Chapter 9: Communications

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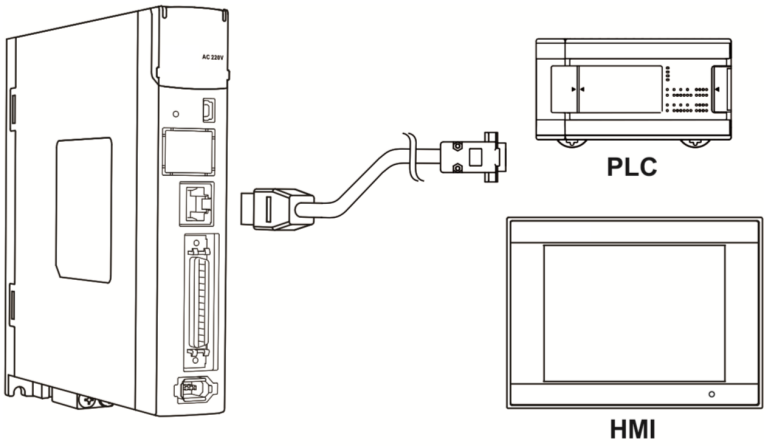
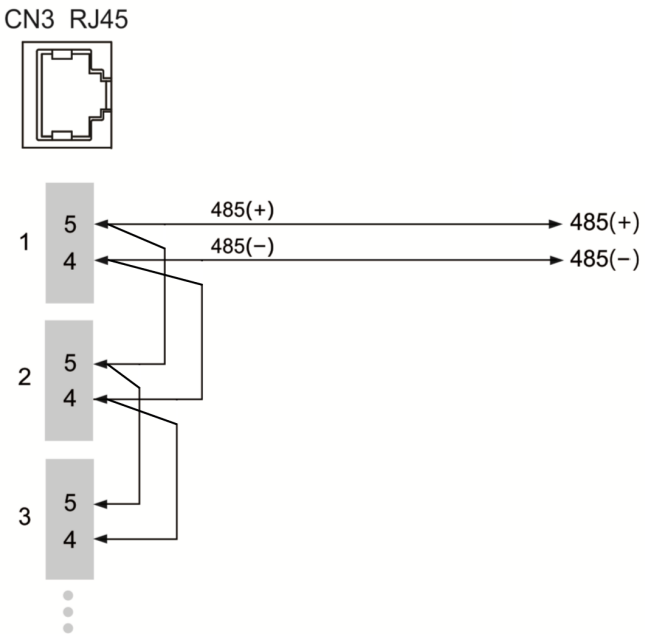
Introduction

This chapter describes the Modbus, Modbus TCP, and EtherNet/IP communications which you use for setting, reading, and writing general parameters.

9.1 - RS-485 Communication Interface (Hardware)

The SureServo2 series servo drive supports RS-485 serial communication that you can use to access and change the parameters of the servo system. See the following description of the wiring:





Notes:

1) The cable length can be up to 100 meters when the servo drive is installed in a quiet environment. If the transmission speed is over 38400 bps, however, a maximum 15 meter cable is recommended to ensure data transmission accuracy.
2) The numbers on the above figure represent the pin number of each connector.
3) When using RS-485 communication, you may connect up to 32 servo drives. You can install a repeater to connect more servo drives (the maximum is 127).
4) Please refer to Section 3.7, Wiring for CN3 pin assignment and the use of SV2-CN3-CON-2 and SV2-CN3-TR2 to create an RS485 network with minimal end-user wiring.

9.2 - RS-485 Communication Parameter Settings

The required parameters for a single servo drive connection are: P3.000 (Address setting), P3.001 (Transmission speed) and P3.002 (Communication protocol). P3.003 (Communication error handling), P3.004 (Communication timeout setting). P3.006 (Digital input (DI) control switch) and P3.007 (Communication delay time) are optional settings.

Please refer to Chapter 8 for detailed descriptions of the relevant parameters.

Parameter	*Function*
P3.000	Address setting
P3.001	Transmission speed
P3.002	Communication protocol
P3.003	Communication error handling
P3.004	Communication timeout

NOTE: It is highly recommended to set P2.030=5 before initiating control with communication. This will disable writing any changes to the servo EEPROM. While the EEPROM can be written to several millions of times, inadvertent messaging could reach that limit within a few years. Setting P2.030 =5 eliminates this potential.

9.3 - MODBUS Communication Protocol

There are two modes of MODBUS network communication: ASCII (American Standard Code for Information Interchange) and RTU (Remote Terminal Unit). You can set both communication protocols (ASCII and RTU) with the P3.002 parameter. The SureServo2 servo drive also supports these functions: accessing data (03H), writing one word (06H) and writing multiple words (10H).

For Modbus address details, see the Hex and Decimal addresses in the parameter details in Chapter 8. For AutomationDirect PLC programs that demonstrate Modbus PLC command and control with SureServo2, please see the SureServo2 support page at go2adc.com/sureservo2. Also, refer to the SureServo2 Modbus videos.

- *SureServo2 Modbus RTU* *Servo Modbus RTU Tutorial using the CLICK PLC and SureServo2*
- *SureServo2 Modbus TCP* *Servo Modbus TCP Tutorial using a Do-more PLC and SureServo2*

The Modbus protocol handles data structure and error checking automatically. For more information on the mechanics of the Modbus protocol, please download the free documentation from www.modbus.org.

9.4 - Setting and Accessing Communication Parameters

Please refer to Chapter 8 for the descriptions of the parameters that you can write or read through the communication interface.

The SureServo2 drive parameters are divided into eight groups: Group 0 (Monitoring parameters), Group 1 (Basic parameters), Group 2 (Extension parameters), Group 3 (Communication parameters), Group 4 (Diagnosis parameters), Group 5 (Motion control parameters) and Group 6 and Group 7 (PR parameters).

Setting parameters through communication:

You can set parameters through communication:

- *Group 0, except (P0.000 ~ P0.001), (P0.008 ~ P0.013) and (P0.046).*
- *Group 1*
- *Group 2*
- *Group 3*
- *Group 4, except (P4.000 ~ P4.004) and (P4.008 ~ P4.009).*
- *Group 5, except (P5.010), (P5.016) and (P5.076).*
- *Group 6*
- *Group 7*

Please note the following additional details:

- *P3.001: when changing to a new communication speed, the next data is written in the new transmission speed after the new speed is set.*
- *P3.002: when changing to a new communication protocol, the next data is written with the new communication protocol after the new protocol is set.*
- *P4.005: JOG control parameters. Please refer to Chapter 8 for detailed descriptions.*
- *P4.006: Force Digital Output (DO) contact control. You can use this parameter to test the DO contact. Set P4.006 to 1, 2, 4, 8, 16, and 32 to test DO1, DO2, DO3, DO4, DO5 and DO6 respectively. Then, set P4.006 to 0 to complete the test.*
- *P4.010: Calibration functions. First set P2.008 to 20 (14H in hexadecimal format) to enable this function.*
- *P4.011 ~ P4.021: these parameters are for adjusting the hardware offset. The parameters were adjusted before delivery, so changing these parameters is not recommended. If it is necessary, set P2.008 to 22 (16H in hexadecimal format) first.*

Accessing parameters through communication:

You can read the values from parameters through communication: Group 0 ~ Group 7.

NOTE: It is highly recommended to set P2.030=5 before initiating control with communication. This will disable writing any changes to the servo EEPROM. While the EEPROM can be written to several millions of times, inadvertent messaging could reach that limit within a few years. Setting P2.030 =5 eliminates this potential.

9.5 - Modbus TCP Communication Card Specifications and Installation

SV2-CM-MODTCP is an Ethernet communication module. In addition, with the MDI / MDI-X automatic detection function, there is no need for crossover cables when using the network cable. Refer to the following for more information about the SV2-CM-MODTCP module.

Features

- *Auto-detection for transmission speed of 10 / 100 Mbps*
- *MDI / MDI-X automatic detection*
- *Supports MODBUS TCP communication protocol*

NOTE: SureServo2 / PLC ModTCP communication requires that the Station ID (typically a serial communication setting) be configured correctly in both the PLC ModTCP message and SureServo2 P3.000.

9.5.1 - Functional Specifications

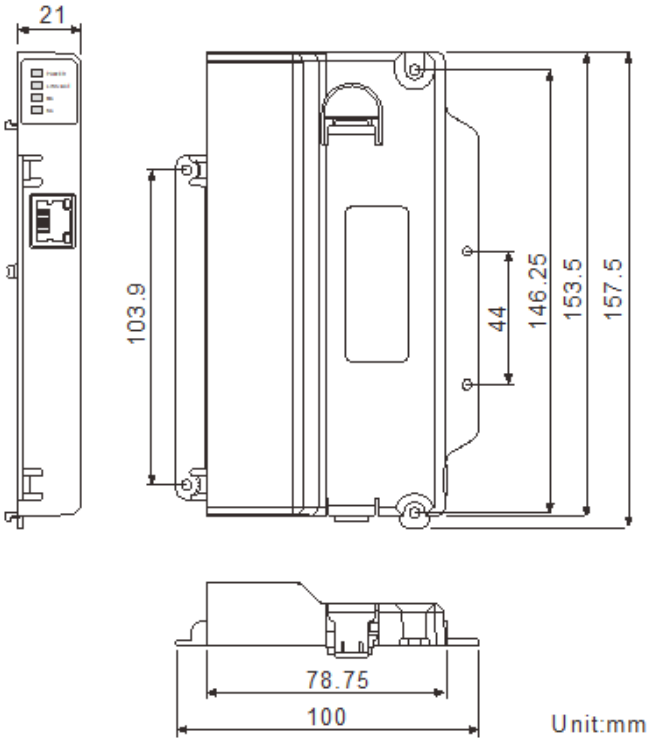
Network Interface	
Item	***Specification***
Interface	RJ45 with Auto MDI / MDIX
Number of ports	1
Transmission standard	IEEE802.3, IEEE802.3u
Transmission cable	Category 5e shielding 100M
Transmission speed	10/100 Mbps Auto-Defect
Network protocol	ICMP, IP, TCP, UDP, DHCP, Modbus TCP
Default IP Address	192.168.1.10
Default Subnet Mask	255.255.255.0

Modbus TCP Specifications		
General	***Device Type***	Server
	Maximum number of connections	4
	Maximum data length of a single connection	32 words

Environmental Specifications	
Item	***Specification***
Noise immunity	ESD (IEC 61800-5-1, IEC 6100-4-2) EFT (IEC 61800-5-1, IEC 6100-4-4) Surge test (IEC 61800-5-1, IEC 6100-4-5) Conducted susceptibility test (IEC 61800-5-1, IEC 6100-4-6)
Operating temperature	-10°C to 50°C (14°F to 122°F), humidity 90% RH
Storage temperature	-25°C to 70°C (-13°F to 158°F), humidity 95% RH
Vibration and impact resistance	IEC 61800-5-1, IEC 60068-2-6 / IEC 61800-5-1, IEC 60068-2-27

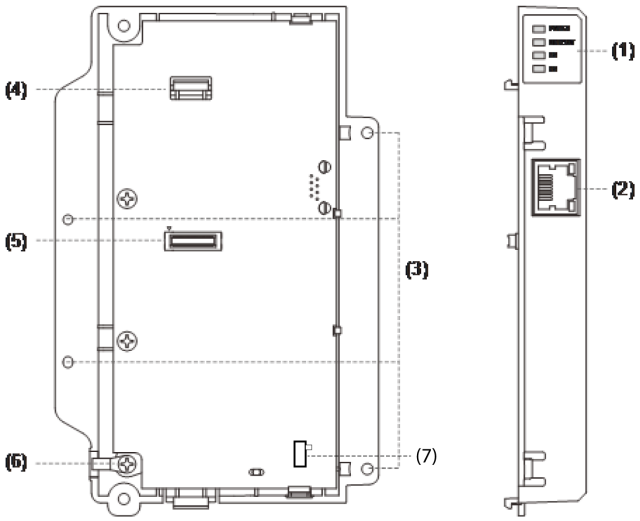
Electrical Specifications	
Item	***Specification***
Power supply voltage	5VDC
Power consumption	0.8 W
Insulation voltage	500VDC
Weight	Approx. 100g

9.5.2 - Modbus TCP Card Dimensions



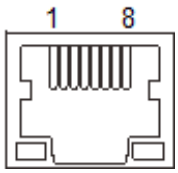
9.5.3 - Modbus TCP Card Parts

Item	Description
1	LED Indicator
2	Ethernet port (RJ45)
3	Servo drive screw fixing hole
4	Positioning hole
5	Servo drive connection port
6	PCB screw fixing hole
7	Firmware update switch



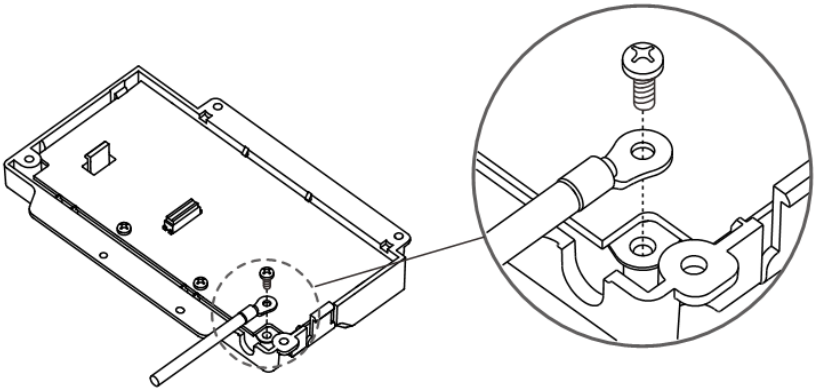
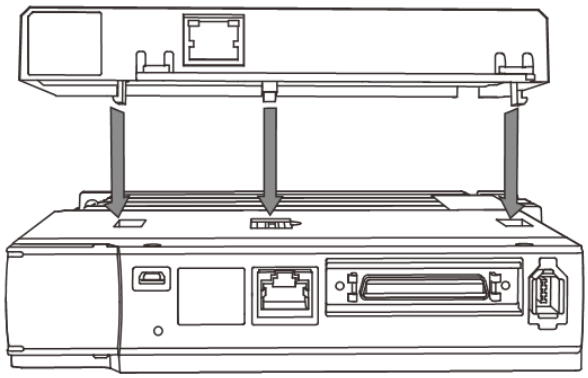
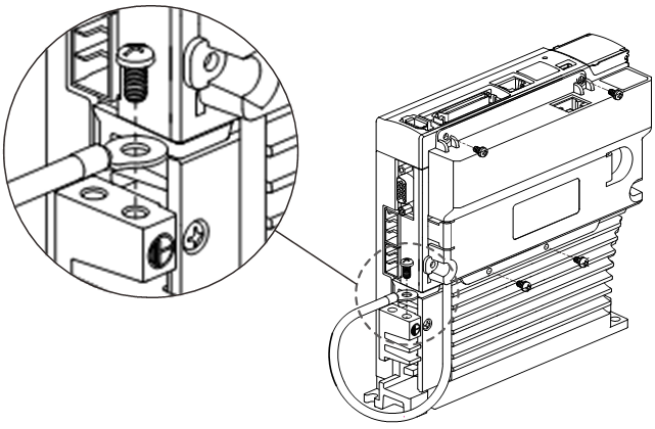
NOTE: Refer to Section 9.9 for the firmware update process.

9.5.4 - RJ45 Pin Assignment

RJ45 Connector	Pin No.	Signal	Description
	1	Tx+	Data transmission positive
	2	Tx-	Data transmission negative
	3	Rx+	Data reception positive
	4	--	N/C
	5	--	N/C
	6	Rx-	Data reception negative
	7	--	N/C
	8	--	N/C

9.5.5 - Installation

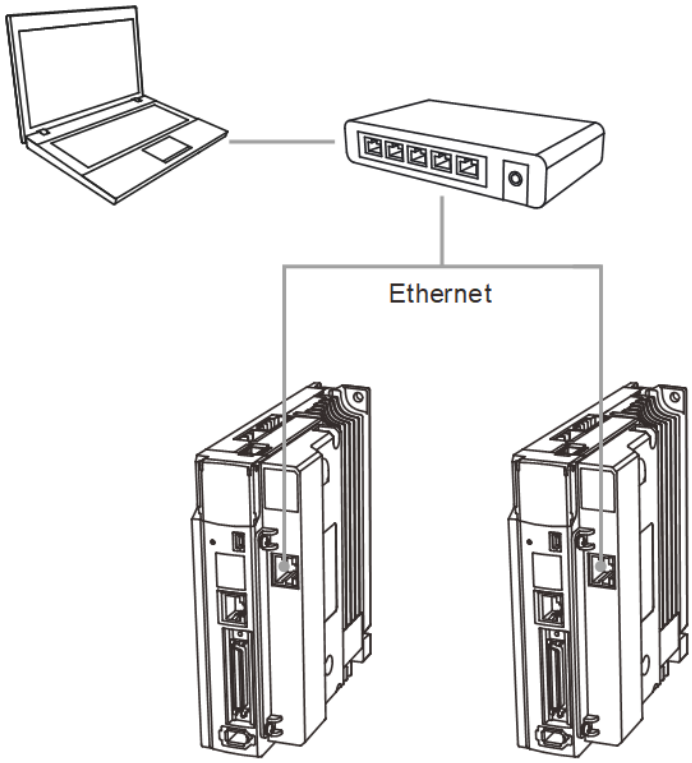
Follow the steps below to install the SV2-CM-MODTCP card in your SureServo2 drive.

Step	Description
1	Remove the screw from the ground terminal of the communication card to screw on the grounding wire that comes with the communication card. 
2	Ensure the firmware update switch is in the "Normal" position. For instructions on updating the firmware (normally not required), see Section 9.9.
3	Align the hooks of the communication card with the installation slot of the servo drive. Evenly press and insert the hooks into the slots to attach the communication card to the servo drive. Inserting the hooks by force may damage the communication card. 
4	Tighten the four screws with a torque of 6.5 Kg-cm (5.64 in-lbs) to secure the communication card. Connect the other end of the grounding wire to the ground terminal of the servo drive. 

9.5.6 - Network Configuration

Connect SV2-CM-MODTCP to an Ethernet hub with the CAT-5e twisted-pair cable. SV2-CM-MODTCP has the Auto MDI / MDIX function, so the CAT-5e twisted-pair cable does not require crossover.

The network connection between the computer and the SV2-CM-MODTCP module is as follows:



9.5.7 - MODBUS Communication Standard

The following function codes are supported:

Function Code	Description
0x03	Read the register.
0x10	Write multiple data sets to the register.

NOTE: It is highly recommended to set P2.030=5 before initiating control with communication. This will disable writing any changes to the servo EEPROM. While the EEPROM can be written to several millions of times, inadvertent messaging could reach that limit within a few years. Setting P2.030 =5 eliminates this potential.

Troubleshooting:

If the servo drive sets the Ethernet card parameters to zero at drive power-up, ensure the following:

1) The Ethernet card is properly seated onto the drive.
2) The Ethernet card ground wire is properly attached to the card and to ground.
3) The Ethernet card Firmware Update switch is set to the “Normal” position.

NOTE: SureServo2 / PLC ModTCP communication requires that the Station ID (typically a serial communication setting) be configured correctly in both the PLC ModTCP message and SureServo2 P3.000.

9.6 - EtherNet/IP Communication Card

EtherNet/IP (IP = Industrial Protocol) is an industrial Ethernet communication protocol managed by ODVA, Inc. (formerly Open DeviceNet Vendors Association, Inc.). EtherNet/IP is built on the TCP / IP communication protocol and is compatible with general IT networks.

The servo drive peripheral device that supports EtherNet/IP communication is the SV2-CM-ENETIP communication card. With the MDI / MDI-X automatic detection function, there is no need for crossover cables when using the network cable. Refer to the following for more information about the SV2-CM-ENETIP communication card.

Features

- *Auto-detection for transmission speed of 10 / 100 Mbps*
- *MDI / MDI-X automatic detection*
- *Supports MODBUS TCP communication protocol*
- *Supports EtherNet/IP Explicit Message*
- *Supports EtherNet/IP Implicit Message (or I/O Connections)*

9.6.1 - Functional Specifications

Network Interface	
Item	***Specification***
Interface	RJ45 with Auto MDI / MDIX
Number of ports	1
Transmission standard	IEEE802.3, IEEE802.3u
Transmission cable	Category 5e shielding 100 M
Transmission speed	10 / 100 Mbps Auto-Detect
Network protocol	ICMP, IP, TCP, UDP, DHCP, BOOTP, Modbus TCP, EtherNet/IP
Default IP Address	192.168.1.10
Default Subnet Mask	255.255.255.0

Modbus TCP Specifications		
General	***Device Type***	Server
	Maximum number of connections	4
	Maximum data length of a single connection	32 words (16 bits/word)

EtherNet/IP Specifications		
General	***Device Type***	Adapter
	Topology	Star
CIP network_ I/O Connection	***Maximum number of CIP connections (Number of communication connections)***	8 (Servers)
	Maximum number of TCP connections (Number of device connections)	8 (Servers)
	Requested Packet Interval (RPI) (Interval setting range)	5ms - 1000ms
	Maximum transmission speed	400pps
	Maximum data length of a single connection	500 bytes

EtherNet/IP Specifications (continued)		
CIP network_ Explicit Message	***Class 3 (Connected)***	8 (Servers), including the connections from UCMM
	UCMM (Unconnected; TCP connections)	8 (Servers), including the connections from Class 3
	CIP objects	Identity Object (0x01) Message Router Object (0x02) Assembly Object (0x04) Connection Manager Object (0x06) TCP/IP Interface Object (0xF5) Ethernet Link Object (0xF6) SV2 Data Object (0x300) User-defined objects are not supported For the object description, refer to Appendix A.

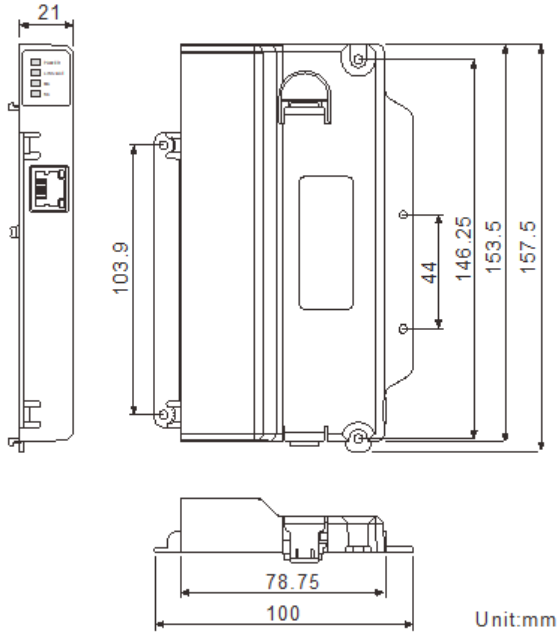
Environmental Specifications	
Item	***Specification***
Noise immunity	ESD (IEC 61800-5-1, IEC 6100-4-2) EFT (IEC 61800-5-1, IEC 6100-4-4) Surge test (IEC 61800-5-1, IEC 6100-4-5) Conducted susceptibility test (IEC 61800-5-1, IEC 6100-4-6)
Operating temperature	-10°C to 50°C (14°F to 122°F), humidity 90% RH
Storage temperature	-25°C to 70°C (-13°F to 158°F), humidity 95% RH
Vibration and impact resistance	IEC 61800-5-1, IEC 60068-2-6 / IEC 61800-5-1, IEC 60068-2-27

Electrical Specifications	
Item	***Specification***
Power supply voltage	5VDC
Power consumption	0.8 W
Insulation voltage	500VDC
Weight	Approx. 100g

9.6.2 - Glossary

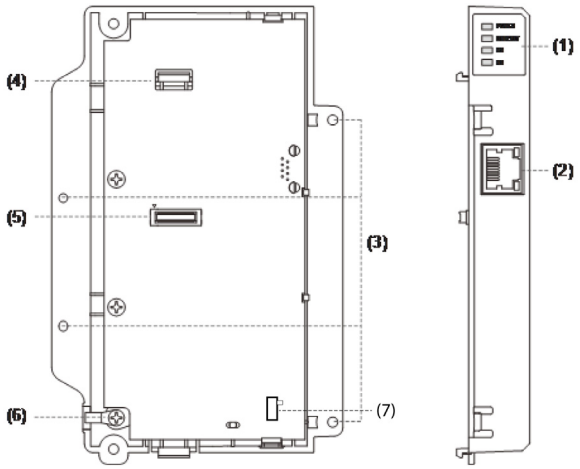
Term	Definition
ODVA	Open DeviceNet Vendor Association; EtherNet/IP is managed by ODVA.
EIP	EtherNet/IP; an industrial Ethernet communication protocol that provides interoperability between products of various providers. IP is the abbreviation for Industrial Protocol. The abbreviation "EIP" (EtherNet/IP) is used throughout this user manual.
I/O Connection	Also known as 'Implicit Messaging', 'I/O Messaging', and 'Class 1 Connection.' Transported via UDP, this communication is used for time-critical data exchange and real-time control applications.
Explicit Message	Data is exchanged between devices using separate request/response model and transported via TCP. Explicit Messaging is less efficient than an I/O Connection but offers more reliability and flexibility.
RPI	Requested Packet Interval; the time interval at which data will be exchanged between devices.
EDS	Electronic Data Sheets; EDS files are simple text files used by EtherNet/IP network configuration tools to help you identify EtherNet/IP products and easily commission them on a network.
Data Mapping	The size and format of data to be exchanged between devices.
EIP Scanner	The client device (PLC, controller) that initiates communication using an I/O connection.
EIP Adapter	The server device (servo drive) that is the target for communication using an I/O connection.
Cyclic	The controller sends commands to the communication card every communication cycle, and the communication card sends commands to the servo drive every communication cycle.
Acyclic	The controller sends commands to the communication card according to the request, and the communication card sends commands to the servo drive according to the actual processing sequence.

9.6.3 - EtherNet/IP Card Dimensions

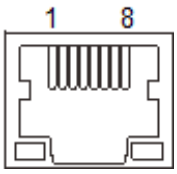


9.6.4 - EtherNet/IP Card Parts

Item	Description
1	LED Indicator
2	Ethernet port (RJ45)
3	Servo drive screw fixing hole
4	Positioning hole
5	Servo drive connection port
6	PCB screw fixing hole
7	Firmware update switch

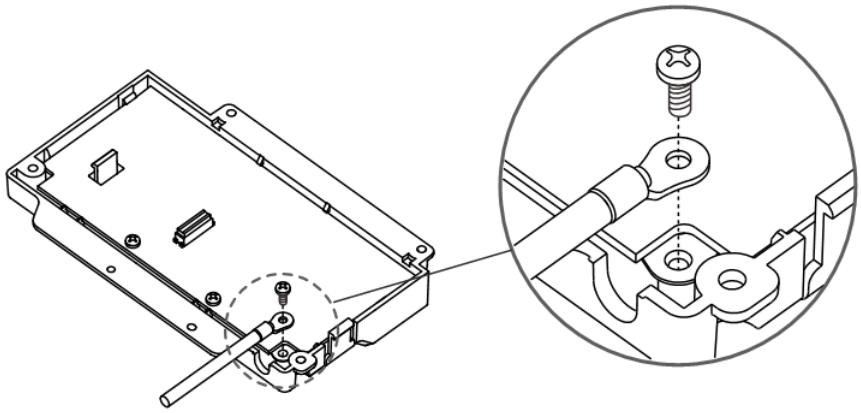
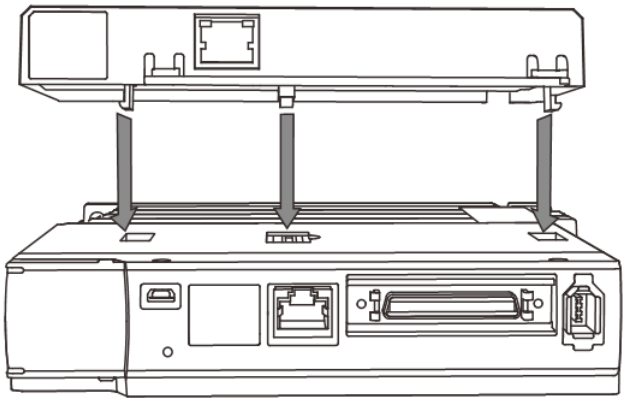
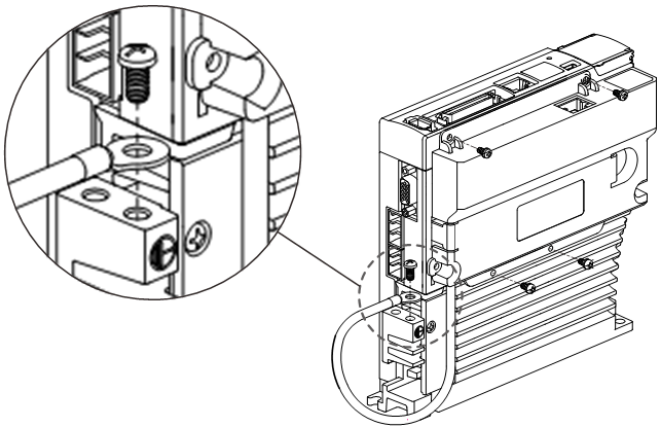


9.6.5 - RJ45 Pin Assignment

RJ45 Connector	Pin No.	Signal	Description
	1	Tx+	Data transmission positive
	2	Tx-	Data transmission negative
	3	Rx+	Data reception positive
	4	--	N/C
	5	--	N/C
	6	Rx-	Data reception negative
	7	--	N/C
	8	--	N/C

9.6.6 - EtherNet/IP Card Installation

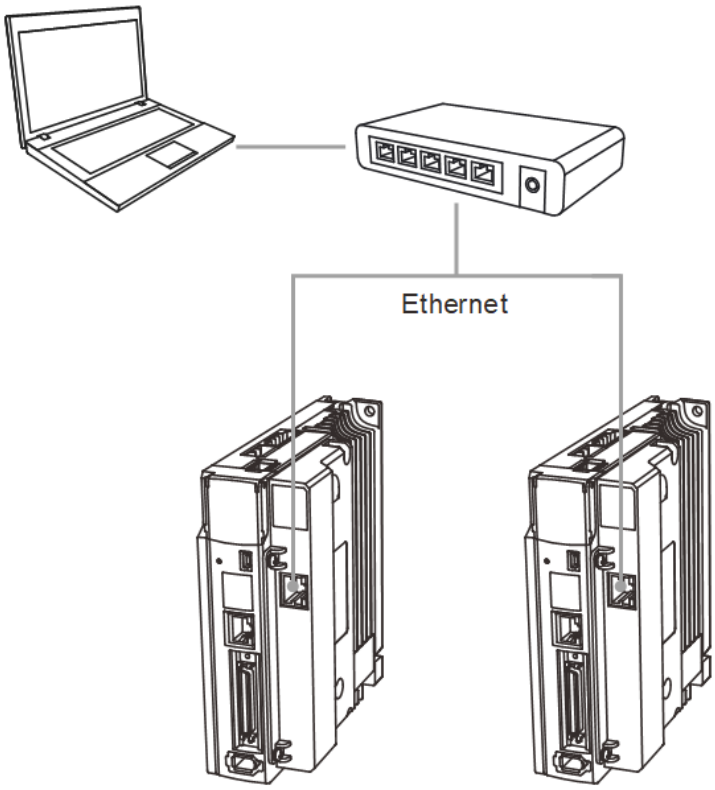
Follow the steps below to install the SV2-CM-ENETIP card in your SureServo2 drive.

Step	Description
1	Remove the screw from the ground terminal of the communication card to screw on the grounding wire that comes with the communication card. 
2	Ensure the firmware update switch is in the "Normal" position. For instructions on updating the firmware (normally not required), see Section 9.9.
3	Align the hooks of the communication card with the installation slot of the servo drive. Evenly press and insert the hooks into the slots to attach the communication card to the servo drive. Inserting the hooks by force may damage the communication card. 
4	Tighten the four screws with a torque of 6.5 Kg-cm (5.64 in-lbs) to secure the communication card. Connect the other end of the grounding wire to the ground terminal of the servo drive. 

9.6.7 - Network Configuration

Connect SV2-CM-ENETIP to an Ethernet Switch with the CAT-5e twisted-pair cable. SV2-CM-ENETIP has the Auto MDI / MDIX function, so the CAT-5e twisted-pair cable does not require crossover.

The network connection between the computer and the SV2-CM-ENETIP communication card is as follows:



9.6.8 - Explicit and Implicit (I/O Connection) Messaging

The EtherNet/IP interface of SV2 supports various servo drive control methods. The communication protocol provides two packet types for data exchange, which are Explicit Message and Implicit Message.

Explicit Message

You can use the controller to directly set the content value of the servo drive, but you need to first set the corresponding object class address for the SV2-CM-ENETIP communication card. The current object class address occupied by the servo drive is 0x300. Refer to the following sections for the supported setting methods and address list.

The Explicit Message corresponds to the parameter address as follows.

EIP communication data type:

Object class		Instance		Attribute
0x300	+	P. Group	+	P. Member

Since the SureServo2 Parameters are 32-bit and EtherNet/IP is basesd on 16-bit words, the Parameter Member value = the Parameter Number x 2.

NOTE: If your Explicit Message instruction targets an odd-numbered register, the PLC command will not be successful. Ensure that your target is a valid (even-numbered) address.

Example:

To write data to P6.004 (PR PATH #2), first refer to the corresponding communication address of this parameter in Chapter 8.

P6.004 = 0x0608

Group		Member
6 (0x06)	+	8 (0x08)

The format of Explicit Message is as follows:

Object class + Instance + Attribute = 0x300 + 0x06 + 0x08

Most all drive parameters can be addressed by Explicit Messaging. The configuration parameters in the drive are in the table below.

Once a configuration parameter has been changed, set P3.065 = 1 to "push" the new values to the Ethernet card.

Parameter Addresses for Setting SV2-CM-ENETIP

Object	*Instance*	*Attribute*	*Parameter*	*Property*	*Function*
0x300	0x03	0x00	P3.000	RW	SV2 Communication Address
		0x5C	P3.046	R	SV2-CM-ENETIP Firmware Version
		0x5E	P3.047	R	SV2-CM-ENETIP Product Code
		0x60	P3.048	R	SV2-CM-ENETIP Error Code
		0x62	P3.049	RW	IP Configuration 0=Static 1=DHCP
		0x64	P3.050	RW	IP Address 1
		0x66	P3.051	RW	IP Address 2
		0x68	P3.052	RW	IP Address 3
		0x6A	P3.053	RW	IP Address 4
		0x6C	P3.054	RW	Net Mask 1
		0x6E	P3.055	RW	Net Mask 2
		0x70	P3.056	RW	Net Mask 3
		0x72	P3.057	RW	Net Mask 4
		0x74	P3.058	RW	Gateway 1
		0x76	P3.059	RW	Gateway 2
		0x78	P3.060	RW	Gateway 3
		0x7A	P3.061	RW	Gateway 4
		0x80	P3.064	RW	Return to Factory Setting
		0x82	P3.065	RW	Save parameters to the communication card
		0x86	P3.067	RW	SV2-CM-ENETIP Timeout, ms
		0x88	P3.068	RW	Ethernet Timeout Detection 0=Enable 1=Disable
		0x8A	P3.069	RW	Ethernet Timeout Function 0=Warn (AL180) & continue operation 1=Warn & ramp to stop (decel=P5.003.C) 2=Warn & coast to stop 3=No warning and continue operation 4=Fault and ramp to stop (P5.003.C as deceleration stop)

I/O Connection (or Implicit Message)

Use the controller to specify the read and write data addresses for the mapping register of the EIP communication card. Then use the mapping register to read and write fixed-size address data at once. The supported object class address and definition of the Implicit Message are shown in the following table.

I/O Message Connection No.	*Function*	*Object*	*Instance*	*Attribute*	*Length*	*Description*
Connection 1	Input	0x04	0x6B	0x03	32 words	Corresponds to the input data to the buffer register.
				0x04	1 word	Corresponds to the input length to the buffer register.
	Output		0x6A	0x03	32 words	Corresponds to the output data of the buffer register.
				0x04	1 word	Corresponds to the output length of the buffer register.
	Configuration		0x83	0x03	96 words	Corresponds to the set object address and data.
				0x04	1 word	Corresponds to the set object length.
Connection 1_ Listen only	Input		0x6B	0x03	32 words	Corresponds to the input buffer register.
				0x04	1 word	Corresponds to the input length to the buffer register.
	Output		0xC7	0x03	0 words	n/a
				0x04	0 words	n/a
	Configuration		0x83	0x03	96 words	Corresponds to the set object address and data.
				0x04	1 word	Corresponds to the set object length.

IN/OUT Register Address Setting

The structure for the 96-word address of the IN / OUT register is shown as follows.

Object	*Instance*	*Attribute*	*SV2-CM-ENETIP*	*Word*	*IN / OUT Corresponding Address*	*Description*
0x04	0x83	0x03	R	0 - 15	IN 1 - IN 16 corresponding address	Non-fixed input address; changeable address data (user-defined address). The default is 0xFFFF.
			R	16 - 47	IN 1 - IN 16 default values	The default value of input.
			RW	48 - 63	OUT 1 - OUT 16 corresponding address	Non-fixed output address; changeable address data (user-defined address). The default is 0xFFFF.
			RW	64 - 95	OUT 1 - OUT 16 default value	The default value of output.

IN/OUT Buffer Address Register Setting

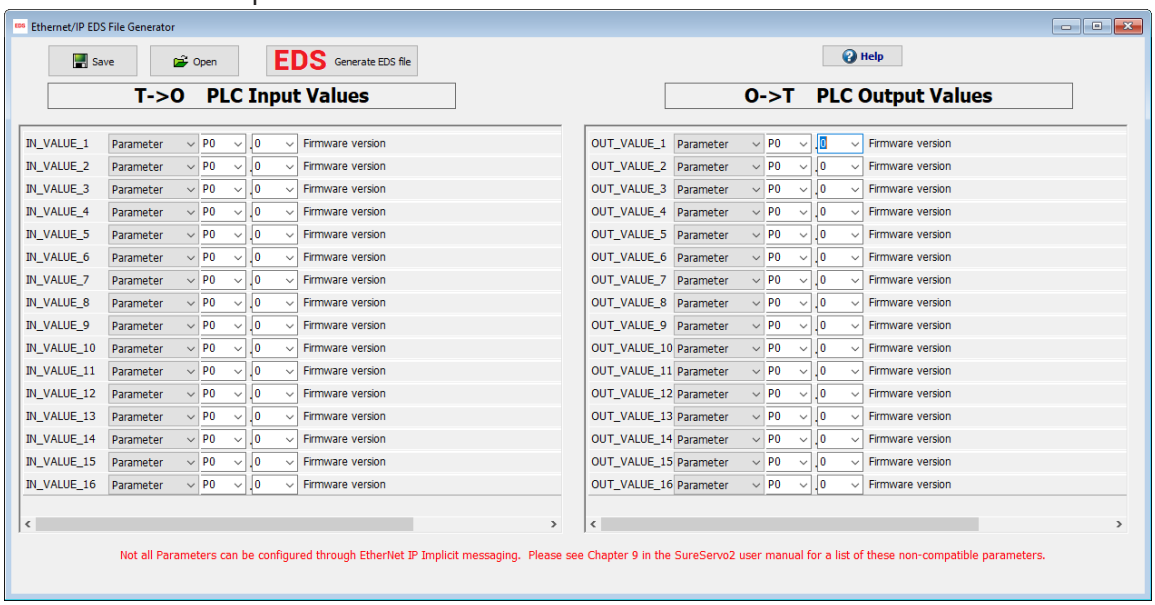
There are 16 sets of IN / OUT buffers available for dynamic mapping. Refer to the following for address planning.

The structure for the 32-word address of the IN / OUT register is shown as follows.

Object	*Instance*	*Attribute*	*SV2-CM-ENETIP*	*Word*	*IN / OUT Corresponding Address*	*Description*
0x04	0x6B	0x03	R	0 - 31	Return value of IN 1 - IN 16 corresponding address	The return value of the input address.
	0x6A		RW	0 - 31	Set value of OUT 1 - OUT 16 corresponding address	The set value written to the output address.

EDS Files - The Easy Way to Define PLC Handshaking for I/O Connections (Implicit Messaging)

PLCs and other EtherNet/IP enabled controllers often use an EDS file to define the Implicit Messaging interfacing and handshaking between the controller (scanner) and the EtherNet/IP adapter (in this case - the SureServo2 EtherNet/IP card). You typically import the EDS file (a very structured text file) into the PLC's software. Most devices have a fixed EDS file that pre-defines the data structure that will be passed between the PLC and the drive. Since the SureServo2 drive has a tremendous amount of flexibility (and the need to specify different values in different applications), there is a need to be able to customize the EDS file. The SureServo2 Pro software has a built-in EDS File Generator that will allow each application to custom-configure the input and output data that will be passed between the PLC and the drive. Open the SureServo2 Pro software, connect to your drive (or select "Offline Operation"), and double-click on the "EtherNet/IP EDS File" link. Enter the desired T->O and O->T parameters in the tables. Then press the "Generate EDS file" file to create your custom EDS file. See the software help file for more information.

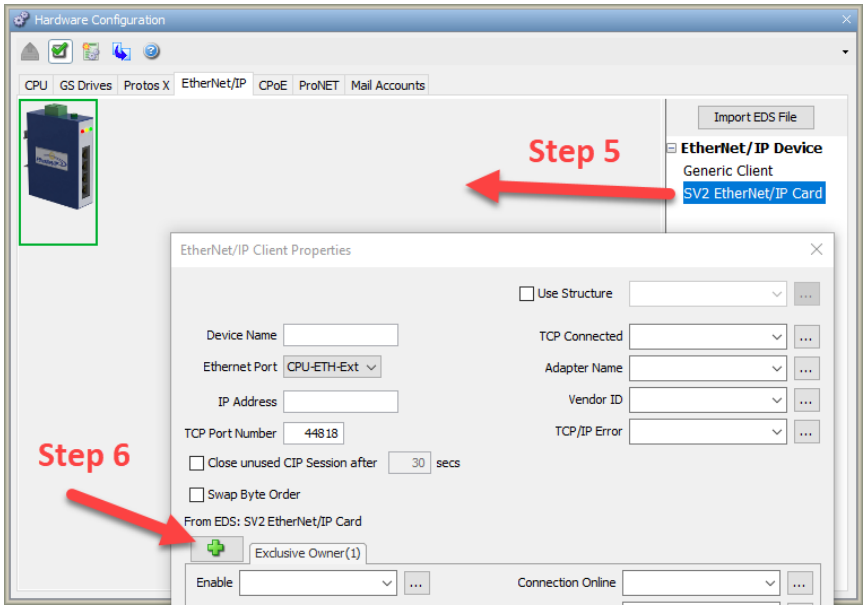


If your PLC supports EDS files, it will be able to import the EDS file into the PLC configuration software.

In the Productivity PLC software, these are the steps to import the SureServo2 EDS File:

1) Open Hardware Config
2) Select the CPU
3) Click on the Ethernet/IP tab

4) Click “Import EDS File” button
5) Choose the EDS file and press OK
6) Drag the EDS file into the Ethernet/IP window
7) Click the green “Plus” Sign and add an “Exclusive Owner” Message (that will use the EDS file).
8) Click “Show EDS Parameters” to view the Parameters you configured in the SureServo2 Pro EDS file.



Please view the SureServo2 Ethernet/IP Implicit Messaging video at AutomationDirect.com for a detailed walk-through on how to set up the Implicit Messaging feature with Productivity PLCs.

NOTE: Not all parameters can be configured through Implicit Messaging. Do not attempt to enter the following parameters in the O->T (PLC Output) values:
P5.007 Trigger Position Command for PR Mode *(instead, use P5.112 Path Target and P5.122 Path Trigger to initiate PR Paths over Implicit Messaging)*

P2.010-P2.022, P2.036-P2.041 *Do not change DI or DO functional assignments over Implicit Messaging. If you must change the definition of DIs and DOs during operation with communication (not advised), do not use Implicit Messaging - use Explicit Messaging instead.*

P5.038 - Number of Times to Capture
Each time the Capture function activates, this parameter decrements by one. So this parameter should not be constantly written to by Implicit Messaging. If you need to write to P5.038, use Explicit Messaging.

NOTE: P5.088 Activate E-Cam Control can be used with Implicit Messaging. The PLC can write to the parameter with P5.088 in O->T and will be able to read back status with P5.088 in T->O.

NOTE: Always set P2.030=5 to disable writing any changes to the servo EEPROM. While the EEPROM can be written to several millions of times, inadvertent messaging could reach that limit within a few years. Always set P2.030 =5 before initiating communication control to the drive.

9.7 - Communication Card Troubleshooting

This section provides alarm descriptions for the error codes displayed on the SV2 panel and the corrective actions you can use for troubleshooting when the LED indicators of the SV2-CM-MODTCP and SV2-CM-ENETIP communication cards are on.

NOTE: If the servo drive sets the communication card parameters to zero at drive power-up, ensure the following:
1) The communication card is properly seated onto the drive.
2) The communication card ground wire is properly attached to the card and to ground.
3) The communication card Firmware Update switch is set to the "normal" position.

9.7.1 - LED Indicators

Indicator	LED Color	Description	Corrective Action
MS (Module Status) Indicator (Valid only for the ENETIP card, MS indicator means nothing for MODTCP card)	Flashing red / green	Self-test.	No action required.
	Steady red	Unrecoverable fault.	Malfunction of the hardware. Contact the distributor.
	Steady green	Parameter setting is configured.	No action required.
	Flashing red	Recoverable fault.	Check the parameter settings.
	Flashing green	Parameter setting has not been configured.	Set the parameters as described in the user manual.
	Steady off	No power.	Check if power is supplied to the servo drive.
NS (Network Status) Indicator (Valid only for the ENETIP card, NS indicator means nothing for MODTCP card)	Flashing red / green	Network status self-test.	No action required.
	Steady red	A duplicate IP address has been identified.	Check the IP address setting.
	Steady green	Network connection is established.	No action required.
	Flashing red	Communication timeout / disconnected / IP address is changed.	Check the communication setting.
	Flashing green	Network packet sending / receiving.	No action required.
	Steady off	Not connected to the network.	Check if the network cable is connected.
POWER indicator is OFF	n/a	No power is supplied to the servo drive.	Check if the servo drive is powered on and the power supply is normal.
		Ethernet card is not connected to the servo drive.	Check if the Ethernet card is firmly connected to the servo drive.
LINK indicator is OFF	n/a	The communication card is not connected to the controller.	Check if the network cable of the communication card is connected to the controller.
		RJ45 connector has poor contact.	Check if the RJ45 connector is firmly connected to the Ethernet communication port.

9.7.2 - SureServo2 Warning/Error Codes

The current Error Code is available in P3.048.

ID	Description	Corrective Actions
75	Manufacturing parameter read error.	Restore the default settings of the communication card. If the issue persists, contact AutomationDirect.
76	Internal parameter setting error.	1. Re-install the communication card or check that the wirings of the control circuit, RST circuit, and grounding meet the requirements for resisting interference. 2. Restore the default settings of the communication card. If the issue persists, contact the servo system distributor.
80	Ethernet connection error.	Make sure the Ethernet cable is firmly connected.
81	The communication between the communication card and SV2 has timed out.	Re-install the communication card or check that the wirings of the control circuit, RST circuit, and grounding meet the requirements for resisting interference.
83	Communication card resets to the default.	Troubleshooting is not required.
84	Modbus TCP exceeds the maximum number of communications.	Reduce the number of communications for the Modbus TCP controller.
85	EtherNet/IP exceeds the maximum number of communications.	Reduce the number of communications for the EtherNet/IP controller.
86	IP address error.	1. Make sure there is no IP address conflict onsite. Remove all other devices from the network to test for IP address conflicts. 2. Reset the IP address or ensure the normal operation of the DHCP/BOOTP Server.
89	Communication card cannot communicate with SV2.	Re-install the communication card or check that the wirings of the control circuit, RST circuit, and grounding meet the requirements for resisting interference.

9.7.3 - EtherNet/IP CIP Connection Status Code

Status Code	Status	Description
0x00	Success	The requested service is successfully executed.
0x01	Connection failure	The connection service failed.
0x04	Path segment error	The program node cannot identify the definition or syntax of a path segment. When this error occurs, the execution of the path program will be terminated.
0x05	Path destination unknown	The path is related to an object type, but the program node does not include or cannot identify the type or structure of the object. When this error occurs, the execution of the path program will be terminated.
0x08	Service not supported	The object type does not support the requested service or this service has not been defined.
0x0E	Attribute not settable	Received a request to modify an unchangeable attribute.
0x13	Not enough data	Received insufficient data to execute the command.
0x14	Attribute not supported	The requested attribute is not supported.
0x15	Too much data	Received more data than needed to execute the command.
0x20	Invalid parameter	The requested parameter is invalid. This status code indicates that the parameter does not meet the requirement definition or the requirement has been defined in the Application Object Specification.
0x26	Path size invalid	The size of the transmission path is not sufficient to route the request to the object or too much routing data is included.

9.8 - EtherNet/IP Services and Objects

9.8.1 - Supported Objects

Class Code	Description
0x01	Device identity object.
0x02	Message router object.
0x04	Assembly object.
0x06	Connection manager object.
0xF5	TCP/IP interface object.
0xF6	Ethernet link object.
0x300	Servo drive data object.

9.8.2 - Supported Data Types

Data Type	Description
BYTE	8-bit string.
WORD	16-bit string.
DWORD	32-bit string.
STRING[n]	A string composed of n bytes.
SHORT_STRING	A string composed of bytes (1-byte length indicator, 1-byte characters).
USINT	8-bit unsigned integer.
UINT	16-bit unsigned integer.
UDINT	32-bit unsigned integer.

9.8.3 - Identity Object (Clase Code: 0x01)

Instance Code:

0x01

Instance Attributes				
Attribute ID	**Access Rule**	**Name**	**Data Type**	**Description of attribute**
0x01	Get	Vendor ID	UINT	660
0x02	Get	Device Type	UINT	Communications adapter 12
0x03	Get	Product Code	UINT	Model code: 0x04302
0x04	Get	Revision	STRUCT of: USINT, USINT	Ethernet/IP version Major Revision, Minor Revision
0x05	Get	Status	WORD	Summary status of devices
0x06	Get	Serial Number	UDINT	32-bit serial number of device
0x07	Get	Product Name	SHORT_ STRING	SV2-CM-ENETIP

Common Services				
Service code	**Implemented for**		**Service Name**	**Description of Service**
	Class	**Instance**		
0x01		✓	Get_Attribute_All	Returns the attribute content of multiple objects.
0x05		✓	Reset	Resets device setting.
0x0E	✓	✓	Get_Attribute_Single	Returns the attribute content of the specified object.

9.8.4 - Message Router Object (Class Code: 0x02)

Instance Code:

0x01

Instance Attributes:

None

Common Services				
Service code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E		✓	Get_Attribute_Single	Returns the attribute content of the specified object.

9.8.5 - Assembly Object (Class Code: 0x04)

Instance Code				
Name	Function	Instance	Size	Description
Connection 1	Input	0x6B	32 words	Corresponds to the input buffer register.
	Output	0x6A	32 words	Corresponds to the output buffer register.
	Configuration	0x83	96 words	Corresponds to the set object.
Connection 1_ Listen only	Input	0x6B	32 words	Corresponds to the input buffer register.
	Output	0xC7	0 words	n/a
	Configuration	0x83	96 words	Corresponds to the set object.

Instance Attributes				
Attribute ID	Access rule	Name	Data Type	Description of Attribute
0x03	Get / Set	Data	ARRAY of BYTE	Instance Code = 0x6A (Get / Set) Others Get only
0x04	Get	Size	UINT	n/a

Common Services				
Service code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Returns the attribute content of the specified object.
0x10		✓	Set_Attribute_Single	Modifies the attribute.

9.8.6 - Connection Manager Object (Class code: 0x06)

Instance Code:

0x01

Instance Attributes:

None

Common Services				
Service code	Implemented for		Service Name	Description of Service
	Class	Instance		
0x0E	✓	✓	Get_Attribute_Single	Returns the attribute content of the specified object.
0x4E		✓	Forward_Close	Closes the connection.
0x54		✓	Forward_Open	Establishes the connection (maximum of 511 bytes per transmission).
0x5B		✓	Large_Forward_Open	n/a

9.8.7 - TCP/IP Interface Object (Class code: 0xF5)

Instance Code:

0x01

Instance Attributes				
Attribute ID	Access Rule	Name	Data Type	Description of Attribute
0x01	Get	Status	DWORD	Interface status
0x02	Get	Configuration Capability	DWORD	Interface capability flags
0x03	Get / Set	Configuration Control	DWORD	Interface control flags
0x04	Get	Path Size, Path	STRUCT of: UINT, Padded EPATH	Path size Path
0x05	Get / Set	Interface Configuration	STRUCT of: UDINT, UDINT, UDINT, UDINT, UDINT, STRING	IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name
0x06	Get / Set	Host Name	STRING	Host name

Additional Attributes			
Attribute	***Bits***	***Name***	***Description***
Status Instance	0-3	Interface Configuration Status	0 = The Interface Configuration attribute has not been configured. 1 = The Interface Configuration attribute contains valid configuration obtained from BOOTP, DHCP or non-volatile storage. 2 = The IP address member of the Interface Configuration attribute contains valid configuration, obtained from hardware settings (e.g.: pushwheel, thumbwheel, etc.) 3 - 15 = Reserved for future use.
Configuration Capability	2	DHCP Client	1 (TRUE) shall indicate the device is capable of obtaining its network configuration via DHCP.
	4	Configuration Settable	1 (TRUE) shall indicate the Interface Configuration attribute is settable.
Configuration Control	0-3	Startup Configuration	0 = The device shall use the interface configuration values previously stored in non-volatile memory. 1 = The device shall obtain its interface configuration values via BOOTP. 2 = The device shall obtain its interface configuration values via DHCP upon start-up. 3 - 15 = Reserved for future use.

Common Services				
Service code	***Implemented for***		***Service Name***	***Description of Service***
	Class	***Instance***		
0x0E	✓	✓	Get_Attribute_Single	Returns the attribute content of the specified object.
0x10		✓	Set_Attribute_Single	Modifies the attribute.

9.8.8 - EtherNet Link Object (Class code: 0xF6)

Instance Code:

0x01

Instance Attributes				
Attribute ID	***Access rule***	***Name***	***Data Type***	***Description of attribute***
0x01	Get	Interface Speed	UDINT	Interface speed currently in use Speed in Mbps (e.g., 0, 10, 100, 1000, etc.)
0x02	Get	Interface Flags	DWORD	Interface status flags
0x03	Get	Physical Address	USINT [6]	MAC address

Bits	**Name**	**Description**
0	Link Status	0 indicates an inactive link; 1 indicates an active link.
1	Half / Full Duplex	0 indicates the interface is running half duplex; 1 indicates full duplex.
2-4	Negotiation Status	Indicates the status of link auto-negotiation 0 = Auto-negotiation in progress. 1 = Auto-negotiation and speed detection failed. Using default values for speed and duplex. Defaults are 10 Mbps and half duplex. 2 = Auto negotiation failed but detected speed. Default is half duplex. 3 = Successfully negotiated speed and duplex. 4 = Auto-negotiation not attempted. Forced speed and duplex.

Common Services				
Service code	**Implemented for**		**Service Name**	**Description of Service**
	Class	**Instance**		
0x01		✓	Get_Attribute_All	Returns the attribute content of multiple objects.
0x0E		✓	Get_Attribute_Single	Returns the attribute content of the specified object.

9.8.9 - SV2 Data Object (Class code: 0x300)

Class Attributes and Instance Attributes:

Object class = 0x300

Instance = Parameter Group

Attribute = Parameter Member = Parameter Number x 2

Example:

P5.007 would be addressed as Instance 5, Attribute 14.

Instance and Attributes					
Instance	**Attribute**	**Access rule**	**Name**	**Data Type**	**Description of attribute**
0x00 - 0x07	0x00 - 0xFF	Get / Set*	SV2 Parameter.	UDINT, STRING	SV2 parameter data
0x10	0x00 - 0xFE	Get / Set	Monitor Parameter	UDINT, STRING	SV2 Monitor Parameter
0x32 - 0x34	0x00 – 0xFF	-	Reserved	-	Internal used
** Refer to the Parameters chapter to check if the parameter is read-only. It is not recommended to modify the attributes for read-only parameters.*					

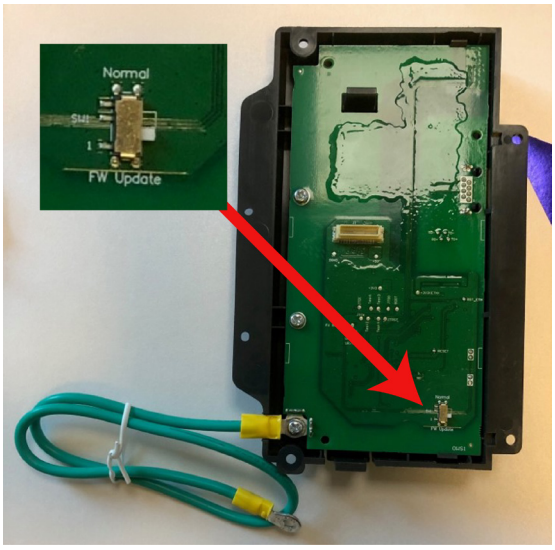
Common Services				
Service code	**Implemented for**		**Service Name**	**Description of Service**
	Class	**Instance**		
0x0E	✓	✓	Get_Attribute_Single	Returns the attribute content of the specified object.
0x10	✓	✓	Set_Attribute_Single	Modifies the attribute.

9.9 - Ethernet Card Firmware Update

NOTE: This procedure is only for the firmware located inside the Ethernet card. For servo drive firmware updates, SureServo2 Pro software and a SV2-PGM-USB15 (or -USB30) cable are required. See the SureServo2 Pro software help file for more information.

The ModTCP and the EtherNet/IP firmware update process is the same for both cards. The Ethernet cards have web servers built-in that will facilitate upgrading the firmware. An Ethernet cable attached to a PC is all that is required.

To determine if the Ethernet card firmware needs to be updated, compare the Ethernet card firmware version in P3.046 to the latest firmware file at the Ethernet card item page on Automationdirect.com.

Ethernet Card Firmware Update Process	
1	To updae firmware, first ensure the "FW Update" switch is in the "FW Update" position.  **NOTE**: The card will only allow firmware updates when the switch is set to "FW Update". The switch must be returned to the "Normal" position after updating for typical servo communication and control.
2	Mount the card to the drive (see the card installation instructions if necessary).
3	Insert one end of an Ethernet cable into the RJ45 connector. Insert the other end into a switch or controller.
4	Turn on power to the drive. The POWER light should turn solid (no blinking). The LINK/ACT should turn on and blink several times while establishing connection to the switch or controller. This indicates the card is negotiating a connection. **NOTE**: If the LINK/ACT light turns on solid when first powered up, cycle power to the switch. If the LINK/ACT light still does not blink after powering up the switch, unplug and replug the controller (PLC, etc.) from the switch. If the card's LINK/ACT light still does not blink this may indicate that the switch in use is an older model that may not work with the drive. Replace the switch or run the ethernet cable from the card directly to the controller. The card will automatically negotiate the direct connection, so a cross-over cable is not needed.

<table>
<tr><th colspan="2">Ethernet Card Firmware Update Process, continued</th></tr>
<tr><td>5</td><td>Set your PC IP address to 192.168.1.xxx where xxx is a number of your choice excepting “3” (the communication card is hard-coded to 192.168.1.3).

If you don’t know how to manually set your PC’s IP address, follow the steps below:
<table>
<tr><th colspan="2">Manually Setting PC IP Address</th></tr>
<tr><td>1</td><td>In your PC’s search box, type “Network Status” and click on the Network Status app.</td></tr>
<tr><td>2</td><td>Select “Change Adapter Options”.</td></tr>
<tr><td>3</td><td>Double-click on the hard-wired ethernet connection to the servo.</td></tr>
<tr><td>4</td><td>Select “Properties”.</td></tr>
<tr><td>5</td><td>Double-click on “Internet Protocol Version 4 (TCP/IPv4).</td></tr>
<tr><td>6</td><td>Make sure “Use the Following IP Address” is selected, then enter 192.168.1.xxx where xxx is a number of your choice other than 3. Enter 255.255.255.0 for the subnet mask.</td></tr>
<tr><td>7</td><td>Click “Ok”.</td></tr>
</table></td></tr>
<tr><td>6</td><td>Using your web browser, go to http://192.168.1.3. This is the hard-coded address for the communication card when the “FW Update” switch is toggled on.

The communication card web server should display. If it does not, try connecting to the card with a direct ethernet connection from your PC to your card (don’t use a switch or hub). A standard ethernet cable will work (cross-over cable is not required).</td></tr>
<tr><td>7</td><td>Press “Choose File” and select the appropriate file for your card (*.web).</td></tr>
<tr><td>8</td><td>Press “Update”. After a few seconds, the Update Status should change to “Firmware Update Success”.</td></tr>
<tr><td>9</td><td>Once the update is complete, remove power from the drive, then remove the ethernet cable and uninstall the ethernet card.</td></tr>
<tr><td>10</td><td>Slide the “SW Update” switch on the card to the “Normal” position. The card will NOT communicate with other devices unless the switch is set correctly.</td></tr>
<tr><td>11</td><td>Re-install the communication card and reconnect the ethernet cable.</td></tr>
<tr><td>12</td><td>Apply power to the drive and ensure that the “Power” light is solid. Ensure that the LINK/ACT light blinks several times after the drive has powered up. See Step 4 if the card doesn’t establish communications.</td></tr>
</table>

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