to 400.0% of the rated the set torque (0–3000, in which 1000 corresponds to 400.0% of the set torque torque torque torque to the set torque to the set to t	0–31	0

Function code	Name	Parameter description	Setting range	Default value
		motor) 9: Virtual input terminal command, 0x000–0x3FF (corresponding to S8, S7, S6, S5, HDIB, HDIA, S4, S3, S2, and S1 in sequence) 10: Virtual output terminal command, 0x00–0x0F (corresponding to RO2, RC1, HDO, and Y1 in sequence) 11: Voltage setting (for V/F separation) (0–1000, in which 1000 corresponds to 100.0% of the rated voltage of the motor) 12: AO1 output setting 1 (-1000–+1000, in which 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, in which 1000 corresponds to 100.0%) 14: MSB of position reference (signed number) 15: LSB of position reference (unsigned number) 16: MSB of position feedback (signed number) 17: LSB of position feedback (unsigned number) 18: Position feedback setting flag (position feedback can be set only after this flag is set to 1 and then to 0) 19–31: Reserved		
P16.43	Transmitted PZD2	0: Invalid 1: Running frequency (×100, Hz)	0–31	0
P16.44	Transmitted PZD3	2: Set frequency (×100, Hz) 3: Bus voltage (×10, V)	0–31	0
P16.45	Transmitted PZD4	4: Output voltage (×1, V) 5: Output current (×10, A)	0–31	0
P16.46	Transmitted PZD5	6: Actual output torque (×10, %) 7: Actual output power (×10, %)	0–31	0
P16.47	Transmitted PZD6	8: Rotating speed of the running (×1, RPM)	0–31	0

Function code	Name	Parameter description	Setting range	Default value
P16.48	Transmitted PZD7	9: Linear speed of the running (x1, m/s) 10: Ramp frequency reference	0–31	0
P16.49	Transmitted PZD8	11: Fault code 12: Al1 value (×100, V)	0–31	0
P16.50	Transmitted PZD9	13: Al2 value (×100, V) 14: Al3 value (×100, V)	0–31	0
P16.51	Transmitted PZD10	15: HDIA frequency (×100, kHz) 16: Terminal input state	0–31	0
P16.52	Transmitted PZD11	17: Terminal output state 18: PID reference (×100, %)	0–31	0
P16.53	Transmitted PZD12	 PID feedback (x100, %) Rated torque of the motor RSB of position reference (signed number) LSB of position reference (unsigned number) MSB of position feedback (signed number) LSB of position feedback (unsigned number) LSB of position feedback (unsigned number) Status word HDIB frequency value (x100, kHz) T-31: Reserved 	0–31	0
P16.54	Ethernet IP communication timeout time	0.5–60.0s	0.5–60.0 s	0.5s
P16.55	Ethernet IP communication rate setting	0: Self-adaption 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0–4	0
P19.00	State of card slot 1	0: No card 1: PLC programmable card	0–65535	0
P19.01	State of card slot 2	2: I/O card 3: Incremental PG card	0–65535	0
P19.02	State of card slot 3	4: Incremental PG card with UVW 5: Ethernet communication card 6: DP communication card	0–65535	0

Function code	Name	Parameter description	Setting range	Default value
		7: Bluetooth card		
		8: Resolver PG card		
		9: CANopen communication card		
		10: WIFI card		
		11: PROFINET communication card		
		12: Sine-cosine PG card without CD		
		signals		
		13: Sine-cosine PG card with CD		
		signals		
		14: Absolute encoder PG card		
		15: CAN master/slave communication		
		card		
		16: Modbus TCP communication card		
		17: EtherCAT communication card		
		18: BACnet communication card		
		19: DeviceNet communication card		
		20: Reserved		
		21: Ethernet IP communication card		



SOURCETRONIC GMBH Fahrenheitstrasse I 28359 Bremen Germany

T +49 421 2 77 99 99 F +49 421 2 77 99 98 info@sourcetronic.com www.sourcetronic.com skype: sourcetronic



