KEYENCE

Laser Marker

EtherNet/IP Communication Interface

User's Manual

for MD-X1000/1500 Series
MD-F3200/5200 Series
MD-U1000 Series
ML-Z9600 Series

1	Getting Started
2	Cyclic Communication
3	Ladder Program Example

Read this manual before using the system in order to achieve maximum performance.
Keep this manual in a safe place for future reference.

Symbol

The following symbols alert you to important messages. Be sure to read these messages carefully.

DANGER	**It indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**It indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**It indicates a situation which, if not avoided, could result in product damage as well as property damage.**

▶ **Important**   **It indicates cautions and limitations that must be followed during operation.**

✎ **Point**   **It indicates additional information on proper operation.**

Reference   It indicates tips for better understanding or useful information.

📖 It indicates the reference pages and items in this manual.

Contents

1 Getting Started

1-1 What is EtherNet/IP?

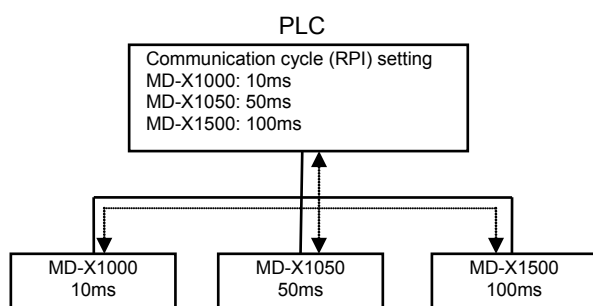EtherNet/IP is an industrial communication network proposed by the ODVA (Open DeviceNet Vendor Association,Inc.).
EtherNet/IP communications can be shared and used with standard Ethernet and network communications.

■ Scanner and adapters

In EtherNet/IP, one of the two devices opens a communication line called a "connection" with the other device. The side that opens a connection is referred to as a "scanner" (originator); and the side that is opened is referred to as an "adapter" (target). Typically, the PLC is the scanner and the laser is the adapter.

■ Cyclic communication

EtherNet/IP offers cyclic communication (Implicit message) for sending and receiving data on a periodic basis.
It allows you to set the RPI (communication cycle) based on the priority of the sent/received data, enabling sending and receiving of data with adjustment of the overall communication load.

PLC

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Communication cycle (RPI) setting
MD-X1000: 10ms
MD-X1050: 50ms
MD-X1500: 100ms
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| MD-X1000 10ms | MD-X1050 50ms | MD-X1500 100ms |

1-2 EtherNet/IP communication specifications and functions

■ EtherNet/IP communication specifications of the laser marker

Cyclic communication (Implicit messages)	Number of connections	16	
	Communication size	Keyence KV Series	2 to 320 bytes
		Rockwell Automation ControlLogix CompactLogix	2 to 320 bytes
		OMRON CJ/CS Series	2 to 320 bytes

■ Overview of the EtherNet/IP functions of the laser marker

You can read the laser marker statuses and/or execute various operations via the EtherNet/IP communication. Refer to the device map for details.

1-3 Compatible laser markers

Laser marker model	Controller software version	Software
MD-X1000/1020/ 1050/1500/1520 Series	02.00.00 or later	Marking Builder 3 (Ver.2.0 or later)
MD-F3200/3220/ 5200/5220 Series	Available on all versions	Marking Builder 3 (Ver.3.0 or later)
MD-U1000/1020 Series	Available on all versions	Marking Builder 3 (Ver.4.0 or later)
ML-Z9610/9620/ 9650 Series	Available on all versions	Marking Builder 3 (Ver.4.0 or later)

1-4 Compatible PLCs

For more details on how to configure each PLC, refer to the instruction manual of the corresponding PLC.

Keyence

PLC model	EtherNet/IP communication unit	Firmware version	Software
KV-3000	KV-EP21V	Ver.2 or later	KV STUDIO (Ver.6.0 or later) *The KV-7300/7500 series uses Ver. 8.0 or later
KV-5000/ 7300	KV-EP21V	Ver.2 or later	
KV-5500/ 7500	Built-in port/KV-EP21V	Ver.2 or later	

OMRON

| PLC model	EtherNet/IP communication unit	Firmware version	Software
SYSMAC CJ2	Built-in port /CJ1WEIP21	V1.0 or later	Cx-One (Ver.3.0 or later)
SYSMAC CJ1	CJ1WEIP21	V1.0 or later	
SYSMAC CS1	CJ1WEIP21	V1.0 or later	

Rockwell Automation

PLC model	EtherNet/IP communication unit	Firmware version	Software
1756 ControlLogix	1756-ENBT	Ver.13 or later	RsLogix5000 (Ver.13 or later)
1769 CompactLogix	Built-in port	Ver.13 or later	
1747 SLC5/05	Built-in port	OD firmware level Series C, FRN 10 or later	RsLogix500 (Ver.7.10 or later)
1761/1766 MicroLogix	Built-in port /1761-NETENI	Series A, Revision A, FRN1	
1762/1763/ 1764 MicroLogix	1761-NETENI		

Reference   Either a straight or crossover LAN cable can be used.

2 Cyclic Communication

2-1 Cyclic communication with the laser marker

Cyclic communication performs periodic communication (several to several dozen ms) and is suitable for real-time control. The update time and communication size depend on the connection settings on the PLC side.
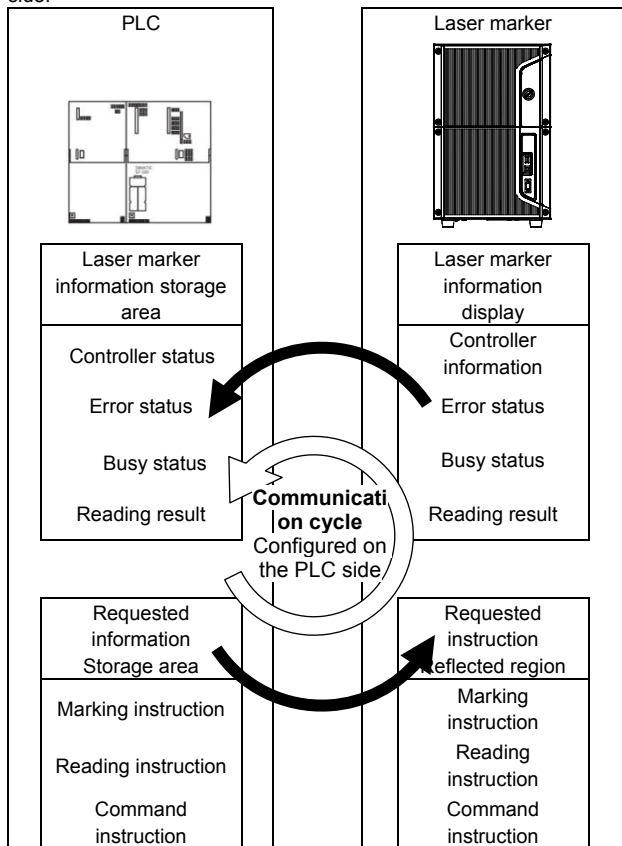
| ⚠ WARNING | ・ Read the "Chapter 2 Safety Information" in the user's manual for the applicable model to perform operation in the state that the safety is secured by using security function even when the network failure occurs.
・ Confirm the safe operation by considering the communication delay due to the communication time or network overload state. |

| ▶ Important | Even when the update time of the cyclic communication is set to 10 ms or longer, this product may temporally or continually be overloaded due to its dialog operation and parallel use of other communication (commands etc.), which results in delay in processing and timeout temporally to disconnect the communication. In such case, the periodic communication settings and use condition need to be reviewed. Including the issues above, be sure to validate that there is no problem in the performance of the system before operation. |

2-2 How to configure the laser marker

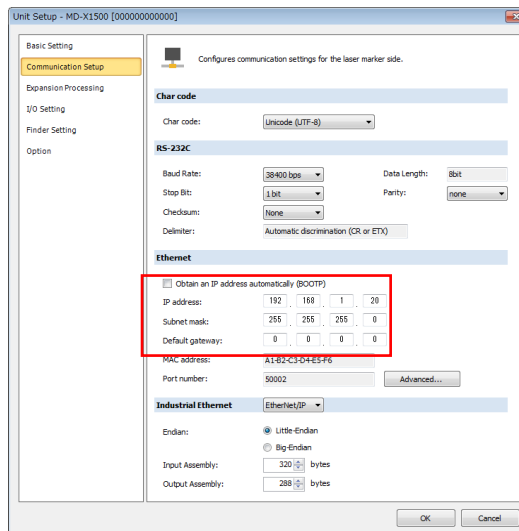The laser marker is configured as follows using Marking Builder 3.

1. **Open [Laser Marker] > [Unit Setup] > [Communication settings] in the ribbon menu.**

2. **Set the Ethernet communication settings.**
   Set these items as appropriate for your network environment.
   ・ Setting example

IP address	192.168.0.20
Subnet mask	255.255.255.0
Default gateway	0.0.0.0

3. **Set Industrial Ethernet to [EtherNet/IP].**
   The EtherNet/IP setting items will appear.
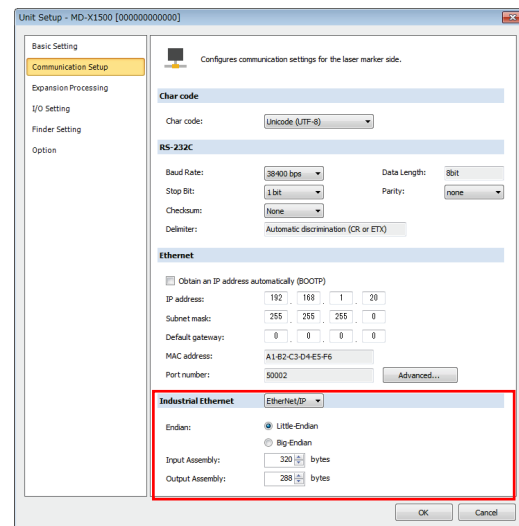
4. **Set the Input/Output assembly size.**
   These items should be set according to the PLC settings.
   Little-Endian should be used to avoid the need to byte-swap.
   ・ Setting example

Endian	Little-Endian
Input assembly size	320 (bytes)
Output assembly size	288 (bytes)

| Reference | If you modify the EtherNet/IP settings, the unit must be restarted for the changes to take effect. |

2-3　Configuring the PLC

PLC settings

Configure the following settings on the PLC when using cyclic communication.
(1) The connection to be used
(2) The device to be used for cyclic communication
(For more details on the setting method, refer to the manual of each PLC.)
* When using the KV series, (1) and (2) are set automatically when you make a selection in the KV STUDIO.

■ Connection to be used

In EtherNet/IP, a connection is opened from the scanner during cyclic communication.
There are many types of connections, and the connection available is different for each device. The type of connection available for the laser marker is Exclusive Owner.

Connection type	Data type	Instance ID	Size (bytes)	RPI (ms)
Exclusive Owner (Data transmission + control)	Result data (Input Assemblies)	0X64 (100)	2 to 320	1 to 10000
	Control data (Output Assemblies)	0X65 (101)	2 to 288	

■ What is Exclusive Owner?

This type of connection allows communication between the PLC and laser marker.
It allows you to send a marking start instruction from the PLC to the laser marker or send a status notification from the laser marker to the PLC.
Only a single [Exclusive Owner] connection can be set for a laser marker.
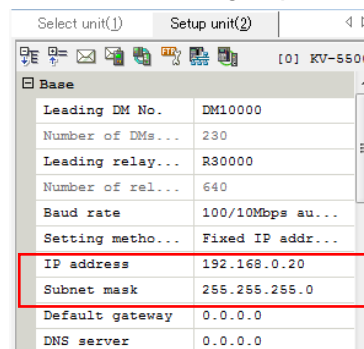
How to configure the KEYENCE KV series

This section describes an example procedure in which the MD-X1000/1500 series is set.
Connect the KV with the PC using an Ethernet cable and launch KV STUDIO.

1. Create a new project.

2. In the [Unit Settings (2)] tab of the unit editor, set the IP address and subnet mask of the unit having the port for EtherNet/IP.
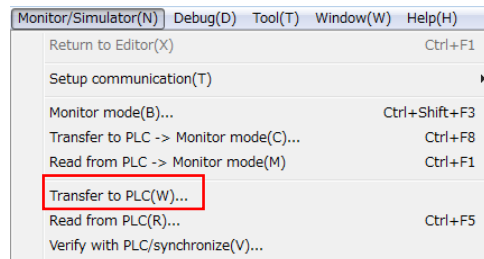

Reference
- Set the IP address such that it is different from that of the laser marker.
- Match the subnet mask value with that of the laser marker.
- If you are using a unit other than KV-5500/7500, configure the IP address and subnet mask after adding the EtherNet/IP communication unit (KV-EP21V) to the unit.
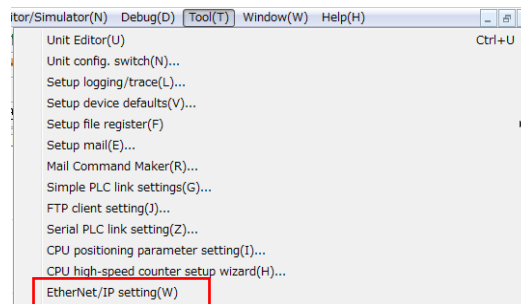
3. Transfer the unit configuration to a PLC.
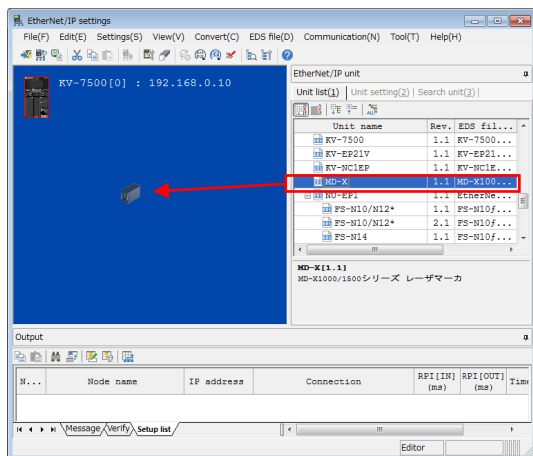Select [Monitor/Simulator(N)] > [PLC Transfer(W)] to start the transfer.

4. Display the EtherNet/IP settings.
Select [Tools(T)] > [EtherNet/IP(W)] to open the setting screen.

5. Add the laser marker to a device.

Add the [MD-X1000/1500 Series] in the [Device List (1)] tab to the device screen by drag and drop.

Reference   If you cannot find the target model in the device list, add MD-X1000/1500 from [File] > [Register sensor setting file]. The ez1 file is stored in the location described below.
C:\Program Files (x86)\keyence\
MarkingBuilder3_Ver*\etc\EtherNetIP\[Model_Name]
(Ver* is the version of Marking Builder3.)

6. Set the IP address of the laser marker.

Match the IP address with the IP address set on the laser marker side.
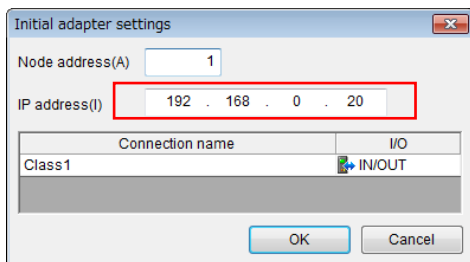
7. Save the settings and close the EtherNet/IP screen.

Save the settings and close the screen after confirming that the laser marker has been added under EtherNet/IP as shown below.
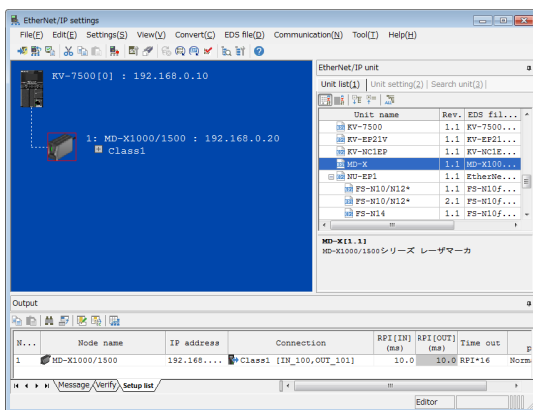
8. Register the device comment.

Double click the device comment in the workspace, and open the device comment edit window. Switch distinct unit editing to "MD-X", click [Detail] button and then click [Register unit Device] and [Reg].
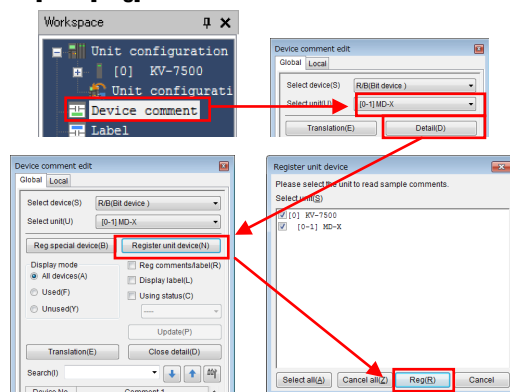
Reference   The device comment related to EtherNet/IP of the laser marker will be registered automatically as follow.

How to configure the OMRON CJ2 series

This section describes an example procedure in which the MD-X1000/1500 series is set.
Connect the PLC with the laser marker using an Ethernet cable and launch CX-Programmer.

1. Create a new project.

2. Connect PLC.
Select [Auto Online] -> [Direct Online] from [PLC] menu, select a connection type with PLC, and re-connect to the PLC.
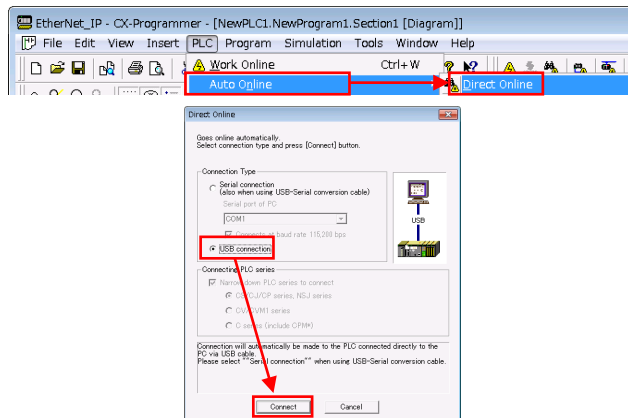
> **Reference** It describes how to connect via USB.

3. Display the TCP/IP parameter edit screen of PLC.
Double click [I/O Table and Unit Setup] in the project workspace, then double click [Built In EtherNet/IP Port] of connected PLC.
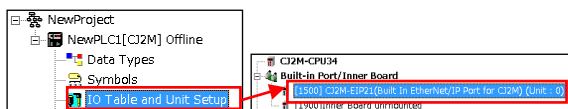
4. Set the IP address of PLC.
After setting the IP address and subnet mask, select [Transfer[PC to Unit]], and transfer the parameter to the unit.
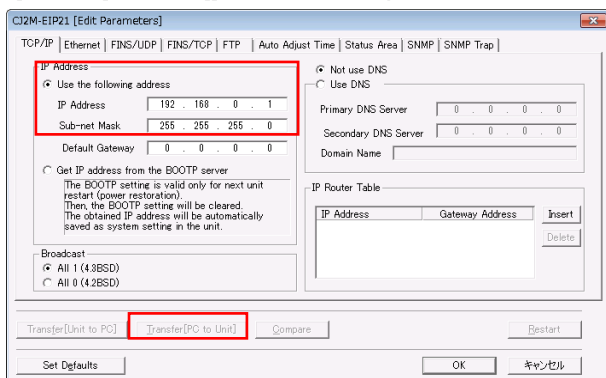
> **Reference**
> • Set the IP address such that it is different from that of the laser marker.
> • Match the subnet mask value with that of the laser marker.
> • To enable the transferred settings, the unit needs to be restarted.

5. Start up Network Configurator.
Right click [Built In EtherNet/IP Port] of connected PLC, select [Start Special Application] and then [Start with Settings Inherited]. The [Select Special Application] screen appears, select [Network Configurator].
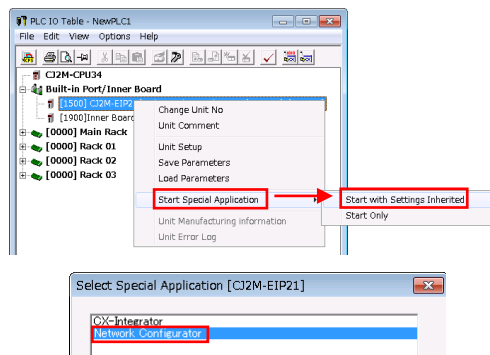
6. Select interface.
Select [Select Interface], then [CJ2 USB/Serial Port] from [Option] menu.
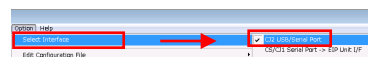
7. Connect with PLC.
Select [Connect] from [Network] menu, set [Setup Interface], [Select Connect Network Port] and [Select Network] according to the device environment, and then connect it.

8. Upload the network setting.
If [Upload] is selected from [Network] menu, the IP address of the device which has been connected to network is displayed. Check that the IP address of the connection target device has been displayed, select [OK] and complete the upload.
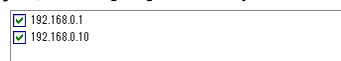
9. Install EDS file
Select [Install] from [EDS File] menu.
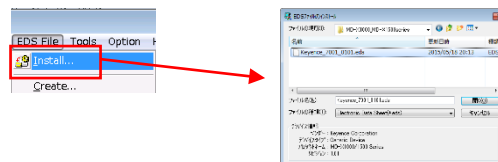
> **Reference** The EDS file of laser marker is in the following folder.
> C:\Program Files (x86)\keyence\MarkingBuilder3_Ver*\etc\EtherNetIP\[Model_Name]
> (Ver* is the version of Marking Builder3.)

10. **Display the device parameter edit window**
    Right click the PLC icon in the network window, and select [Parameter] and then [Edit].
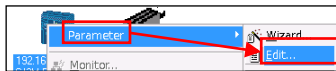
11. **Set the In-Consume/Out-Produce area tag.**
    Select In-Consume tab, and click [New]. Set the tag name to "E0_00000" (first address of input data memory), and set the size to "320Byte". Next, select Out-Produce tab, and click [New]. Set the tag name to "D00000" (first address of output data memory), and set the size to "288Byte".

Edit window of device parameter   In-Consume tag
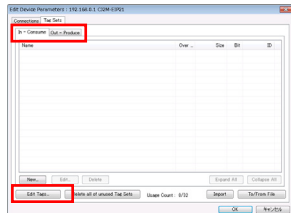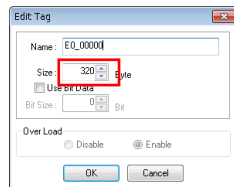
Out-Produce tag
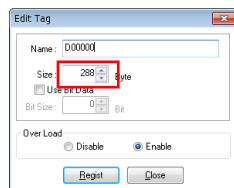
Reference   The data size of this setting method is the default setting value.

12. **Associate the tags between PLC and MD-X**
    Select [Connection] tab. Select the MD-X in the [Unregister Device List]. Then click [↓] to register the device in the [Register Device List].
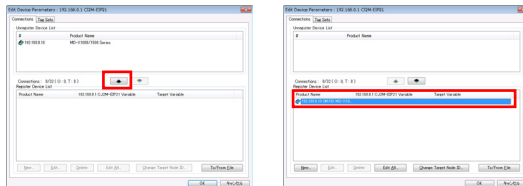
13. **Double click the device to be registered, and display [Edit Connection] screen.**
    Set "Connection I/O Type", "Originator Device", and "Target Device" as follow, and click [Regist].
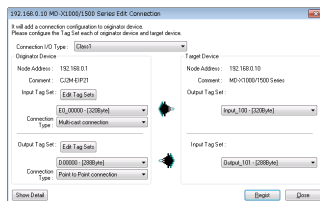
・ Setting example: Connection I/O type: Class1

PLC		Laser Marker	
Originator Device		Target Device	
Input Tag Set	E0_00000	Output Tag Set	Input_100
Connection Type	Multi-cast connection		
Output Tag Set	D00000	Input Tag Set	Input_100
Connection Type	Point to Point connection		

14. **Return to "Edit Device Parameters" screen, select [OK].**
    The PLC setting is completed by the above setting method.

Reference   For details about how to operate CX-Programmer and Network Configurator, refer to PLC user's manual

How to configure the Allen-Bradley Control/Compact Logix series

This section describes an example procedure in which the MD-X1000/1500 series is set.
Connect the PLC to the laser marker using an Ethernet cable and launch RSLogix5000.

1. Install the MD-X EDS File.

In RSLogix5000, click [Tools] then select [EDS Hardware Installation Tool]. Follow Rockwell Automation's EDS wizard for registering an EDS file.

> **Reference** The EDS file of the laser marker is located in the folder below.
> C:\Program Files (x86)\keyence\ MarkingBuilder3_Ver*\etc\EtherNetIP\[Model_Name] (Ver* is the version of Marking Builder3.)

2. Add an MD-X Ethernet Module.

Right-click [Ethernet] in the I/O Configuration tree and click [New Module...]. Select MD-X1000/1500 and click [Create].
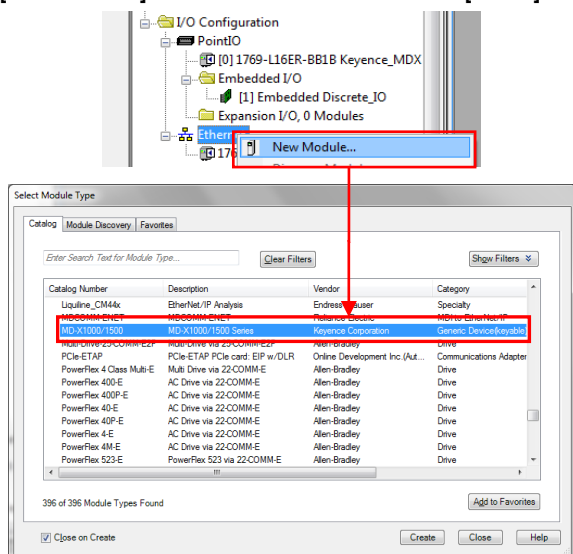
3. Configure the MD-X Ethernet Module
Name the module and enter the Ethernet IP Address of the MD-X laser marker. Then, click [Change…] and change the data size from SINT to INT. Click [OK] when finished.
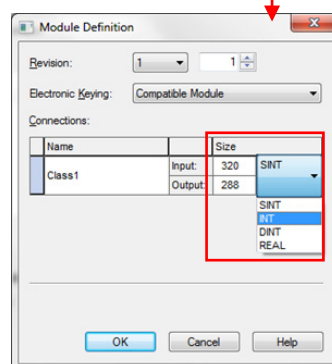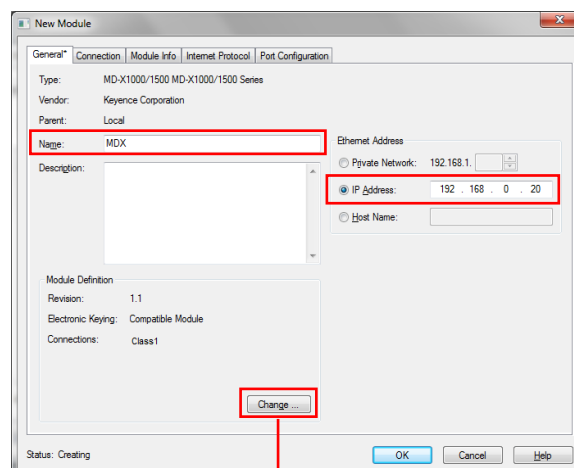
> ▶ **Important** INT should be selected since the MD-X1000/1500 series, MD-F3200/5200 series, MD-U1000 Series, and ML-Z9600 Series uses 16-bit (2-byte) addresses. You must enter the assembly size obtained by dividing the assembly size of the laser marker by 2. By default, the laser marker's input assembly size is 320 and output assembly size is 288. Therefore the PLC's input assembly size should be 160 and output assembly size should be 144.

In the device, there is an area for writing laser marker state to the PLC and an area for writing instructions from the PLC to the laser marker. It is divided into bit area and word area.

Input Assemblies Memory Map

Laser marker -> PLC

Address	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0					Contactor Status/ Safety Shutter Status	Remote Interlock Status	Shutter Control Status	Laser Emitted Status		Program Change Ready Status	Network Status	Shutter Status	I/O Error Status	Warning Status	Error status	Ready Status
1										Mark Check /2DC Read Busy Status	Program Edit Busy Status	Communication Priority Error status	Program Change Busy Status	Guide Laser Busy Status	Marking Busy Status	Busy Status
2	Marking Complete1	Mark Check /2DC Read NG Status	Mark Check /2DC Read OK Status	Counter End4 Status	Counter End3 Status	Counter End2 Status	Counter End1 Status	Date Attach Status					Date Hold Status	Laser Control Status	Operation Stop Status	Trigger Lock Status
3																
4								Program Edit Complete				2DC Read Complete	Error Clear Complete	Laser Stop Complete	Guide Laser Complete	Marking Complete2
5								System Info ID Change Complete		Counter Reset Complete	Counter Down Complete	Counter Up Complete	Counter Value Complete	Counter No Complete	Rank Change Complete	Program Change Complete
6														String Change Complete	Marked String Read Complete	Set String Read Complete
7								Command Send Complete								
8								Program Edit Error				2DC Read Request Error	Error Clear Request Error	Stop Marking Request Error	Guide Laser Request Error	Start Marking Request Error
9									System Info ID Change Error	Counter Reset Request Error	Counter Down Request Error	Counter Up Request Error	Counter Value Change Request Error	Counter No Change Request Error	Rank Change Request Error	Program Change Request Error
10														String Change Request Error	Marked String Read Request Error	Set String Read Request Error
11								Command Send Request Error								
12	Error Code 1															
13	Error Code 2															
14	Command Send Error Status															
15																
16	Program No Status															
17	Counter No Status															
18/19	Counter Value Status															
20	Rank Value Status															
21	System Info ID															
22/23	System Info Value															
24	Marking Check Score / 2DC Read Grade Status															
25	Marking Check / 2DC Read Total Count Status															
26/27																
28/29	Total Marking Count Status															
30	Response Data Size															
31 to 155	Response Data															

■ Bit area for writing laser marker state on the PLC

In the following areas, information is divided by bit. The bit values are either 0 or 1.
The laser marker information is written in the PLC bit area via cyclic communication. An area without a description is reserved.

Address	bit	Name	Status Information	Description	
0	0	Ready Status	0:Not Ready 1:Ready	Displays the ready status. When the device status is Ready, operations such as start marking, setting changes, and character string edition are accepted	
				Linked I/O Terminal	Trigger ready output
	1	Error Status	0:Not Error 1:Error	Displays the error (E***) status. To recover from an error, eliminate the causes of the error first, and then turn on Error Clear.	
				Linked I/O Terminal	Error output
	2	Warning Status	0:Not Warning 1:Warning	Displays the warning error (W***) status.	
				Linked I/O Terminal	Warning output
	3	I/O Error Status	0:Not I/O Error 1:I/O Error	Displays the terminal block error (T***) status.	
	4	Shutter Status	0:Open Shutter 1:Close Shutter	Displays whether the internal shutter is opened or closed.	
				Linked I/O Terminal	Shutter status output
	5	Network Status	0:No Connection 1:Connection	Displays the Fieldbus network communication status.	
	6	Program Change Ready Status	0: Not Ready 1: Ready	Displays whether the program can be changed or not.	
				Linked I/O Terminal	Program change ready status
	8	Laser Emitted Status	0:Laser Not Excited 1:Laser Excited	Displays the laser excitation status.	
				Linked I/O Terminal	Laser excitation status output
	9	Shutter Control Status	0:OFF (Close) 1:ON (Open)	Displays whether the shutter control input is on or off.	
	10	Remote Interlock Status	0:OFF (Close) 1:ON (Open)	Displays whether the remote interlock input is on or off.	
	11	Contactor Status/ Safety Shutter Status	0:OFF(Close) 1:ON (Open)	This bit area will become Contactor Status on MD-X1000/1500 series, MD-F3200/5200 series, and MD-U1000 series. Displays whether the contactor control input is on or off. Always "0" for devices that do not have a contactor. This bit area will become Safety Shutter Status on ML-Z9600 series. Displays whether the safety shutter control input is on or off.	
1	0	Busy Status		If one or more of the following busy statuses are on, Busy Status turns on. Marking Busy, Guide Laser Busy, Program Change Busy, Communication Priority, Program Edit Busy, Mark Check / 2DC Read Busy Status	
	1	Marking Busy Status		Turn on during marking (including laser inspection).	
				Linked I/O Terminal	Marking in-operation output
	2	Guide Laser Busy Status		Turn on when guide laser marking is in operation (including the distance pointer).	
				Linked I/O Terminal	Guide laser output
	3	Program Change Busy Status	0:Not Busy 1:Busy	Turn on when a program is being deployed. (Deployment timing: when changing marking programs, content, and so on)	
	4	Communication Priority Error Status		Displays the communication priority status. Turn on when the laser marker is connected to an external control device and in the no priority state.	
	5	Program Edit Busy Status		Turn on when the Program Edit Start Request turns on and editing starts. Returns to "OFF" when the Program Edit Start Request is turned off and editing is completed.	
	6	Mark Check /2DC Read Busy Status		Turn on when the marking verification function or 2DC reading is operating. * Always turned off on the MD-F3200/5200 series, and ML-Z9600 Series.	

Address	bit	Name	Status Information	Description	
2	0	Trigger Lock Status	0 : OFF 1 : ON	Displays whether the trigger lock input is on or off.	
	1	Operation Stop Status		Displays whether the processing operation stop input is on or off.	
	2	Laser Control Status		Displays whether the laser stop input is on or off.	
	3	Date Hold Status		Displays whether the date hold input is on or off.	
	8	Date Attach Status	0 : OFF 1 : ON	Displays the status of date attach output.	
				Linked I/O Terminal	Date attach output
	9	Counter End1 Status	0 : Not Complete 1 : Complete	Displays the status of counter end output 1 - 4. You can use the Marking Builder 3 device settings to assign the individual and common counters (0 to 9, A to J).	
	10	Counter End2 Status			
	11	Counter End3 Status		Linked I/O Terminal	Counter end output 1 - 4
	12	Counter End4 Status			
	13	Mark Check/2DC Read OK Status	0→1: OK 1→0: - [Reset Timing] Reset when 2DC Read Request or 2DC Read Complete Bit Clear turns on.	Displays whether the marking verification function or 2D code grade assessment result is OK or not.* 1 * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.	
				Linked I/O Terminal	Marking/2D code check OK output
	14	Mark Check/2DC Read NG Status	0→1: NG 1→0: - [Reset Timing] Reset when 2DC Read Request or 2DC Read Complete Bit Clear turns on.	Displays whether the marking verification function or 2D code grade assessment result is NG or not.* 1 * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.	
				Linked I/O Terminal	Marking/2D code check NG output
	15	Marking Complete 1	0: Not Complete 1: Complete	Displays the status of marking complete output.	
				Linked I/O Terminal	Marking complete output
4	0	Marking Complete 2	0: Not Complete 1: Complete [Reset Timing] Reset when the Complete Clear Bit statuses turn on or the next Request turns on.	Displays the completion status of marking started with Start Marking Request. If marking has been canceled, the bit does not turn on.* 2	
	1	Guide Laser Complete		Displays the completion status of guide laser marking started with Guide Laser Request. If marking completes, regardless of how it was canceled, be it communications, I/O, or the like, the bit turns on.* 2	
	2	Laser Stop Complete		Displays the completion status of Stop Marking Request. Even if marking is started from other communications or I/O, if cancellation is completed with Stop Marking Request, the bit turns on.	
	3	Error Clear Complete		Displays the completion status of Clear Error Request. After completion, the bit turns on, regardless of whether error clearing was successful or not.* 2	
	4	2DC Read Complete		Displays the completion status of 2DC Read Request.* 2 * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.	
	8	Program Edit Complete		Displays the completion status of editing started with Program Edit Start Request. If it completes successfully, the bit turns on.	
5	0	Program Change Complete		Displays the completion status of Program Change Request.* 2	
	1	Rank Change Complete		Displays the completion status of Rank Change Request.* 2	
	2	Counter No Complete		Displays the completion status of Counter No Change Request.* 2	
	3	Counter Value Complete		Displays the completion status of Counter Value Change Request.* 2	
	4	Counter Up Complete		Displays the completion status of the value changed with Counter Up Request.* 2	
	5	Counter Down Complete		Displays the completion status of the value changed with Counter Down Request.* 2	
	6	Counter Reset Complete		Displays the completion status of the reset with Counter Reset Request.* 2	
	8	System Info ID Change Complete		Displays the change to be completed of the operation information ID by System Info ID Change Request. * It cannot be used on the MD-X1000/1500 series and MD-F3200/5200 series.	
6	0	Setting String Read Complete		Displays the completion status of Setting String Read Request.* 2	
	1	Marked String Read Complete		Displays the completion status of Marked String Read Request.* 2	
	2	String Change Complete		Displays the completion status of String Change Request.* 2	
7	8	Command Send Complete		Displays the completion status of Command Send Request.* 2	

Reference *1 If a code is read with the settable 2D code reading function on Marking Builder 3, OK/NG is output with the grade that is set as the threshold as the reference.
If code is read with 2DC Read Request, OK/NG is output for whether the code was successfully read or not. (If the code is read even at Grade F, OK is output.)

*2 The bit turns on when complete only if the operation is started by Profinet and Ethernet/IP communications.
If you start the operation with other forms of communication or I/O, the bit will not turn on, even if the operation completes.

Reference Remote interlock input, shutter interlock input, and laser excitement input cannot be controlled from Ethernet/IP. Control those inputs from I/O.

Address	bit	Name	Status Information	Description
8	0	Start Marking Request Error	0: Not Error 1: Error [Reset Timing] Reset when the Complete Bit Clear statuses turn on or the next Request turns on.	If the marking operation started with Start Marking Request fails, the bit turns on. If marking is canceled or marking cannot start without priority, the bit turns on.* 2
	1	Guide Laser Request Error		If the guide laser operation started with Guide Laser Request fails, the bit turns on. If Guide Laser Request is turned on when the guide laser cannot be irradiated or cannot be started without priority, the bit turns on.* 2
	2	Stop Marking Request Error		If a Stop Marking Request fails to stop marking, the bit turns on. *2
	3	Error Clear Request Error		If an Error Clear Request fails to clear the error, the bit turns on. *2
	4	2DC Read Request Error		If a 2DC Read Request fails to read a 2D code, the bit turns on. * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.
	8	Program Edit Error		If a Program Edit Start Request fails to edit the program, the bit turns on. If edit start is not received or if data cannot be deployed when editing finishes, the bit turns on.
9	0	Program Change Request Error		If a program change with a Program Change Request fails, the bit turns on. * 2
	1	Rank Change Request Error		If an I/O specified character change with a Rank Change Request fails, the bit turns on.* 2
	2	Counter No Change Request Error		If a number change with a Counter No Change Request fails, the bit turns on. * 2
	3	Counter Value Change Request Error		If a value change with a Counter Value Change Request fails, the bit turns on. *2
	4	Counter Up Request Error		If a value change with a Counter Up Request fails, the bit turns on.* 2 Receivable condition: Ready ON
	5	Counter Down Request Error		If a value change with a Counter Down Request fails, the bit turns on.* 2 Receivable condition: Ready ON
	6	Counter Reset Request Error		If a reset with a Counter Reset Request fails, the bit turns on.* 2 Receivable condition: Ready ON
	7	System Info ID Change Error		If changing operation information ID with System Info ID Change Request fails, it turns on.* 2 * It cannot be used on the MD-X1000/1500 series and MD-F3200/5200 series.
10	0	Setting String Read Request Error	0: Not Complete 1: Complete [Reset Timing] Reset when the Complete Bit Clear statuses turn on or the next Request turns on.	If reading with a Setting String Read Request fails, the bit turns on.* 2
	1	Marked String Read Request Error		If reading with a Marked String Read Request fails, the bit turns on.* 2
	2	String Change Request Error		If a change with a String Change Request fails, the bit turns on.* It will also fail if the data length exceeds 250 bytes.* 2
11	8	Command Send Request Error	0: Not Error 1: Error [Reset Timing] Reset when Command Send Complete Bit Clear turns on or the next Command Send Request turns on.	If Command Send Request fails, the bit turns on. It will also fail if the data length exceeds 250 bytes.* 2

Reference *2 The bit turns on when complete only if the operation is started by Profinet and Ethernet/IP communications.
If you started the operation with other forms of communication or I/O, the bit will not turn on, even if an error occurs.

■ Word area for writing laser marker state on the PLC

In the following areas, the information is divided by word. The information is shown with 2-byte unsigned integer (0 to 65535).
The laser marker information is written in the PLC word area via cyclic communication. An area without a description is reserved.

Address	Data Type	Name	Status Information	Description
12	Word	Error Code 1	Error Number	Displays the number for the error currently occurring. The error number display differs to the normal display. The error codes is displayed as four digits such as 1*** for an error (E***), 2*** for a warning error (W***), and 3*** for an I/O error (T***). Up to two errors can be displayed. When three or more errors occur, check them with Marking Builder 3.
13	Word	Error Code 2		
14	Word	Command Send Error Status	Error Number [Reset Timing] Reset when Command Send Request Complete Bit Clear turns on or the next Command Send Request turns on.	If Command Send Request fails due to a software error, the error number is displayed. The error number display differs to the normal display. A software error (S***) is displayed as 4*** in four digits.
16	Word	Program No Status	Program Number (0 to 1999)	Displays the currently selected program number.
17	Word	Counter No Status	Counter Number (0 to 19)	• Counter Value Change/Up/Down/Reset Request that is to be changed • Counter Value Status that is to be displayed Displays the number of the target counter listed above. Changes with Counter No Change Request.
18/19	DWord	Counter Value Status	Counter Value (0 to 4294967295)	Displays the current counter value set to be displayed for Counter No Change Request.
20	Word	Rank Value Status	I/O Encoded Character Value (0 to 35)	Displays the value for I/O specified characters.
21	Word	System Info ID	System Info ID (0〜301)	Displays the currently selected operation information ID. * It cannot be used on the MD-X1000/1500 series and MD-F3200/5200 series.
22/23	DWord	System Info Value	System Info Value (0〜4294967295)	Displays the operation information ID specified by System Info ID. * It cannot be used on the MD-X1000/1500 series and MD-F3200/5200 series.
24	Word	Marking Check Score / 2DC Read Grade Status	[When using the marking verification function] 000 to 100 [When acquiring 2DC reading] 0 to 4 [Reset Timing] Reset when 2DC Read Complete Bit Clear turns on or the next 2DC Read Request turns on.	The following is displayed: • Marking verification function: score • 2D code reading: AIM DPM comprehensive determination grade Read fail or F(0)/D(1)/C(2)/B(3)/A(4) Even if you started the operation with communications and I/ other than 2DC Read Request, the result is displayed after the operation completes. * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.
25	Word	Marking Check/2DC Read Total Count Status	0 to 65535 [Reset Timing] Reset to "0" when the power is turned off.	The count determined by the marking verification function and the number of times the 2D code is read are displayed. * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.
28/29	DWord	Total Marking Count Status	Marking Count (0 to 4294967295)	Displays the marking count.
30	Word	Response Data Size	Data size (two bytes)	Stores the data length of "Response Data" in 16-bit binary data.
31-155	Character	Response Data	Response [Reset Timing] Reset when each Complete Bit Clear request turns on or the next Request turns on.	Displays the response data for the Setting/Marked String Request, 2DC Read Request (read content), and Command Send Request. * Selectable capacities are from 32, 64, 128, and 252 bytes on the PLC settings. (Default: 128 bytes. Fixed at 250 bytes in the KEYENCE PLC "KV Series".) However, if the response data is greater than the selected byte number, all the data cannot be received. Additionally, even if 252 bytes is selected, the maximum amount of data that will be received is 250 bytes.

Output Assemblies Memory Map

PLC -> Laser Marker

Address	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0								Program Edit Start Request				2DC Read Request	Error Clear Request	Stop Marking Request	Guide Laser Request	Start Marking Request
1								System Info ID Change Request		Counter Reset Request	Counter Down Request	Counter Up Request	Counter Value Change Request	Counter No Change Request	Rank Change Request	Program Change Request
2						String Change Request	Marked String Read Request	Set String Read Request								
3								Command Send Request								
4													Date Hold Request	Laser Stop Request	Operation Stop Request	Trigger Lock Request
5																
6								Program Edit Complete Bit Clear				2DC Read Complete Bit Clear	Error Clear Complete Bit Clear	Laser Stop Complete Bit Clear	Guide Laser Complete Bit Clear	Marking Complete Bit Clear
7								System Info ID Change Complete Clear		Counter Reset Complete Bit Clear	Counter Down Complete Bit Clear	Counter Up Complete Bit Clear	Counter Value Change Complete Bit Clear	Counter No Change Complete Bit Clear	Rank Change Complete Bit Clear	Program Change Complete Bit Clear
8														String Change Complete Bit Clear	Marked String Read Complete Bit Clear	Set String Read Complete Bit Clear
9								Command Send Complete Bit Clear								
10/11	Request No															
12	Request Data Size															
13 to 137	Request Data															

■ Bit area for writing the request from the PLC onto the laser marker

In the following areas, the information is divided by bit. The bit values are either 0 or 1.
The request from the PLC is written onto the laser marker via cyclic communication. An area without a description is reserved.

Address	bit	Name	Status Information	Description
0	0	Start Marking Request	0→1: Start 1→0: - [Condition of operation] The Ready Status is turned on.	Starts marking. If marking cannot be performed or is canceled, Start Marking Request Error turns on. The Marking Busy Status turns on during marking. If marking completes successfully, Marking Complete 1 and 2 turn on.
	1	Guide Laser Request	0→1: Start 1→0: - [Condition of operation] The Ready Status is turned on. * During shutter control, contactor control, and safety shutter control, the request is received even if the ReadyStatus is turned off.	Starts guide laser marking. Enter the number into Request No. beforehand. 0: Distance pointer 1: Guide laser once 2: Guide laser continuously 3: Area frame 4: Work image 5: Block frame If marking completes or is canceled (including canceled due to an error) after a set amount of time, the Guide Laser Request Complete bit turns on. If guide laser marking cannot start, Guide Laser Request Error turns on. If the move marking setting is selected, guide laser marking cannot be used. The error bit turns on.
	2	Stop Marking Request	0→1: Stop 1→0: - [Condition of operation] The Marking Busy Status is turned on.	Cancels marking.
	3	Error Clear Request	0→1: Error Clear 1→0: -	If an error occurs, remove the cause of the error and then turn this bit on to clear the error. An Error Status Bits error cannot be cleared (it is reset when the Complete Bit Clear statuses turn on or the next Request turns on). After the operation has been completed, Error Clear Complete turns on regardless of whether the error is cleared successfully or not. If the error cannot be cleared, Error Clear Request Error turns on.
	4	2DC Read Request	0→1: Start 1→0: - [Condition of operation] The Ready Status is turned on.	Reads 2D code. If this request is run when the condition of operation is not satisfied, Mark Check/2DC Read OK Status, Mark Check/2DC Read NG Status, and 2DC Read Complete turns on. * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.
	8	Program Edit Start Request	0→1 : Edit Start 1→0 : Edit End	Changes operation information ID. The operation information corresponding to ID is displayed on the System Info Value.* 1

Operation ID	Operation Information	Remarks
1	Controller Operating Time	
2	Laser Exited Time	
3	Scanner Operating Time	
101	Number of Shutter Operations	
102	Number of Contactor Operations	It is available on MD-U1000 series only.
103	Number of Operations of Safety Shutter A	It is available on ML-Z9600 series only.
104	Number of Operations of Safety Shutter B	It is available on ML-Z9600 series only.
201	Head Temperature	
202	Controller Temperature	It is available on MD-U1000 series only.
203	Laser Oscillating Tube Temperature	It is available on ML-Z9600 series only.
301	The result of laser power calibration	It is available on MD-U1000 series only.

Address	bit	Name	Status Information	Description
1	0	Program Change Request	0→1 : Request 1→0 : -	Changes the program number.* 1
	1	Rank Change Request		Changes the I/O specified characters.* 1
	2	Counter No Change Request		Changes the number of the counter to be changed.* 1
	3	Counter Value Change Request		Changes the value of the counter set to be displayed for Counter No Change Request. * 1
	4	Counter Up Request		Increases the value of the counter set to be displayed for Counter No Change Request. * 1
	5	Counter Down Request		Reduces the value of the counter set to be displayed for Counter No Change Request. * 1
	6	Counter Reset Request		Resets the counter set to be displayed for Counter No Change Request.* 1
2	8	Setting String Read Request	0→1 : Request 1→0 : -	Loads the settings.* 2
	9	Marked String Read Request		Loads the marked content.* 2 Sending the request before marking results in an error.
	10	String Change Request		Changes the content to be marked in the current program. Store the block no. in Request No., the string in Request Data, and the length of the string in Request Data Size. The maximum data length is 250 bytes.
3	8	Command Send Request	0→1 : Request 1→0 : -	Sends communication commands. Store the communication command in Request Data and the length of the string in Request Data Size. The maximum data length is 250 bytes. Store the response in Response Data.

> **Reference** *1 Turn on this bit after storing the program No., I/O specified character No., counter No., and Operation information ID in the applicable Request No.
> *2 If you turn on this bit on after storing the block No. in Request No., the content will be loaded from the specified block in the current program. Store the load result in Response Data.

Address	bit	Name	Status Information	Description
4	0	Trigger Lock Request	0: Input Off 1: Input On	Disables the trigger input. If this bit turns on while marking, the trigger lock status is activated after all of the mark data is marked. Test marking and sample marking is immediately canceled when this bit turns on.
	1	Operation Stop Request		Stops the laser radiation (the internal shutter remains open). Use this bit to stop the laser radiation at the desired position while processing a workpiece.
	2	Laser Stop Request		Stops the marking laser and the guide laser. The internal shutter closes while this bit is turned on.
	3	Date Hold Request		If the controller's internal clock passes 0 o'clock when this bit is turned on, the date of updated string is subtracted one day and the subtracted date is marked.
6	0	Marking Complete Bit Clear	0→1: Complete Clear 1→0: -	Resets Marking Complete and Start Marking Request Error.
	1	Guide Laser Complete Bit Clear		Resets Guide Laser Complete and Guide Laser Request Error.
	2	Laser Stop Complete Bit Clear		Resets Laser Stop Complete and Stop Marking Request Error.
	3	Error Clear Complete Bit Clear		Resets Error Clear Complete and Error Clear Request Error.
	4	2DC Read Complete Bit Clear		Resets 2DC Read Complete and 2DC Read Request Error. Mark Check/2DC Read OK Status and Mark Check/2DC Read NG Status is also cleared at the same time. * It cannot be used on the MD-F3200/5200 series and ML-Z9600 Series.
	8	Program Edit Complete Bit Clear	0→1: Complete Clear 1→0: -	Resets Program Edit Complete and Program Edit Error.
7	0	Program Change Complete Bit Clear	0→1: Complete Clear 1→0: -	Resets Program Change Complete and Program Change Request Error.
	1	Rank Change Complete Bit Clear		Resets Rank Change Complete and Rank Change Request Error.
	2	Counter No Change Complete Bit Clear		Resets Counter No Complete and Counter No Change Request Error.
	3	Counter Value Change Complete Bit Clear		Resets Counter Value Complete and Counter Value Change Error.
	4	Counter Up Complete Bit Clear		Resets Counter Up Complete and Counter Up Request Error.
	5	Counter Down Complete Bit Clear		Resets Counter Down Complete and Counter Down Request Error.
	6	Counter Reset Complete Bit Clear		Resets Counter Reset Complete and Counter Reset Request Error.
	8	System Info ID Change Complete Clear		Resets System Info ID Change Complete and System Info ID Change Error. * It cannot be used on the MD-X1000/1500 series, and MD-F3200/5200 series.
8	0	Setting String Read Complete Bit Clear	0→1: Complete Clear 1→0: -	Resets Setting String Read Complete and Setting String Read Request Error.
	1	Marked String Read Complete Bit Clear		Resets Marked String Read Complete and Marked String Read Request Error.
	2	String Change Complete Bit Clear		Resets String Change Complete and String Change Request Error.
9	8	Command Send Complete Bit Clear	0→1: Complete Clear 1→0: -	Resets Command Send Complete and Command Send Request Error.

Word area for writing a PLC request

In the following areas, the information is divided by word. The information is shown with 2-byte unsigned integer (0 to 65535).
The detailed information of the request from the PLC is written.

Address	Data Type	Name	Status Information	Description
10/11	DWord	Request No	Numbers (Four bytes)	Stores the program no., block no., counter no., and Operation information ID to be changed.
12	Word	Request Data Size	Data size (Two bytes)	Stores the data length of "Request Data" in 16-bit binary data.
13-137	Character	Request Data	Assigned commands (Default: 250 bytes) * Selectable from 32, 64, 128, and 252 bytes on the PLC.	Use for String Change Request and Command Send Request. Store the change string and communication command data. Headers and delimiters are not required. * Selectable capacities are from 32, 64, 128, and 252 bytes on the PLC settings. (Default: 250 bytes.) However, even if 252 bytes is selected, the maximum amount of data that can be sent is 250 bytes.

2-5 Command communications

Control via command communications in EtherNet/IP is also possible. Since the communication mode is "command/response type", multiple commands cannot be sent simultaneously. Therefore, make sure to send the command only after a response has been received.

Communication format

Header and delimiter settings are not required. Store the send data size in "Request Data Size" and the send data in "Request Data" in the PLC command area. Then set the "Command Send Request" bit to "1" to enable the stored data to be sent to the controller.
For information about communication commands, refer to "Communication Interface Manual."

2-6 When "Request" bit does NOT work

If a request is turned on but does not work, check the communications history. You can check the history of commands sent and received between the PLC and laser marker in the Marking Builder 3 communications history. To check the history, start Marking Builder 3, click the "LASER MARKER" tab, and on the "Communications" pull-down list, click the "Communications History" button.
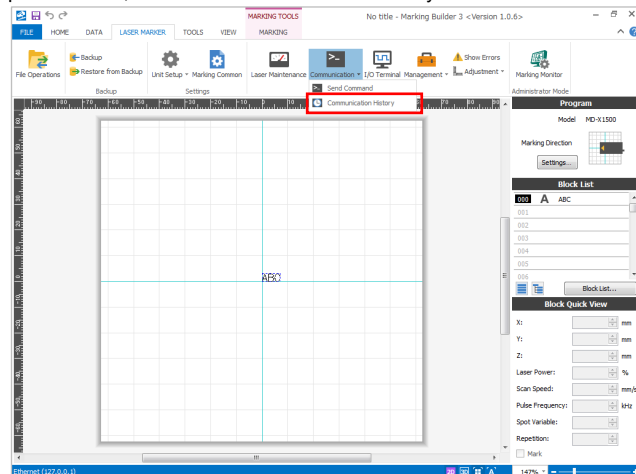
The "Communications history" window appears. Click the "Update" button to display the latest history.
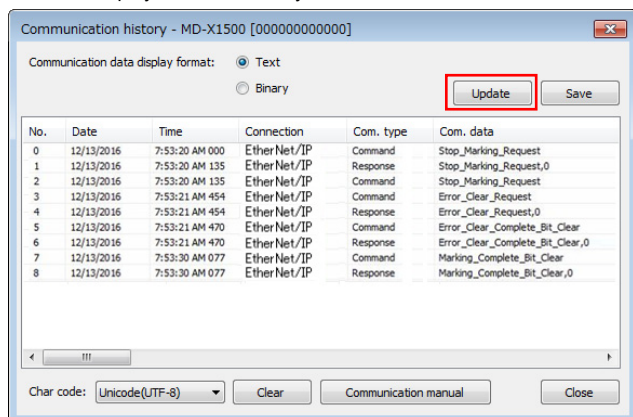
Reference If the communications history is empty, the laser marker has not received any communications. Double check the communication settings between the laser marker and the PLC, and make sure that the HUB and cable are not defective.

Each request will be stored in the communication history in the following format:
Command: ***** Request
Response: ***** Request,X (X = 0: Success; X = 1: Fail)

However, the requests below have a different format. (X = 0: Success; X = 1: Fail)

Request	History format (">" = command; "<" = response)
2DC Read Request	> 2DC_Read_Request,0 < 2DC_Read_Request,X,[Grade],[Content]
Program Edit Start Request	> Program_Edit_Start_Request,[Program No] < Program_Edit_Start_Request,X
Program Change Request	> Program_Edit_Start_Request,[Program No] < Program_Change_Request,X
Rank Change Request	> Rank_Change_Request,[I/O Character No] < Rank_Change_Request,X
Counter No Change Request	> Counter_No_Change_Request,,[Counter No],1 < Counter_No_Change_Request,X, [Counter Current Value]
Counter Value Change Request	> Counter_Value_Change_Request,,[Counter No], [Counter Current Value] < Counter_Value_Change_Request,X
System Info ID Change Request	> System_Info_ID_Change_Request, [System_Info_ID] < System_Info_ID_Change_Request,X
Setting String Read Request	> Setting_String_Read_Request,BLK=[Block No], CharacterString < Setting_String_Read_Request,[OK/NG], [Character String]
Marked String Read Request	> Marked_String_Read_Request,MarkedCharacter= [Program No],[Block No] < Marked_String_Read_Request,[OK/NG], [Character String]
String Change Request	> String_Change_Request,,[Block No], [Character String] < String_Change_Request,X
Command Send Request	> [Stored data for Request Data] < [Response]

Reference An error may be the cause of the request not working. You can check up to two error numbers, Error Code 1 and Error Code 2. Error details and resolutions are listed in the User's Manual for the applicable model.

MEMO

3 Ladder Program Example

3-1 KEYENCE KV Series Program Example

This chapter introduces an example of a ladder program for controlling the laser marker using the KV series. The data memory numbers are described based on the default values of KV-5500/7500. Modify the numbers as necessary according to your environment.

Changing the program No. and starting the marking (An example of bit control)

■ **Reference ladder**
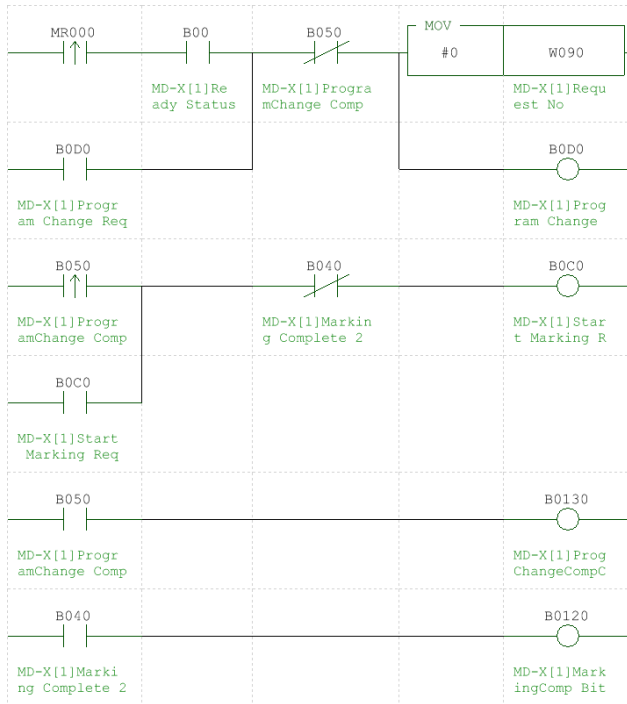
■**Sequence**

(1) If Ready Status is ON at the rising edge of MR000, transfer program No."0" to Request No.
End the sequence if Ready Status is OFF.

(2) Execute Program Change Request after the completion of sequence (1).
A switch is made to program No.0.

(3) When Program Change Complete becomes ON, Start Marking Request are set to ON.
The marking process starts.

(4) When Marking Complete2 becomes ON, Program Change Complete Bit Clear and Marking Complete Bit Clear are set to ON.The completion flag is cleared.

■**Timing chart**

Reference
- "Ready Status" becomes OFF and the "Busy" bit becomes ON while the program No. switching is in progress.
- If the program No. switching fails, "Program Change Request Error" will become ON.
- "Program Change Complete" retains its ON status until "Program Change Complete Clear" becomes ON or until "Program Change Request" becomes ON again.
- "Marking Complete" retains its ON status until "Marking Complete Bit Clear" becomes ON or until "Marking Request" becomes ON again.
- The request bit should be ON for longer than the communication time intervals of the cyclic communication.

Changing the string (An example of bit control)

■ Reference ladder

```
MR001                                    ┌─ MOV ──────────────┐
─┤↑├─────────────────┬─────────────────  │    #0      │  W090  │
                     │                   └────────────────────┘
                     │                    MD-X[1]Reque
                     │                    st No
                     │
                     │                   ┌─ SMOV ─────────────┐
                     ├─────────────────  │ "MD-X1500" │ DM100  │
                     │                   └────────────────────┘
                     │
                     │  ┌─ RCPSASC ──────────────────────────┐
                     └─ │   DM100    │   W092   │   DM200     │
                        └────────────────────────────────────┘
                         MD-X[1]Requ
                         est Data Si

MR001       B00        B062                              B0EA
─┤↑├────────┤ ├────────┤/├──────────────────────────────( )
MD-X[1]Re   MD-X[1]String                          MD-X[1]Strin
ady Status  Change Comp                            g Change Req

B0EA
─┤ ├───────┘
MD-X[1]Strin
g Change Req

B062                                                    B0142
─┤ ├────────────────────────────────────────────────────( )
MD-X[1]Strin                                       MD-X[1]Strin
g Change Comp                                      gCha CompClr
```

■Timing chart

```
Ready Status            ──────┐      ┌──────────────────

Request Data No         ──────╳──────────────────────────

Request Data            ─────────╳───────────────────────

Request Data            ─────────╳───────────────────────

String Change
Request                 ──────────┌↑┐──────────────────

String Change
Complete                ──────────────┌──┐──────────────

String Change
Complete Bit Clear      ──────────────┌─┐────────────────
```

Reference
- "Ready" becomes OFF and "Busy" becomes ON while a string is being changed.
- If changing the string fails, the [String Change Request Error] will turn on.**.**
- "String Change Complete" will not become OFF until "String Change Complete Bit Clear" becomes ON or until "String Change Request" becomes ON again.
- The request bit should be ON for longer than the communication time intervals of the cyclic communication.

■Sequence

(1) Perform the following at the rising edge of MR001:
- Transfer the block No. "0" to Request No.
- Transfer "8" to Request Data size
- Transfer "MD-X1500" to Request Data

Reference The character string data data needs to arrange the order (endian) according to the CIP rules. By the RCPSASC command of KVSeries convert the character string stored in "DM100" into the CIP character string type data, and store the converted data in "W092(Request Data Size)"*, and store the converted data size in "DM200".
   * The character string data length is stored in "W092(Request Data Size)", and the character string data is stored in "W093(Request Data (0))".

If Ready Status is ON, perform String Change Request.

The command for changing the string of block No.0 to "MD-X1500" will be sent.

(2) When String Change Complete becomes ON, String Change Complete Bit Clear is set to ON.
The completion flag is cleared.

Changing the string
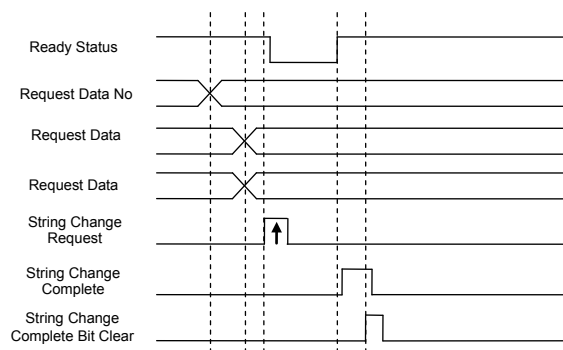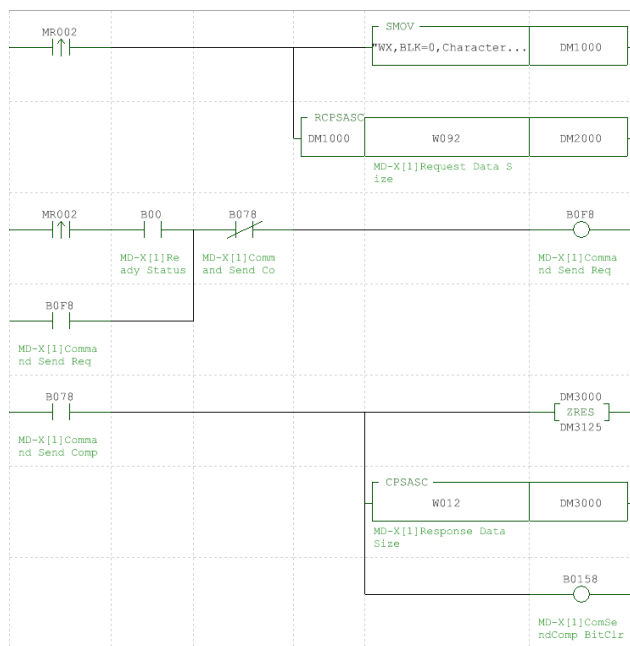## (An example of command communication)

■ Reference ladder


```
    MR002                                    ┌─ SMOV ──────┐
────┤↑├───────────────────────────────┐     │"WX,BLK=0,Character...│ DM1000 │
                                       │     └─────────────┘

                                       │     ┌─ RCPSASC ───┐
                                       └─────┤ DM1000 │ W092 │ DM2000 │
                                             └─────────────┘
                                             MD-X[1]Request Data S
                                             ize

    MR002   B00      B078                                        B0F8
────┤↑├────┤ ├──────┤/├──────────────────────────────────────( )
         MD-X[1]Re  MD-X[1]Comm                              MD-X[1]Comma
         ady Status and Send Co                              nd Send Req

    B0F8
────┤ ├─────┘
  MD-X[1]Comma
  nd Send Req

    B078                                                     ┌ DM3000 ┐
────┤ ├──────────────────────────────────────────────────── ZRES
  MD-X[1]Comm                                                └ DM3125 ┘
  nd Send Comp
                                             ┌─ CPSASC ────┐
                                             │ W012 │ DM3000 │
                                             └─────────────┘
                                             MD-X[1]Response Data
                                             Size

                                                             B0158
                                                           ─( )
                                             MD-X[1]ComSe
                                             ndComp BitClr
```

■ Sequence

(1) Perform the following at the rising edge of MR002:
- ・Transfer the number of sent bytes "29" to Request Data Size
- ・Transfer "WX,BLK=0,CharacterString=MD-X" to Request Data

> Reference
> ・For details on commands, refer to "Communication Interface Manual".
> ・The send data needs to arrange the order (endian) according to the CIP rules. By the RCPSASC command of KV Series convert the character string ("WX,BLK=0,CharacterString=MD-X") stored in "DM1000" into the CIP character string type data, and store the converted data in "W092(Request Data Size)"*, and store the data size after being converted into "DM2000".
> * The character string data length is stored in "W092(Request Data Size)" and "W093(Request Data (0))".

If Ready Status is ON at the rising edge of MR002, perform Command Send Request, and the command to change the character string of block No. 0 to "MD-X" will be sent.

(2) When Command Send Complete becomes ON, store Response Data in the data memory "DM3000".

> Reference
> Once the command communication ends, the received data will be stored in "W012 (Response Data Size)" and "W013 (Response Data)". The received data likewise needs to arrange the order (endian). By using the CPSASC command of KV Series convert the "W012 (Response Data Size)" and "W013 (Response Data)" into the converted data in DM3000.

■Timing chart
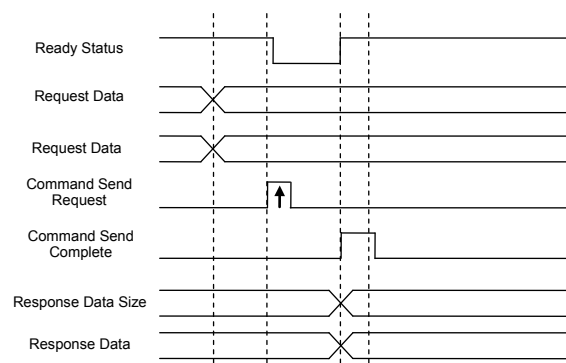
> Reference
> ・ "Ready" becomes OFF and "Busy" becomes ON while a string is being changed via sending communication commands.
> ・ The "Command Send Request Error" error becomes ON when the command sending fails.
> ・ "Command Send Complete" will not become OFF until "Command Send Complete Bit Clear" becomes ON or until "Command Send Request" becomes ON again.
> ・ The response to "Command Send Request" stores the data length in "Response Data Size" and data content in "Response Data".
> ・ The request bit should be ON for longer than the communication time intervals of the cyclic communication.

3-2 OMRON PLC CJ2 Series Program Example

This chapter introduces an example of a ladder program for controlling the laser marker using the CJ2 series. The data memory numbers are described based on the default values of CJ2 series. Modify the numbers as necessary according to your environment.

Changing the program No. and starting the marking (An example of bit control)
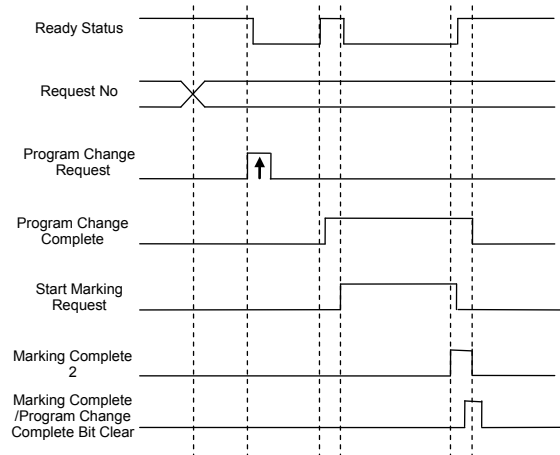
■ Reference ladder
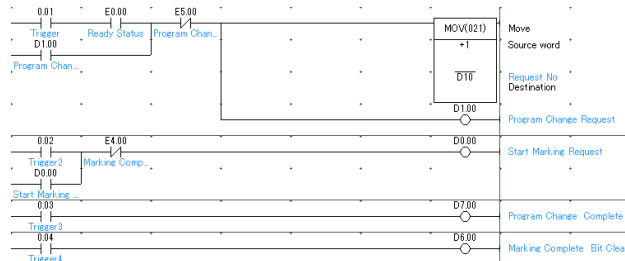
■Sequence

(1) If Ready Status is ON at the rising edge of 0.01, transfer program No."1" to Request No.
End the sequence if Ready Status is OFF.

(2) Execute Program Change Request after the completion of sequence (1).
A switch is made to program No.1.

(3) Set Start Marking Request at the rising edge of 0.02 to ON .
The marking process starts.

(4) Set Program Change Complete Bit Clear at the rising edge of 0.03, and set Marking Complete Bit Clear at the rising edge of 0.04 to ON.
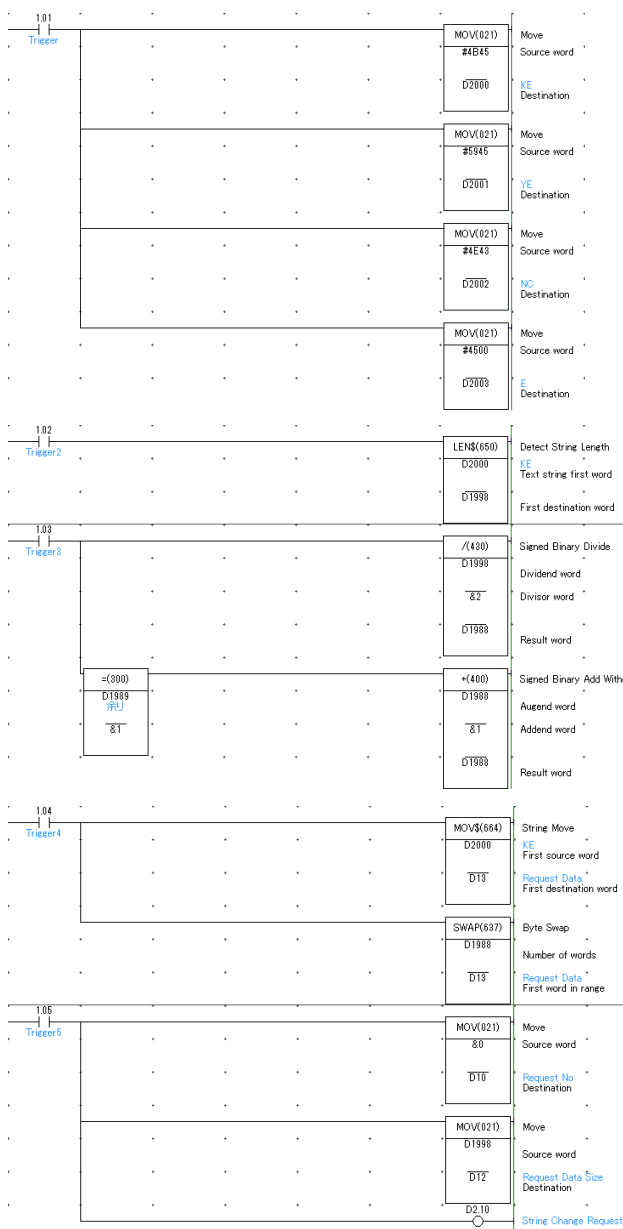The completion flag is cleared.

■Timing chart

Reference
- "Ready Status" becomes OFF and the "Busy" bit becomes ON while the program No. switching is in progress.
- If the program No. switching fails, "Program Change Request Error" will become ON.
- "Program Change Complete" retains its ON status until "Program Change Complete Clear" becomes ON or until "Program Change Request" becomes ON again.
- "Marking Complete" retains its ON status until "Marking Complete Bit Clear" becomes ON or until "Marking Request" becomes ON again.
- The request bit should be ON for longer than the communication time intervals of the cyclic communication.

Changing the string (An example of bit control)

■ Reference ladder

| Rung	Instruction	Operands	Labels
1.01 Trigger	MOV(021)	#4B45 / D2000	Move / Source word / KE Destination
	MOV(021)	#5945 / D2001	Move / Source word / YE Destination
	MOV(021)	#4E43 / D2002	Move / Source word / NC Destination
	MOV(021)	#4500 / D2003	Move / Source word / E Destination
1.02 Trigger2	LEN$(650)	D2000 / D1998	Detect String Length / KE Text string first word / First destination word
1.03 Trigger3	/(430)	D1998 / &2 / D1988	Signed Binary Divide / Dividend word / Divisor word / Result word
=(300) D1989 余り &1	+(400)	D1988 / &1 / D1988	Signed Binary Add Without Carry / Augend word / Addend word / Result word
1.04 Trigger4	MOV$(664)	D2000 / D13	String Move / KE First source word / Request Data First destination word
	SWAP(637)	D1988 / D13	Byte Swap / Number of words / Request Data First word in range
1.05 Trigger5	MOV(021)	&0 / D10	Move / Source word / Request No Destination
	MOV(021)	D1998 / D12	Move / Source word / Request Data Size Destination
		D2.10	String Change Request

■Sequence

(1) Input "KEYENCE" in D2000 at the rising edge of 1.01.

(2) Detect the character string length of D2000 at the rising edge of 1.02.

(3) Divide the detected character string length by 2 at the rising edge of 1.03 (2), and detect the memory count which is going to store the character data.

(4) Perform the following at the rising edge of 1.04:
   ・Transfer the character data "KEYENCE" to Request Data
   ・Byte swap the Request Data.

> **Reference** The send data needs to arrange the order (endian) according to the CIP rules. By the SWAP command of CJ2 Series convert the character string ("KEYENCE") stored in "D3000" into the CIP character string type data, and store the converted data in "D13 (Request Data Size)".

(5) Perform the following at the rising edge of 1.05.
   ・Store the block No. "0" to be changed to Request No.
   ・Store the character string length "7" to Request Data size
   ・Set String Change Request to ON.

■ Timing chart
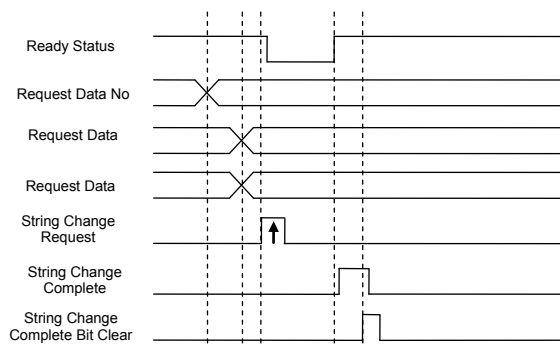
> **Reference** ・"Ready" becomes OFF and "Busy" becomes ON while a string is being changed.
> ・If changing the string fails, the [String Change Request Error] will turn on.
> ・"String Change Complete" will not become OFF until "String Change Complete Bit Clear" becomes ON or until "String Change Request" becomes ON again.
> ・The request bit should be ON for longer than the communication time intervals of the cyclic communication.

Changing the string
(An example of command communication)
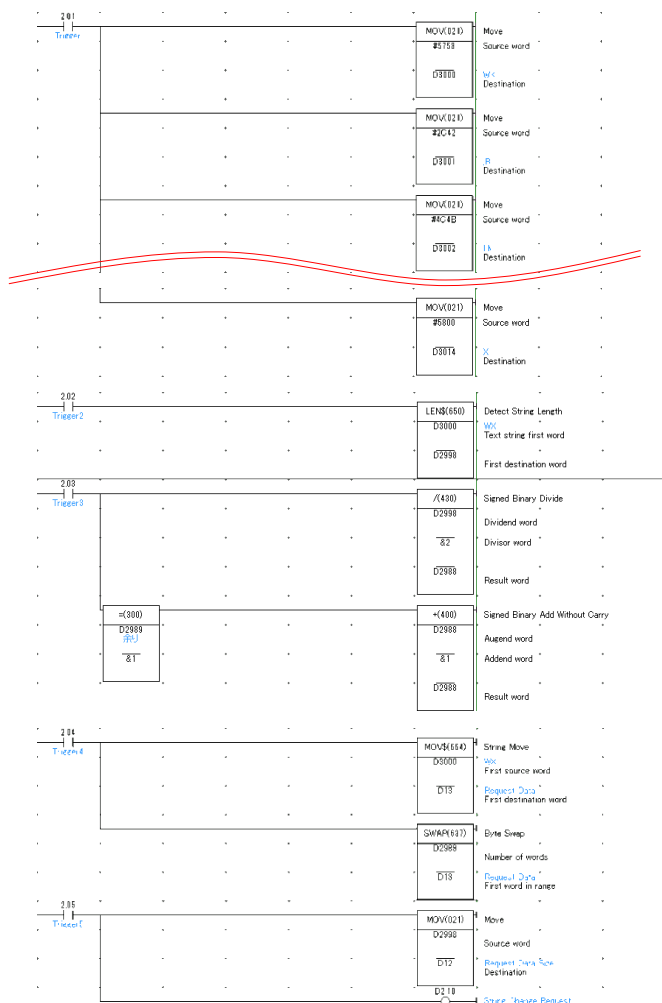
■ Reference ladder

■Sequence

(1) Input "WX,BLK=0,CharacterString=MD-X" in D3000 at the rising edge of 2.01.
   * In the reference ladder, part of it is omitted.

(2) Detect the character string length of D3000 at the rising edge of 2.02.

(3) Divide the detected character string length by 2 at the rising edge of 2.03 (2), and detect the memory count which is going to store the character data.

(4) Perform the following at the rising edge of 2.04:
   ・Transfer the character data "WX,BLK=0,CharacterString=MD-X" to Request Data
   ・Byte swap the Request Data.

> **Reference** ・For details on commands, refer to "Communication Interface Manual".
> ・The send data needs to arrange the order (endian) according to the CIP rules. By the SWAP command of CJ2 Series convert the character string ("WX,BLK=0,CharacterString=MD-X") stored in "D3000" into the CIP character string type data, and store the converted data in "D13 (Request Data Size)".

(5) Perform the following at the rising edge of 2.05.
   ・Store the character string length "29" to Request Data size
   ・Set the Bit of Command Send Request to ON.
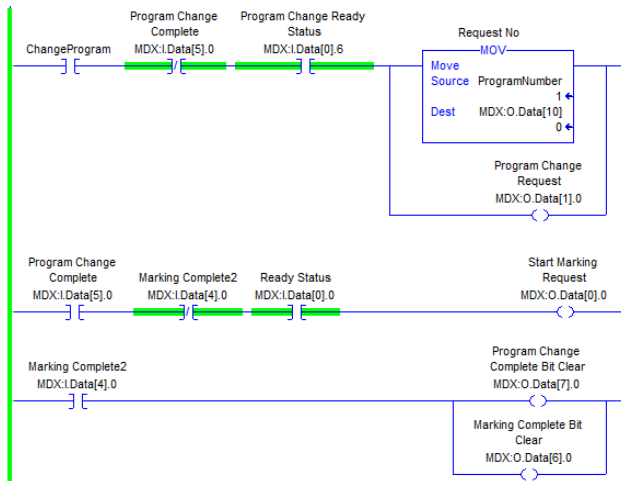
■Timing chart
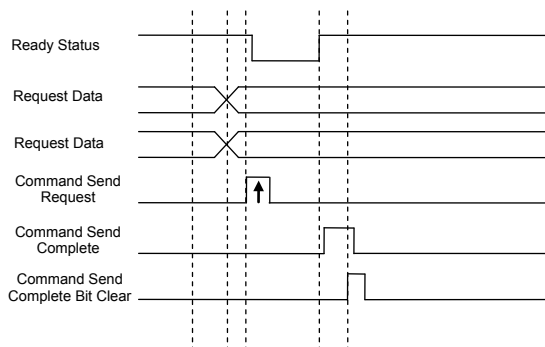
> **Reference** ・"Ready" becomes OFF and "Busy" becomes ON while a string is being changed via sending communication commands.
> ・The "Command Send Request Error" error becomes ON when the command sending fails.
> ・"Command Send Complete" will not become OFF until "Command Send Complete Bit Clear" becomes ON or until "Command Send Request" becomes ON again.
> ・The response to "Command Send Request" stores the data length in "Response Data Size" and data content in "Response Data".
> ・The request bit should be ON for longer than the communication time intervals of the cyclic communication.

3-3 Studio 5000 Logix Designer Ladder Program Example

This chapter introduces an example of an RSLogix5000 ladder program for controlling the laser marker using an Allen-Bradley Compact/Control Logix PLC.

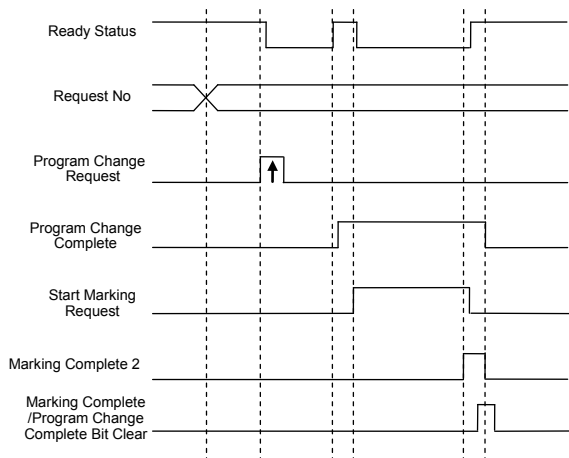### Changing the Program No. and Starting Marking (Bit Control Example)

Reference ·
· Ready Status turns OFF and the Busy bit turns ON while program No. switching is in progress.
· If program No. switching fails, Program Change Request Error turns ON.
· Program Change Complete remains ON until Program Change Complete Bit Clear turns ON or until Program Change Request turns ON again.
· Marking Complete2 remains ON until Marking Complete Bit Clear turns ON or until Marking Request turns ON again.
· The request bit should be ON for longer than the cyclic communication time interval (RPI).

■ Reference ladder

■ Sequence

(1) If Program Change Complete is OFF and Program Change Ready Status is ON when ChangeProgram turns ON, the program number "1" is moved to Request No.

(2) Program Change Request is set to ON after the completion of sequence (1).

(3) When Program Change Complete turns ON, Start Marking Request is set to ON if Marking Complete2 is OFF and Ready Status is ON.

(4) When Marking Complete2 turns ON, the Program Change Complete Bit Clear and Marking Complete Bit Clear are turned ON.
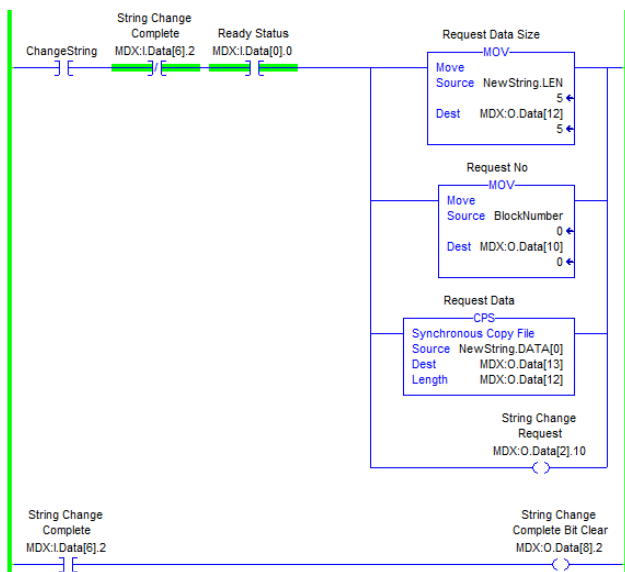
■ Timing chart
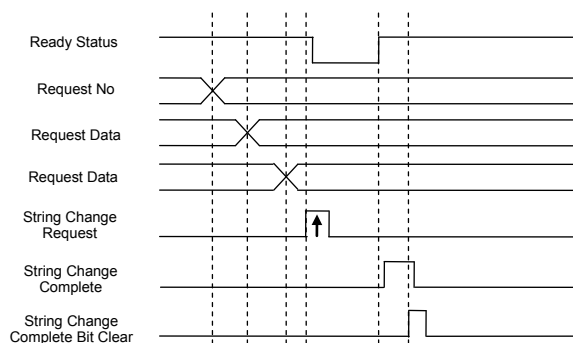
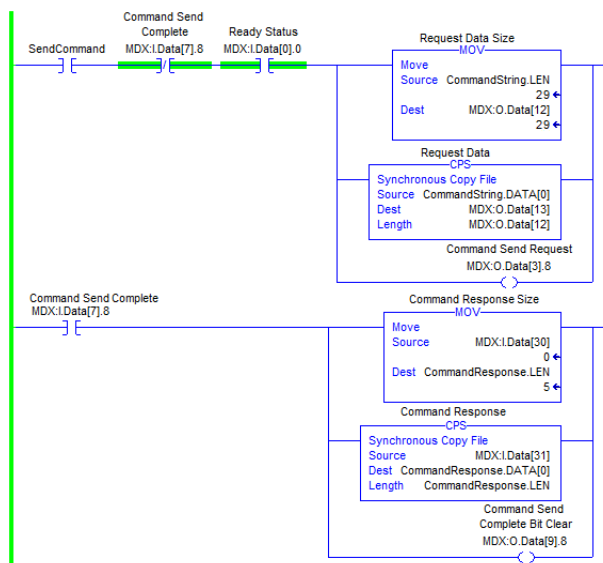## Changing a character string

■ Reference ladder

■ Sequence

(1) If String Change Complete is OFF and Ready Status is ON when ChangeString turns ON, the following occurs:
  - The length of the new string "5" is moved to Request Data Size
  - The Block Number "0" is moved to Request No
  - The new string "ABCDE" is moved to Request Data (Addresses 13 to 17)
  - String Change Request turns ON

(2) When String Change Complete turns ON, the String Change Complete Bit Clear turns ON

### ■ Timing chart

Sending a Command

■ Reference ladder

■ Sequence

(1) If Command Send Complete is OFF and Ready Status is ON when SendCommand turns ON, the following occurs:
  - The length of the command string "29" is moved to Request Data Size
  - The command string "WX,BLK=0,CharacterString=MD-X" is moved to Request Data (Addresses 13 to 41)
  - Command Send Request turns ON

(2) When Command Send Complete turns ON, the following occurs:
  - The Response Data Size "5" is moved to CommandResponse.LEN
  - The Response Data "WX,OK" is moved to CommandResponse.DATA (Addresses 0 to 4)
  - Command Send Complete Bit Clear turns ON.

■ Timing chart
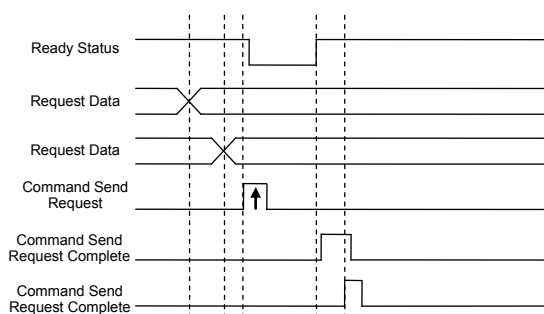
Reference
- Ready turns OFF and Busy turns ON while a command is being processed.
- Command Send Request Error turns ON when Command Send Request fails.
- Command Send Complete will not turn OFF until Command Send Complete Bit Clear turns ON or until Command Send Request turns ON again.
- The response data length to Command Send Request is stored in Response Data Size and the data content is stored in Response Data.
- The request bit should be ON for longer than the cyclic communication time interval (RPI).

MEMO

3

Ladder Program Example

MEMO

Revision History

Date of printing	Version	Revision contents
April 2015	Official release	
September 2015	2nd edition	・ Change part of the name ・ Change the specifications of Response Data
June 2016	3rd edition	・ Chap.2　Configuring the PLC : Additional correction ・ Chap.3　Sample program : Additional correction
December 2016	4th edition	Added the MD-F3200/5200 Series
April 2017	5th edition	Corrections and additions
January 2018	6th edition	Added the MD-U1000 Series, ML-Z9600 Series

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