FS/VS Smart Camera Series

Industrial Ethernet Guide

ZEBRA

MN-003811-02EN Rev A

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Revision History

Revision	Date	Description
-02 Rev. A	6/23	Updates Include: • Additional Modbus and Profinet details
-01 Rev. A	6/21	Initial Rev A. Release

Contents

EtherNet/IP

PROFINET Interface

Modbus TCP Interface

About This Guide

The FS/VS Smart Camera Industrial Ethernet Guide provides instructions for setting up and programming the device for Industrial Ethernet applications.

IMPORTANT: If you have a problem with your equipment, contact Zebra Global Customer Support for your region. Contact information is available at: zebra.com/support

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When contacting support, please have the following information available:

- Serial number of the unit
- Model number or product name
- Software type and version number.

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Initial Setup

Refer to the FS/VS Smart Camera Product Reference Guide for detailed information on:

- Connection Diagrams, including how to power the device.
- Status Indicators (LED and Beeper) and their meanings.
- Default Factory Settings, including how to restore Factory Settings.
- Ethernet Setup, including how to discover a device and set an IP address.
- Firmware update methods.
- Building and deploying Jobs, including configuration of Trigger modes.
- Accessing the Web HMI
- Licensing and Security

Hardware/Software Prerequisites

The following list of components is required for initial setup, testing, and development of Industrial Ethernet applications that use the FS/VS Smart Camera.

- An FS/VS Smart Camera with Ethernet support that is configured to the correct Industrial Ethernet Protocol and IP address. The device should be configured with the jobs required to perform the work needed by the Industrial Ethernet application.
- An M12 X-Coded cable that can connect the FS/VS Smart Camera Ethernet port to your network.
- The appropriate cabling and power supply necessary to power the FS/VS Smart Camera.
- A PC running Windows 7 or higher (Windows 10 recommended) to view the Web HMI, Zebra's Aurora Application, and development software for PLC applications.
- An Ethernet switch or router (if not connecting FS/VS Smart Camera directly to a PLC).
- An Industrial Ethernet PLC (Programmable Logic Controller) that supports one of the supported protocols (EtherNet/IP, PROFINET, or Modbus TCP) and an Ethernet switch or router (if not connecting the device directly to a PLC).

NOTE: Industrial Ethernet testing has been performed with the following PLCs and software:
Rockwell Compact Logix 5069-L306ER and Logix Studio 5000 v32.02.00 Software
Siemens S7 1500/1200 PLC and Totally Integrated Automation (TIA) v15.1 Software.

- FS/VS Smart Camera Industrial Ethernet Developer Files (CAAFSS00-001-Rxx.zip)

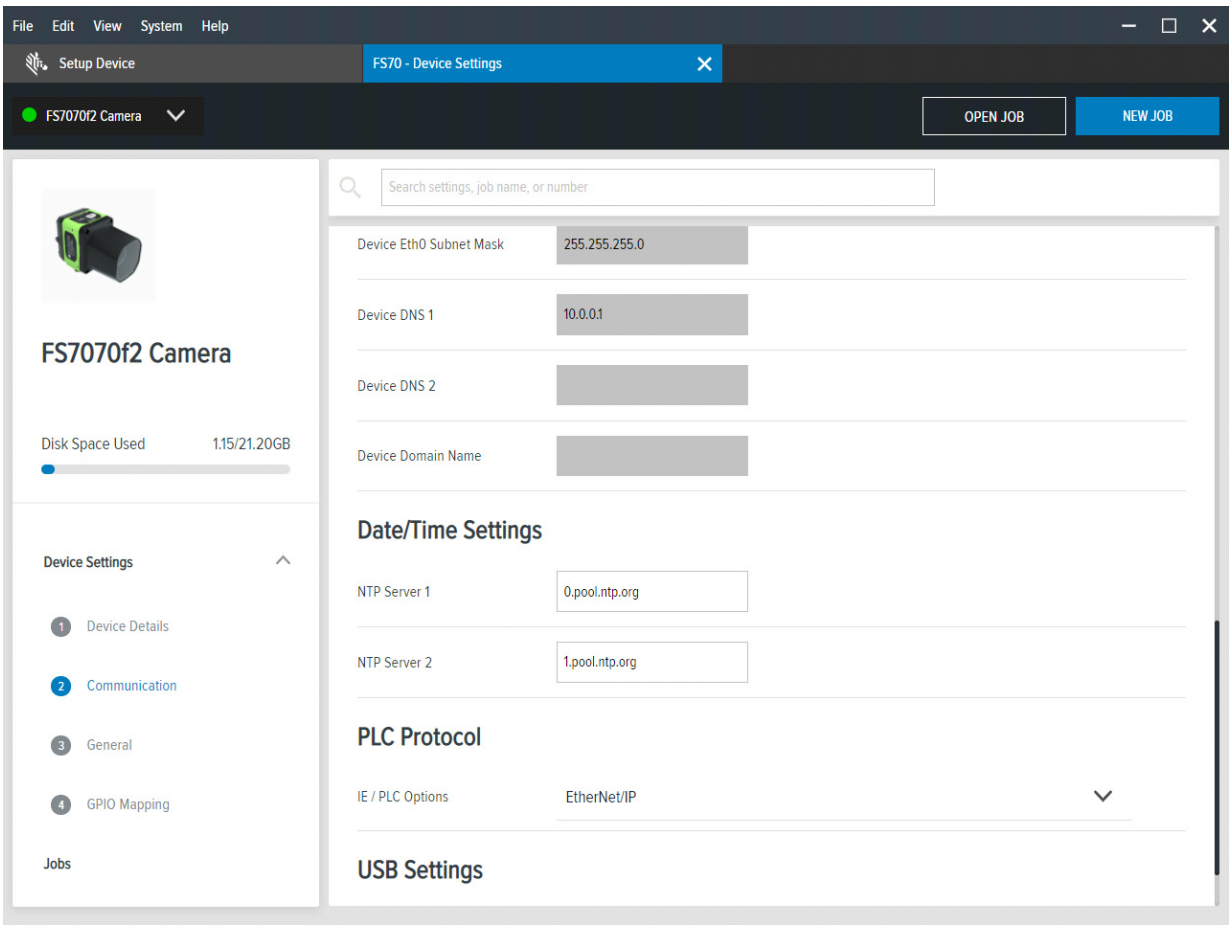
Activating Industrial Ethernet

The Zebra Aurora Focus device settings provide an option to select which PLC protocol can be enabled on the device, as shown in the PLC Protocol selection in the following figure.

IMPORTANT: It is required that on any PLC Protocol change, the device must be rebooted for the change to go into effect.

IMPORTANT: After enabling PROFINET protocol support, the FS/VS Smart Camera is only accessible on the network through the PROFINET protocol. It is recommended that after enabling the protocol you use the TIA Portal to find all the accessible devices and set the PROFINET device name of the FS/VS Smart Camera.

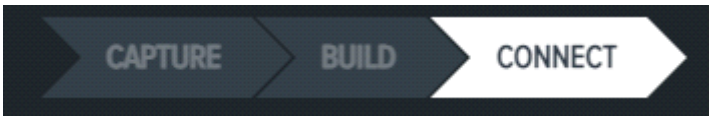
Figure 1 PLC Protocol



Configuring Industrial Ethernet Input & Output

Users can specify what results and configuration is provided to the PLC through the Zebra Aurora Focus **Connect** workflow. When **Connect** is selected, click the **Industrial Ethernet** list item on the left of the application.

Figure 2 Connect



NOTE: The updated job must be deployed and set as active on the device for any changes to be seen from the PLC.

User Control Data

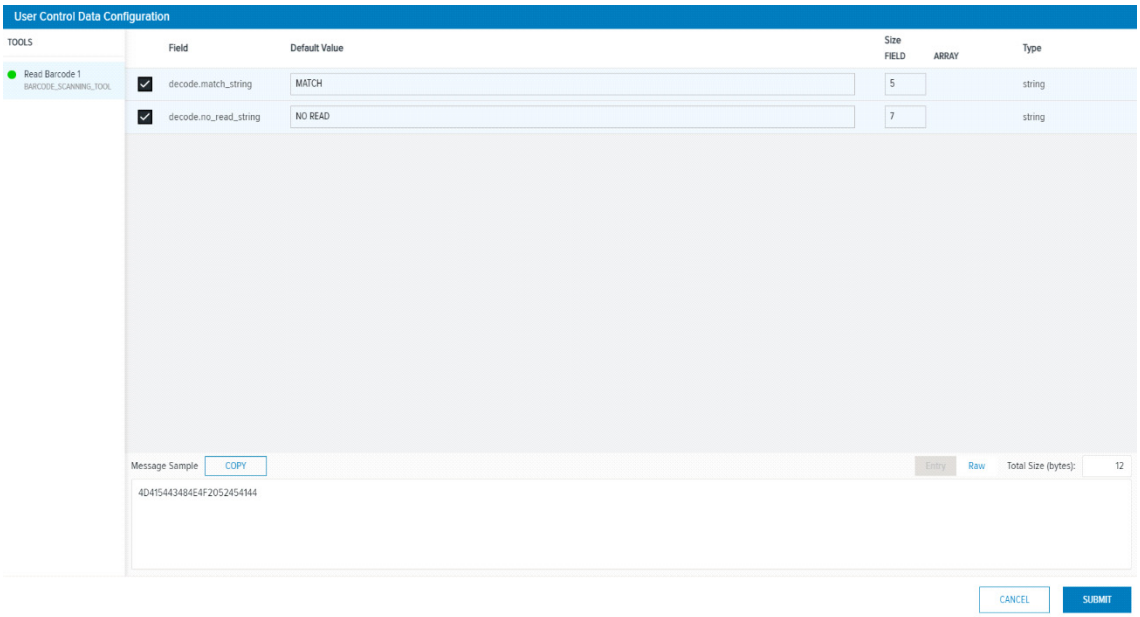
The User Control Data user interface allows for the PLC to make runtime changes to Job input parameters, such as Barcode Match Strings or No Read strings.

Click **Add** or **Edit** to display the User Control Data Configuration dialog and the possible input parameters. Check the specific input parameter to be changed from the PLC and configure the default value and the size. Refer to the Message Sample window for a view of what the data must look like when sent from the PLC to the device. For User Control Data, it is recommended that Raw Mode is selected. This removes the need to set the proper Entry header for Entry mode. When the form is complete, click the **Submit** button. From the main window, reorder the input parameters using a drag and drop technique.

IMPORTANT: Default value changes do not affect the job, they are used for Message Sample preview only.

IMPORTANT: User Control Data should be selected in the Raw Mode.

Figure 3 User Control Data Configuration



Results Data

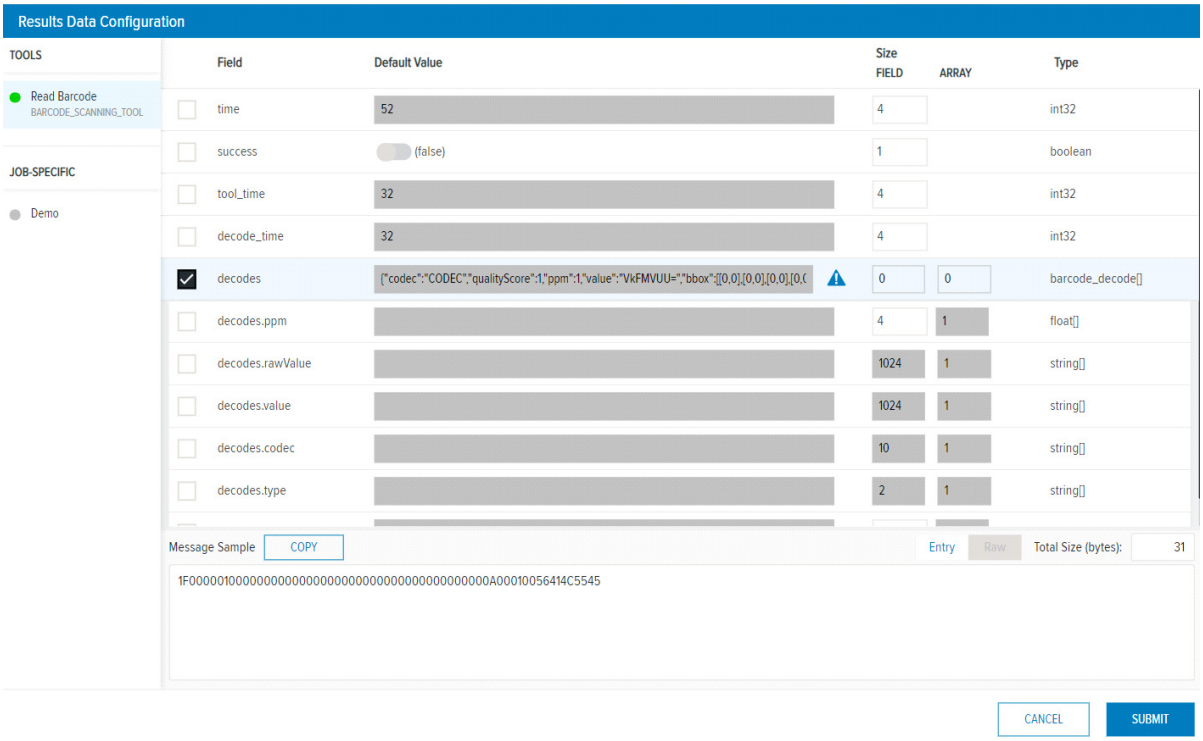
The Results Data user interface allows for the user to control which results are sent to the PLC upon job completion.

NOTE: The default barcode job on the FS/VS device is configured to provide the FS Barcode Structure to the PLC. Also, new FS jobs have FS Barcode Structure automatically configured as the result output to the PLC.

Click **Add** to display the Results Data Configuration Dialog and the possible tools and output parameters that can be added to the Result Data. Check the result parameter you intend to receive from the FS/VS Smart Camera when a Job completes. Refer to the Message Sample window for a view of what the data looks like when sent to the PLC. Entry or Raw mode can be selected, for more information on these modes refer to the Results Status and Data Structure on page 19. Once complete, click the **Submit** button. From the main window, reorder the result data items using a drag and drop technique.

IMPORTANT: Default value changes do not affect the job, they are used for Message Sample preview only.

Figure 4 Results Data Configuration



Industrial Ethernet Interface

All Industrial Ethernet protocols supported by the FS/VS Smart Camera use the interface described in this section. Review this section before proceeding to the specific Industrial Ethernet protocol section relevant to your use case.

Job Control/Status

The FS/VS Smart Camera runs scripts, also known as jobs, to decode barcodes and solve machine vision problems. This section includes information on Job Control and Status features available to the PLC programmer.

Table 1 Job Control/Status Feature Description

Name	Direction	Size (Bits)	Description
Job Control	PLC to Device	1	Job Control sets the state of the job. When set to 0, the job is inactive (stopped, for example, no job loaded or not active). When the value is set to 1 while the Job Slot Control bit is 0, the default (or last active) job is loaded and set to the loaded or active state. If the Job Slot Control bit is 1, the job specified by the Job Slot Number is loaded and set to the Loaded or Active state. If a job load fails, an error code is provided as specified in the Error Codes section.
Reset Counters	PLC to Device	1	When this bit is toggled from 0 to 1, all job counters are reset. As a result, the job sequence number is reset to 1 and any remaining results in the Result Queue are cleared.
Job Slot Control	PLC to Device	1	Job Slot Control is used in conjunction with the Job Slot Number. Set the Job Slot Number to the desired slot number to load, then toggle the Job Slot Control bit from 0 to 1. The job in the Slot Number becomes loaded and active.
Job Slot Number	PLC to Device	2	This number field is used in conjunction with the Job Slot Control bit. Set the Job Slot Number to the desired slot number to load, then toggle the Job Slot Control bit from 0 to 1. The job in this Slot Number becomes loaded and active. If the number is 0, the job is unloaded (made inactive).

Table 1 Job Control/Status Feature Description (Continued)

Name	Direction	Size (Bits)	Description
Job Status	Device to PLC	1	Job Status indicates whether a job is in the loaded or active state or in the Unloaded Stopped state. Depending on the jobs trigger type, a Loaded Job may either be Running or Idle (waiting on trigger). 0 = Stopped/Unloaded, 1 = Active/Loaded. Under normal conditions (non-error conditions) this bit matches the Job Control bit.
Active Job Slot Number	Device to PLC	16	The Active Job Slot Number represents the Current Job Slot. This 16-bit integer corresponds to the job slot of the currently Loaded or Active Job.
Results Job Slot Number	Device to PLC	16	The Results Job Slot Number represents the Results Job Slot. This 16-bit integer corresponds to the Job slot of the Job that was run to produce the results in the Results data section.
Job Pass	Device to PLC	1	This bit is set to 1 if the job results pass, or set to 0 if the job results fail.
Job Fail	Device to PLC		This bit is set to 1 if the job results fail, or set to 0 if the job results pass. Some error conditions may not be considered to be a fail, refer to the Error Codes section for additional information.
Echo Register Control	PLC to Device	16	This 16-bit value is reflected in the PLC based on the value that the PLC writes to it. This field allows the PLC programmers to verify that the output assembly has been written to the camera when this value matches the written value.
Echo Register Status	Device to PLC	16	This 16-bit value matches the value that the PLC writes to its Echo Register Control. This field allows the PLC programmers to verify that the output assembly has been written to the camera when this value matches the written value.

Trigger Control/Status

Each Job will have one of the following trigger modes:

- Single Shot
- Continuous
- Presentation
- Burst
- Level

Depending on the Trigger Mode, the action that the device takes when an external Trigger is initiated may differ. For example, when a job is set for Single Shot, a PLC/GPIO Trigger initiates a single run of that job. However, if the job is set to Continuous, a PLC/GPIO Trigger may produce no change in behavior. Refer to the Trigger Modes Configuration section in the FS/VS Smart Camera Series Product Reference Guide for additional information.

The following table describes the control and status of Trigger functionality as it relates to Industrial Ethernet.

Table 2 Trigger Controls/Status Field Description

Name	Direction	Size (Bits)	Description
Trigger Enable Control	PLC to Device	1	Set to 1 to enable triggering Set to 0 to ignore trigger
Trigger	PLC to Device	1	When changed from 0 to 1, the current job begins running or processing. This bit is only acted upon when the following conditions are met: • Job Status is 1 (Job is loaded/active) • Trigger Ready is 1 (Device is ready to accept triggers)
Trigger Ready	Device to PLC	1	Indicates when the device is ready to accept a new trigger. This bit is set to 1 when Trigger Enable Control is 1 and the active Job Slot is not 0. If the bit is set to 0, the triggers are ignored.
Trigger Status	Device to PLC	1	This bit is set to 1 when the job is currently executing or running. This bit is cleared when the job is stopped or idle.

Results Control/Status

Job results are made available upon completion of the job. The result data is dependent upon the type of job that is run and the job that was configured. If multiple results are made available before the PLC can process them, it is suggested that Results Buffering is enabled to ensure that no results are lost.

Table 3 Results Control/Status Field Description

Name	Direction	Size (Bits)	Description
Results Buffer Control	PLC to Device	1	Results Buffer Control enables the queuing of result data (queue size is set to 32). If set to 1, new results are queued on the device and remain present until acknowledged. To retrieve the next set of results from the queue on the Results Ack, the bit must transition from 0 to 1. The device responds to this acknowledgment by clearing the Results Available bit when no more results are queued on the device. See the Results Queue Count row in this table for more information on how results are queued on the device. If results buffering is not enabled (set to 0), newly received read results overwrite the content of the Result Data in the Response/Status section of the Input Assembly. The Results Overflow bit is set when this bit is set and there is no more space in the queue to accept a new result.
Results Ack	PLC to Device	1	This bit is only applicable when Results Available is set to 1. When this bit transitions from 0 to 1, the PLC is then sent the next set of results. If there are no additional results queued on the device, the Results Available bit is cleared.
Results Available	Device to PLC	1	Indicates that a new set of read results are available. This bit is cleared when the results are acknowledged.
Results Buffer Overflow	Device to PLC	1	Indicates that the device has discarded a set of read results because the results queue is full. This is cleared when the next set of results are successfully queued.
Results Queue Count	Device to PLC	8	Results Queue Count records the number of results currently in the queue on the device. This bit is set to 0 if there are no results in the queue.
Result Data	Device to PLC	Array of Bytes	See Results Status and Data Structure on page 19 for more information on contents of the Results Data Structure.
Results Packet Sequence	PLC to Device	16	This number is used in conjunction with Results Ack. It is expected to be changed before Results Ack is set to ensure that Result Ack is not missed by the device.

User Data Control/Status

A PLC program can modify Job input parameters at runtime through User Data Control. Updating Job input parameters are not permanent and are reset to the Job defaults if the Job is reloaded.

Table 4 User Data Control/Status Description

Name	Direction	Size (Bits)	Description
User Data Control	PLC to Device	1	When this bit is toggled from 0 to 1, the current Job's User Data is overwritten with data provided by the PLC. See the User Data Status bit description to know when the User Data has taken affect. When this bit is cleared, the User Data Status bit will also be cleared.
User Data Enable	PLC to Device	1	When set to 0, job uses the Default User Data. When set to 1, PLC can overwrite User Data as controlled using the User Data Control bit.
User Data	PLC to Device	Array of Bytes	See User Data Structure for more information on the contents of User Data Structure.
User Data Status	Device to PLC	1	When User Data Enable is 0, this bit should be ignored. When User Data Enable is 1 and User Data Control has transitioned from 0 to 1, this bit goes to 1 once the new User Data has been written to the current Job. This bit is set to 0 when User Data Control has transitions from 1 to 0.

Error Codes Control/Status

If any errors occur on the device, codes will provided to the PLC to determine the cause. See the Error Codes for a list of error codes and their meaning. The table below describes interpret and utilize error codes.

Table 5 Error Code Descriptions

Name	Direction	Size (Bits)	Description
Error Buffer Enable	PLC to Device	1	Enables queuing of Error Codes. If enabled, the current Error Code will remain in the Error Code field until acknowledged (even if new Error Codes arrive). To clear the Error Code, toggle the Error Ack bit from 0 to 1. If another Error Code is queued, the current code is replaced with the queued code after each 0 to 1 transition of the Error Ack. If this field is set to 0, no Error Codes are queued and only the latest Error Code is available in the Error Code field, all other codes are overwritten.
Error Ack	PLC to Device	1	Toggle this bit from 0 to 1 to acknowledge or clear the current Error Code. This bit clears both the Error Available bit and Error Code field if there are no other Errors in the queue.

Table 5 Error Code Descriptions (Continued)

Name	Direction	Size (Bits)	Description
Error Overflow	Device to PLC	1	Indicates that the device has discarded an error code because the error queue is full. This bit is cleared when the current Error Code is acknowledged.
Error Available	Device to PLC	1	When set to 1, this bit indicates that there is data in the Error Code field. This bit is cleared when the error is acknowledged and there are no more errors queued.
Error Code	Device to PLC	16	This bit represents the number (16-bit integer) of an error that has occurred on the device. See Error Codes for more information on specific Error Codes.

User Data Structure

The User Control and Data Structure can be sent to the FS/VS Smart Camera from the PLC to change job input parameters at runtime. The User Data Structure is configured using two different formats, Entry Mode and Raw Mode. When a job is configured to use Entry Mode, each data entry that is provided by PLC needs to be proceeded by a 4-byte header. This header includes information on data length and the type of data provided. When a job is configured to use Raw Mode, there is no additional metadata provided (raw data is provided).

Table 6 User Data Structure

Name	Offset	Size (Bytes)	Description
User Control Global Header			
Sequence Number	0	4	Not currently used. Always set to 0.
Total Length	4	2	Total size in bytes of the User Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at User Data and includes all the bytes following it. It is required that the Total Length value matches the length as specified in the job's Industrial Ethernet User Data configuration.
Reserved	6	4	Not currently used. Can be 0.
Mode	10	1	Specifies the User Data format. This bit is 0 for Entry Mode and 1 for Raw Mode.
Reserved	11	3	Not currently used. Can be 0.
Count	14	2	Number of data entries in User data. The count should be 0 if no data exists in User data. The count never exceeds 1 when the mode is set to Raw.
User Data	16	...	Actual User Data to be used. See the User Data format section in Table 7 and Table 8 based on the Chosen Mode.

NOTE: User data typically follows the Global Header. However, refer to the Industrial Ethernet protocol section for more information on where the User Data resides for the given protocol.

User Data Format for Raw Mode (Mode = 1)

Table 7 User Data Format for Raw Mode

Name	Size (Bytes)	Description
Raw Data	Varies	All of the associated data that is sent from the PLC to the device to change the job input parameters. The data provided is based on the Industrial Ethernet User Control Data Configuration for the job.

User Data Format for Entry Mode (Mode = 0)

Table 8 User Data Format for Entry Mode

Name	Size (Bytes)	Description
Entry Length <n>	2	Size in bytes of the data in Entry <n> + 4 (the entry meta data)
Entry Device # <n>	1	Device number (always 0)
Entry Type <n>	1	Specifies the type of the entry. Refer to the Entry Type List on page 21 for more information on valid Entry Types.
Entry Data <n>	Varies	Data associated with the Entry <n>. The data provided is based on the Industrial Ethernet User Control Data Configuration for the job.
<n+1, n+2 to “Count”>	...	

Results Status and Data Structure

The Results Data Structure is provided in the Results Data array following the completion of a job run. The Results Data Structure can be configured using two different formats, Entry Mode and Raw Mode. When a job is configured to use Entry Mode, each data entry that is provided by the device to the PLC is proceeded by a 4-byte header. This header includes information on data length and type of data provided. When a job is configured to use Raw Mode, there is no additional metadata provided (raw data is provided).

Table 9 Results Data Structure

FS Job Result	Offset	Size (Bytes)	Description
Results Status Global Header			
Sequence Number	0	4	The sequence number for the Results. This is tied to the Job Sequence Number. A job Sequence Number is a counter that automatically increments every time a job is run.
Total Length	4	2	Total size in bytes of the Results Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at the beginning of Result Data and includes all the bytes following it. For multi-fragment results, this count would include the total size of Result Data after stitching all the data fragments together.

Table 9 Results Data Structure (Continued)

FS Job Result	Offset	Size (Bytes)	Description
Fragment #	6	2	For multi-fragment results, this entry indicates which fragment is the current fragment being provided. For non-fragmented results, this entry is set to 1.
Fragment Total Count	8	2	For multi-fragment results, this entry indicates how many total fragments make up the complete result. For non-fragmented results, this entry is set to 1.
Mode	10	1	Specifies the Results Data format. 0 for Entry Mode, 1 for Raw Mode.
Status	11	1	Provides the overall job status information. 0 for Fail, 1 for Pass.
Time	12	2	In milliseconds, the time it took to run the Job.
Count	14	2	Number of data entries in the Results data. The count is 0 if no data exists in the Result data. The count never exceeds 1 when Mode is set to Raw.
Results Data	16	Varying	Actual Result Data provided by Job Run. See Table 10 and Table 11 for Result data structure based on mode selection.

NOTE: Result data typically follows the Global Header. However, refer to the specific Industrial Ethernet protocol chapter for more information on where the Result Data resides for the given protocol.

Results Data Format Raw Mode (Mode = 1)

Table 10 User Data Format for Raw Mode

Name	Size (Bytes)	Description
Raw Data	Varies	All the data associated with the job run result. The data provided is based on the Industrial Ethernet Results Configuration for the job.

Results Data Format for Entry Mode (Mode = 0)

Table 11 User Data Format for Entry Mode

Name	Size (Bytes)	Description
Entry Length <n>	2	Size in bytes of the data in Entry <n> + 4 (the Entry meta data)
Entry Device # <n>	1	Device number (always 0)
Entry Type <n>	1	Specifies the type of the entry. Refer to the Entry Type List on page 21 for more information on valid Entry Types.
Entry Data <n>	Varies	Data associated with this Entry <n>. The data provided is based on the Industrial Ethernet User Control Data Configuration for the Job.
<n+1, n+2 to “Count”>	...	

NOTE: For items of array format (such as Manycode), each item includes its own Entry header.

Entry Type List

Table 12 Entry Type List

Entry Type Number	Entry Data Description	Size (bytes) of Entry Data
0	Generic unknown data array of bytes.	Varies
1	Fixed Scanning Barcode Structure array. Also referred to as decodes in Aurora. Refer to Fixed Scanning Barcode Results Structure for more information on individual members that make up the structure	Varies
2	String that includes an array of characters that may be multiple bytes in length.	Varies
3	Integer	4
4	Byte	1
5	Pattern Match Structure array. Also referred to as pattern_match_result[] in Aurora. See the Pattern Match Results Structure section for more information on individual members that make up the structure.	20
6	String Array. Note that some single strings may be presented as a string array with a single string.	Varies
7	Integer array	Varies (multiple of 4)
8	Float, a single precision floating point value.	4
9	Float array. Array of single precision floating point values.	Varies (multiple of 4)
10	Boolean	1
11	Boolean array	Varies
12	Single Fixed scanning barcode structure	Varies
13	Single Pattern Match Result	Varies

Fixed Scanning Barcode Results Structure

Table 13 Fixed Scanning Barcode Results Structure

Name	Size (Bytes)	Description
Code Type	2	Symbology type of the Barcode. This value is always 0 for OCR.
Location	16	Bounding box coordinates of the barcode. (4 x,y coordinates)

Table 13 Fixed Scanning Barcode Results Structure

Name	Size (Bytes)	Description
Quality	2	Barcode Quality Metrics Overall value. Always 0 for OCR.
PPM	2	Pixel Per Module (PPM). The PPM value is multiplied by 10 to allow for 1 decimal place. Always 0 for OCR.
Data	Varies	Barcode or OCR data. No read strings (if set) is also output.

Pattern Match Results Structure

Table 14 Pattern Match Results Structure

Name	Size (Bytes)	Description
Center_x	4	Single precision float includes x position of found pattern.
Center_y	4	Single precision float includes y position of found pattern.
Rotation	4	Single precision float includes rotation of matched result in degrees.
Scale	4	Single precision float includes scale of the matched pattern in relation to the original model.
Score	4	Single precision float includes the score associated with the result. 0 to 100, where 100 is a perfect match.

EtherNet/IP

The EtherNet/IP interface on the FS/VS Smart Camera supports CIP Adapter functionality. The device can receive or be the target of I/O connections from a CIP Scanner. However, it is not able to originate connections itself.

IMPORTANT: By default, the FS/VS Smart Camera Requested Packet Interval is set to 10 ms. The configurable range of RPI values is 10 ms to 1000 ms. Ladder logic operations that occur quicker than the RPI may result in lost transitions. For example, if ladder logic toggles the Results Ack bit with a pulse of 1 ms, the FS/VS Smart Camera may miss the logic change and take no action.

Electric Data Sheet (EDS) File

An EtherNet/IP EDS file describes the Identity and I/O capabilities of the device. The FS/VS Smart Camera EDS file must be registered with the Studio 5000 software before adding the device as an I/O module. The EDS file can be registered by downloading it from the device or obtaining it from the Developer Files ZIP and manually registering it.

TCP/IP Interface Object

The TCP/IP Interface object provides the ability to get and set TCP/IP configuration parameters, such as IP address and Hostname. However, these changes require a device reset.

I/O Assemblies

The EtherNet/IP interface includes two assembly object instances that hold parameters and data used in the transfer of data received from and sent by the device to the controller.

Status and Results Assembly (Device to PLC)

Instance: 101

Access: Get

Size: 496 bytes

The Status and Results assembly holds the current status of the FS/VS Smart Camera and the results data, if available. The format of the assembly data is described in the Status and Results Input Assembly section.

Job Control and Setup Assembly (PLC to Device)

Instance: 150

Access: Set

Size: 496 bytes

The Job Control and Setup assembly is used for Job, Results, and Error management. The format of the assembly data is described in the Job Control and Setup Assembly section.

I/O Connections

The EtherNet/IP interface supports an I/O connection to transfer the assemblies.

Exclusive Owner Connection

Trigger and Transport: Class 1, Cyclic

RPI Range: 10 - 1000 ms

O > T

Connection Point: 150

Size: 496 bytes

Format: Assembly instance 150

T > O

Connection Point: 101

Size: 496 bytes

Format: Assembly instance 101

Configuring Rockwell ControlLogix Communication

Register the FS/VS EDS File

Before the communication to the FS/VS Smart Camera can be configured, the EDS file must be registered with RSLogix. Only do this once. There are two methods that can be used to register the EDS file.

Method One: Download from the Device

NOTE: The FS/VS Smart Camera must be network accessible from the PC in order for the steps below to be completed successfully.

1. Using the **RSLogix Classic,** choose the Ethernet adapter.
2. Next, select the FS/VS device and right-click.
3. Select **Upload EDS File From Device**. The **EDS Wizard** displays. Click **Next**.
4. The **EDS File Installation Test Results** displays. Ensure that the EDS file is selected and click **Next.**
5. The **Change Graphic Image** displays. Click **Next.** The **Final Task Summary** displays. Click **Next.**
6. Click **Finish**.

Method Two: Manually Install from the Developer Zip File

1. From the **Logix Studio 5000 Designer** menu, select **Tools > EDS Hardware Installation Tool.**
2. The **EDS Wizard** displays. Click **Next**.
3. Select the **Register an EDS File** radio button, and click **Next**.
4. Select the **Register a Single File** radio button.
5. Browse to the location of the unzipped Developers Zip file and select the FS/VS EDS file from its contents.
6. The **Change Graphic Image** displays. Click **Next**.
7. The **Final Task Summary** displays. Click **Next.**
8. Click **Finish**.

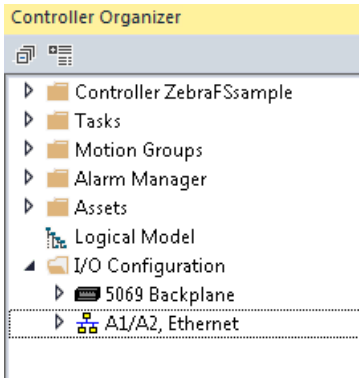
Adding the FS/VS Smart Camera to the I/O Configuration

For the PLC to communicate with the FS/VS Smart Camera, it must be added to the I/O configuration in the program.

To add the I/O configuration:

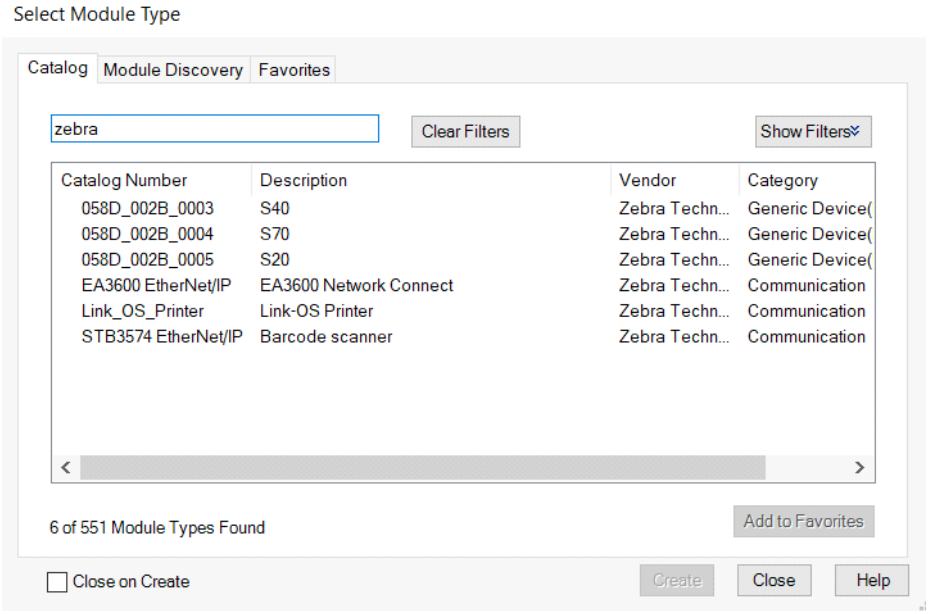
1. Expand the I/O Configuration tree in the **Controller Organizer** pane to display the Ethernet network.

Figure 5 I/O Configuration Tree



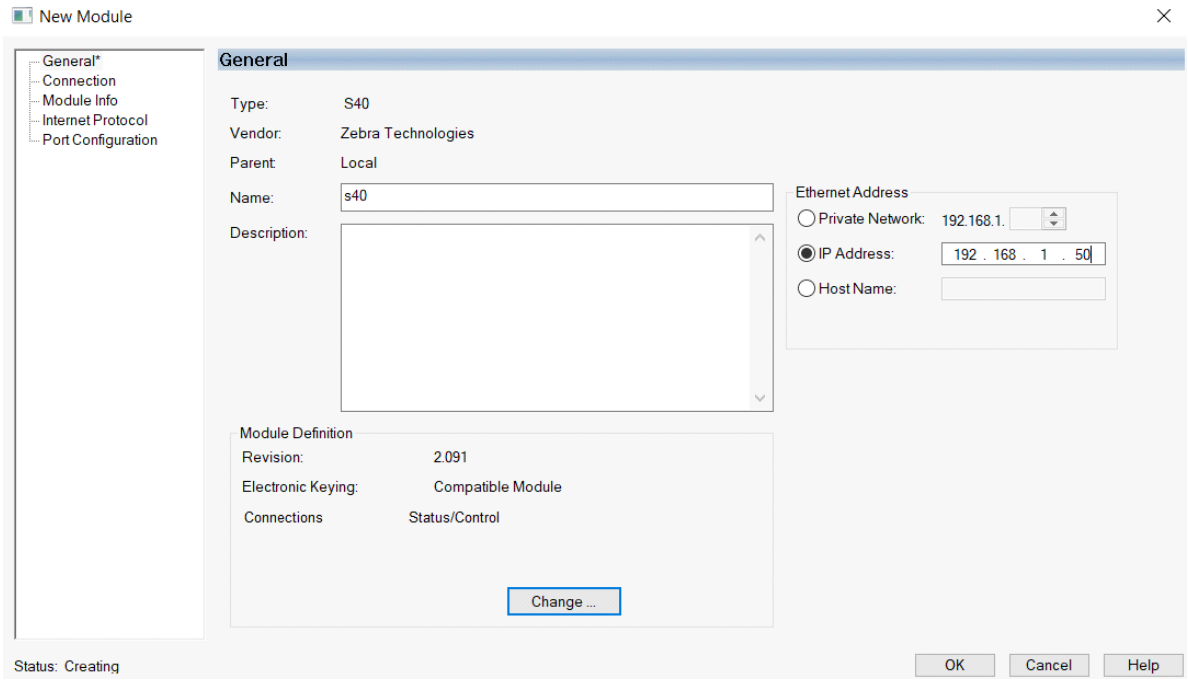
NOTE: In the figure above, A1/A2 is used as the Ethernet interface. Depending on the application, a different type of Ethernet Interface module may be used.

2. Right-click on the Ethernet node in the tree and select **New Module**. Alternatively, if the FS/VS Smart Camera is on the same network and configured for EtherNet/IP support, you can also select **Discover Modules.**
3. The **Select Module Type** dialog displays. Change the vendor filter to only select Zebra Technologies. The FS/VS Smart Camera displays in the device list.



4. Select the FS/VS Smart Camera from the list and click the **Create** button.The **New Module** dialog displays.
5. Enter the desired name and IP address of the FS/VS Smart Camera.

Figure 6 New Module, Setting Name and IP Address



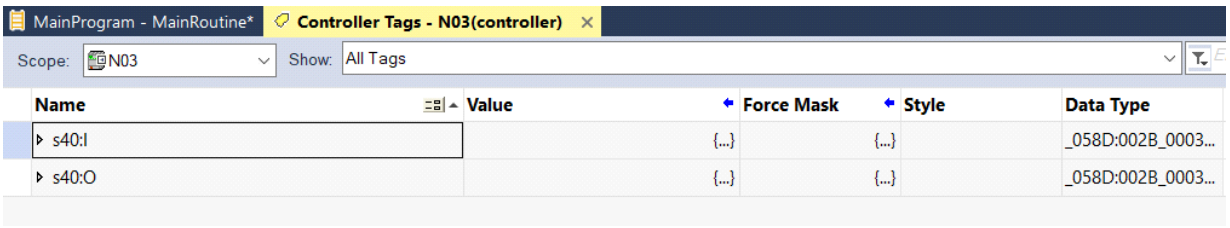
6. Set an appropriate name for the module and click **OK**.

NOTE: All I/O connection parameters and I/O Tags are automatically configured when the module is added to the I/O Configuration.

FS/VS Smart Camera I/O Tags

When the FS/VS Smart Camera is added to the I/O configuration, a set of tags is created to allow the PLC logic to read and write data to the device through the I/O connection. The following figure displays the tags that are created.

Figure 7 FS/VS Smart Camera Related Tags



NOTE: The tag names are based on the name that was configured in the **New Module** dialog when the device was added to the I/O Configuration. In the example in Figure 7, the module is named s40.

Status and Results Input Assembly

The input assembly provides status information, process state, and decode results.

Table 15 Response/Status Input Assembly (Device to PLC)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Available	Error Overflow	Results Overflow	Results Fragment	Results Available	Trigger Status	Trigger Ready	Job Run Status
1						User Data Status	Job Fail	Job Pass
2	GPIO 7	GPIO 6	GPIO 5	GPIO 4	GPIO 3	GPIO 2	GPIO 1	GPIO 0
3							GPIO 9	GPIO 8
4	ECHO Register							
5								
6	Active Job Slot Number							
7								
8	Error Code							
9								
10								
11								
12	Result Queue Count							
13	Reserved							
14	Results Job Slot Number							
15								
16...	Result Data (See Results Status and Data Structure on page 19 for more information)							
495								

Job Control and Setup Assembly

The output assembly contains control signals, software event signals, and any user data required for the trigger and decode.

Table 16 Job Control and Setup Assembly (PLC to Device)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Ack	Error Buffer Control	Results Buffer Control	Job Slot Control	Results Ack	Trigger	Trigger Enable	Job Control
1	Reset Counters					User Data Control		
2	Reserved							
3								
4	ECHO Register							
5								
6	Job Slot Number							
7								
8	Packet Sequence Number							
9								
10	Reserved							
11								
12								
13								
14								
15								
16...	User Data (See User Data Structure on page 18 for more information)							
499								

Fixed Scanner Add-On Instruction (AOI)

The fixed scanner Add-On Instruction (AOI) provides a simple abstraction for handling fixed scanning jobs.

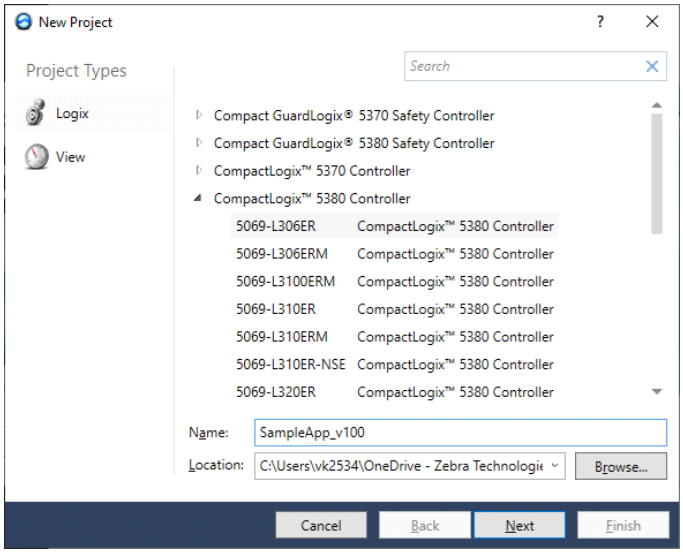
Included within the AOI is support for the following:

- Easy control of multiple Zebra Fixed Industrial Scanners.
- User friendly naming of Input and Output parameters with no Add-On Profile required.
- The automatic stitching together of barcodes larger than 464 bytes using fragmentation.
- Extraction of Fixed Barcode Structure data into easy-to-use user defined types, including support for Manycode, in which multiple barcodes are parsed and provided in an array

Creating a New Project that Uses AOI_FixedScanner

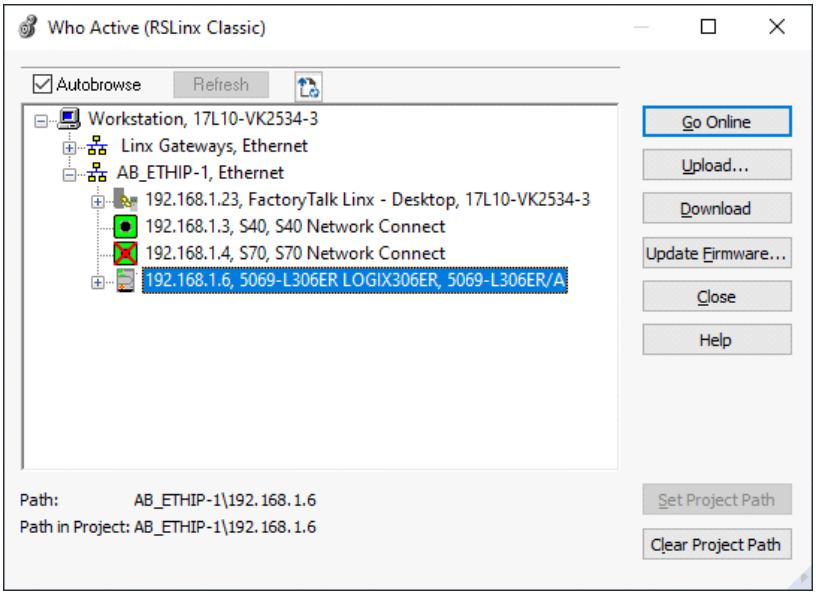
1. Obtaining the AOI. Obtain the AOI by unzipping the Industrial Ethernet Developer Zip file (CAAFSS00-001-xxxB0.zip). The exported AOI file can be found under the EtherNet/IP and Logix folder (AOI_FixedScannerVxx.L5X).
2. Creating a new project. Create a new project by launching Logix Studio 5000 and selecting **Create a New Project**.
3. Next, select the appropriate PLC controller and name for the project. Proceed through the wizard and click **Finish** to create the new project.

NOTE: Logix Studio 5000 version 32 was used during development and testing.

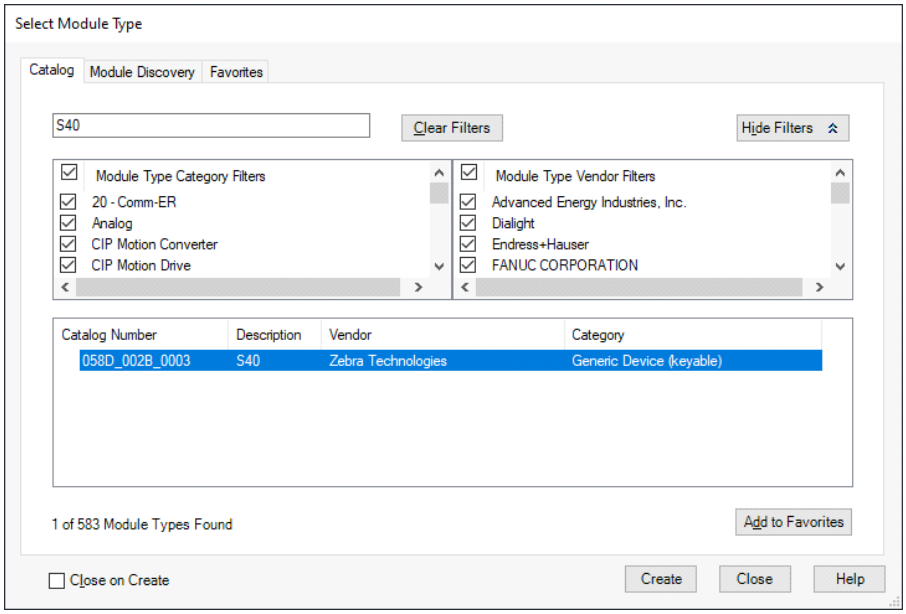


4. Click the Communications dropdown menu and select **Who Active** to set up the PLC communication path from Studio 5000.
   a. From the **Who Active** dialog, expand the network Interface driver and select the PLC controller.
   b. Once selected, click **Set Project Path** to set the selected controller path to the project. Following the Path selection, click **Close** to exit the **Who Active** dialog.

NOTE: The controller path appears under **Path** in the project.

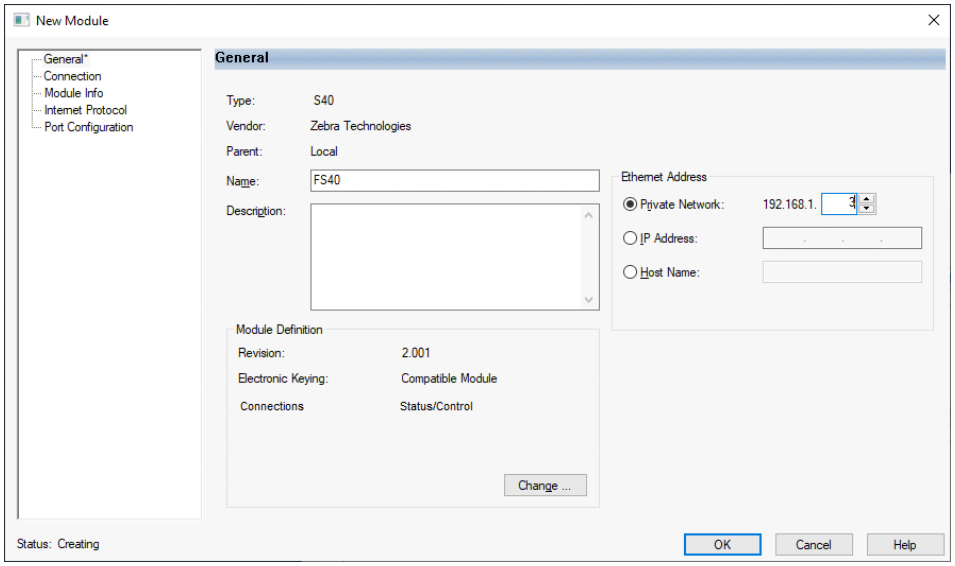


5. Add the FS/VS Smart Camera to the project. Click on the controller's Ethernet port from the left pane and select **New Module**.
6. Next, filter the catalog for the appropriate model (S40/S70/S20) that matches the device and click **Create**. Click **Create** in the **Select Module Type** dialog, and observe the **New Module** information.



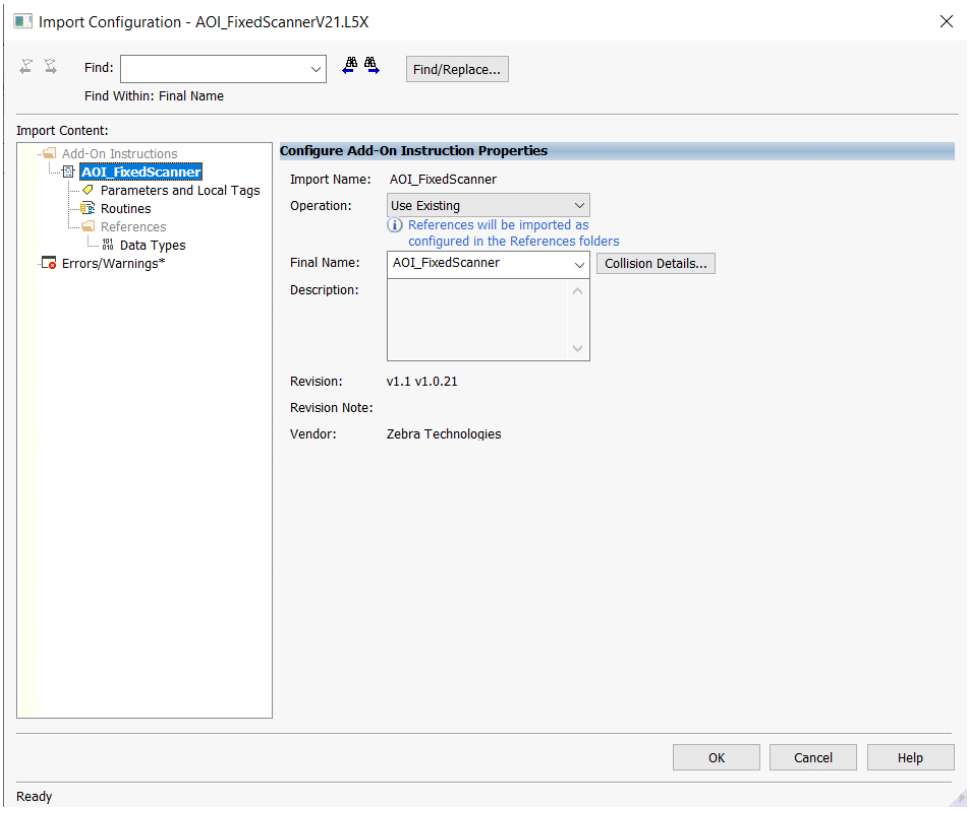
7. From this dialog, provide a name and set the IP address of the device.
8. Once complete, click **OK** and the new module is added to the project.

Figure 8 New Module Settings



9. Importing the Add-On Instruction (AOI) to the project. Import an AOI to the project by expanding the asset folder from project's left pane and right click on **Add-On Instruction**.
10. From the dropdown menu, select the **Import Add-On Instruction** option.
11. Browse to the unzipped AOI_FixedScannerVxx.L5X and click **OK** to import it into the project. The **Import Configuration** dialog displays.
12. Click **OK** to complete the import process.

Figure 9 AOI Import Configuration



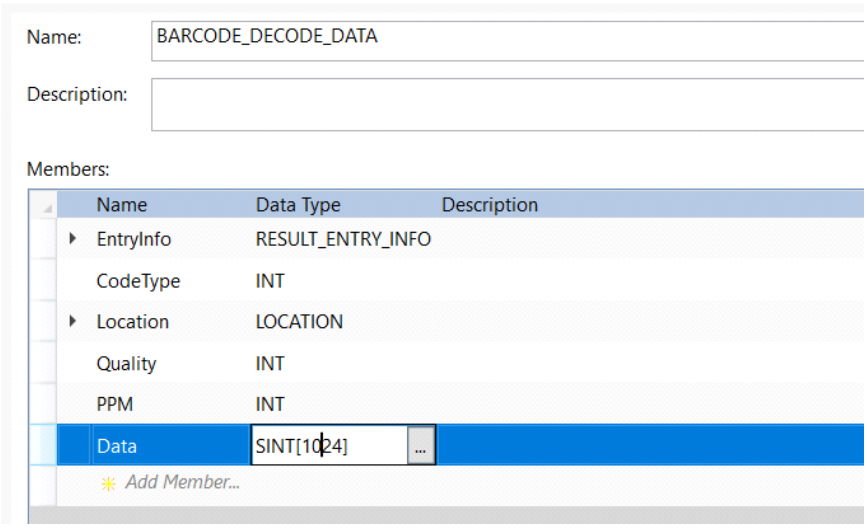
13. By default, the AOI is created to support up to five barcodes with a data size of up to 1024 bytes long. Since this may not match a specific use case, these sizes can be modified.

    To modify the sizes in AOI, follow the steps below:

    a. Go to **Assets > Data Types > User-Defined** and open the BARCODE_DECODE_DATA structure.

    b. Modify the array size of Data field as per the required length of each barcode decode data and click **OK**.

Figure 10 Barcode Decode Data Structure



    c. To adjust the size in internal logic of AOI, navigate to **Assets > Add-On Instructions** and open **Parameter and Local Tags**. Change the value of the tag names in **MAX_BARCODE_LENGTH** to a value equal to the Data size. Change the **MAX_RAW_DATA_SIZE** if the maximum raw data size is less than the size given by default (5250).

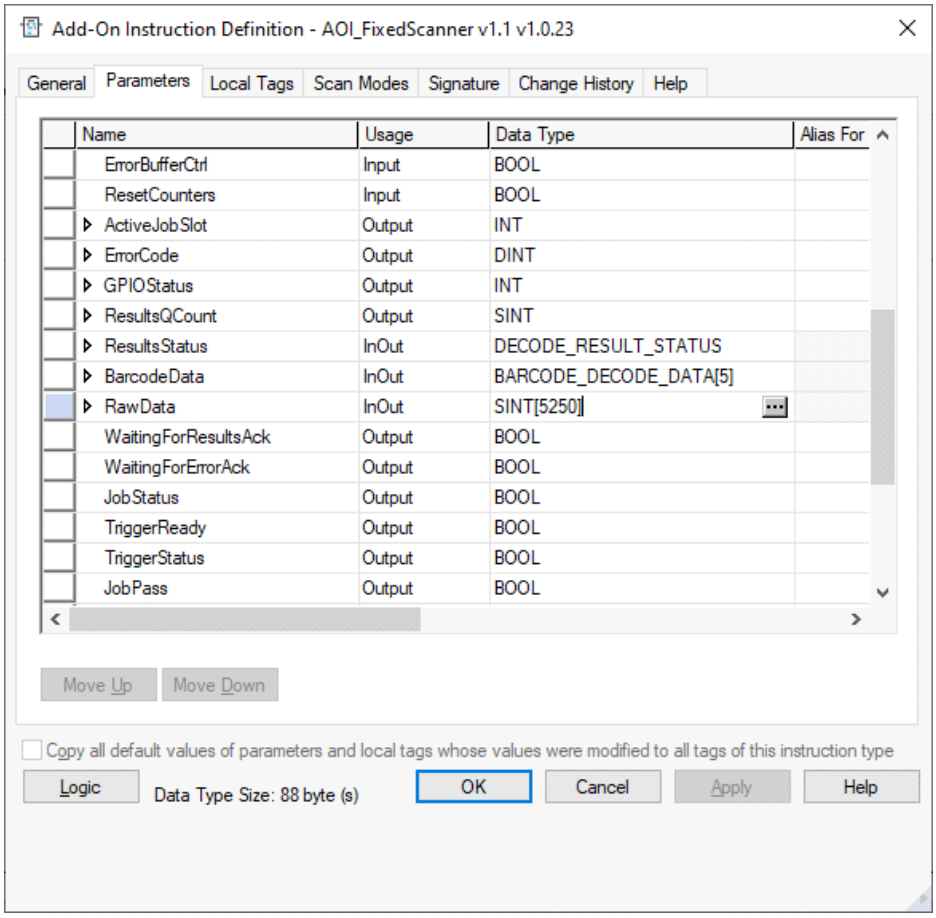
Figure 11 Max Barcode Length

    d. Next, modify the default sizes in AOI's internal structure. Go to **Assets > Add-On Instructions** and open the properties of **AOI_FixedScanner** AOI by right-clicking and selecting **Properties**. From the AOI's properties window, go to the **Parameters** tab and modify the size of parameters below:

        i. **BarcodeData** – Modify the array index to the max number of expected barcodes

        ii. **RawData** – Modify the array size to same value of " " as mentioned in point 'd' above.

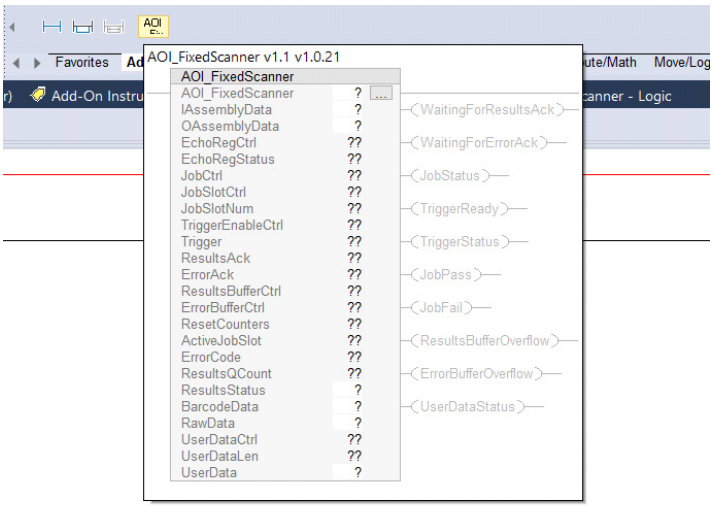
Figure 12 AOI Definition



e. Click **Apply** and **OK** to accept the changes.

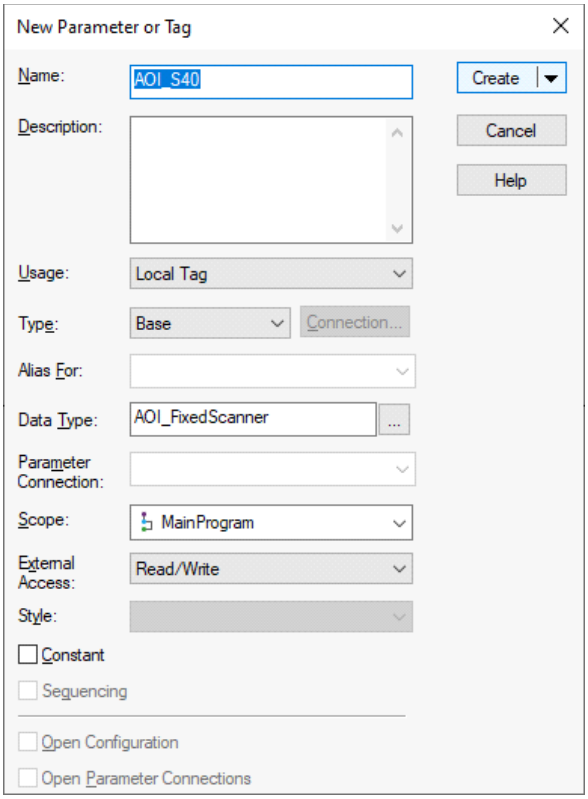
14. Once imported successfully, the AOI is found under Assets/Add-On Instructions located on the left-hand pane of Studio 5000. The AOI can now be used in the ladder logic program to communicate with the FS/VS Smart Camera. Add the AOI to the main program RUNG by clicking the **Add-On Element Group** and clicking the AOI.

Figure 13 AOI Fixed Scanner



15. Once added, assign the tag name to the newly added AOI and create a new tag by right clicking on the tag name.

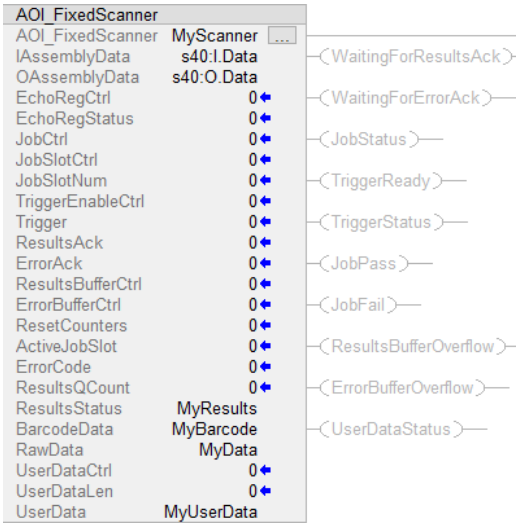
Figure 14 Assigned TAG Name



Assign IAssemblyData with FS40:I.Data and OAssemblyData with FS40:O.Data such that FS40 is the name of created module for the FS/VS Smart Camera.

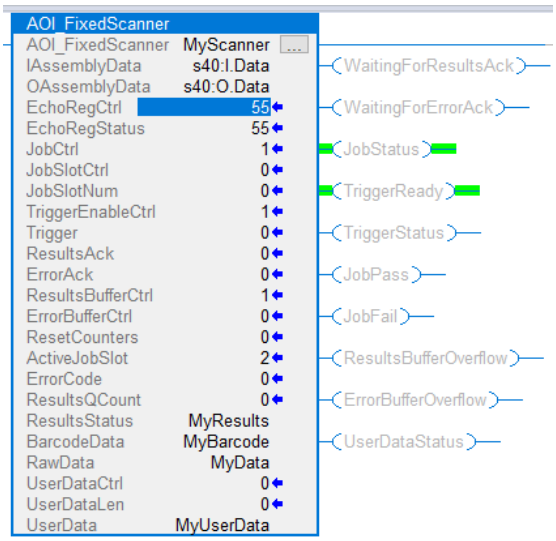
16. After adding the AOI to the main RUNG, assign tags to the IN/OUT AOI parameters (ResultsStatus, BarcodeData, RawData, and UserData). Create a new tag by right clicking and selecting **New Tag**.

Figure 15 Creating Required TAGs



17. To load the project by performing a download and going online, verify that the communication is working as expected by modifying a value in the EchoRegCtrl field in the AOI. If the same value is read back in the EchoRegStatus field, the connection is successful between the PLC and the Device.

Figure 16 Load the Project and Verify Communication



Using the Fixed Scanner Add-On Instruction

The typical usage sequence for a fixed scanner AOI is defined below:

1. Set the current job to be active by setting **JobCtrl** to **1**.
2. Enable trigger control by setting **TriggerEnableCtl** to **1**.
3. Verify that the **TriggerReady** bit is set to **true**.
4. Enable Result Buffering on the device by setting **ResultBufferCtrl** to **1**.
5. Trigger the job to run by toggling the trigger from **0** to **1**.
6. Verify that **WaitingForResultsAck** is set to **true** to indicate that job results are available.
7. Act on the result data provided by **ResultStatus, RawData,** and **BarcodeData.**
8. Clear **WaitingForResultsAck** by toggling **ResultsAck** from **0** to **1**.

PROFINET Interface

The PROFINET interface on the FS/VS Smart Camera supports PROFINET-IO Device functionality. The device is able to receive, or be the target of, I/O connections from a PROFINET Controller, but it is not able to originate connections itself.

GSDML File

The PROFINET GSDML file describes the identity and I/O capabilities of the FS/VS Smart Camera. The file is used by the controller configuration tools to configure the I/O connections and data tags that allow for communication with the FS/VS Smart Camera over the PROFINET network.

The GSDML file can be found in the Developer Zip file.

PROFINET IO Modules

The FS/VS Smart Camera I/O interface includes multiple I/O modules that provide access to Command and Response data.

NOTE: Only a single Command Data and Response Data modules can be used at one time by selecting 32, 64, or 128 version for the given slot.

Command IO Module

Module ID: 11

Submodule ID: 1

Access: Output

Output Size:16 bytes

The Command Module contains provides control and configuration of the FS/VS Smart Camera.

Table 17 Command Module (PLC to Device)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Ack	Error Buffer Enable	Results Buffer Control	Job Slot Control	Results Ack	Trigger	Trigger Enable	Job Control
1	Reset Counters					User Data Control		

Table 17 Command Module (PLC to Device) (Continued)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	Reserved							
3								
4	ECHO Register							
5								
6	Job Slot Number							
7								
8	Packet Sequence Number							
9								
10	Reserved							
11								
12								
13								
14								
15								

CommandData32 IO Module

Module ID: 12

Submodule ID: 1

Access: Output

Output Size: 32 bytes

CommandData Modules allow for the user to control Job input parameters at runtime by updating UserData.

Table 18 CommandData32 IO Module

Name	Offset	Size (Bytes)	Description
User Control Global Header			
Sequence Number	0	4	Not currently used. Always be 0.
Total Length	4	2	Total size in bytes of the User Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at User Data and includes all the bytes following it. It is required that the Total Length value matches the length as specified in the Job's Industrial Ethernet User Data configuration.
Reserved	6	4	Not currently used. Can be 0.
Mode	10	1	Specifies the User Data format. This bit is 0 for Entry Mode and 1 for Raw Mode.

Table 18 CommandData32 IO Module

Name	Offset	Size (Bytes)	Description
Reserved	11	3	Not currently used. Can be 0.
Count	14	2	Number of data entries in User data. The count should be 0 if no data exists in User data. The count never exceeds 1 when the mode is set to Raw.
User Data	16	16	Actual User Data to be used. See User Data format in Table 7 and Table 8 based on the Chosen Mode.

CommandData64 IO Module

Module ID: 13

Submodule ID: 1

Access: Output

Output Size: 64 bytes

CommandData Modules allow for the user to control Job input parameters at runtime by updating UserData.

Table 19 CommandData64 IO Module

Name	Offset	Size (Bytes)	Description
User Control Global Header			
Sequence Number	0	4	Not currently used. Always be 0.
Total Length	4	2	Total size in bytes of the User Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at User Data and includes all the bytes following it. It is required that the Total Length value matches the length as specified in the Job's Industrial Ethernet User Data configuration.
Reserved	6	4	Not currently used. Can be 0.
Mode	10	1	Specifies the User Data format. This bit is 0 for Entry Mode and 1 for Raw Mode.
Reserved	11	3	Not currently used. Can be 0.
Count	14	2	Number of data entries in User data. The count should be 0 if no data exists in User data. The count never exceeds 1 when the mode is set to Raw.
User Data	16	48	Actual User Data to be used. See User Data format in Table 7 and Table 8 based on the Chosen Mode.

CommandData128 IO Module

Module ID: 14

Submodule ID: 1

Access: Output

Output Size:128 bytes

CommandData Modules allow for the user to control Job input parameters at runtime by updating UserData.

Table 20 CommandData128 IO Module

Name	Offset	Size (Bytes)	Description
User Control Global Header			
Sequence Number	0	4	Not currently used. Always be 0.
Total Length	4	2	Total size in bytes of the User Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at User Data and includes all the bytes following it. It is required that the Total Length value matches the length as specified in the Job's Industrial Ethernet User Data configuration.
Reserved	6	4	Not currently used. Can be 0.
Mode	10	1	Specifies the User Data format. This bit is 0 for Entry Mode and 1 for Raw Mode.
Reserved	11	3	Not currently used. Can be 0.
Count	14	2	Number of data entries in User data. The count should be 0 if no data exists in User data. The count never exceeds 1 when the mode is set to Raw.
User Data	16	112	Actual User Data to be used. See User Data format in Table 7 and Table 8 based on the Chosen Mode.

Response IO Module

Module ID: 21

Submodule ID: 1

Access: Input

Output Size: 32 bytes

The response module provides status information and process state.

Table 21 Response Module (Device to PLC)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Available	Error Overflow	Results Overflow	Results Fragment	Results Available	Trigger Status	Trigger Ready	Job Status
1						User Data Status	Job Fail	Job Pass
2	GPIO 7	GPIO 6	GPIO 5	GPIO 4	GPIO 3	GPIO 2	GPIO 1	GPIO 0
3							GPIO 9	GPIO 8
4	ECHO Register							
5								
6	Active Job Slot Number							
7								
8	Error Code							
9								
10								
11								
12	Result Queue Count							
13	Reserved							
14	Results Job Slot Number							
15								
16	Result Sequence Number							
17								
18								
19								
20	Result Total Length							
21								
22	Result Fragment Number							
23								
24	Result Fragment Total Count							
25								
26	Result Mode							
27	Result Status							
28	Result Time							
29								
30	Result Count							
31								

ResponseData32 IO Module

Module ID: 22

Submodule ID: 1

Access: Input

Output Size:32 bytes

ResponseData Modules provide the user with the resultant data associated with a Job run.

Table 22 ResponseData32 IO Module

Name	Offset	Size (Bytes)	Description
User Control Global Header			
Sequence Number	0	4	Not currently used. Always be 0.
Total Length	4	2	Total size in bytes of the User Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at User Data and includes all the bytes following it. It is required that the Total Length value matches the length as specified in the Job's Industrial Ethernet User Data configuration.
Reserved	6	4	Not currently used. Can be 0.
Mode	10	1	Specifies the User Data format. This bit is 0 for Entry Mode and 1 for Raw Mode.
Reserved	11	3	Not currently used. Can be 0.
Count	14	2	Number of data entries in User data. The count should be 0 if no data exists in User data. The count never exceeds 1 when the mode is set to Raw.
User Data	16	16	Actual Result Data provided by Job Run. Please see Table 10 and Table 11 for Result data structure based on mode selection.

ResponseData64 IO Module

Module ID: 23

Submodule ID: 1

Access: Input

Output Size:64 bytes

ResponseData Modules provide the user with the resultant data associated with a Job run. 0 to 31 bytes of data are defined in the table below.

Table 23 ResponseData64 IO Module

FS Job Result	Offset	Size (Bytes)	Description
Sequence Number	0	4	The sequence number for the Results. This is tied to the Job Sequence Number. A Job Sequence Number is a counter that automatically increments every time a Job is run.
Total Length	4	2	Total size in bytes of the Results Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at the beginning of Result Data and includes all the bytes following it. For multi-fragment results, this count would include the total size of Result Data after stitching all the data fragments together.
Fragment #	6	2	For multi-fragment results, this entry indicates which fragment is the current fragment being provided. For non-fragmented results, this entry will be set to 1.
Fragment Total Count	8	2	For multi-fragment results, this entry indicates how many total fragments make up the complete result. For non-fragmented results, this entry is set to 1.
Mode	10	1	Specifies the Results Data format. 0 for Entry Mode, 1 for Raw Mode.
Status	11	2	Provides the overall job status information. 0 for Fail, 1 for Pass.
Time	12	2	In milliseconds, the time it took to run the Job.
Count	14	2	Number of data entries in the Results data. Count will be 0 if no data exists in the Result data. Count will never exceed 1 when Mode is set to Raw.
Result Data	16	48	Actual Result Data provided by Job Run. Please see Table 10 and Table 11 for Result data structure based on mode selection.

ResponseData128 IO Module

Module ID: 24

Submodule ID: 1

Access: Input

Output Size:128 bytes

ResponseData Modules provide the user with the resultant data associated with a Job run.

Table 24 ResponseData128 IO Module

FS Job Result	Offset	Size (Bytes)	Description
Sequence Number	0	4	The sequence number for the Results. This is tied to the Job Sequence Number. A Job Sequence Number is a counter that automatically increments every time a Job is run.
Total Length	4	2	Total size in bytes of the Results Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at the beginning of Result Data and includes all the bytes following it. For multi-fragment results, this count would include the total size of Result Data after stitching all the data fragments together.
Fragment #	6	2	For multi-fragment results, this entry indicates which fragment is the current fragment being provided. For non-fragmented results, this entry is set to 1.
Fragment Total Count	8	2	For multi-fragment results, this entry indicates how many total fragments make up the complete result. For non-fragmented results, this entry is set to 1.
Mode	10	1	Specifies the Results Data format. 0 for Entry Mode, 1 for Raw Mode.
Status	11	2	Provides the overall job status information. 0 for Fail, 1 for Pass.
Time	12	2	In milliseconds, the time it took to run the Job.
Count	14	2	Number of data entries in the Results data. Count will be 0 if no data exists in the Result data. Count will never exceed 1 when Mode is set to Raw.
Result Data	16	112	Actual Result Data provided by Job Run. Please see Table 10 and Table 11 for Result data structure based on mode selection.

Configuring Siemens S7 Communications

Register the GSDML File

Before the communication to the FS/VS Smart Camera can be configured, the GSDML file must be registered with TIA Portal. This is done only once.

To register the GSDML file using TIA Portal:

1. In the project view menu, select: **Options > Install General Station Description File (GSD).**
2. Locate and select the FS/VS Smart Camera GSDML file.
3. Click **Install**.

NOTE: The GSDML file is found in the Industrial Ethernet Developer ZIP file under the PROFINET folder.

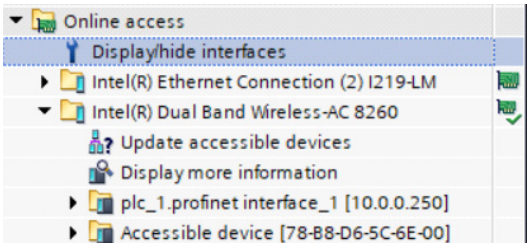
Finding the Device and Configuring the Device Name

After enabling PROFINET protocol support as described in the Activating Industrial Ethernet section, the FS/VS Smart Camera will only be accessible on the network through the PROFINET protocol. It is recommended that after enabling the protocol you use TIA Portal to find all accessible devices and set the PROFINET device name of the FS/VS Smart Camera.

To set the FS/VS Smart Camera PROFINET Device Name using TIA Portal:

1. From the TIA portal's online access in the project tree, click the network adapter used to access the device and click **Update Accessible Devices** to list all PROFINET devices on the network.

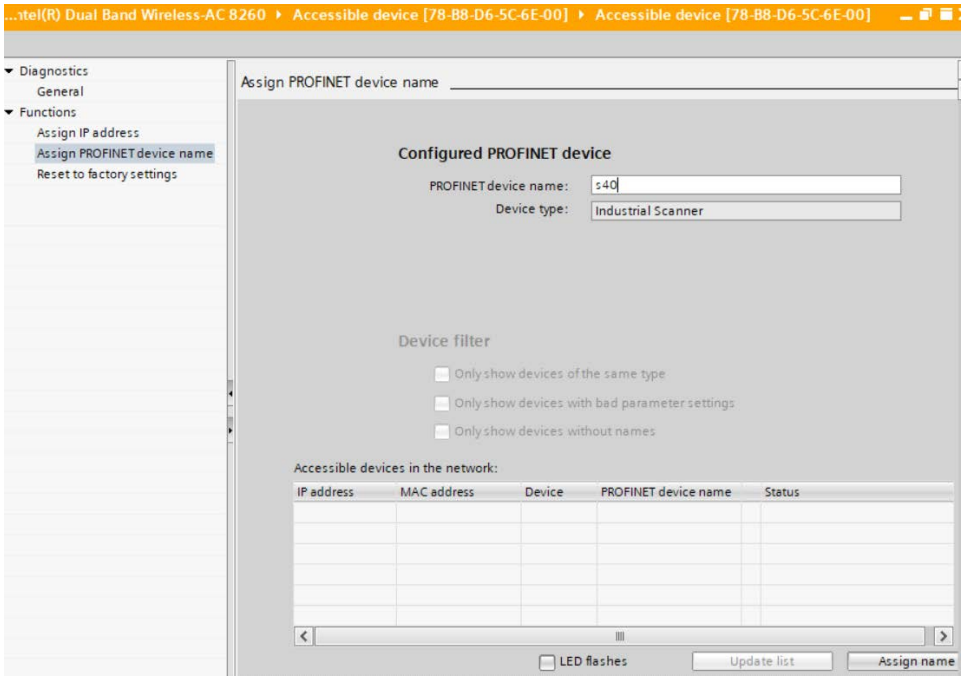
Figure 17 TIA Portal Project Tree



If not previously configured, the FS/VS Smart Camera displays as an accessible device, and the MAC address shown matches the one printed on the device label.

2. Click on the device you are configuring and click **Online and Diagnostics** to go online.
3. Select **Functions** and **Assign PROFINET device name** from the online properties menu**.** Fill out the **PROFINET device name** field and click **Assign name**.

Figure 18 Assigning a PROFINET Device Name



Adding the FS/VS Smart Camera to the I/O Configuration

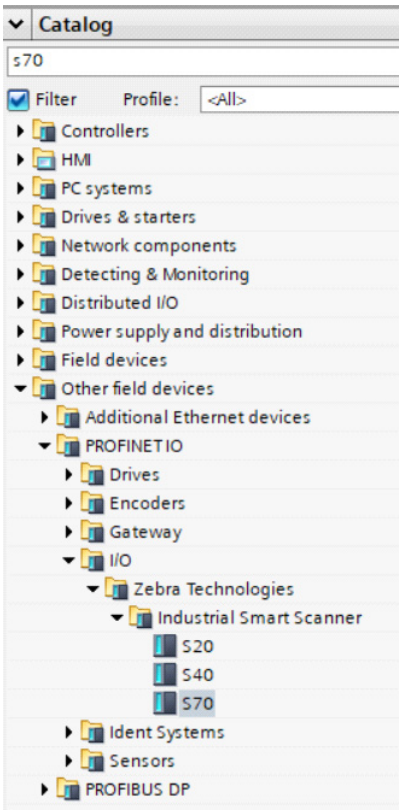
The controller must be added to the I/O configuration in the controller program to communicate with the device.

NOTE: The following steps assume a PLC and a PROFINET network are configured in the project and the GSDML file is installed.

To add the FS/VS Smart Camera to the controller's I/O configuration using TIA Portal:

1. Double click on **Devices and Networks** in the project tree and open the network view tab.
2. Find the FS/VS Smart Camera from the hardware catalog.

Figure 19 Hardware Catalog



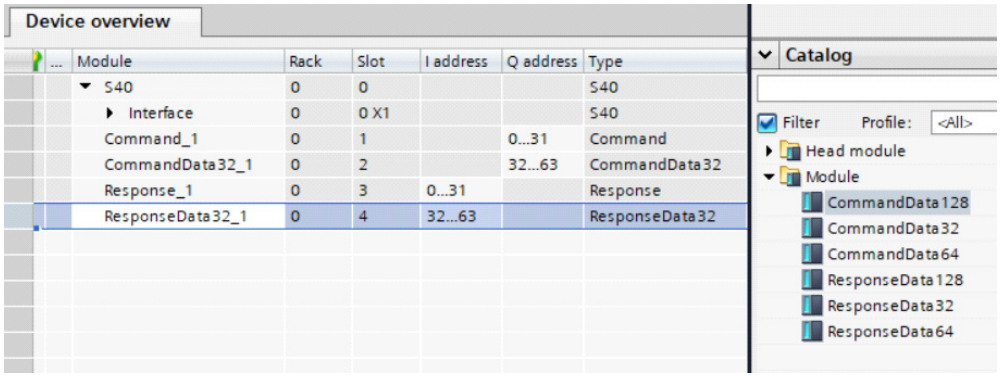
3. Select the appropriate model from the list and drag it into the network view. By default, the new device is not assigned. Click on the text to assign a PLC port.

Figure 20 Network View

4. Next, double-click the device in the network view. The **Device Overview** tab displays the module I/O data mapping. By default, Command_1 and Response_1 are set to slots 1 and 3, respectively. Drag the desired size for **CommandData** and **ResponseData** from the hardware catalog over to slots 2 and 4.

IMPORTANT: The same size should be selected for both CommandData and ResponseData.

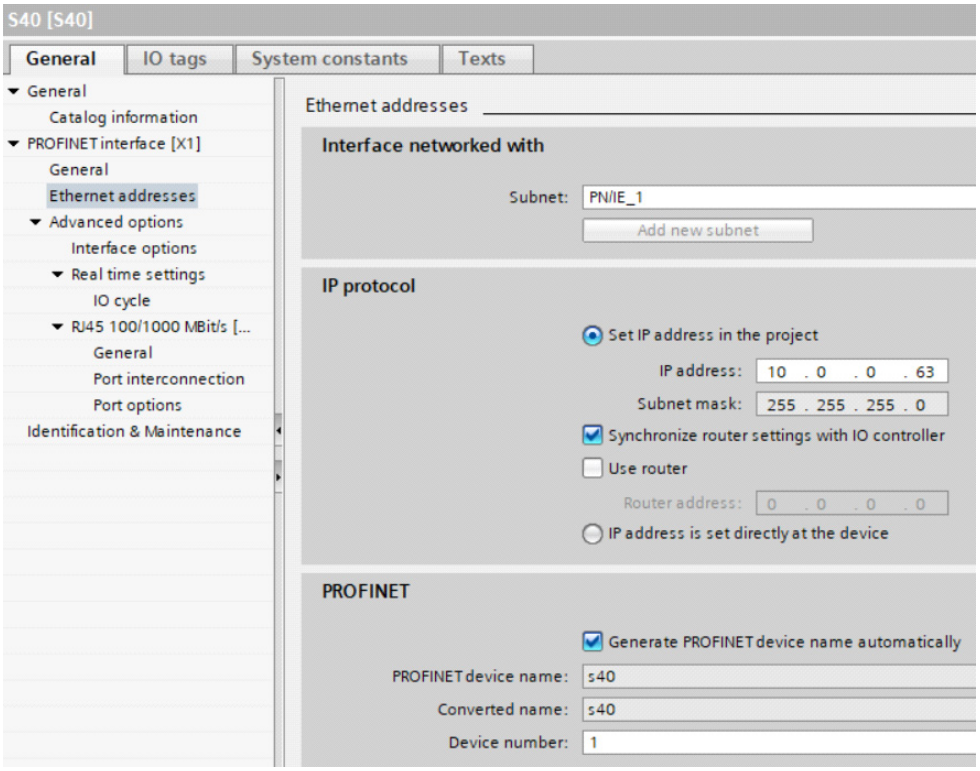
Figure 21 Device Overview



5. From the device view, double-click the device module to view device properties. The Ethernet address properties allow users to set the PROFINET device name the project expects to find the device using.

NOTE: If **Set IP address in the project** is enabled, the project reconfigures the device to use that IP address if it is found on the network.

Figure 22 General Device Properties



Fixed Scanner Function Block (FB)

The Fixed Scanner Function Block provides a simple abstraction for handling fixed scanning jobs. The Function Block supports the following:

- Intuitive control of multiple Zebra Fixed Industrial Scanners.
- User friendly naming of Input and Output parameters.
- The automatic stitching together of barcodes and/or data larger than 464 bytes using fragmentation.
- Extraction of Fixed Barcode Structure data into easy-to-use user defined types, including support for Manycode, which multiple barcodes are parsed and provided in an array.

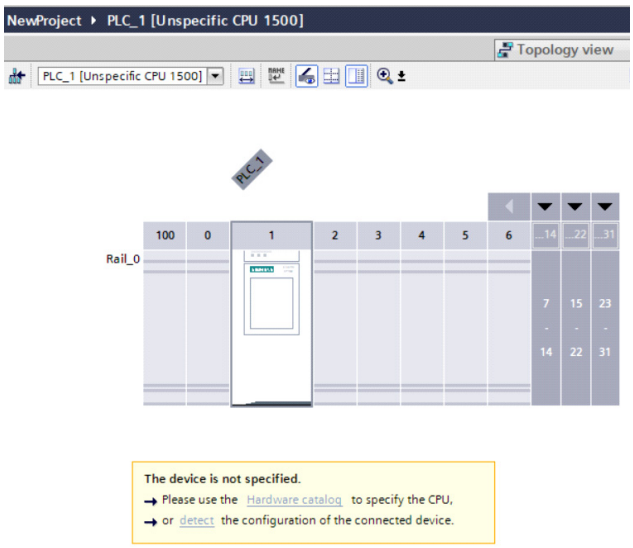
Creating a Project that uses FB_FixedScanner

To obtain the Function Block Global Library, unzip the Industrial Ethernet Developer Zip file (CAAFSS00-001-xxxB0.zip). The exported Global Library file is found under the PROFINET and TIA15_1 folder. (FB_FixedScannerLibV5.zal15_1).

1. Create a new project by launching the TIA Portal 15.1 or higher and choose to create a new project. Next, open the **Project View**. From the **Project View**, click **Add new device** from the project tree and select the PLC being used.

NOTE: Users can also select the Unspecified version of your PLC and use the detect logic to assign it to the correct hardware. Click detect and assign the PLC found on your network.

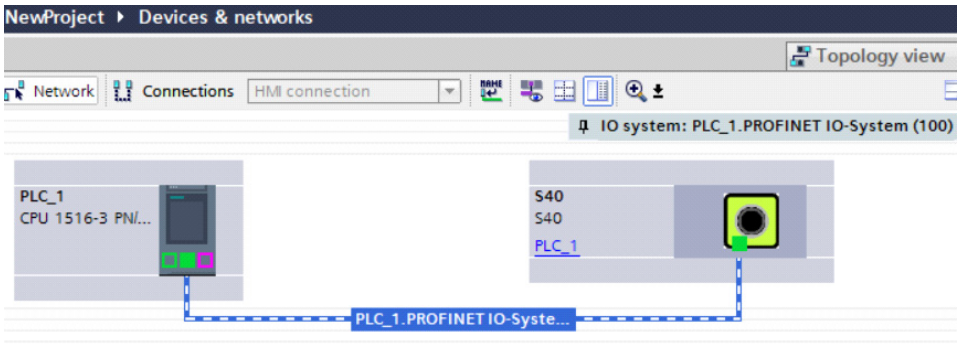
Figure 23 Unspecified PLC Version



2. Add the FS/VS Smart Camera to your project by clicking **Devices and networks** from the project tree. From the **Hardware Catalog** window, search for Zebra. Under **Other Field devices and I/O**, find the appropriate model for the fixed scanner.

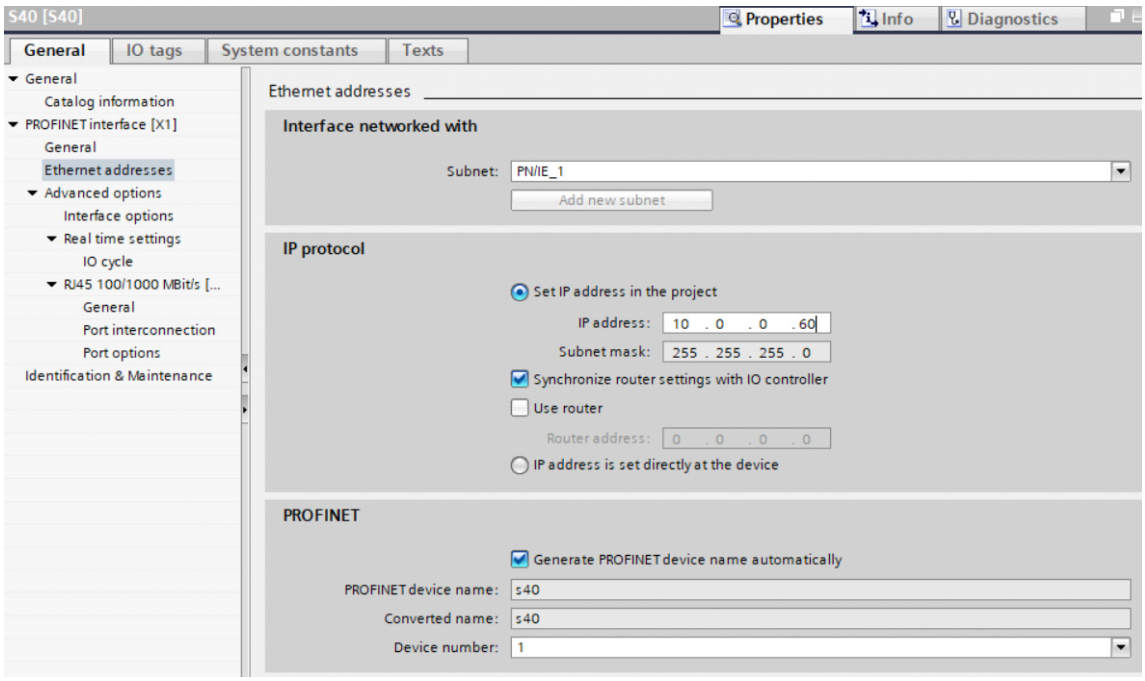
3. Next, drag and drop the model to the **Network View** window. Assign the fixed scanner to the PLC by clicking **Not assigned** and select the appropriate PLC network port to be used while in the **Network View** tab.

Figure 24 Devices and Networks



4. Configure the device by clicking the **Device View** tab. From the **Properties** window, set the appropriate PROFINET device name and IP address for use within the project.

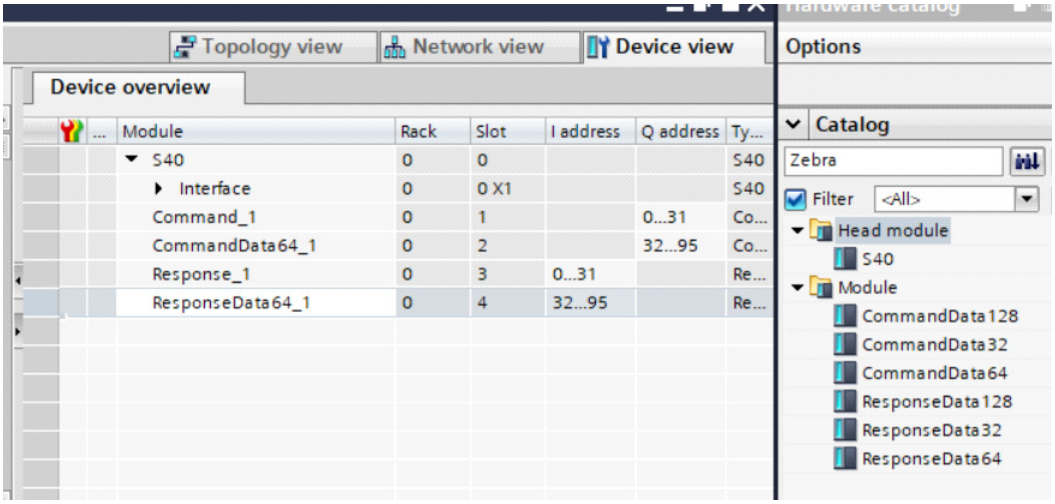
Figure 25 Properties Window



5. Assigning Data I/O to the fixed scanner. Assign CommandData and ResponseData modules to the fixed scanner by using the **Device Overview** tab. This is where the device will reside in I/O space.

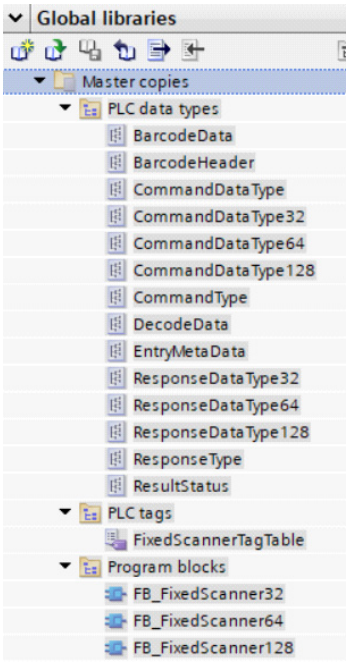
IMPORTANT: Take note of I and Q address locations and size. The size for both CommandData and ResponseData should match.

Figure 26 Device Overview



6. To import the Global Library Function Block (FB_FixedScannerLibVx.zal15_1) to the project, select **Global Libraries** and **Retrieve Library...** from the **Options** menu. Next, browse to the FB_FixedScannerLibVx folder and select FB_FixedScannerLibVx.al15_1 to load it into the project.

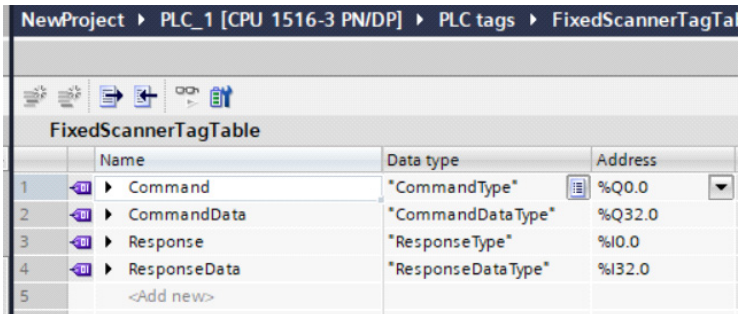
Figure 27 Global Libraries Function Block



7. Copy the Library contents to the project. Program Blocks, PLC tags, and PLC data types are to be copied to their respective locations within the project. For Program Blocks, it is only necessary to copy over the size of the Function Block that matches the CommandData and ResponseData sizes.

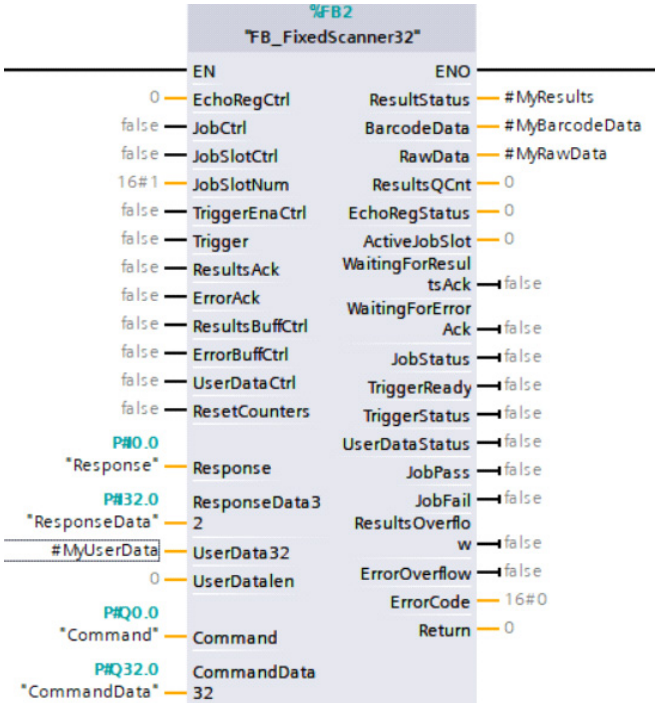
IMPORTANT: Adjust FixedScannerTagTable to match the appropriate I and Q addresses of the fixed scanner as displayed in the **Device Overview** tab.

Figure 28 Tag Table



8. Modifying the Function Block (FB). By default, the FB is created with support of up to 5 barcodes with a data size of up to 512 bytes long and Total Max data of a single result is 2560 Bytes. Since this may not match your use case, these sizes can be modified. This step is optional.
9. Creating ladder logic using the Function Block (FB). To create ladder logic using the Function Block, add the Fixed Scanner Function Block to the Main program by clicking on the empty box and adding it to Network 1 rung. Replace the empty data with the FB_FixedScanner function block type. This will prompt necessitate the creation of a DataBlock for it.
10. Click **OK** to create a DataBlock.
11. Next, connect Command, CommandDataxx, Response, and ResponseDataxx to the tags from the FixedScannerTagTable. Add tags for the User Defined Data Types: ResultStatus, BarcodeData, RawData, and UserDataxx.

Figure 29 Adding Tags



12. Loading the project and verifying communication. Load the project by performing a compile and download to the device. Use the monitor feature to see the runtime values from the fixed scanner. To verify that the communication is working as expected, modify the value in EchoRegCtrl by mapping it to a memory location tag (%MWx.x). The EchoRegStatus register should automatically match the control value if the device communication is working.

Figure 30 Perform Compile and Download Icon

Using the Fixed Scanner Function Block

Typical usage sequence is defined as follows:

1. Set the current Job to be active by setting JobCtrl to 1.
2. Enable Trigger control by setting TriggerEnableCtl to 1.
3. Check that TriggerReady bit is true.
4. Enable Result Buffering on the device by setting ResultBufferCtrl to 1.
5. Trigger the job to run by toggling Trigger from 0 to 1.
6. Check that WaitingForResultsAck is set to true to indicate that Job results are available.
7. Act on result data in provided by ResultStatus, RawData, and BarcodeData.
8. Clear WaitingForResultsAck by toggling ResultsAck from 0 to 1.

Modbus TCP Interface

This chapter provides information about using the Modbus TCP interface to send and receive data from the FS/VS Smart Camera. The Modbus TCP interface supports Modbus TCP server functionality. The device can receive, or be the target of, I/O connections from a Modbus TCP client, but is not able to originate connections itself.

Modbus Register Locations

The Modbus TCP interface provides access to the registers that hold parameters and data. Command registers can be written while Response registers are read only. The following tables list all of the addressable locations available on the fixed scanner.

NOTE: In the above sections, size field is described in byte format. Modbus registers are 16 bits (2 bytes), the registers are (size/2) for each module.

Table 24 Modbus Register Locations

Name	Access Code	Access Function	Address Space	Offset (0x) Holding Regular Location	Size (Bytes)	Description
Command	16	Write Multiple Registers	Holding	1000 (41000)	16	Allows PLC to control device and generate triggers.
Command User Data	16	Write Multiple Registers	Holding	1100 (41100)	250	Used by PLC to change Job input parameters
Response	3	Read Holding Registers	Holding	2000 (42000)	16	Provides PLC with status information from the device.
Response Data	3	Read Holding Registers	Holding	2100 (42100)	250	Provides PLC with results data associated with a specific Job run.

Command Registers Mapping

The command registers provide control over the FS/VS Smart Camera. The following table describes the byte and bit locations of the controllable features.

Table 25 Command Registers Mapping

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Ack	Error Buffer Enable	Results Buffer Control	Job Slot Control	Results Ack	Trigger	Trigger Enable	Job Control
1	Reset Counters					User Data Control		
2	Reserved							
3								
4	ECHO Register							
5								
6	Job Slot Number							
7								
8	Packet Sequence Number							
9								
10	Reserved							
11								
12								
13								
14								
15								

NOTE: See Modbus Register Locations on page 54 for a description of each field and their usage.

Command Data Registers Mapping

Command data is an array of bytes that allow for runtime changes to Job input parameters based on the Jobs Industrial Ethernet User Data configuration.

Table 26 Command Data Registers Mapping

Name	Offset	Size (Bytes)	Description
User Control Global Header			
Sequence Number	0	4	Not currently used. Always be 0.
Total Length	4	2	Total size in bytes of the User Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at User Data and includes all the bytes following it. It is required that the Total Length value matches the length as specified in the job's Industrial Ethernet User Data configuration.

Table 26 Command Data Registers Mapping

Name	Offset	Size (Bytes)	Description
Reserved	6	4	Not currently used. Can be 0.
Mode	10	1	Specifies the User Data format. This bit is 0 for Entry Mode and 1 for Raw Mode.
Reserved	11	3	Not currently used. Can be 0.
Count	14	2	Number of data entries in User data. The count should be 0 if no data exists in User data. The count never exceeds 1 when the mode is set to Raw.
User Data	16	234	The actual User Data being. See the User Data formatting in Table 7 and Table 8 based on the specified mode.

Response Register Mapping

The response module provides status information and process state. The following table provides byte and bit locations for reading data from the FS/VS Smart Camera.

Table 27 Response IO Module - Byte and Bit Locations

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Available	Error Overflow	Results Overflow	Results Fragment	Results Available	Trigger Status	Trigger Ready	Job Status
1							Job Fail	Job Pass
2	GPIO 7	GPIO 6	GPIO 5	GPIO 4	GPIO 3	GPIO 2	GPIO 1	GPIO 0
3							GPIO 9	GPIO 8
4	ECHO Register							
5								
6	Active Job Slot Number							
7								
8	Error Code							
9								
10								
11								
12	Result Queue Count							
13	Reserved							
14	Results Job Slot Number							
15								

Response Data Registers Mapping

Response data is an array of bytes that provide results for a given Job currently being run. The result data is based on the Industrial Ethernet Result Configuration set in the Job.

Table 28 Response Data Registers Mapping

Name	Offset	Size (Bytes)	Description
Results Status Global Header			
Sequence Number	0	4	The sequence number for the Results. This is tied to the Job Sequence Number. A Job Sequence Number is a counter that automatically increments every time a job is run.
Total Length	4	2	Total size in bytes of the Results Data. This length value does not include the 16 bytes taken up by the Global Header. The count starts at the beginning of Result Data and includes all the bytes following it. For multi-fragment results, this count would include the total size of Result Data after stitching all the data fragments together.
Fragment #	6	2	For multi-fragment results, this entry indicates which fragment is the current fragment being provided. For non-fragmented results, this entry is set to 1.
Fragment Total Count	8	2	For multi-fragment results, this entry indicates how many total fragments make up the complete result. For non-fragmented results, this entry is set to 1.
Mode	10	1	Specifies the Results Data format. 0 for Entry Mode, Set to 1 for Raw Mode.
Status	11	1	Provides the overall job status information. Set to 0 for Fail, 1 for Pass.
Time	12	2	In milliseconds, the time it took to run the Job.
Count	14	2	Number of data entries in the Results data. The count is set to 0 if no data exists in the Result data. The count does not exceed 1 when Mode is set to Raw.
User Data	16	234	Actual Result Data is provided by Job Run. See Table 10 and Table 11 for the Result data structure based on the specified mode.

Typical Use Case for Triggering a Job

1. Set the current Job to be active by setting **JobCtrl** to **1**.
2. Enable Trigger control by setting **TriggerEnableCtl** to **1**.
3. Check that the **TriggerReady** bit is **true**.
4. Enable **Result Buffering** on the device by setting **ResultBufferCtrl** to **1**.
5. Trigger the job to run by toggling the **Trigger** from **0** to **1**.
6. Check that the **ResultsAvailable** bit is set to **true** to indicate that job results are available.
7. Read in the **Response** and **Response Data**.
8. Clear the **ResultsAvailable** bit by toggling **ResultsAck** from **0** to **1**.

Error Codes

The following table provides a list of potential Error Codes that be received by the PLC.

Table 29 Error Codes List

Error Code	Description
0030064	Service Error: Task Cleanup failure
0030065	Service Error: Failed to unload Industrial Ethernet service
0030066	Service Error: Failed to unload Industrial Ethernet service
0030067	Service Error: Failed to push command to Industrial Ethernet core
0030068	Job Error: Failed to load job into job slot
0030069	Job Error: Failed to load currently active job
003006A	Job Error: Failed to load last valid job
003006B	Job Error: No valid job to load
003006C	Job Error: Failed to load job
003006D	Network Error: Unable to receive data
003006E	Network Error: Invalid assembly ID for response data
003006F	Network Error: No response packet
0030070	Network Error: Malformed data
0030071	Memory Error: Invalid buffer for reading result
0030072	Memory Error: Failed to allocate memory for job result
0030073	Memory Error: Failed to allocate memory for decode data
0030074	Memory Error: Failed to assign decode data
0030075	Memory Error: Failed to push result buffer
0030076	Memory Error: No task slots available
0030077	Memory Error: Failed to create command process thread
0030078	Memory Error: Failed to allocate memory for command data
0030079	Memory Error: Failed to initialize command processing task
003007A	Memory Error: Receive response not initialized properly
003007B	Internal Communications Error: IPC interface not found
003007C	Internal Communications Error: Call failed

Table 29 Error Codes List (Continued)

Error Code	Description
003007D	Internal Communications Error: Interface Error
003007E	Internal Communications Error: Invalid Command Handle
003007F	Internal Communications Error: Unknown