SLMP/MC Protocol Scanner (Ethernet)
Communications for In-Sight Vision Systems
Integration Note

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Executive Summary

With the release of In-Sight Explorer version 4.5, Cognex introduced a new and improved method of communicating to a Mitsubishi PLC via SLMP / MC Protocol on Ethernet. The new method allows the In-Sight Vision System to accept certain commands directly from the PLC, which in the past required a separate Telnet communications session.

This document is intended to assist users to configure Ethernet based MC Protocol Scanner communications between In-Sight vision systems and Mitsubishi L- and Q-Series PLCs. MC Protocol Scanner communication enables Mitsubishi PLCs to communicate directly with In-Sight vision systems without requiring extensive ladder logic, and to send vision commands without establishing a Telnet connection to send string commands. Examples in this document are based on In-Sight Explorer software version 4.5, using the EasyBuilder interface, and Mitsubishi’s GX Works2 software, version 1.

Connecting In-Sight and Q-Series PLCs via Ethernet

Ethernet based MC Protocol Scanner communications are set up through an Ethernet connection between the In-Sight vision system and the Ethernet port on the Q-Series PLC. In this example, In-Sight is directly connected to the CPU module Q06UDEHCPU. The connection can also be made through an Ethernet module (QJ71E71-100), an In-Sight I/O board (CIO-MICRO or CIO-MICRO-CC), through an Ethernet switch, router, or through the network connection on a VisionView 700 HMI.

Communicating Between In-Sight and Q-Series PLCs

In-Sight can read and write many different data types via MC Protocol Scanner, including tool results, data strings and tolerances. This example will demonstrate writing X, Y and Angle data from In-Sight to the PLC, and reading the Rotation Tolerance for a PatMax tool from the PLC to In-Sight. In addition, the PLC can directly control certain In-Sight vision functions. This example will demonstrate PLC-initiated trigger command.
Communicating Timing Between In-Sight and Q-Series PLCs

The following diagram illustrates the communication method between In-Sight and Q-Series PLCs using MC Protocol Scanner. This diagram shows the periodic communication request when In-Sight is online, and the sequence of communications when In-Sight detects a trigger command from the PLC.

Periodic batch read continues throughout sequence

Vision system sends inspection results, then sends updated Inspection Complete and Results Valid status information

PLC sets Trigger bit
Setting Up an Application to Send Data in EasyBuilder

In the following examples, the In-Sight vision system is set up with the following network configuration:

- IP address: 192.168.1.14
- Subnet mask: 255.255.255.0

NOTE: It is possible to configure the MC Protocol Scanner settings from this dialog by selecting ‘SLMP/MC Protocol Scanner’ and clicking on ‘Settings…’. For this example, we will leave this setting on ‘None’ and configure the MC Protocol Scanner settings using the step-by-step method in EasyBuilder.
Setting Up an Application to Send Data In EasyBuilder

In this example, we will set up a PatMax location tool to send X, Y and Angle data to a PLC using MC Protocol Scanner. We will also read the angle tolerance for the PatMax location tool from the PLC.

Create a new job:

Press New Job

Go to the ‘Get Connected’ Step

Set the Trigger Type to Network. Later, we will demonstrate how the PLC can issue trigger commands via the MC Protocol network.
Add a PatMax Pattern tool to the job:

Train the PatMax model.
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Note that the Rotation Tolerance is currently set to 15. This is the value that we will update by reading a new value from the PLC.

Configuring MC Protocol Scanner In EasyBuilder

We will now set up In-Sight to communicate via MC Protocol Scanner:
Configure the MC Protocol Scanner settings:

Set:
- Device to ‘PLC’
- Manufacturer to ‘Mitsubishi’
- Protocol to ‘SLMP/MC Protocol Scanner’
  Click ‘OK’

Input the host port for communications. This value will also be set up in GX Developer.

Input the IP address of the PLC

Since the In-Sight system will control the communications, enter values for the timeout and the poll interval.

**NOTE:** If the PLC is already configured, click ‘Test Connection’ to insure that the settings are correct.

It is also possible to communicate to a Remote Station. We will not use that configuration here.
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Click on the ‘Device Addressing’ tab to configure the PLC addressing that the In-Sight system will use:

<table>
<thead>
<tr>
<th>Name</th>
<th>Selected Device</th>
<th>Offset</th>
<th>Number of Devices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>D - Data Register</td>
<td>100</td>
<td>2</td>
<td>Starting PLC address of the vision control block.</td>
</tr>
<tr>
<td>Status</td>
<td>D - Data Register</td>
<td>102</td>
<td>2</td>
<td>Starting PLC address of the vision status block.</td>
</tr>
<tr>
<td>Input Block</td>
<td>D - Data Register</td>
<td>104</td>
<td>4</td>
<td>Starting PLC address of the user data block.</td>
</tr>
<tr>
<td>Output Block</td>
<td>D - Data Register</td>
<td>109</td>
<td>16</td>
<td>Starting PLC address of the inspection results block.</td>
</tr>
<tr>
<td>Command</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>Starting PLC address of the command string.</td>
</tr>
<tr>
<td>Command Result</td>
<td>None</td>
<td>0</td>
<td>0</td>
<td>Starting PLC address of the command result data.</td>
</tr>
</tbody>
</table>

There are six data blocks that can be configured. The **Control and Status** blocks are used to send commands to the In-Sight system, and receive status indication from the In-Sight system. These blocks are each 32-bits, with the function of each bit pre-defined in the In-Sight system. The **Input and Output** blocks are used to send and receive application data. The **Command and Command Result** blocks are used to send string-based “Native Mode” commands to the In-Sight system. The size of the last four data blocks is determined by the user, based on the amount of application data to be exchanged. (We will not use the Command and Command Result blocks in this example.)

Select the type of device and the offset for the address of each data block in the PLC. In this example, we will use a data register device for all four of the data blocks we are using. The Command block will use an offset of 100, and consume two 16-bit data register devices (D100 and D101). The Status block will use the next available data register address, with an offset of 102. It will also consume two data register devices. The Input block will use an offset of 104, and will use four data registers. Finally, the Output block will use an offset of 109, and 16 data registers.

Click on the Format Output Data tab to select the items to write to the PLC:

Press the Add button, and select the items to send to the PLC.
Select the items to send to the PLC. By pressing the CRTL or Shift key, you can select multiple items.

The Format Output Data tab should now look like this:

- Under the Job header, Inspection Count is selected.
- Under the Pattern_1 header, Angle, X and Y data is selected.
- Press OK to accept.

Inspection count, Angle, X and Y are selected to send to the PLC. Set the data type for all variables to '32 bit float'.

Total size of the output data shown here.

Now, we will select the items to read from the PLC. Go to the Format Input Data tab and press Add:
Select Rotation_Tolerance from the list and press OK:

![Image of In-Sight Micron UI - Select Input Data]

Rotation Tolerance will be read from the PLC.

Press OK to accept.

Select the data type from the list. In this example, we will use a 32 bit float:

![Image of In-Sight Micron UI - Select Input Data]

Select 32 bit float

Go to the Run Job step and put In-Sight online.

![Image of In-Sight Micron UI - Run Job]

Go to the Run Job step.

Press the Online button.
Configuring MC Protocol Scanner In GX Works2

To configure the Q Series PLC, open the Ethernet settings by double clicking PLC Parameters in the Project data list:

In the Q Parameter Setting dialog, configure the PLC IP settings. Configure the IP settings to match the settings in the In-Sight system, check the ‘Enable online change (FTP, MC Protocol)’ box, and click the ‘Open Setting’ button.

Click on the ‘Built-in Ethernet Port Settings’ tab

When all the IP settings are correct, click the ‘Open Setting’ button

Set the IP address of the PLC to 192.168.1.8. Set the subnet mask to 255.255.255.0

Click the box to select ‘Enable online change (FTP, MC Protocol)’
Configure the Built-in Ethernet Port Open Settings:

- Set the Host Station Port No. to match the setting in In-Sight. In this example, Host Station = 3000 (hex)
- Set Protocol to 'TCP'.
- Set Open System to 'MC Protocol'
- Click 'End' to continue

Write the settings to the PLC through the icon (or Online ➔ 'Write to PLC' on the menu bar)

- Check the boxes to select the Parameter settings to write to the PLC.
- Click 'Execute' to begin the transfer.

When complete, reset the PLC by cycling power or through the reset switch on the PLC’s CPU.
Monitoring Communication

Start the Device/Buffer Memory Batch Monitor in GX Works2 through the Online → Monitor → Device/Buffer Memory Batch menu selection.

Set ‘Device Name’ to D100

Click ‘Display Format…’ to open the Display Format dialog

Click to set the display to ‘Real Number (32Bit)’

Let’s take a closer look at the devices we configured, and the pre-defined function of the In-Sight MC Protocol Scanner data blocks.

Control Block – We configured the control block to begin at device D100. The control block is 32 bits long, so it uses memory devices D100 and D101. The function of each bit can be found in the In-Sight Explorer on-line help by clicking on ‘Help’ → ‘In-Sight Explorer Help’ (or by pressing F1).

Enter “MC Protocol Scanner” in the Search box
Scroll down to the Vision Control Bit Block section, and look at the bit functions listed there. Bits 0-15 map to device D100 in the PLC, and bits 16-31 map to device D101.

**Status Block** – We configured the status block to begin at device D102. The control block is 32 bits long, so it uses memory devices D102 and D103. From the same help topic, we can find the bit functions for the status block.
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**Input Data Block** – We configured the Input Data block to begin at device D104. We are reading one 32 bit floating point register (angle tolerance), and we set the input data block to be 4 devices long. Therefore, the input data block uses memory devices D104 through D107. The input, output, command, and command results blocks use pre-defined headers that we must account for. The input data block uses word 0 and 1 for its header, so our data will begin with word 2 (D106). From the same help topic, we can find the word functions for the input data block. Note that the “input” to the In-Sight system is listed in the help file as the “output” from the PLC, keeping with the nomenclature used throughout the In-Sight communications documentation.

**Output Data Block** – We configured the Output Data block to begin at device D109. We are writing four 32 bit floating point registers (inspection count, angle, X, and Y), and we set the output data block to be 16 devices long. Therefore, the output data block uses memory devices D109 through D125. The output data block uses words 0 through 4 for its header, so our data will begin with word 5 (D115). From the same help topic, we can find the word functions for the output data block. Note that the “output” from the In-Sight system is listed in the help file as the “input” to the PLC, keeping with the nomenclature used throughout the In-Sight communications documentation.
Now that we know the function and address locations of each device, we will set the rotation tolerance from 15 to 30 and trigger the In-Sight system from the PLC. The rotation tolerance value is a 32-bit float, beginning at Device 106.

In order to send data from the PLC to the In-Sight system, the ‘Set User Data’ bit in the Control block must be toggled. Click on Bit 0 of device D101, and use the Modify Value dialog to toggle the bit on. When the ‘Set User Data Ack’ bit in the Status block (D103 Bit 0) goes high, indicating that the In-Sight system received the data, toggle the ‘Set User Data’ bit off again.

Click on ‘Modify Value…’ to set the new value

Enter 30.0 in the ‘Value’ field and click ‘Set’

Click on the real number value for D106

Select D101 bit 0, and monitor D103 bit 0

Click to toggle the bit value
Now we are ready to trigger the In-Sight system. This will update the rotation tolerance value we just sent, execute the job, and send back the results to the PLC. To trigger the camera, we need to set the ‘Trigger Enable’ bit (D100, bit 0) to 1, and then toggle the ‘Trigger’ bit (D100, bit 1) until the ‘Trigger Ack’ bit (D102, bit 1) goes high. Use the Modify Value dialog as before.

Select D100 bit 1, and monitor D102 bit 1

Click to toggle the bit value

Notice the output from the In-Sight system. This indicates that the inspection count reads 2, the angle is 2.018 degrees, X is 996.61, and Y is 520.04

Going back over to In-Sight Explorer, we can confirm that the rotation tolerance was updated to 30, and that the angle, X, and Y values match what we see in the PLC device locations.

Results show X, Y, and angle match the PLC

Rotation tolerance value updated to 30