

Intuitive Vision System

CV-X400 Series

Easy Configuration Manual

EtherNet/IP™ Edition (Allen-Bradley ControlLogix Series)

Documentation for the installation and configuration methods of the controller, and CAD data can be downloaded from the following URL.

www.keyence.com/cvx_support

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1. Connecting over EtherNet/IP

This document has been created on the assumption that it will be used to check connections with the basic configuration.

Until a connection is successfully established, configure the settings according to this document. Thereafter, change the settings as necessary.

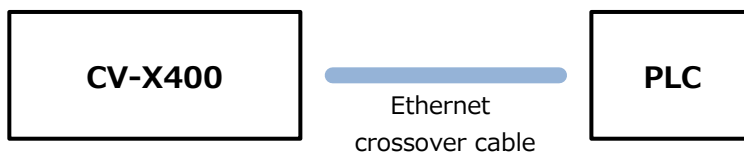
This chapter explains how to establish a connection between the CV-X400 and the PLC over EtherNet/IP.

1.1 Connecting Devices

1.1.1 Wiring

Use one of the following methods to connect the devices. Use a CAT5e or higher Ethernet cable.

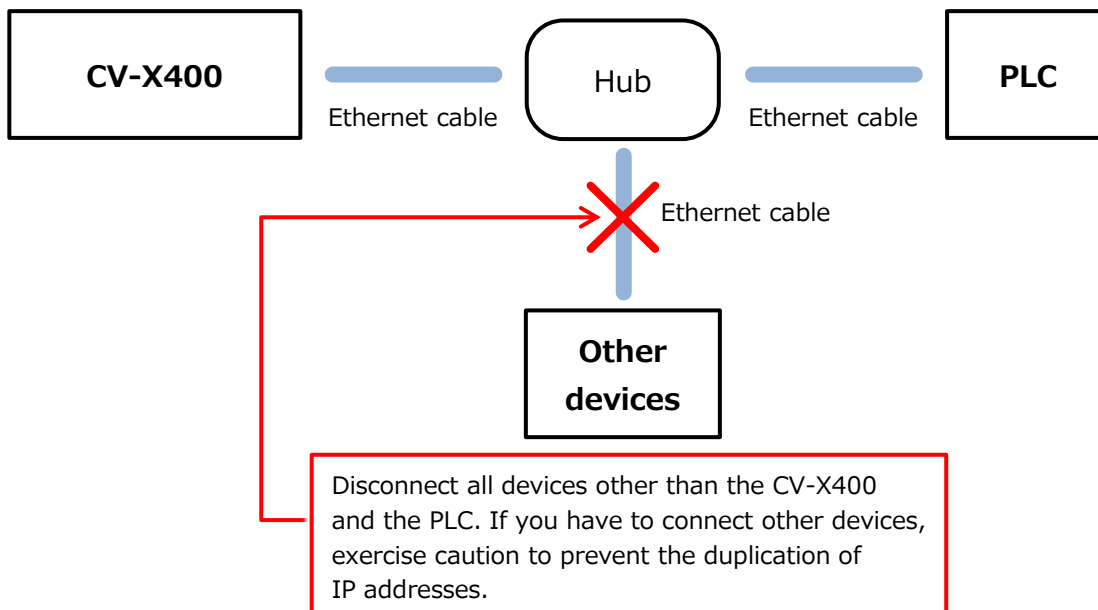
Connecting in a 1 to 1 Configuration



Connecting through a Hub

To give priority to the checking of the EtherNet/IP connection, disconnect all devices other than the CV-X400 and the PLC from the hub before establishing the connection.

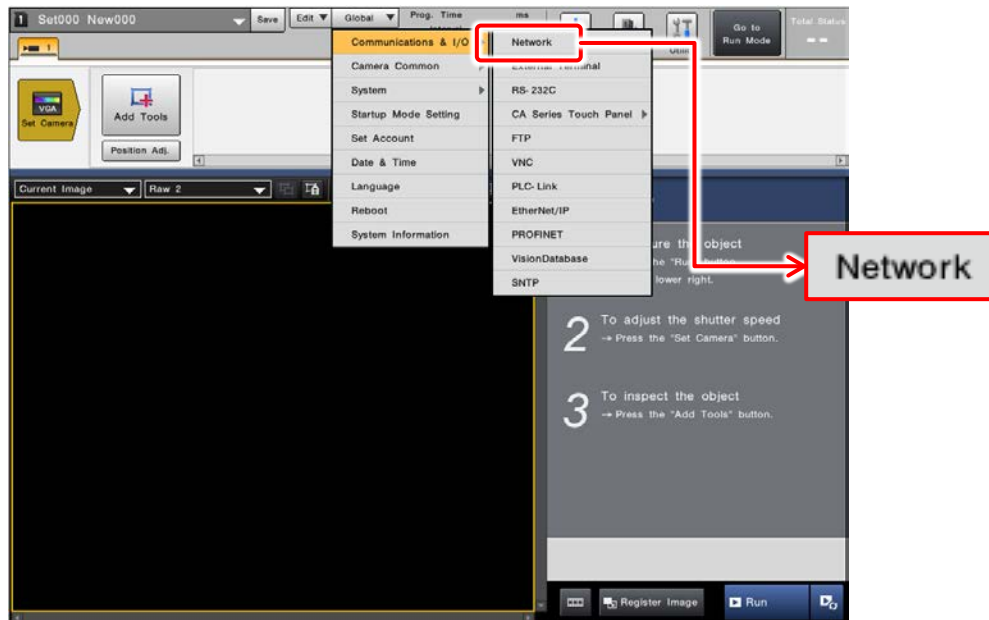
To connect other devices, first configure the settings as described in this document, successfully establish the connection, set the IP address to an appropriate value, and then connect the other devices.



1.1.2 Configuring CV-X400 Settings

Configure the CV-X400 to enable a connection over Ethernet/IP.

- (1) At the top of the setup mode screen, click "Global," point to "Communications & I/O," and then click "Network."

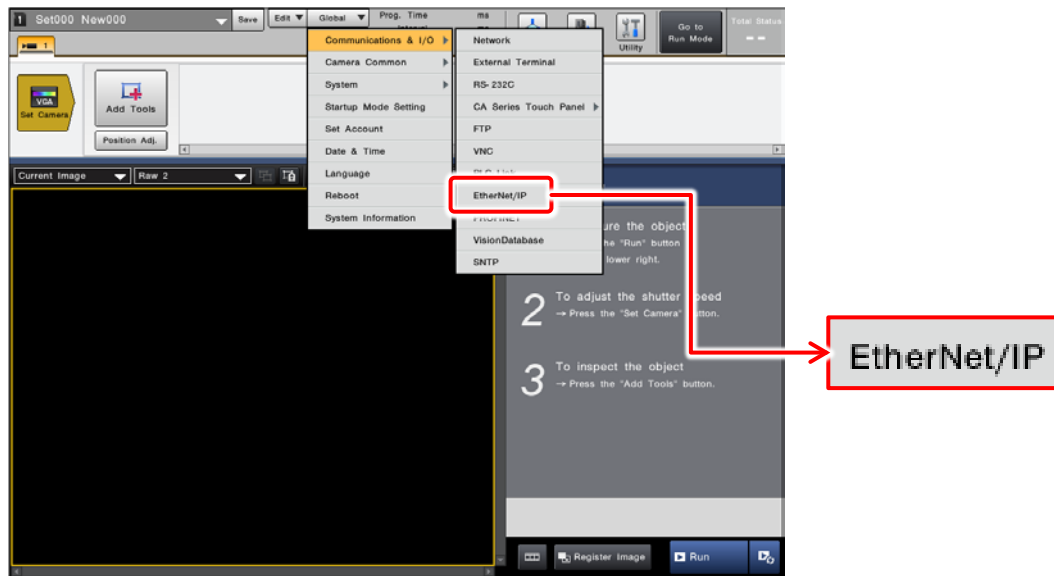


- (2) Set the IP address of the CV-X400. (In the initial values, this is set as 192.168.0.10.)

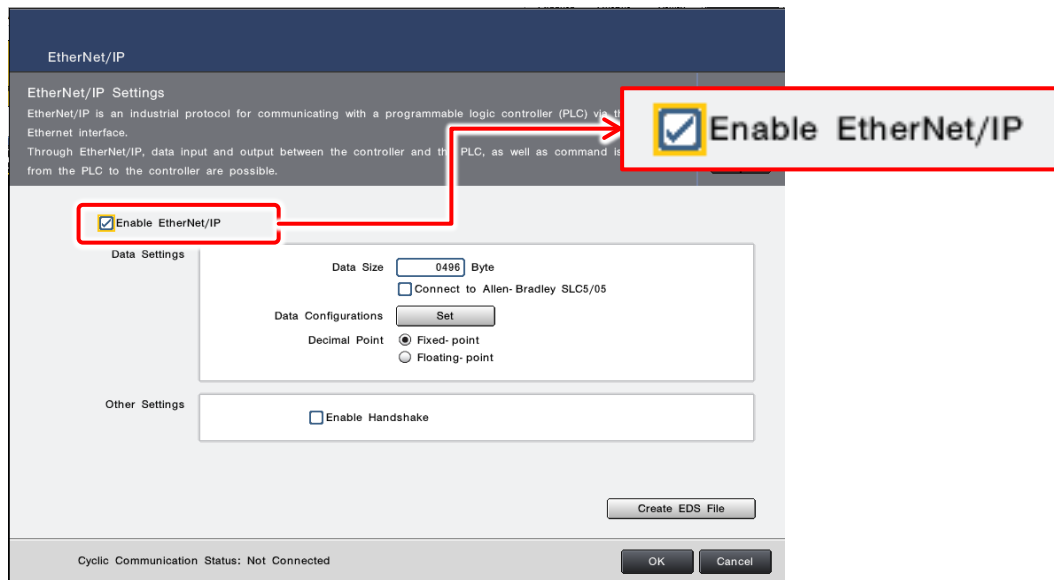


You have to configure the settings to ensure that the IP address is not the same as that of any other device on the network.

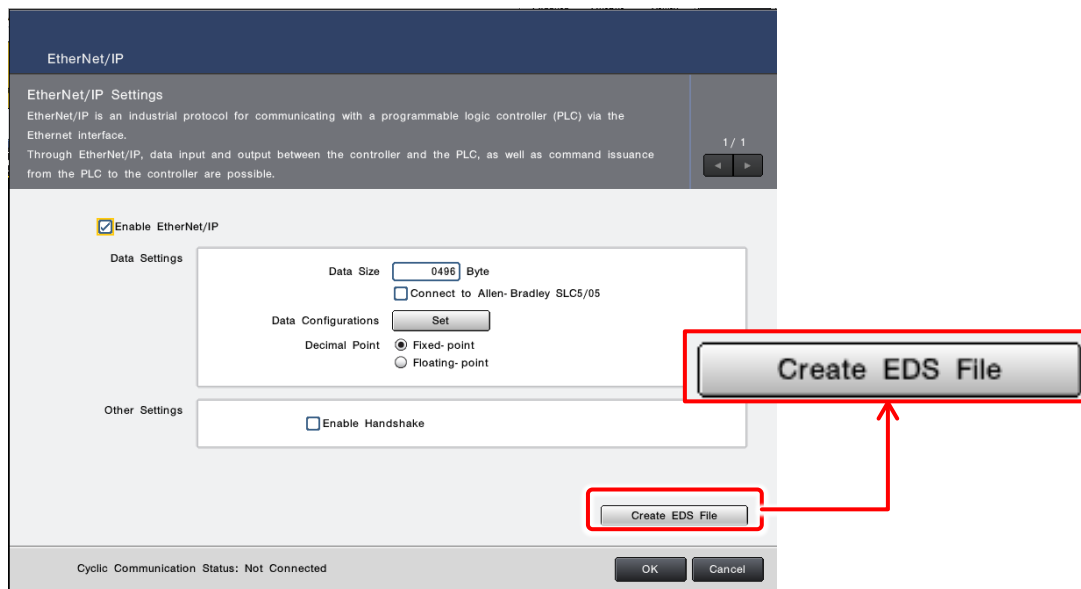
- (3) At the top of the setup mode screen, click "Global," point to "Communications & I/O," and then click "EtherNet/IP."



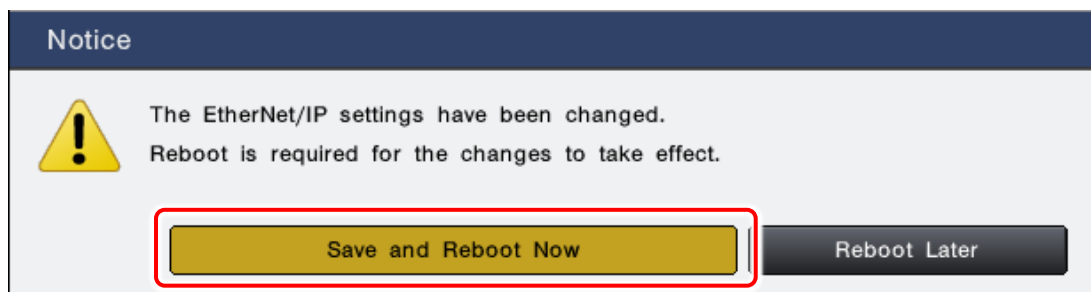
- (4) Select the "Enable EtherNet/IP" check box.



- (5) Check that SD2 has been inserted into the CV-X400, and then click "Create EDS File" to output the EDS file to SD2.



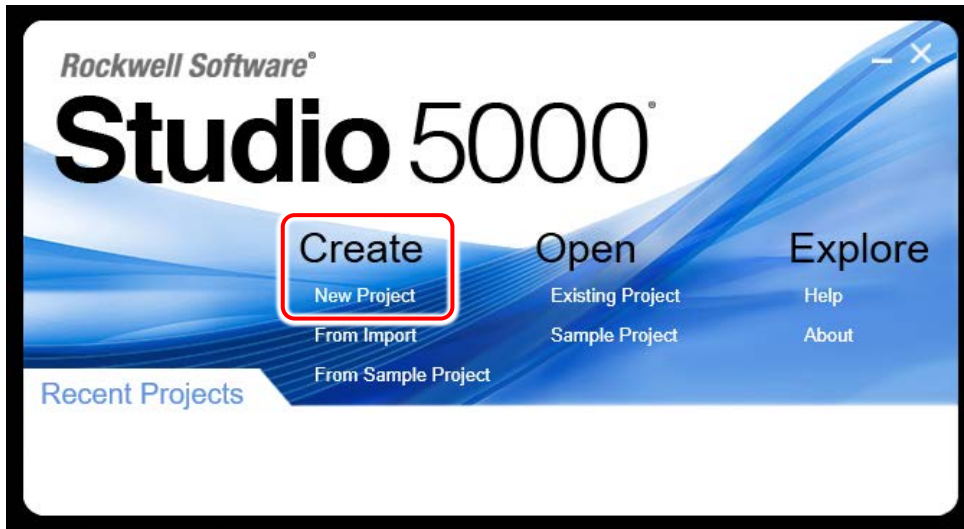
- (6) Click "OK" to display a confirmation dialog box for restarting the CV-X400. Click "Save and Reboot Now" to restart the CV-X400.



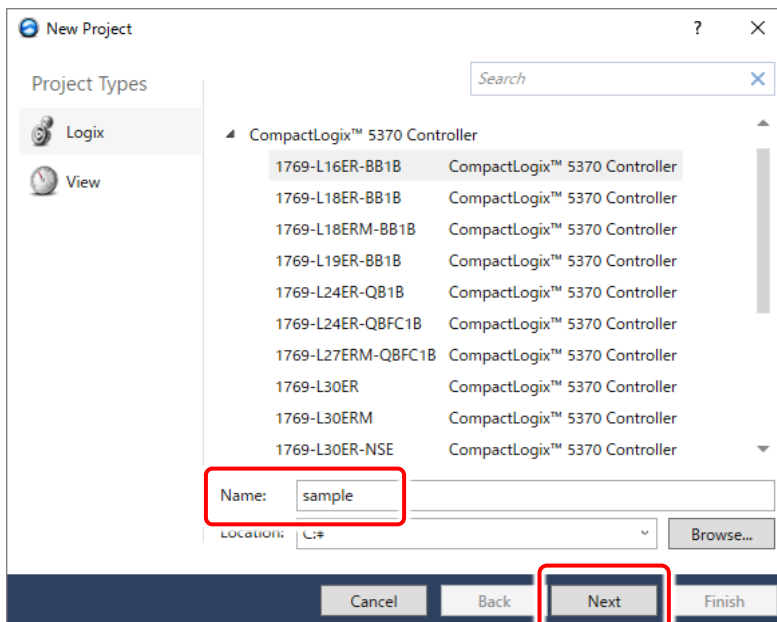
1.1.3 Configuring the PLC

In order to connect using EtherNet/IP, configure the PLC using Studio 5000.

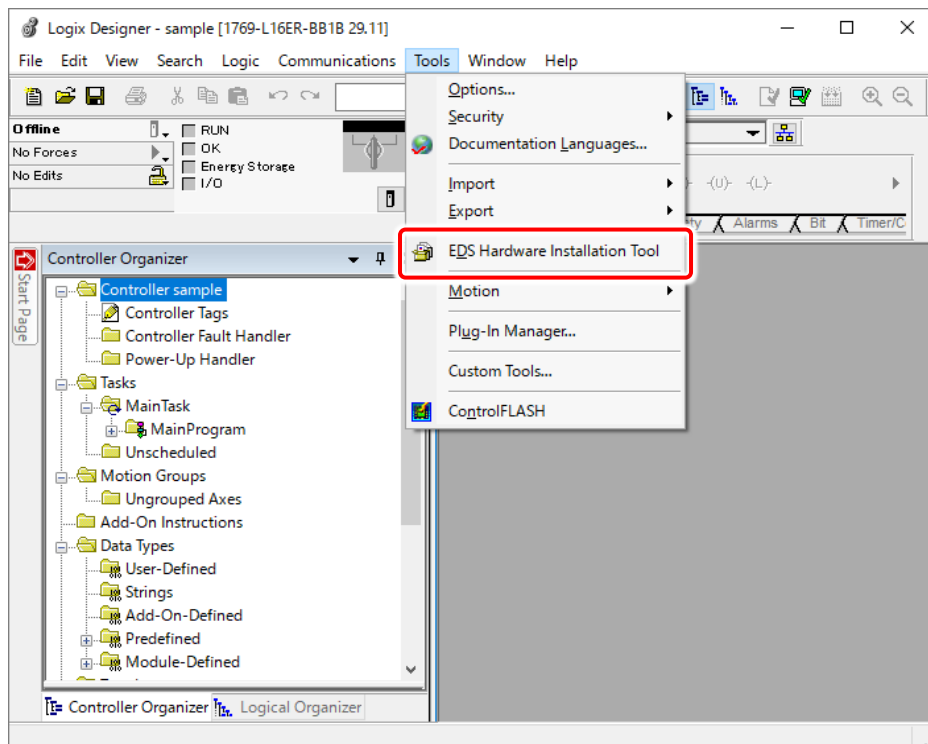
(1) Launch the Studio 5000 and select "Create">"New Project".



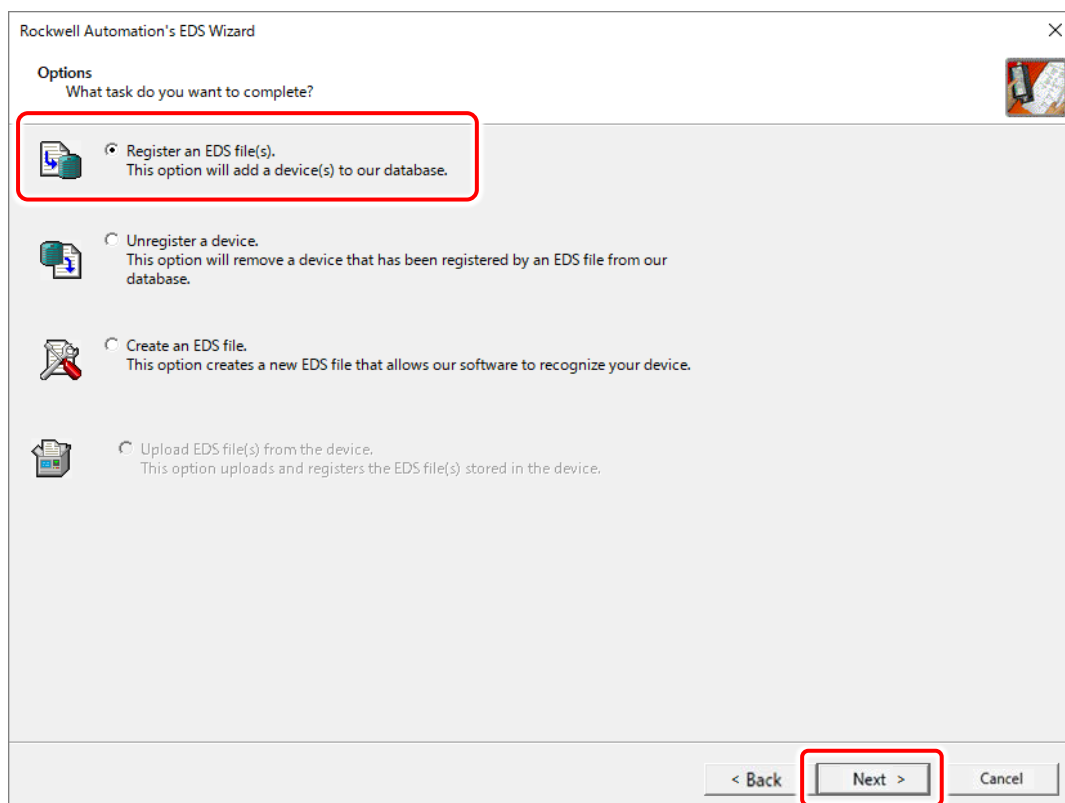
(2) Select the PLC controller model, enter the desired project name in "Name", and then select "Next".



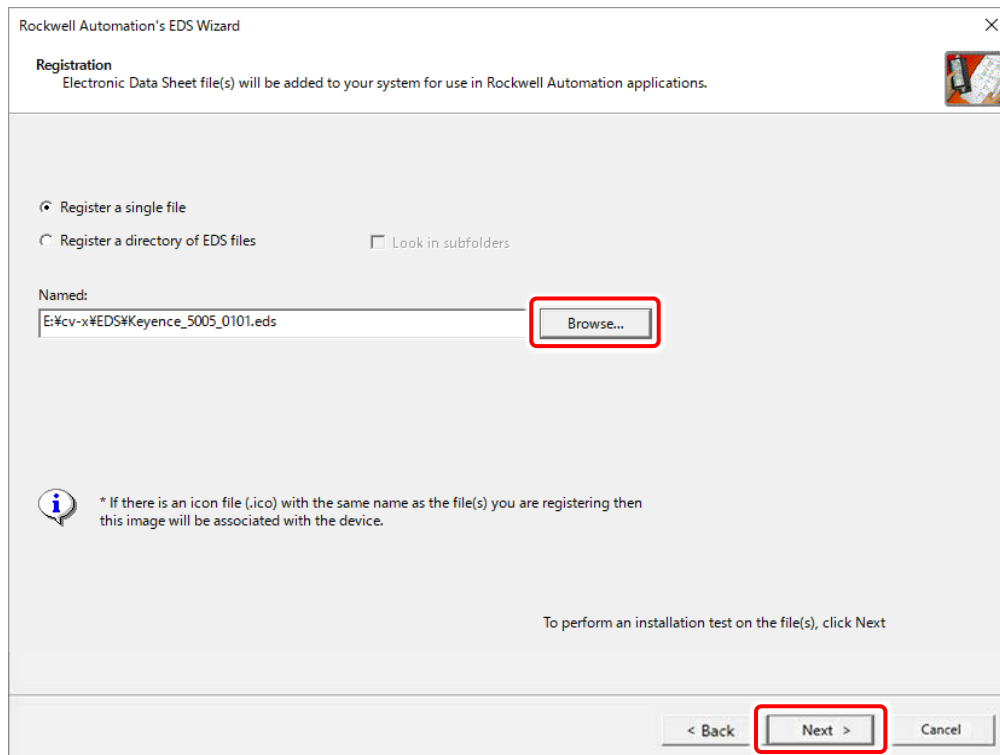
(3) Select "Tools"> "EDS Hardware Installation Tool".



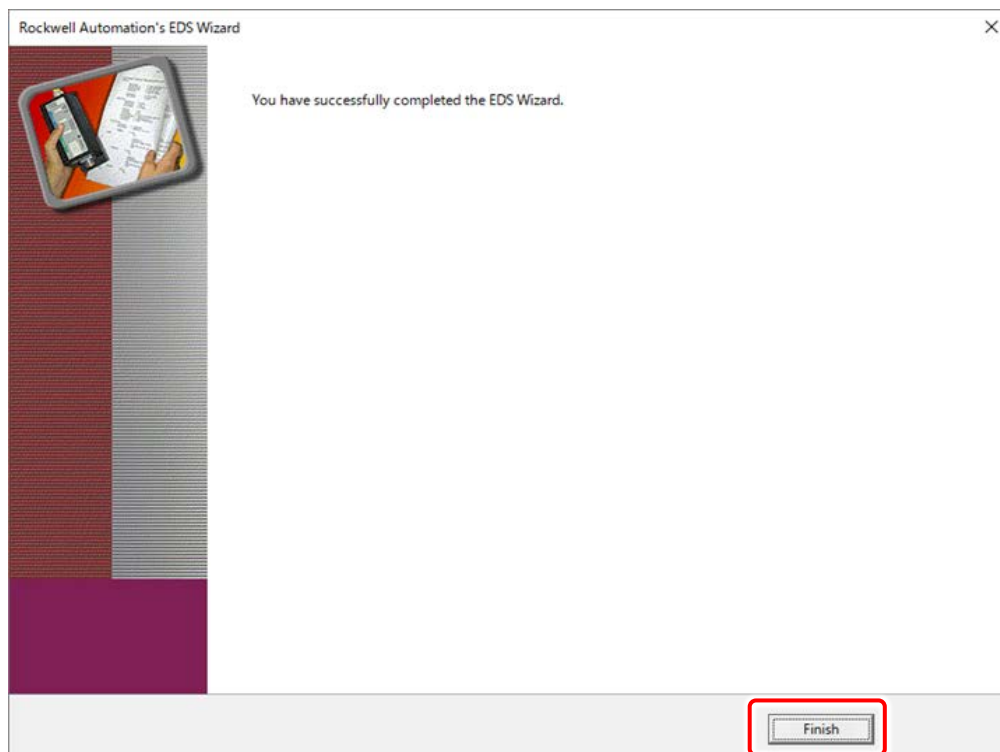
(4) Select "Register an EDS file(s).", and then select "Next".



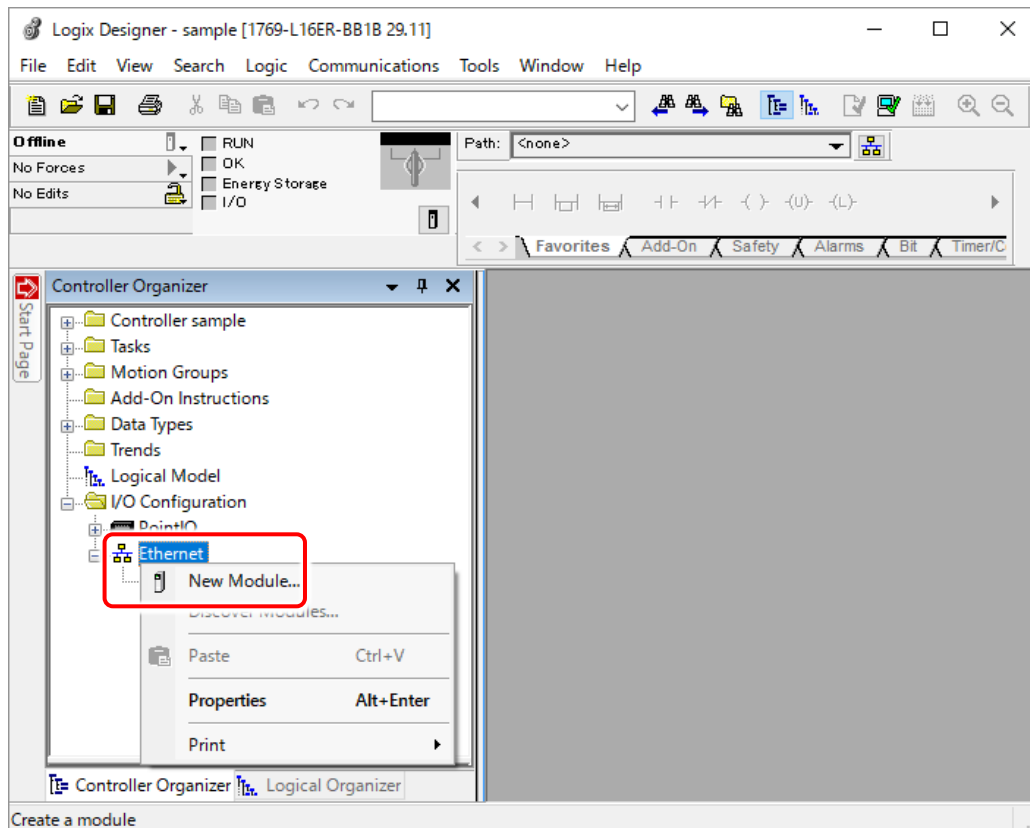
- (5) Select "Browse..." and select the EDS file saved in Step (5) of "1.1.1.2 Configuring the CV-X400".
(The EDS file is saved inside the folder "cv-x¥EDS" in the SD2 of the CV-X controller.)



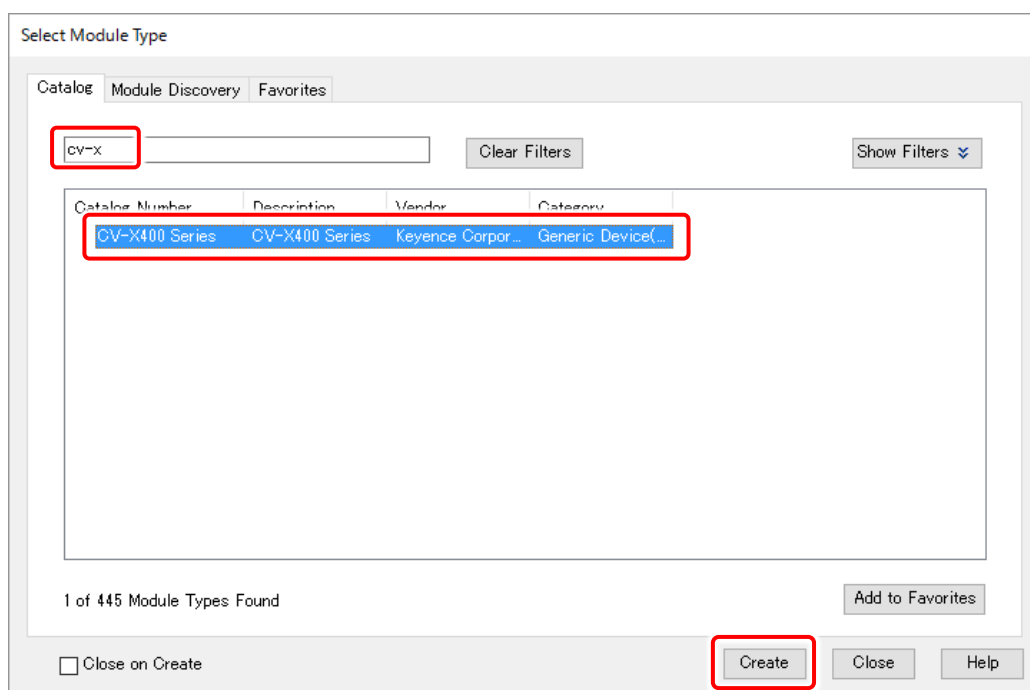
- (6) Select "Next" in the screen above and in the remaining screens as well. In the end, the completion screen is displayed as shown below. Select "Finish".



- (7) Right-click "Ethernet" under "Controller Organizer"> "I/O Configuration" and select "New Module...".



- (8) If you enter "CV-X" in the text box, "CV-X400 Series" will be displayed based on the EDS file that was loaded.
With "CV-X400 Series" in a selected state, select "Create".



- (9) Enter the desired name in "Name" and enter the IP address that was set for the CV-X400 in Step (2) of "1.1.2 Configuring CV-X400 Settings" in "IP Address". Then, select "Change ...".

The 'New Module' dialog box is shown with the following details:

- General*** tab is active.
- Type: CV-X400 Series CV-X400 Series
- Vendor: Keyence Corporation
- Parent: Local
- Name: CVX
- Description: (empty text box)
- Module Definition:
 - Revision: 1.001
 - Electronic Keying: Compatible Module
 - Connections: Class1
- Ethernet Address:
 - ☒ IP Address: 192 . 168 . 0 . 10
 - ☐ Private Network: 192.168.1.
 - ☐ Host Name: (empty text box)
- Buttons: Change ... (highlighted), OK, Cancel, Help.
- Status: Creating

- (10) Change "Size" to "DINT" and select "OK".

The 'Module Definition*' dialog box is shown with the following details:

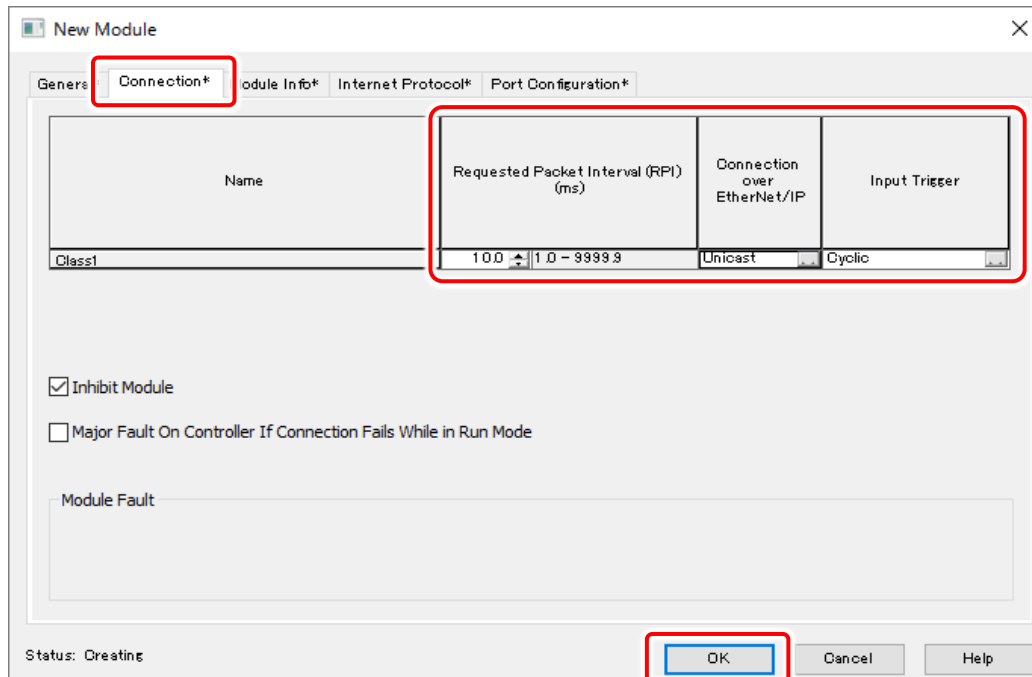
- Revision: 1.001
- Electronic Keying: Compatible Module
- Connections:

Name	Size
Class1	Input: 124 Output: 124
- Size dropdown menu is open, showing 'DINT' selected.
- Buttons: OK (highlighted), Cancel, Help.

- (11) Select the "Connection" tab and check the parameters such as the "Requested Packet Interval (RPI)".

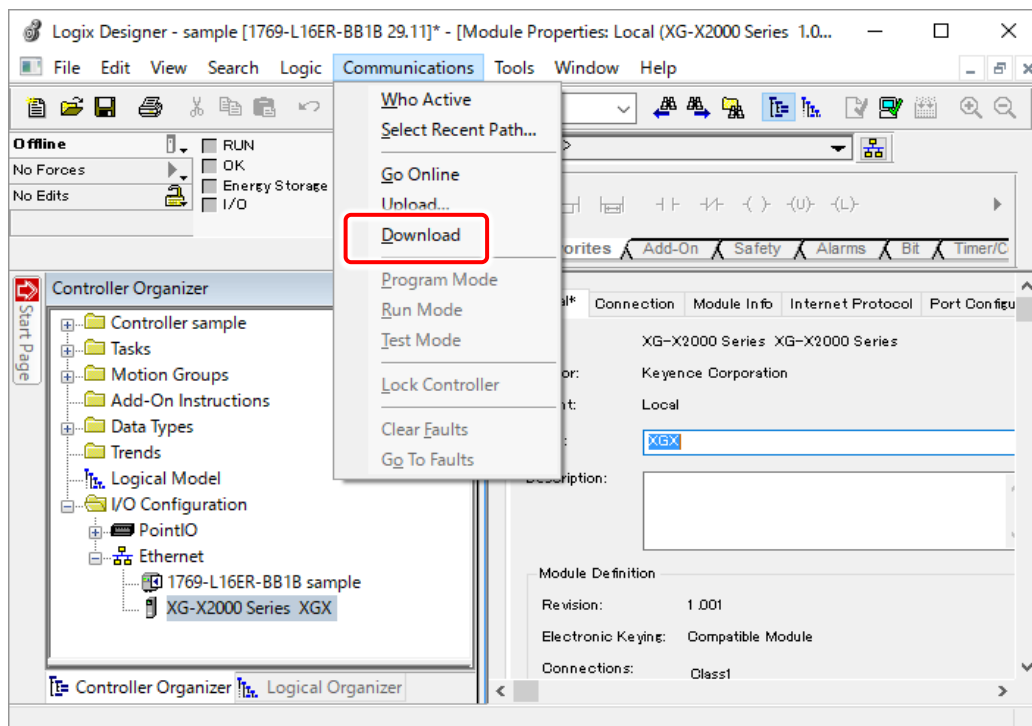
Change the parameters if necessary and select "OK".

(The RPI verified here will be the cyclic communication interval for the EtherNet/IP communication between the CV-X controller and the PLC.)



- (12) Select "Communications">"Download" to transfer the data to the PLC.

(With regard to the settings for communication between the PC and the PLC, please refer to the instruction manual of the PLC.)

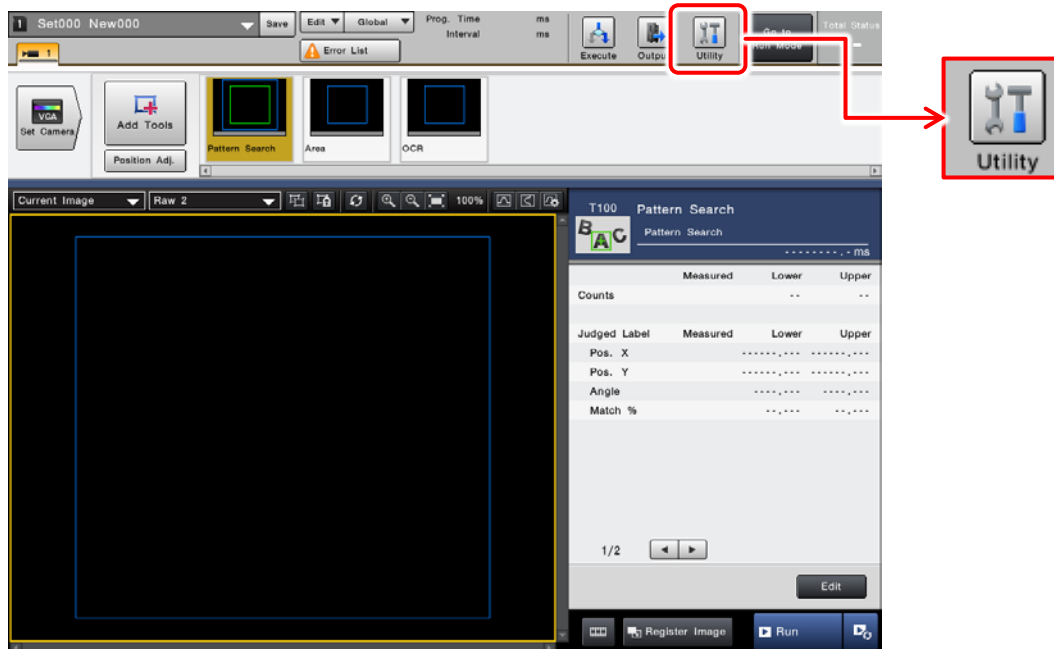


1.2 Checking the Connection

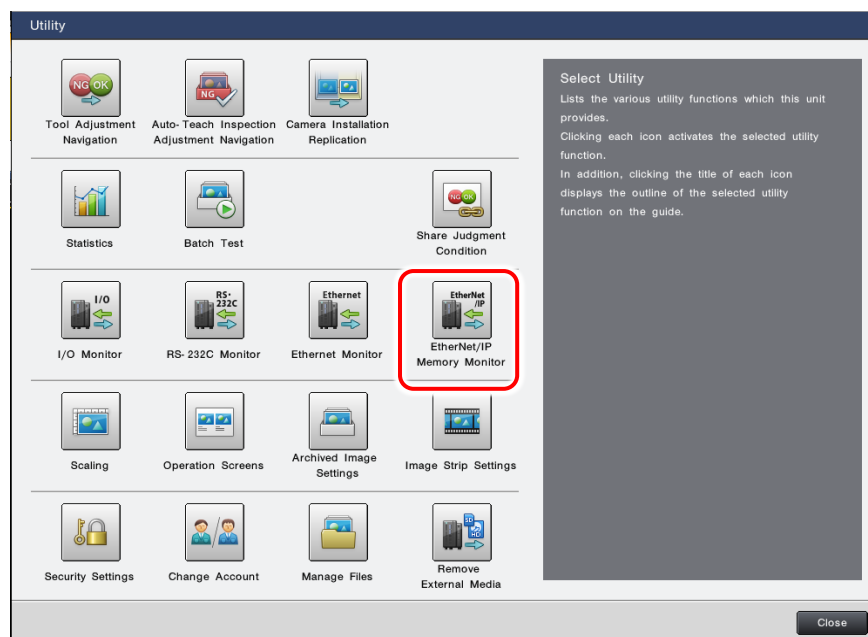
1.2.1 Using the EtherNet/IP Memory Monitor to Check the Connection

Use the EtherNet/IP memory monitor of the CV-X400 to check whether it is connected to the PLC.

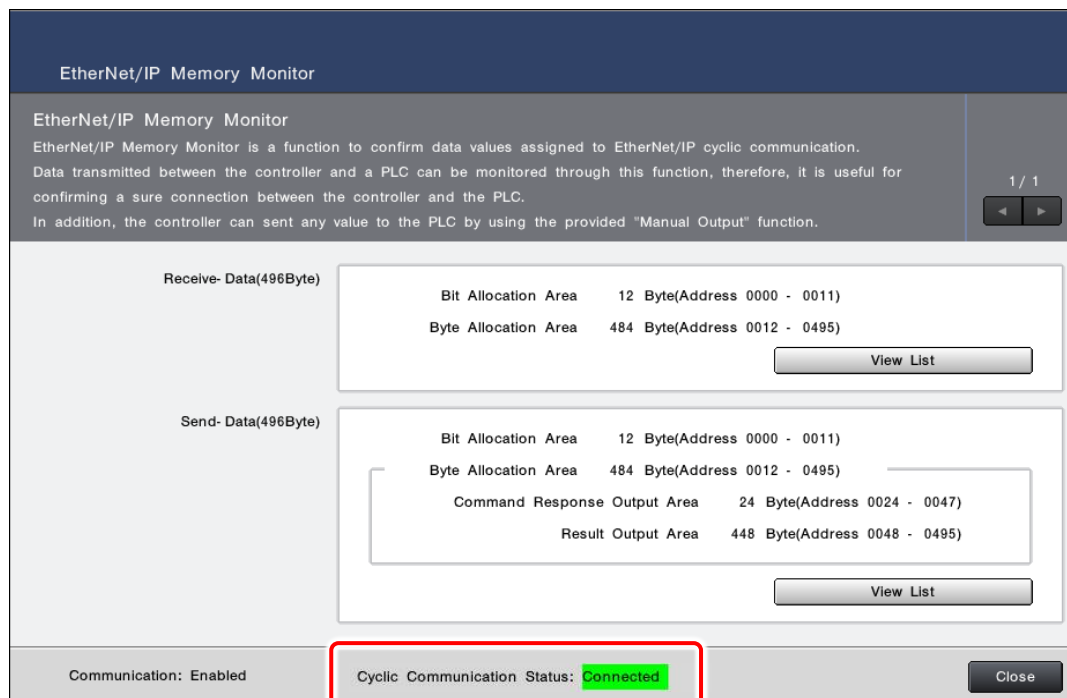
(1) Click the "Utility" button at the top of the setup mode screen.



(2) Click "EtherNet/IP" to open the EtherNet/IP memory monitor.



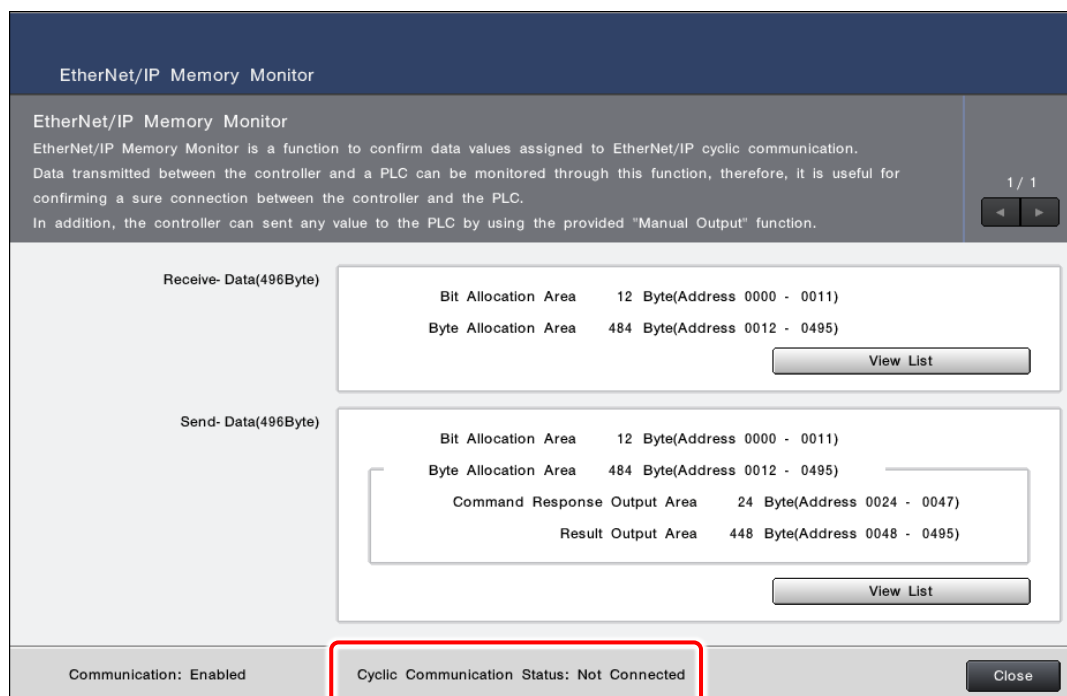
(3) If the "Cyclic Communication Status" is "Connected," the connection is complete.



(4) If the "Cyclic Communication Status" is "Not Connected," the connection failed.

Check the details in "1.1 Connecting Devices" again.

When checking these details, use the exact values from the setting examples in this document for items such as the device's connection configuration and IP address.



2. Controlling the Image Capture Timing

This chapter explains how to output data such as inspection results and measured values from the CV-X400 to the PLC over EtherNet/IP. Before configuring the settings shown below, connect the CV-X400 to a PLC according to the procedure in "1. Connecting over EtherNet/IP."

Also, if operations are performed at high speed and images must be captured in real time (that is, a very short time between the application of the trigger and the capturing of the image is required), use I/O (the terminal block), not EtherNet/IP, to apply the triggers

2.1 Checking the Timing Diagram

Check the timing diagram when you are controlling the image capture timing with EtherNet/IP.

2.1.1 Checking the Address Assignments

When controlling the image capture timing, use the data of the bit area shown below.

When seen from the CV-X400, this data is assigned to the CV-X400 addresses shown below.

When seen from the PLC, this data is assigned to the PLC tags shown below.

The PLC tag assignments shown below are an example in which "Name" is set to "CVX" in step (8) under "1.1.3 Configuring PLC Settings."

For the ON/OFF timing of each piece of bit data, see "2.1.2 Checking the Timing Diagram." To check the current value in each address, see the procedure in "3.2.1 Checking the Output Data."

Bit Area Data Assignments

Bit data type	CV-X400 address (decimal)	PLC tag (decimal)
TRG1	Receive-data: Bit Allocation Area: Address 0001: Bit 0	CVX:0.Data[0].8
TRG2	Receive-data: Bit Allocation Area: Address 0001: Bit 1	CVX:0.Data[0].9
TRG3	Receive-data: Bit Allocation Area: Address 0001: Bit 2	CVX:0.Data[0].10
TRG4	Receive-data: Bit Allocation Area: Address 0001: Bit 3	CVX:0.Data[0].11
ACK1	Send-data: Bit Allocation Area: Address 0002: Bit 0	CVX:I.Data[0].16
ACK2	Send-data: Bit Allocation Area: Address 0002: Bit 1	CVX:I.Data[0].17
ACK3	Send-data: Bit Allocation Area: Address 0002: Bit 2	CVX:I.Data[0].18
ACK4	Send-data: Bit Allocation Area: Address 0002: Bit 3	CVX:I.Data[0].19
READY1	Send-data: Bit Allocation Area: Address 0001: Bit 0	CVX:I.Data[0].8
READY2	Send-data: Bit Allocation Area: Address 0001: Bit 1	CVX:I.Data[0].9
READY3	Send-data: Bit Allocation Area: Address 0001: Bit 2	CVX:I.Data[0].10
READY4	Send-data: Bit Allocation Area: Address 0001: Bit 3	CVX:I.Data[0].11

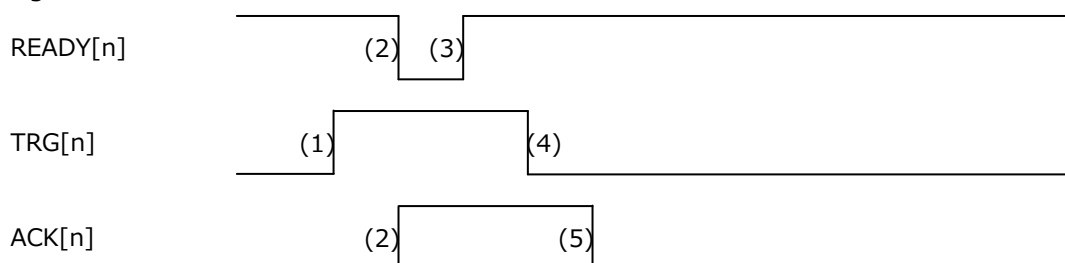
2.1.2 Checking the Timing Diagram

The timing diagram when you are controlling the image capture timing with EtherNet/IP (when you are applying triggers) is shown below.

Use data combinations that correspond to the triggers you want to use for READY[n], TRG[n], and ACK[n].

(For example, if you are using trigger 1, use READY1, TRG1, and ACK1.)

For the assignments of the addresses of the data, see "2.1.1 Checking the Address Assignments."



- (1) After checking that READY[n] is ON and ACK[n] is OFF, the PLC turns TRG[n] ON.
- (2) After receiving the trigger input, the controller starts capturing the image and turns READY[n] OFF and ACK[n] ON.
- (3) When the image capture is finished and the controller is able to start the next image capture, the controller turns READY[n] ON.
- (4) After checking that ACK[n] is ON (the controller has read that TRG[n] is ON), the PLC turns TRG[n] OFF.
- (5) Linked with (4), the controller turns ACK[n] OFF.

To make the PLC check that the controller has received the applied trigger, check that ACK[n] is ON, not that READY[n] is OFF.

(If you attempt to check this with READY[n] being OFF, it may not be possible to detect READY[n] being OFF from the PLC side if the time that READY[n] is OFF is shorter than the EtherNet/IP communication cycle.)

3. Outputting Measured Values and Judgment Values

This chapter explains how to output data such as inspection results and measured values from the CV-X400 to the PLC over EtherNet/IP.

Before configuring the settings shown below, connect the CV-X400 to a PLC according to the procedure in "1. Connecting over EtherNet/IP."

3.1 Configuring Output Data Settings

3.1.1 Configuring CV-X400 Settings

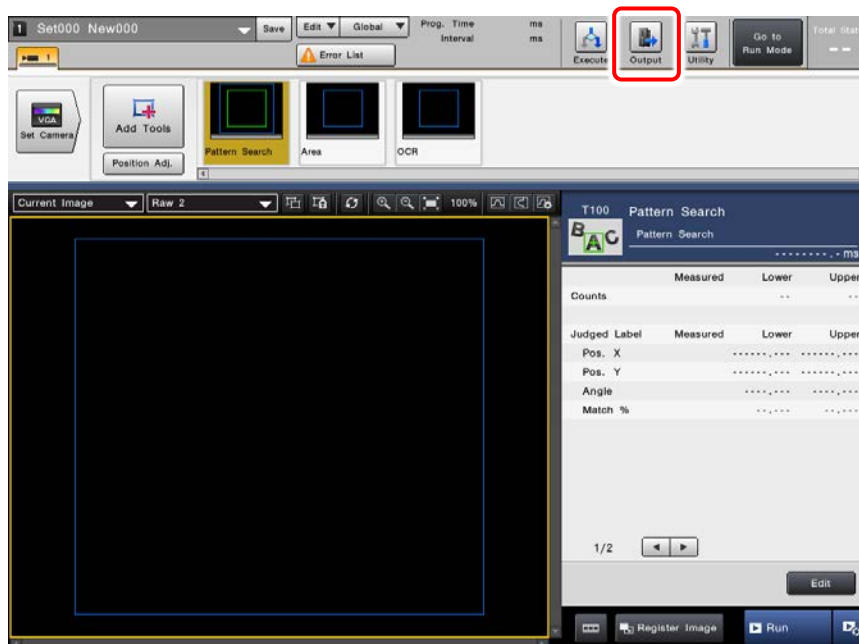
As an example, this section explains how to configure the settings in order to output the types of data shown below.

EtherNet/IP does not support the outputting of images or setup data.

Bit allocation area (You can output the OK/NG judgment value.)	Byte allocation area (You can output the measured values/judgment values/system variables.)
Total judgment T101: Area tool judgment	T100: Misalignment correction with lightness/darkness pattern (X position) T100: Misalignment correction with lightness/darkness pattern (XY position) T101: Area T102: OCR (recognized character string) Measurement count Measurement time

Setting the Bit Allocation Area

(1) Click the "Output" button at the top of the setup mode screen.



- (2)Click "EtherNet/IP," click the "Bit Allocation Area" tab, and then select the "Item to Output" at the address where you want to output data.
(Here, we have selected bit 0 of address 004.)

Output Settings

EtherNet/IP Output Settings
Specifies the items to output when outputting results via the EtherNet/IP communication of this controller.

- Bit Allocation Area: Outputs judged values.
- Byte Allocation Area: Outputs measured values, judged values and variables. Click [Select Data] to specify output data.

1 / 1

Judgment Settings

- OR Terminal
- OUT Terminal
- RS-232C (Non-Procedural)
- Ethernet (Non-Procedural)
- SD Card 2
- USB HDD
- PC Program**
- PLC- Link**
- EtherNet/IP**
- PROFINET
- FTP
- Image Output
- VisionDatabase

Bit Allocation Area | Byte Allocation Area

Address	Item to Output	Output Timing
0004:bit0	Total Status	
0004:bit1		
0004:bit2		
0004:bit3		
0004:bit4		
0004:bit5		
0004:bit6		
0004:bit7		
0005:bit0		
0005:bit1		

OK Cancel

- (3)Under "Output Item Settings," select the data to output, and then click "OK."
(Here, we have selected "Total Status.")

Output Item Settings

☒ **Total Status**

☐ CAM Judgment

☐ Partial Judgment

☐ Tool Judgment

OK Cancel

- (4)Check that the data you selected in step (3) is set as the "Item to Output."

Address	Item to Output
0004:bit0	Total Status
0004:bit1	

(5) Repeat steps (2) to (4) to add the data that you want to output.

If you want to output the OK/NG judgment of a specific tool, select "Tool Judgment" under "Output Item Settings" in step (3), select the check box for the tool whose judgment you want to output, and then click "OK."

(Here, we have selected "T101: Area.")

The first screenshot shows the 'Output Item Settings' dialog box. It has four radio button options: 'None', 'Total Status', 'CAM 1 Judgment', and 'Tool Judgment'. The 'Tool Judgment' option is selected and highlighted with a red rectangular box. Below the options are 'OK' and 'Cancel' buttons.

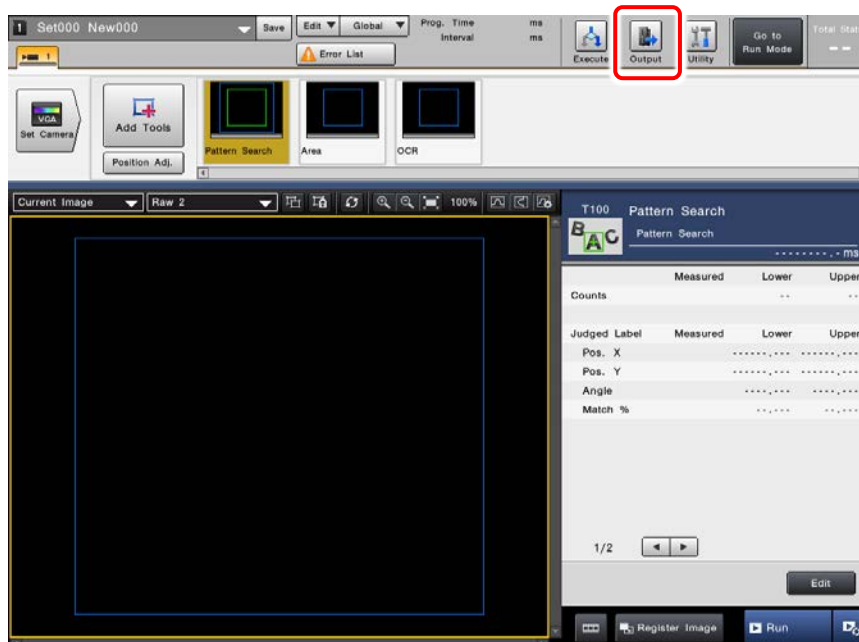
The second screenshot shows the 'Tool Judgment' dialog box. It contains a 'Candidate Selection List' with three items: 'T100: Pattern Search', 'T101: Area', and 'T102: OCR'. The 'T101: Area' item is selected with a checkmark and highlighted with a red rectangular box. Below the list, it says 'Selected: 1/3'. At the bottom are 'OK' and 'Cancel' buttons.

(6) After you have added all the data that you want to output, click "OK" to complete the settings.

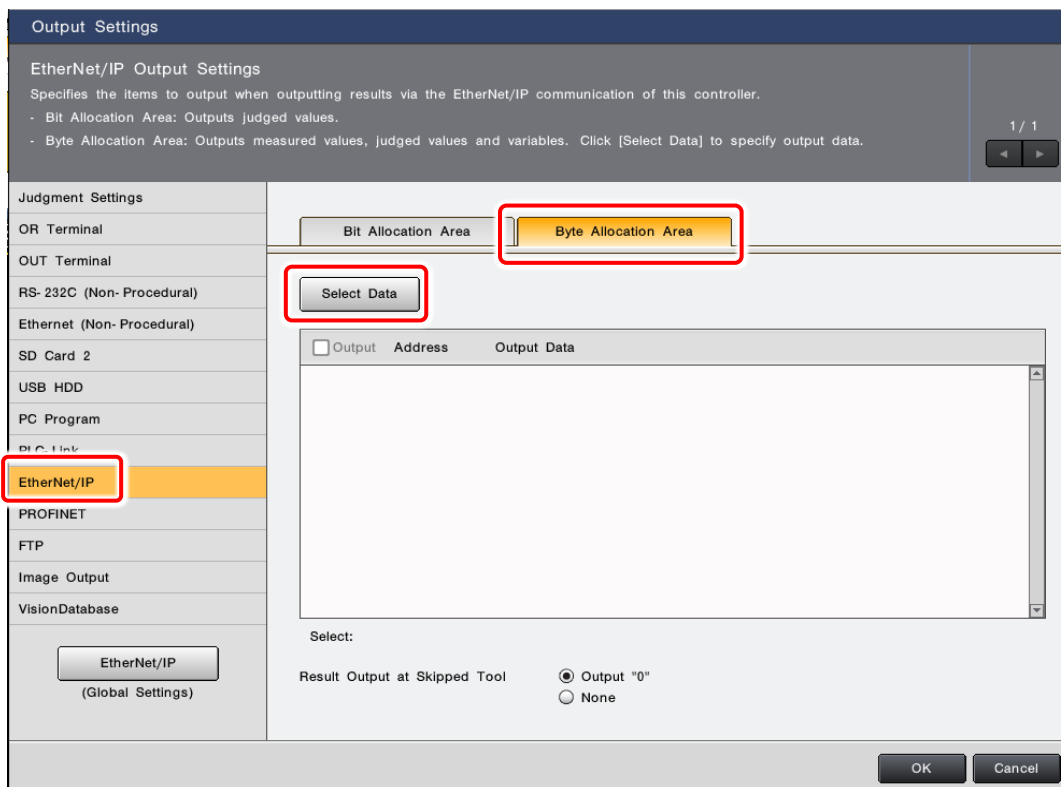
The screenshot shows the 'Output Settings' window. On the left is a sidebar with various communication protocols, with 'EtherNet/IP' selected. The main area has two tabs: 'Bit Allocation Area' (active) and 'Byte Allocation Area'. Below the tabs is a table with columns for 'Address' and 'Output Timing'. The first two rows are highlighted with a red box: the first row has '0004:bit0' and 'Total Status', and the second row has '0004:bit1' and 'T101'. To the right of the table are two dropdown menus, both set to 'On NG Status'. At the bottom right, the 'OK' button is highlighted with a red box, next to a 'Cancel' button.

Setting the Byte Allocation Area

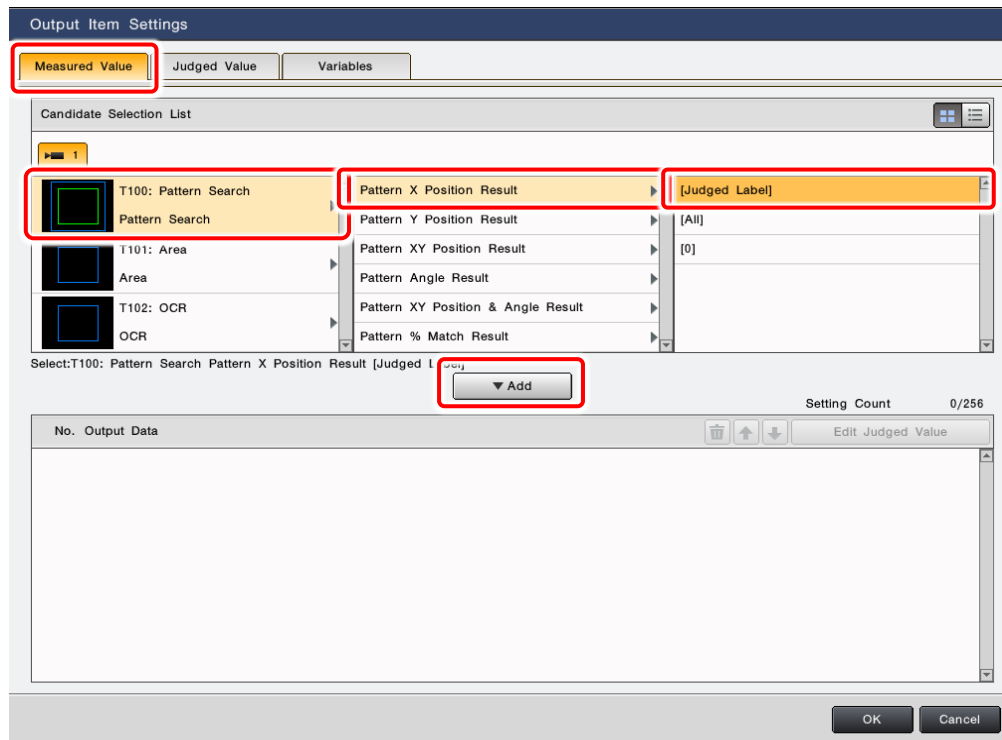
(1)Click the "Output" button at the top of the setup mode screen.



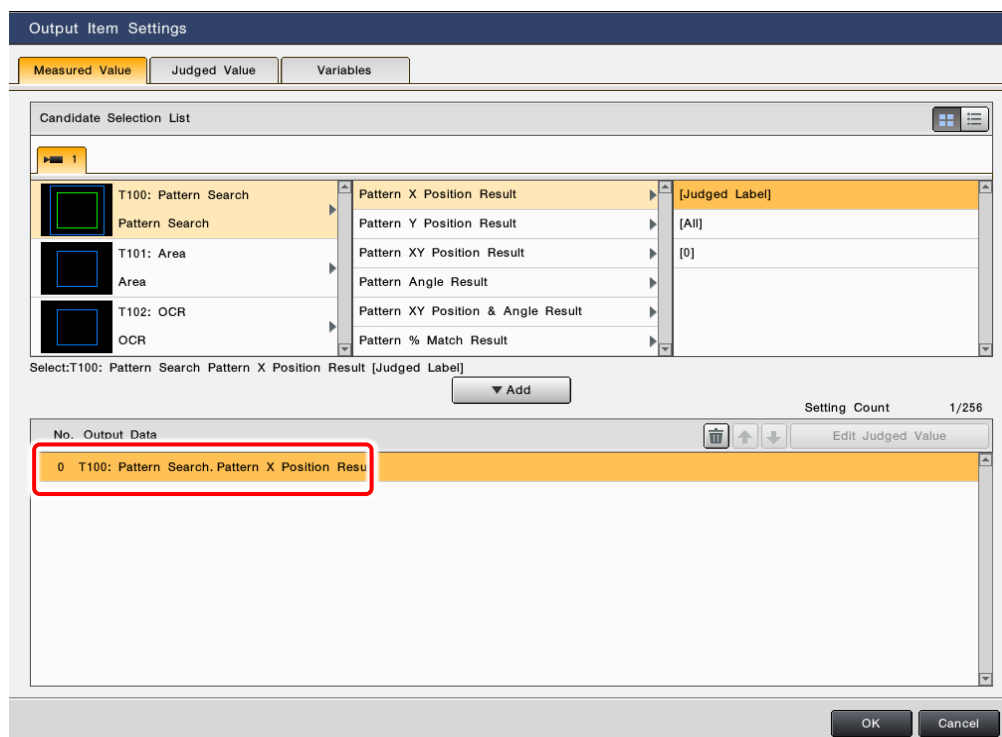
(2)Click "EtherNet/IP," click the "Byte Allocation Area" tab, and then click "Select Data."



- (3) Under "Output Item Settings," select the data to output, and then click "Add."
 (Here, we have clicked the "Measured Value" tab and selected "T100: Pattern Search" and "Pattern X Position Result.")



- (4) Check that the data you selected in step (3) has been added under "Output Data."



(5) Repeat steps (3) and (4) to add the data that you want to output.

If you want to output the measured value of a specific tool, click the "Measured Value" tab.

If you want to output data such as the measurement count, measurement time, and date, click the "Variables" tab.

Check that all the data has been added, and then click "OK."

Output Item Settings

Measured Value | Judged Value | **Variables**

Candidate Selection List

- Total Count
- OK Count
- NG Count
- Program Time**
- Interval
- Date & Time
- CAM 1 Execute Count

▼ Add

Setting Count 6/256

No.	Output Data
0	T100: Pattern Search. Pattern X Position Result
1	T100: Pattern Search. Pattern XY Position Result
2	T101: Area. Area Result
3	T102: OCR. Recognized Character (String)
4	Total Count
5	Program Time

OK Cancel

(6) Check the addresses to which the data will be output, and then click "OK" to complete the settings.

Output Settings

EtherNet/IP Output Settings

Specifies the items to output when outputting results via the EtherNet/IP communication of this controller.

- Bit Allocation Area: Outputs judged values.
- Byte Allocation Area: Outputs measured values, judged values and variables. Click [Select Data] to specify output data.

1 / 1

Judgment Settings

- OR Terminal
- OUT Terminal
- RS-232C (Non- Procedural)
- Ethernet (Non- Procedural)
- SD Card 2
- USB HDD
- PC Program
- PLC-Link
- EtherNet/IP**
- PROFINET
- FTP
- Image Output
- VisionDatabase

EtherNet/IP (Global Settings)

Bit Allocation Area | **Byte Allocation Area**

Select Data

Address	Output Data
0048	T100: Pattern Search. Pattern X Position Result
0052	T100: Pattern Search. Pattern X Position Result
0056	Pattern Y Position Result
0060	T101: Area. Area Result
0064	T102: OCR. Recognized Character (String)
0104	Total Count
0108	Program Time

Select:

Result Output at Skipped Tool ☒ Output "0" ☐ None

OK Cancel

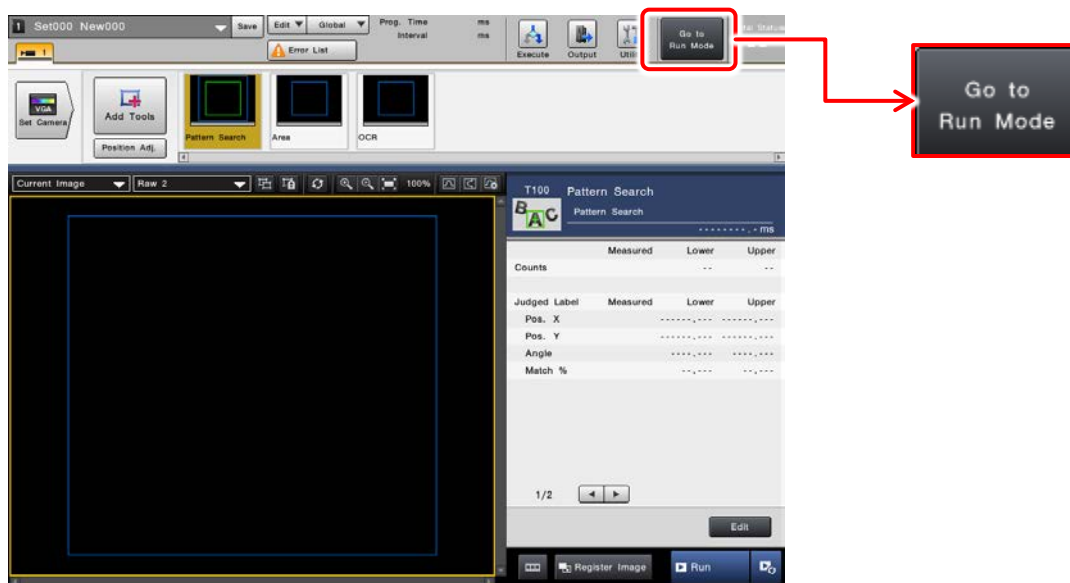
3.2 Checking the Output Data

3.2.1 Checking the Output Data

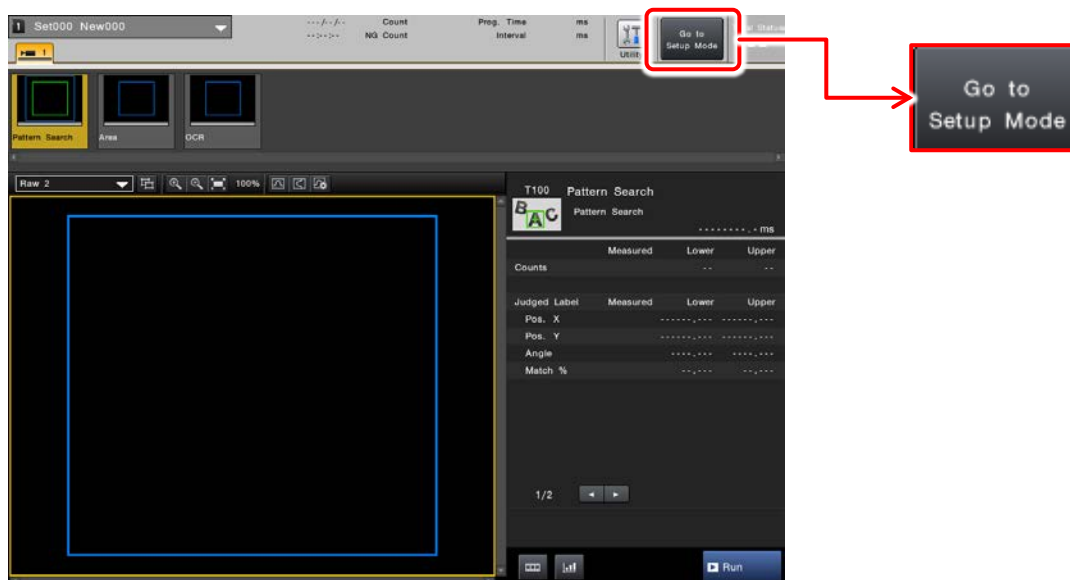
This section explains how to check the output data on the CV-X400 and on the PLC.
To output data, first switch the CV-X400 to run mode.
(Data is not output in setup mode.)

Switching the CV-X400 to Run Mode

- (1)Click "Go to Run Mode" at the top of the setup mode screen to switch to run mode.



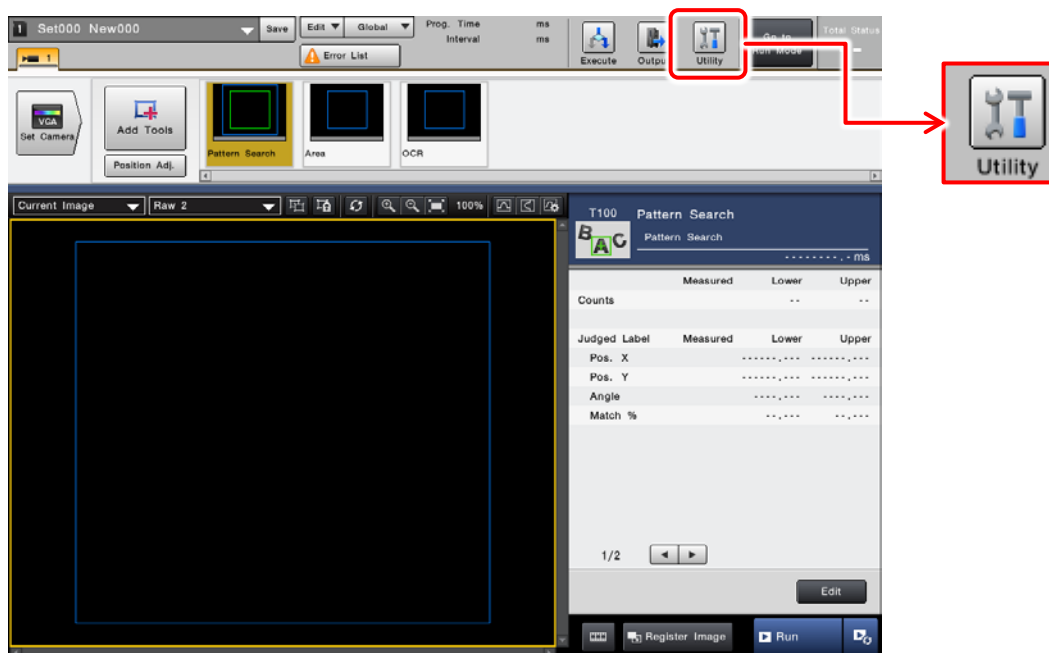
- (2) When the text on the button switches to "Go to Setup Mode," the switch to run mode is complete.



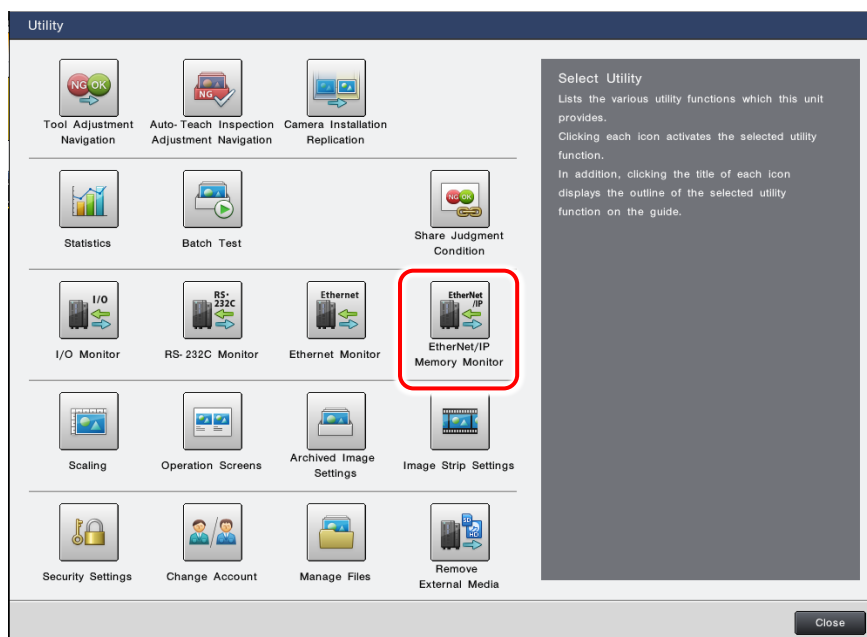
Using the CV-X400 to Check the PLC Data Memory

Use the EtherNet/IP memory monitor of the CV-X400 to check the data output from the CV-X400.

(1) Click the "Utility" button at the top of the run mode screen.



(2) Click "EtherNet/IP" to open the EtherNet/IP memory monitor.



- (3) Check that "Cyclic Communication Status" is "Connected," and then click "View List" next to "Send-Data."

EtherNet/IP Memory Monitor

EtherNet/IP Memory Monitor is a function to confirm data values assigned to EtherNet/IP cyclic communication. Data transmitted between the controller and a PLC can be monitored through this function, therefore, it is useful for confirming a sure connection between the controller and the PLC. In addition, the controller can sent any value to the PLC by using the provided "Manual Output" function.

1 / 1

Receive-Data(496Byte)

Bit Allocation Area 12 Byte(Address 0000 - 0011)
Byte Allocation Area 484 Byte(Address 0012 - 0495)

Send-Data(496Byte)

Bit Allocation Area 12 Byte(Address 0000 - 0011)
Byte Allocation Area 484 Byte(Address 0012 - 0495)
Command Response Output Area 24 Byte(Address 0024 - 0047)
Result Output Area 448 Byte(Address 0048 - 0495)

Communication: Enabled

Cyclic Communication Status: **Connected**

View List

View List

Close

- (4) The details of the output to the PLC data memory are displayed as a list. Data is output to the bit allocation area with "address 0004: bit 0" as the leading address. Data is output to the byte allocation area with the addresses checked in step (6) of "Setting the Byte Allocation Area" under "3.1.1 Configuring CV-X400 Settings." (In the default settings, the data is output with "address 0048" as the leading address.)

EtherNet/IP Send-Data List

Bit Allocation Area			Byte Allocation Area		
Address	Value	Descriptions	Address	Value	Descriptions
0004:bit0	<input type="checkbox"/>	Tool Judge Value0	0048	00000000	Result Data1
0004:bit1	<input type="checkbox"/>	Tool Judge Value1	0052	00000000	Result Data2
0004:bit2	<input type="checkbox"/>	Tool Judge Value2	0056	00000000	Result Data3
0004:bit3	<input type="checkbox"/>	Tool Judge Value3	0060	00000000	Result Data4
0004:bit4	<input type="checkbox"/>	Tool Judge Value4	0064	00000000	Result Data5
0004:bit5	<input type="checkbox"/>	Tool Judge Value5	0068	00000000	Result Data6
0004:bit6	<input type="checkbox"/>	Tool Judge Value6	0072	00000000	Result Data7
0004:bit7	<input type="checkbox"/>	Tool Judge Value7	0076	00000000	Result Data8
0005:bit0	<input type="checkbox"/>	Tool Judge Value8	0080	00000000	Result Data9
0005:bit1	<input type="checkbox"/>	Tool Judge Value9	0084	00000000	Result Data10
0005:bit2	<input type="checkbox"/>	Tool Judge Value10	0088	00000000	Result Data11
0005:bit3	<input type="checkbox"/>	Tool Judge Value11	0092	00000000	Result Data12
0005:bit4	<input type="checkbox"/>	Tool Judge Value12	0096	00000000	Result Data13
0005:bit5	<input type="checkbox"/>	Tool Judge Value13	0100	00000000	Result Data14
0005:bit6	<input type="checkbox"/>	Tool Judge Value14	0104	00000000	Result Data15
0005:bit7	<input type="checkbox"/>	Tool Judge Value15	0108	00000000	Result Data16

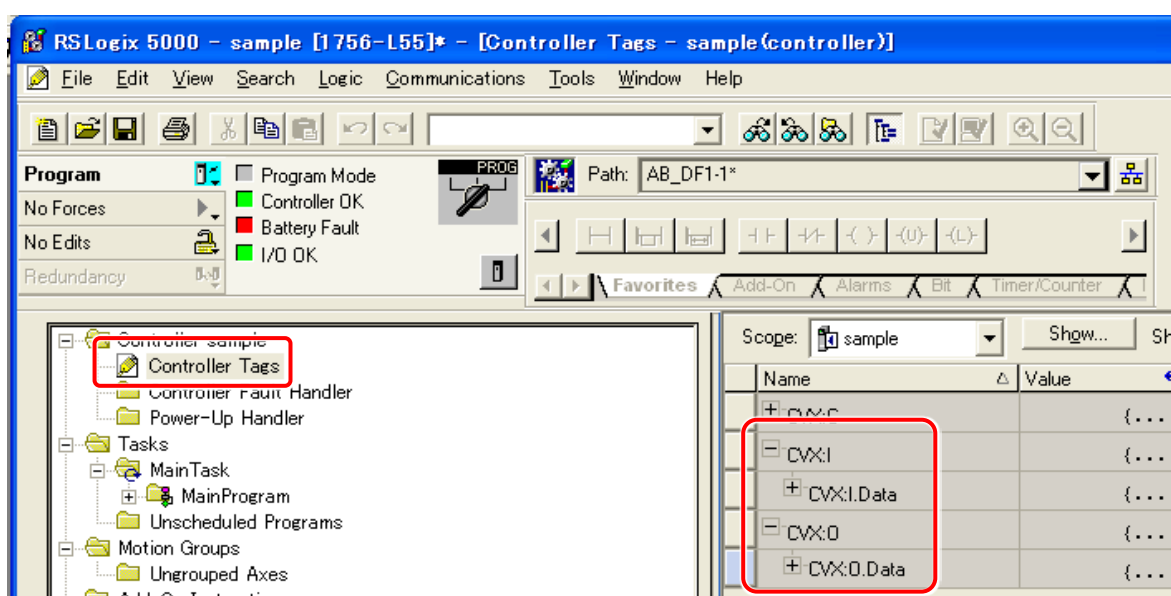
Using the PLC to Check the Output from the CV-X400

Use RSLogix5000 "Controller Tags" to check the data received from the CV-X400.

The PLC tag assignments shown below are an example in which "Name" is set to "CVX" in step (8) under "1.1.3 Configuring PLC Settings."

The data received from the controller is stored in the "CVX:I" tag. The data output to the controller is stored in the "CVX:O" tag.

For the detailed tags in which the data is stored, see "3.3.1 Checking the Address Assignments."



3.2.2 Checking the Format of the Output Data

This section explains the format of the data output from the CV-X400 to the PLC.

As an example, this section explains the output formats when the CV-X400 is set as shown in "3.1 Configuring Output Data Settings."

Checking the Bit Allocation Area Format

This section explains the bit allocation area format when the judgment values are as shown below.

Total judgment:	NG
T101: Area tool judgment:	OK

When "Output Timing" is set to "On NG Status" (the default setting)

When "Output Timing" is set to "On NG Status" in step (6) of "Setting the Bit Allocation Area" under "3.1.1 Configuring CV-X400 Settings," the output is as shown below.

アドレス	出力項目	出力タイミング
0004:bit0	総合判定	NG判定時 ▼
0004:bit1	T101	NG判定時 ▼

CV-X400 send-data address	Output data	Output format
0004: Bit 0	1	"1" is stored when the status is NG and "0" is stored when the status is OK
0004: Bit 1	0	

When "Output Timing" is set to "On OK Status"

When "Output Timing" is set to "On OK Status" in step (6) of "Setting the Bit Allocation Area" under "3.1.1 Configuring CV-X400 Settings," the output is as shown below.

アドレス	出力項目	出力タイミング
0004:bit0	総合判定	OK判定時 ▼
0004:bit1	T101	OK判定時 ▼

CV-X400 send-data address	Output data	Output format
0004: Bit 0	0	"0" is stored when the status is NG and "1" is stored when the status is OK
0004: Bit 1	1	

Checking the Byte Allocation Area Format

When the measured values are as follows, the byte allocation area format is that shown below. Integer data is stored as-is in the data memory entries. Decimal fraction data is multiplied by 1000 before being stored in the data memory entries.

T100: Misalignment correction with lightness/ darkness pattern (X position):	744.050
T100: Misalignment correction with lightness/ darkness pattern (XY position):	X = 744.050, Y = 578.199
T101: Area:	249174
T102: OCR (recognized character string):	KEYENCE
Measurement count:	34
Measurement time:	116.718 ms

CV-X400 send-data address	Output data (decimal)	Output format
48	744050	Decimal fraction data is multiplied by 1000 and stored in 2 words. (744.050 → 744050)
52	744050	When XY data is output, it is stored in the order of X followed by Y, with each piece stored in 2 words.
56	578199	
60	249174	Integer data is stored as-is in 2 words.
64	75	Character data is stored as ASCII code with 2 words used per character. The number of characters output is determined by the value set for the "number of characters for character extraction" for the OCR tool. Here this is set to "10," so even though the read character string only consists of 7 characters, 20 words are used from 64 to 103 in order to store 10 characters with the empty trailing characters filled in with "0."
68	69	
72	89	
76	69	
80	78	
84	67	
88	69	
92	0	
96	0	
100	0	
104	34	Integer data system variables are stored as-is in 2 words.
108	116718	Decimal fraction data system variables are multiplied by 1000 and stored in 2 words.

The output format shown above is from the case when "Decimal Point" is set to **"Fixed-point"** in step (4) under "1.1.2 Configuring CV-X400 Settings."

If you select **"Floating-point"** for "Decimal Point," the data is output in 32-bit single precision floating-point value format.

If we use CV-X400 input data address "48" (shown above) as an example, the decimal value "744050" is output when "Fixed-point" is specified and the single precision floating-point value "744.050" is output when "Floating-point" is specified.

3.3 Checking the Data Output Flow Chart and Timing Diagrams

Use this section to check the data output flow chart and timing diagrams when data is being output over EtherNet/IP.

3.3.1 Checking the Address Assignments

The data of the bit areas and the word areas shown below is used to output data over EtherNet/IP. When seen from the CV-X400, this data is assigned to the CV-X400 addresses shown below. When seen from the PLC, this data is assigned to the PLC tags shown below.

The PLC tag assignments shown below are an example in which "Name" is set to "CVX" in step (8) under "1.1.3 Configuring PLC Settings."

For the ON/OFF timing of each piece of bit data and the output timing of each piece of word data, see "3.3.2 Checking the Data Output Flow Chart" and "3.3.3 Checking the Timing Diagrams." To check the current value in each address, see the procedure in "3.2.1 Checking the Output Data."

Bit Area Data Assignments

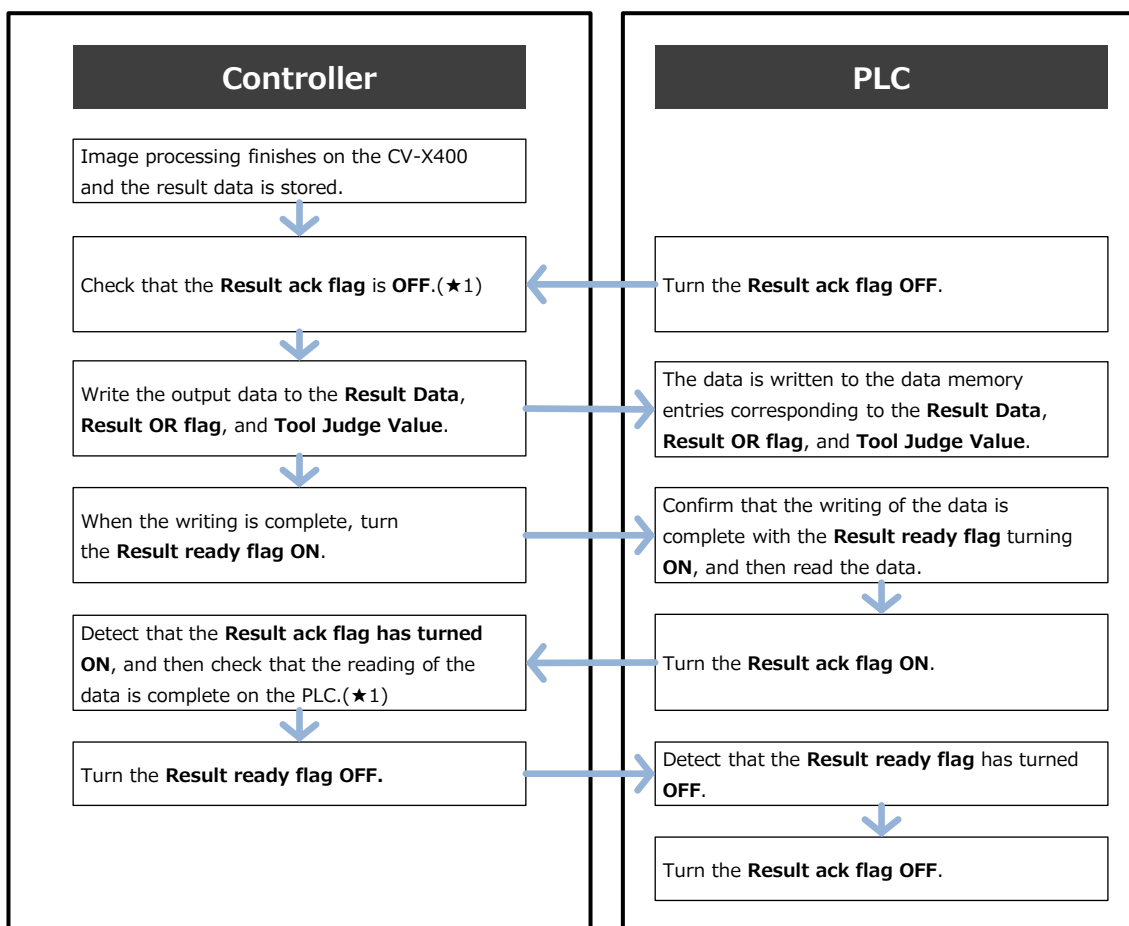
Bit data type	CV-X400 address (decimal)	PLC tag (decimal)
Result ack flag	Receive-data: Bit Allocation Area: Address 0000: Bit 3	CVX:0.Data[0].3
Result ready flag	Send-data: Bit Allocation Area: Address 0000: Bit 3	CVX:I.Data[0].3
Result OR flag	Send-data: Bit Allocation Area: Address 0000: Bit 4	CVX:I.Data[0].4
Tool Judge Value0	Send-data: Bit Allocation Area: Address 0004: Bit 0	CVX:I.Data[1].0
Tool Judge Value1	Send-data: Bit Allocation Area: Address 0004: Bit 1	CVX:I.Data[0].1
Tool Judge Value2	Send-data: Bit Allocation Area: Address 0004: Bit 2	CVX:I.Data[0].2
.....

Byte Area Data Assignments

Byte data type	CV-X400 address (decimal)	PLC tag (decimal)
Result Data 1	Send-data: Byte Allocation Area: Address 0048	CVX:I.Data[12]
Result Data 2	Send-data: Byte Allocation Area: Address 0052	CVX:I.Data[13]
Result Data 3	Send-data: Byte Allocation Area: Address 0056	CVX:I.Data[14]
.....

3.3.2 Checking the Data Output Flow Chart

The flow chart for when the CV-X400 outputs data over EtherNet/IP is shown below.
For the assignments of the addresses of the data, see "3.3.1 Checking the Address Assignments."



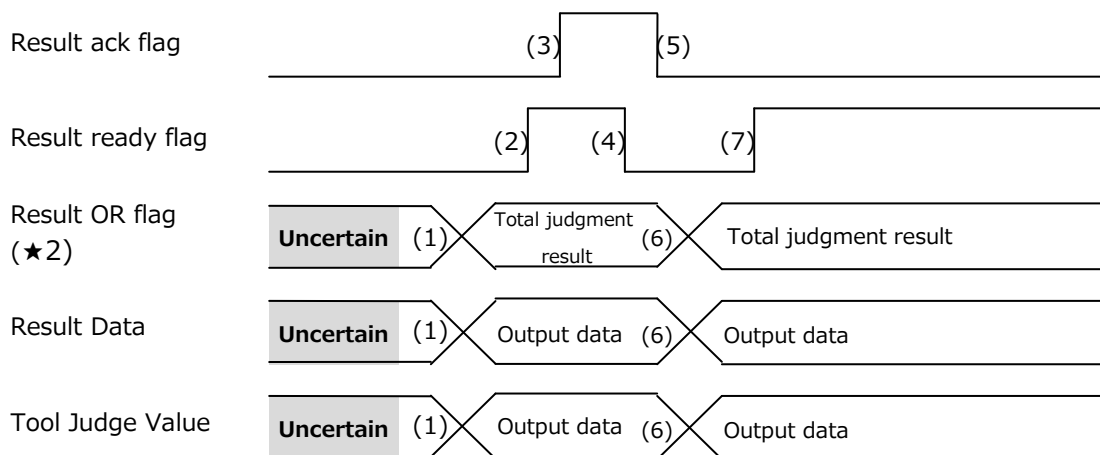
- ★1 The flow chart shown above is from the case in which handshake is ON.
To turn handshake ON/OFF, select/clear the "Enable Handshake" check box in step (4) under "1.1.2 Configuring CV-X400 Settings."

When handshake is OFF, the controller overwrites data memory when the image processing finishes regardless of the status of the **Result ack flag**. The **Result ready flag** also remains **ON** thereafter.
When it is necessary to check the completion of writing due to the **Result ready flag** changing from **OFF** to **ON**, turn the **Result ready flag OFF** by turning the **Result ack flag ON**.

3.3.3 Checking the Timing Diagrams

The timing diagrams for when the CV-X400 outputs data over EtherNet/IP are shown below.
For the assignments of the addresses of the data, see "3.3.1 Checking the Address Assignments."

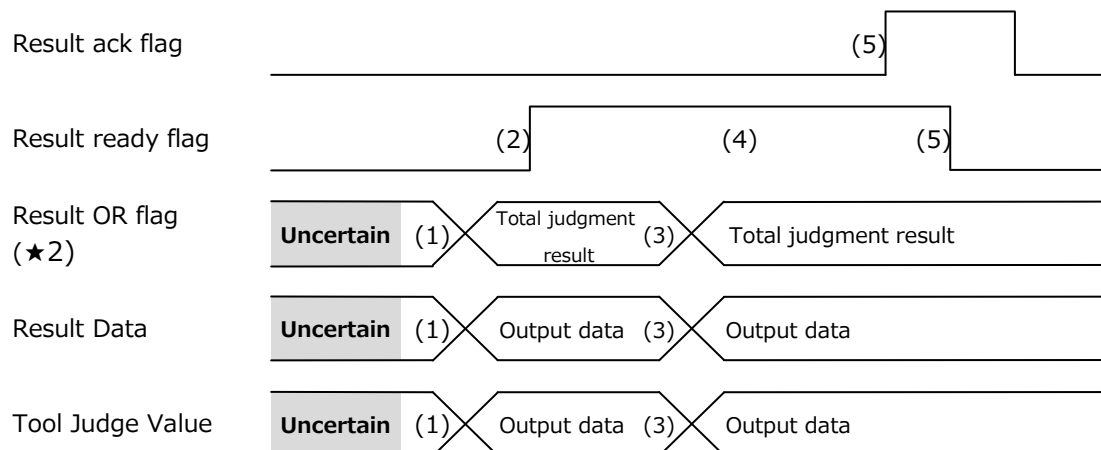
When Handshake Is ON



- ★2 When you are using the Result OR flag, it is necessary for the output settings to be configured so that at least 1 piece of data is output to EtherNet/IP.

- (1) The controller updates the output data.
- (2) After updating the output data, the controller turns the Result ready flag ON.
- (3) After reading the output data, the PLC turns the Result ack flag ON.
- (4) Linked with (3), the controller turns the Result ready flag OFF.
- (5) The PLC turns the Result ack flag OFF.
- (6) Receiving the signal from (5), the controller updates the output data if the next batch of output data is present.
- (7) In the same manner as (2), after updating the output data, the controller turns the Result ready flag ON.

When Handshake Is OFF



- ★2 When you are using the Result OR flag, it is necessary for the output settings to be configured so that at least 1 piece of data is output to EtherNet/IP.

- (1) The controller updates the output data.
- (2) After updating the output data, the controller turns the Result ready flag ON.
- (3) The controller updates the output data. (The data is updated regardless of the Result ack flag and the Result ready flag.)
- (4) After updating the output data, the controller updates the Result ready flag to ON. (If this flag was already ON, it is not changed.)
- (5) When the PLC turns the Result ack flag ON, the controller turns the Result ready flag OFF. In this way, the Result ready flag turns ON the next time the data is updated, which makes it possible to check that the data has been updated. (If it is not necessary to check the updating of the data, step [5] is unnecessary.)

4. Controlling the Controller with Commands

This chapter explains how to use commands to control the CV-X400 from a PLC over EtherNet/IP (such as switching the program and changing the OCR judgment character string).

Before configuring the settings shown below, connect the CV-X400 to a PLC according to the procedure in "1. Connecting over EtherNet/IP."

4.1 Checking Commands

4.1.1 Checking Command Details and Number-specified-command Nos.

To control the CV-X400 over EtherNet/IP using commands, use the "number-specified-command Nos." that have been assigned to the commands.

An example of the "commands" and "number-specified-command Nos." that can be used with the CV-X400 is shown below. The detailed usage methods for these commands are explained in "4.3 Command Execution Procedure Examples."

Command details	Command	Number-specified-command No.
Saving settings	SS command	12
Switching the program	PW command	24
Obtaining the current program	PR command	25
Changing the OCR/1D code reader/ 2D code reader judgment character string	CW command	43

You can use many other commands in addition to those listed above. For details, see the "CV-X Series User's Manual."

Excerpts from the applicable locations are given on the next page.

If you have other necessary commands, see the "CV-X Series User's Manual" for their usage methods.

Command type	Assigned commands	Command	Number-specified-command No.	Availability by device			
				Non-procedural		PLC-Link, EtherNet/IP, PROFINET	
				Run	Setup	Run	Setup
Trigger	Trigger 1 (Page 6-5)	T1	1	○		○	
	Trigger 2 (Page 6-5)	T2	2	○		○	
	Trigger 3 (Page 6-5)	T3	3	○		○	
	Trigger 4 (Page 6-5)	T4	4	○		○	
	Issue all triggers (Page 6-5)	TA	5	○		○	
System control	Switch to run mode (Page 6-6)	R0	8		○		○
	Switch to setup mode (Page 6-6)	S0	9	○		○	
	Reset (Page 6-7)	RS	10	○		○	
	Reboot (Page 6-7)	RB	11	○		○	
	Save program (Page 6-7)	SS	12	○		○	
	Clear error (Page 6-8)	CE	13	○	○	○	○
	Change operation screens (Page 6-8)	VW	14	○		○	
	Trigger reset (Page 6-9)	RE	15	○		○	
	Read run/setup mode (Page 6-9)	RM	16	○	○	○	○
Change programs	Change programs (Page 6-10)	PW	24	○		○	
	Read programs (Page 6-10)	PR	25	○		○	
Capture control	Shutter speed setting (Page 6-11)	CSH	32	○		○	
	Camera sensitivity setting (Page 6-12)	CSE	33	○		○	
	Trigger delay (Page 6-13)	CTD	34	○		○	
	Lighting intensity value setting (Page 6-14)	CLV	35	○		○	
Vision tool	Image Registration (Update Reference Value) (Page 6-16)	BS	40	○		○	
	Write execute condition (Page 6-17)	EXW	41	○		○	
	Read execute condition (Page 6-17)	EXR	42	○		○	
	Change registered string (Page 6-18)	CW	43	○		○	
	Read registered string (Page 6-19)	CR	44	○		○	
	Change judgment condition (Page 6-20)	DW	45	○		○	
	Read judgment condition (Page 6-20)	DR	46	○		○	
	Change defect level (Page 6-21)	SLW	47	○		○	
	Read defect level (Page 6-22)	SLR	48	○		○	
	Register 1 Character to Library (Page 6-22)	CA	49	○		○	
	Delete 1 Character from Library (Page 6-23)	CD	50	○		○	
	Update Capture Position (Page 6-24)	CPW	51	○		○	
Measured Value Correction	Change Measured Value before Correction of Measured Value Correction (Page 6-24)	MCC	52	○		○	
	Write Measured Value Correction (Page 6-25)	MCW	53	○		○	
	Read Measured Value Correction (Page 6-27)	MCR	54	○		○	
I/O control	Enable/disable trigger input (Page 6-28)	TE	56	○	○	○	○
	Enable/disable output (Page 6-28)	OE	57	○		○	
Utility	Clear statistical data (Page 6-29)	TC	64	○		○	
	Save statistical data (Page 6-30)	TS	65	○		○	
	Clear archived image (Page 6-30)	HC	66	○		○	
	Save archived image (Page 6-31)	HS	67	○		○	
	Image capture (Page 6-32)	BC	68	○	○	○	○
	Change output file/folder (Page 6-32)	OW	69	○		○	
	Echo (Page 6-33)	EC	—	○	○		
System	Write date/time (Page 6-33)	TW	80	○		○	
	Read date/time (Page 6-34)	TR	81	○		○	
	Version information readout (Page 6-34)	VI	82	○	○	○	○
	Write Time Zone (Page 6-35)	TZW	83	○		○	
	Read Time Zone (Page 6-36)	TZR	84	○		○	
VisionDatabase (sold separately)	Delete the output image (Page 6-36)	DDF	96	○		○	
	Change External Input String (Page 6-37)	DSW	97	○		○	
	Read External Input String (Page 6-37)	DSR	98	○		○	

4.1.2 Checking How to Execute Commands

Use this section to check how to use commands to control the CV-X400 over EtherNet/IP. The "PW command," which switches the program, will be used here as an example.

Checking the Command Format

The format of the **PW command** (program switching), which is being used as an example in this section, is shown below.

PW, "SD card number," "program number"

For example, when the command "PW, 1, 25" is executed, the program is switched to number "25," which is stored on SD card "1."

The numeric values (command parameters) that follow the command vary from one command to another.

For details on the command parameters used with commands other than the PW command, see the "CV-X Series User's Manual."

Using EtherNet/IP to Execute Commands

To execute a command over EtherNet/IP, enter the "number-specified-command No." into the address to which "**Command Number**" has been assigned, enter the parameters into the address to which "**Command Parameter**" has been assigned, and then execute the command.

For example, to use the PW command (program switching) to switch to program number "25" on SD "1," considering that the "number-specified-command No." for the PW command is "24," enter "24" into "**Command Number**," "1" into "**Command Parameter 1**," and "25" into "**Command Parameter 2**."

For the detailed command execution procedure, see "4.2 Checking the Command Processing Flow Chart and Timing Diagram."

4.2 Checking the Command Processing Flow Chart and Timing Diagram

Use this section to check the command processing flow chart and timing diagram when executing commands with EtherNet/IP.

4.2.1 Checking the Address Assignments

The data of the bit areas and the word areas shown below is used to execute commands over EtherNet/IP.

When seen from the CV-X400, this data is assigned to the CV-X400 addresses shown below.

When seen from the PLC, this data is assigned to the PLC tags shown below.

The PLC tag assignments shown below are an example in which "Name" is set to "CVX" in step (8) under "1.1.3 Configuring PLC Settings."

For the ON/OFF timing of each piece of bit data and the output timing of each piece of byte data, see "4.2.2 Checking the Command Process Flow Chart" and "4.2.3 Checking the Timing Diagram."
To check the current value in each address, see the procedure in "3.2.1 Checking the Output Data."

Bit Area Data Assignments

Bit data type	CV-X400 address (decimal)	PLC tag (decimal)
Command request flag	Receive-data: Bit Allocation Area: Address 0000: Bit 0	CVX:O.Data[0].0
Command complete flag	Send-data: Bit Allocation Area: Address 0000: Bit 0	CVX:I.Data[0].0
Command error flag	Send-data: Bit Allocation Area: Address 0000: Bit 1	CVX:I.Data[0].1
Command ready flag	Send-data: Bit Allocation Area: Address 0000: Bit 2	CVX:I.Data[0].2

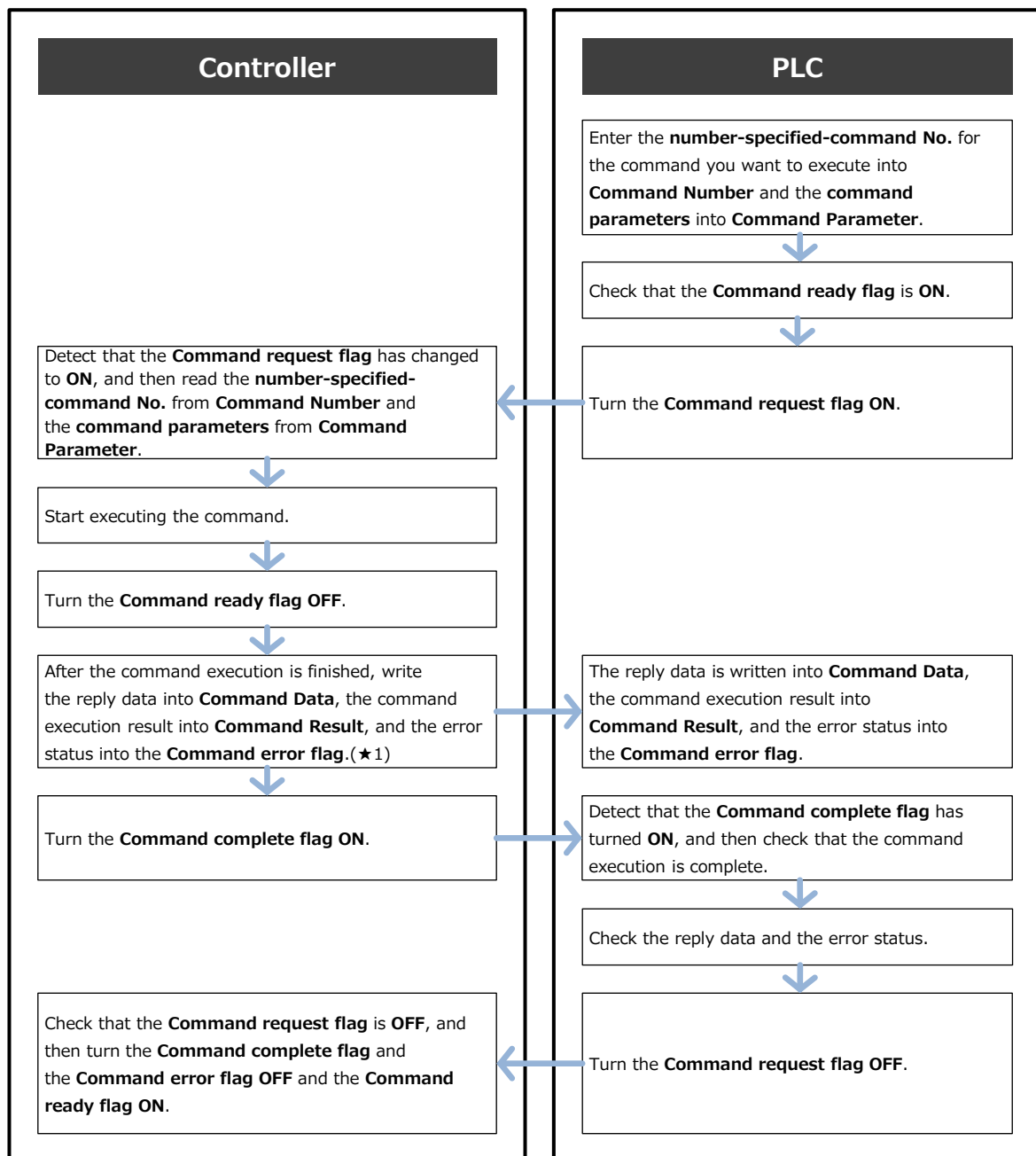
Byte Area Data Assignments

Byte data type	CV-X400 address (decimal)	PLC tag (decimal)
Command Number	Receive-data: Byte Allocation Area: Address 016	CVX:O.Data[4]
Command Parameter 1	Receive-data: Byte Allocation Area: Address 020	CVX:O.Data[5]
Command Parameter 2	Receive-data: Byte Allocation Area: Address 024	CVX:O.Data[6]
.....
Command Result	Send-data: Byte Allocation Area: Address 020	CVX:I.Data[5]
Command Data 1	Send-data: Byte Allocation Area: Address 024	CVX:I.Data[6]
Command Data 2	Send-data: Byte Allocation Area: Address 028	CVX:I.Data[7]
.....

4.2.2 Checking the Command Process Flow Chart

The flow chart for executing commands over EtherNet/IP is shown below.

For the assignments of the addresses of the data, see "4.2.1 Checking the Address Assignments."

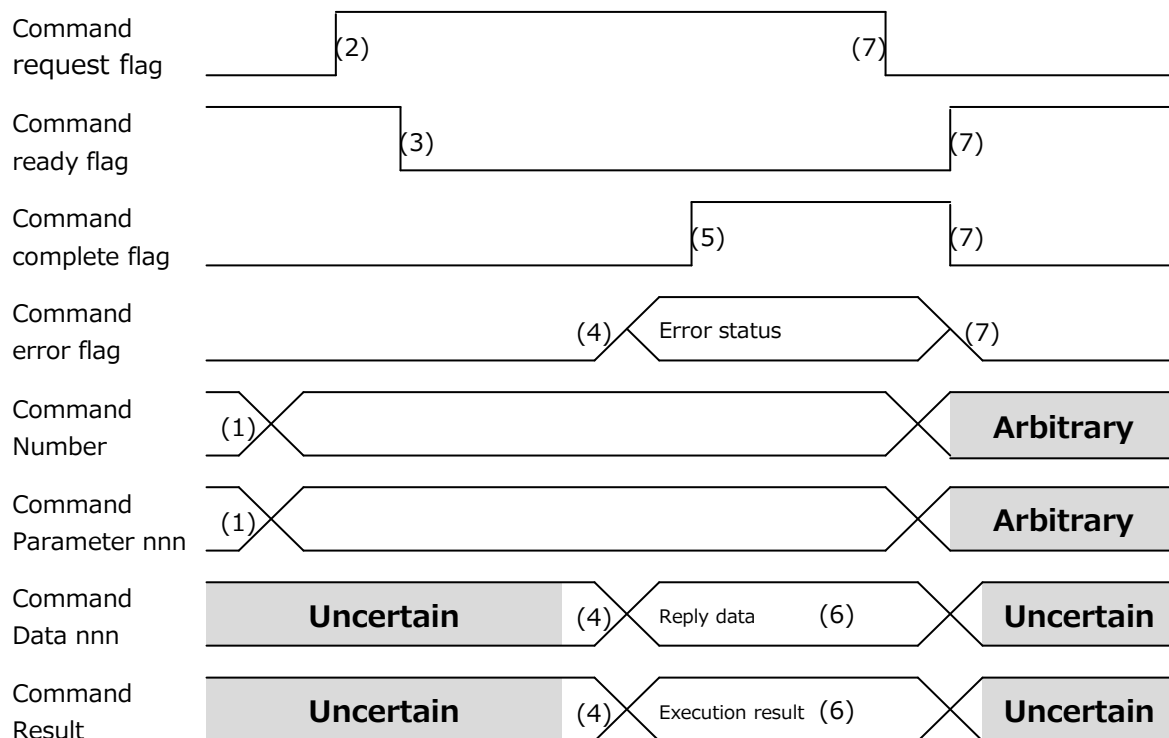


- ★1 For commands that have no reply data, the reply data is not output to **Command Data**.
The value written to **Command Result** is a **0** when the command processing is successful and is the **error code** when the command processing fails.

4.2.3 Checking the Timing Diagram

The timing diagram for executing commands over EtherNet/IP is shown below.

For the assignments of the addresses of the data, see "4.2.1 Checking the Address Assignments."



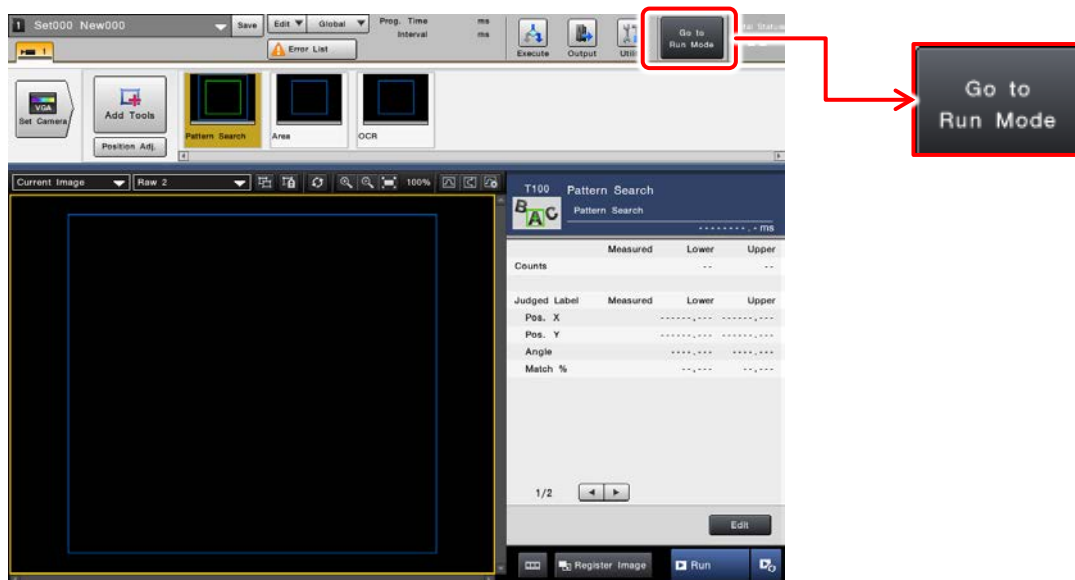
- (1) The PLC stores the number-specified-command No. in Command Number and the command parameters in Command Parameter.
- (2) The PLC turns the Command request flag ON. Detecting this, the controller executes the command.
- (3) The controller turns the Command ready flag OFF.
(For this to turn OFF, at minimum, the link scan time is required after [2].)
- (4) When the command execution is finished, the controller stores the reply data in Command Data, the error status in the Command error flag, and the execution result in Command Result.
(The Command error flag being "ON" indicates that the command processing failed. The Command error flag being "OFF" indicates that the command processing was successful.)
(Command Result being a value other than "0" indicates that the error code is stored therein. Command Result being "0" indicates that the command processing was successful.)
- (5) The controller turns the Command complete flag ON as the confirmation signal of command execution completion.
- (6) If there is reply data, the PLC reads the value of Command Data prior to step (7).
When an error occurs (when the Command error flag is ON), read the value of Command Result to check the cause of the error.
- (7) To enable the next command execution, the PLC turns the Command request flag OFF, and the controller turns the Command ready flag ON and the Command complete flag and the Command error flag OFF in response.

4.3 Command Execution Procedure Examples

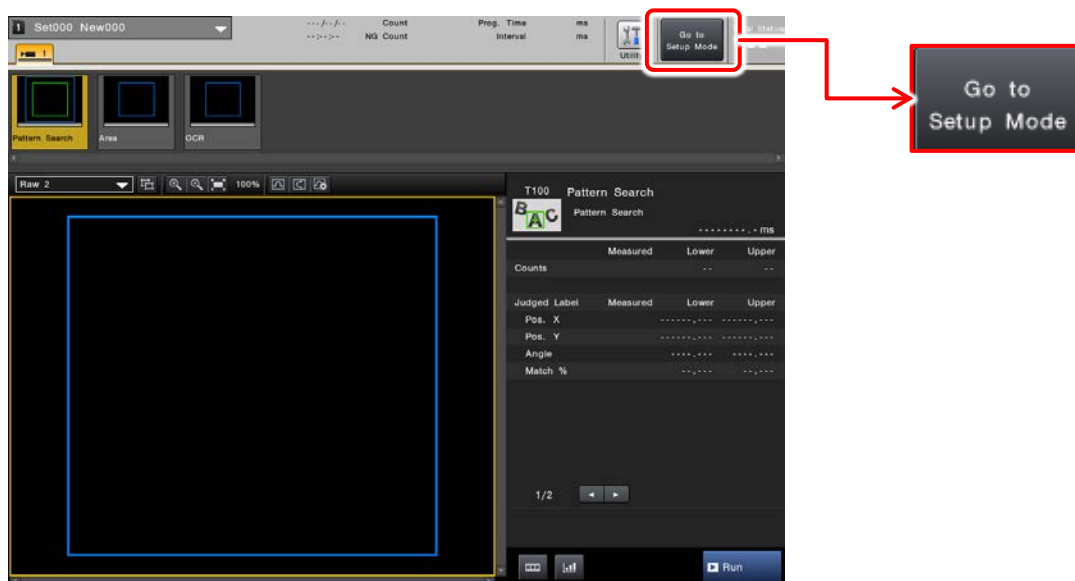
This section explains the detailed procedure to follow in order to actually execute commands. With some commands, an error occurs in setup mode, so follow the procedure shown below to switch to run mode.

- (1) Click "Go to Run Mode" at the top of the setup mode screen to switch to run mode.

There are commands that cannot be executed in setup mode.



- (2) When the text on the button switches to "Go to Setup Mode," the switch to run mode is complete.



4.3.1 Checking Typical Command Applications

This manual explains detailed usage procedures for typical commands.
A list of the details of these commands is shown below.

Command details	Command to use	Procedure reference
Saving settings	SS command	"4.3.2 SS Command"
Switching the program	PW command	"4.3.3 PW Command"
Obtaining the current program	PR command	"4.3.4 PR Command"
Changing the OCR/1D code reader/ 2D code reader judgment character string	CW command	"4.3.5 CW Command"

4.3.2 SS Command (Saving Settings)

This section explains how to use the "SS command" as an example of the commands that do not use command parameters.

The SS command saves the current program and system settings.

The "number-specified-command No." of the SS command is "12."

Command Execution Procedure Example (Saving the Current Program and System Settings)

(1) Enter "12," which is the command number of the SS command, into the tag (CVX:O.Data[4]) to which **Command Number** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	0
CVX:I.Data[5]	0
CVX:O.Data[4]	12
CVX:O.Data[5]	0

(2) Turn **ON** the tag (CVX:O.DATA[0].1) to which the **Command request flag** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0
CVX:O.Data[4]	12
CVX:O.Data[5]	0

(3) The SS command is executed.

(4) Check that the tag (CVX:I.Data[0].0) to which the **Command complete flag** has been assigned turns **ON**.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0

(5) Check whether the tag (CVX:I.Data[0].1) to which the **Command error flag** has been assigned is **ON or OFF**.

If it is **OFF**, the command has been processed normally.

If it is **ON**, the command processing failed, so check the **error code** written to the tag (CVX:I.Data[5]) to which **Command Result** has been assigned.

When the command is successful, this remains "OFF."

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0

When the command fails, this turns "ON," so check the error code.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	1
CVX:O.Data[0].1	1
CVX:I.Data[5]	3

4.3.3 PW Command (Program Number Switching)

This section explains how to use the "PW command" as an example of the commands that use command parameters.

The PW command closes all the open dialog boxes and switches to the specified program number.

The "number-specified-command No." of the PW command is "24."

Command Execution Procedure Example (Switching to Program Number 5 on SD1)

- (1) Enter "24," which is the command number of the PW command, into the tag (CVX:O.Data[4]) to which **Command Number** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	0
CVX:I.Data[5]	0
CVX:O.Data[4]	24

- (2) Enter in units of 2 words the parameters into the tags (starting with CVX:O.Data[5]) to which **Command Parameter** has been assigned.

CVX:O.Data[5]: 1 (SD card number to switch to)
CVX:O.Data[6]: 5 (program number)

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	0
CVX:I.Data[5]	0
CVX:O.Data[4]	31
CVX:O.Data[5]	1
CVX:O.Data[6]	5

- (3) Turn **ON** the tag (CVX:O.Data[0].1) to which the **Command request flag** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0

- (4) The PW command is executed.

- (5) Check that the tag (CVX:I.Data[0].0) to which the **Command complete flag** has been assigned turns **ON**.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0

- (6) Check whether the tag (CVX:I.Data[0].1) to which the Command error flag has been assigned is ON or OFF.

If it is OFF, the command has been processed normally.

If it is ON, the command processing failed, so check the error code written to the tag

(CVX:I.Data[5]) to which Command Result has been assigned.

When the command is successful, this remains "OFF."

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0

When the command fails, this turns "ON," so check the error code.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	1
CVX:O.Data[0].1	1
CVX:I.Data[5]	3

4.3.4 PR Command (Program Number Reading)

This section explains how to use the "PR command" as an example of the commands that use command data output.

The PR command reads the current program number.

The "number-specified-command No." of the PR command is "25."

Command Execution Procedure Example (Reading the Current Program Number)

- (1) Enter "25," which is the command number of the PR command, into the tag (CVX:O.Data[4]) to which **Command Number** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	0
CVX:I.Data[5]	0
CVX:O.Data[4]	25

- (2) Turn **ON** the tag (CVX:O.DATA[0].1) to which the **Command request flag** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0

- (3) The PR command is executed.

- (4) Check that the tag (CVX:I.Data[0].0) to which the **Command complete flag** has been assigned turns **ON**.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0

- (5) Check whether the tag (CVX:I.Data[0].1) to which the **Command error flag** has been assigned is **ON or OFF**.
If it is **OFF**, the command has been processed normally.

When the command is successful, this remains "OFF."

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0

If it is **ON**, the command processing failed, so check the **error code** written to the tag (CVX:I.Data[5]) to which **Command Result** has been assigned.

When the command fails, this turns "ON," so check the error code.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	1
CVX:O.Data[0].1	1
CVX:I.Data[5]	3

- (6) After it can be confirmed that the command was processed normally in step (5), the reply data is output in units of 2 words into the tags (starting with CVX:I.Data[6]) to which **Command Data** has been assigned, so check these tags.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0
CVX:I.Data[6]	1
CVX:I.Data[7]	5

CVX:I.Data[6]: 1 (program SD card number)
CVX:I.Data[7]: 5 (program number)

You can see that the current program is program number 5 on SD1.

4.3.5 CW Command (Overwriting the OCR/ Code Reader Judgment Character String)

This section explains how to use the "CW command" as an example of the commands that use character strings for the command parameters.

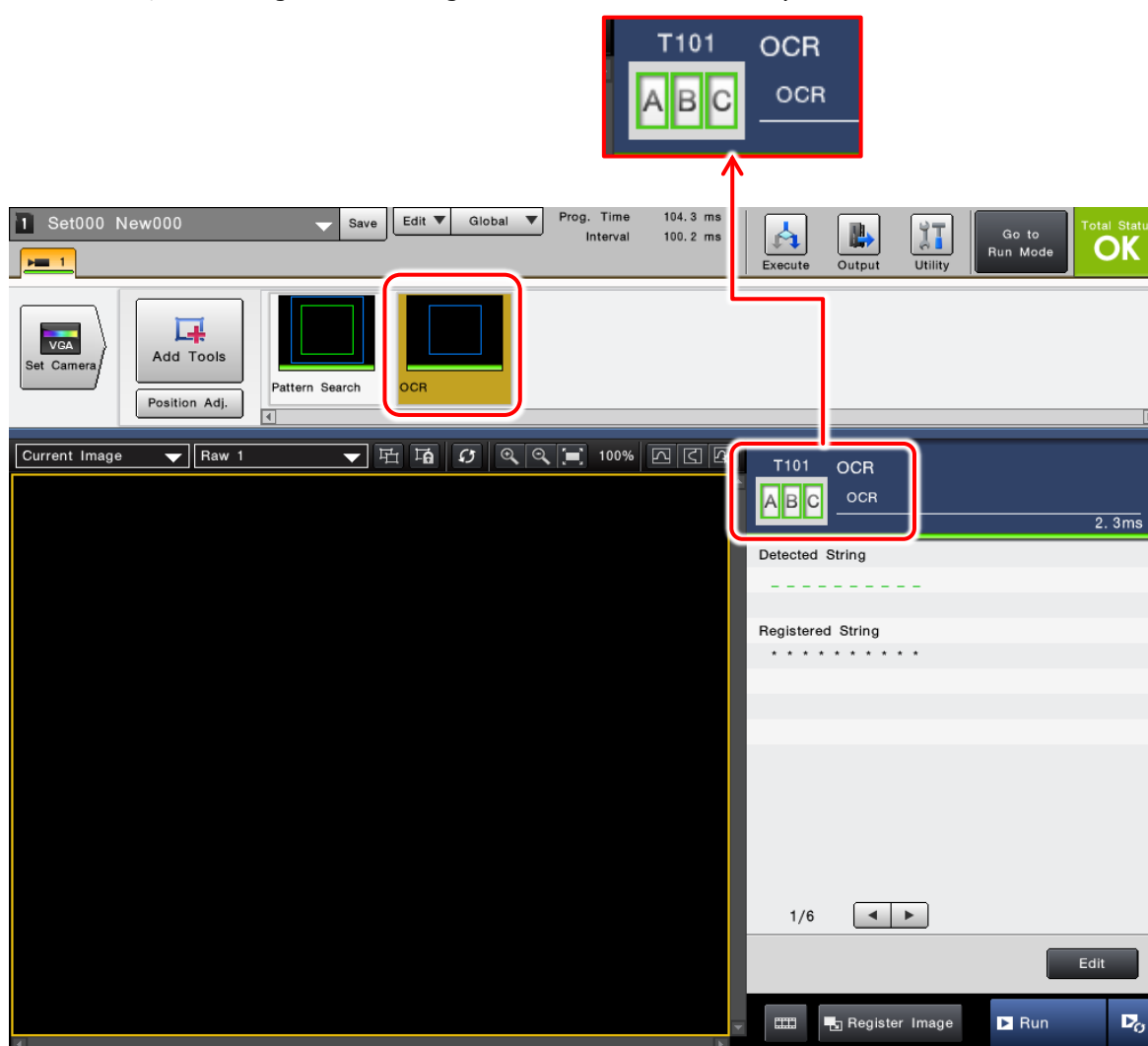
The CW command overwrites the judgment character string of the OCR/1D code reader/ 2D code reader.

The "number-specified-command No." of the CW command is "43."

Command Execution Procedure Example (Setting the Judgment Character String of the OCR Tool with Tool Number T101 to "ABCDE")

As shown below, you have to create the OCR tool and complete the settings to enable the recognition of characters in advance.

(In this section, the settings will be configured for the T101 OCR tool.)



- (1) Enter **"43,"** which is the command number of the CW command, into the tag (CVX:O.Data[4]) to which **Command Number** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	0
CVX:I.Data[5]	0
CVX:O.Data[4]	43

- (2) Enter in units of 2 words the command parameters into the tags (starting with CVX:O.Data[5]) to which **Command Parameter** has been assigned.

CVX:O.Data[5]: 101 (tool number)
 CVX:O.Data[6]: 1 (fixed to 1)★1
 CVX:O.Data[7]: 1 (fixed to 1)★1
 CVX:O.Data[8]: 65 ("A" in ASCII code)
 CVX:O.Data[9]: 66 ("B" in ASCII code)
 CVX:O.Data[10]: 67 ("C" in ASCII code)
 CVX:O.Data[11]: 68 ("D" in ASCII code)
 CVX:O.Data[12]: 69 ("E" in ASCII code)
 CVX:O.Data[13]: **0 (Be sure to use "0" as the terminator of the character string.)**

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	0
CVX:I.Data[5]	0
CVX:O.Data[4]	43
CVX:O.Data[5]	101
CVX:O.Data[6]	1
CVX:O.Data[7]	1
CVX:O.Data[8]	65
CVX:O.Data[9]	66
CVX:O.Data[10]	67
CVX:O.Data[11]	68
CVX:O.Data[12]	69
CVX:O.Data[13]	0

★1 You can also enter values other than "1." For details on the parameters, see the "CV-X Series User's Manual."

- (3) Turn **ON** the tag (CVX:O.Data[0].1) to which the **Command request flag** has been assigned.

Tag	Value
CVX:I.Data[0].0	0
CVX:I.Data[0].1	0
CVX:O.Data[0].1	1
CVX:I.Data[5]	0

- (4) The CW command is executed.

- (5) Check that the tag (CVX:I.Data[0].0) to which the **Command complete flag** has been assigned turns **ON**.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0

- (6) Check whether the tag (CVX:I.Data[0].1) to which the **Command error flag** has been assigned is **ON or OFF**.

If it is **OFF**, the command has been processed normally.

If it is **ON**, the command processing failed, so check the **error code** written to the tag (CVX:I.Data[5]) to which **Command Result** has been assigned.

When the command is successful, this remains "OFF."

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	0

When the command fails, this turns "ON," so check the error code.

Tag	Value
CVX:I.Data[0].0	1
CVX:I.Data[0].1	1
CVX:O.Data[0].1	1
CVX:I.Data[5]	3