



Cognex 3D-A1000 - Setting Up PROFINET

2/24/2020

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1 Introduction

In-Sight 3D supports PROFINET, an industrial communications protocol that allows you to map the In-Sight vision system's inputs and outputs into the process memory of Siemens PLCs. Once these values have been established, they are synchronized at an interval defined by the update rate of the PROFINET IO system. PROFINET IO describes a device model that consists of insertion places (slots) and groups of I/O channels (subslots). The technical characteristics of the field devices are described by an XML-based GSD (General Station Description) file.

PROFINET IO distinguishes between the three following device types:

- IO-Controller: Vision system on which the automation program is run.
- IO-Device: A remotely assigned field device, which is assigned to an IO-Controller.
- IO-Supervisor: A programming device (PC), which runs commissioning and diagnostic functions.

The PROFINET IO engineering process is similar to PROFIBUS: decentralized field buses are assigned to one or more control systems during configuration. The IO-Device is configured to the actual system expansion based on the content in the GSD file. The IO-Device is simultaneously integrated, appropriately parametrized, and configured into the PROFINET topology.

After the engineering process is complete, the expansion data is loaded into the IO-Controller. The IO-Controller then independently takes over the data exchange with the IO-Device.

Follow these steps to enable the PROFINET protocol for In-Sight 3D:

1. Launch or switch to In-Sight VC Explorer, and open the [Industrial Ethernet](#) dialog from the Utilities window.
2. Select *PROFINET* from the drop-down list. The protocol-specific settings display. Configure the connection according to the local network properties. See the [Industrial Ethernet – PROFINET Configuration](#) topic for more information.
3. Install SIMATIC TIA Manager on the same PC as In-Sight VC Explorer.
4. Open SIMATIC TIA Manager and load the PLC's project.
5. To add PROFINET IO nodes to the vision system, a PROFINET IO system must be present in the hardware configuration diagram. If there isn't a PROFINET IO system in the diagram, complete the following steps:
 - a. Ensure that the PROFINET IO interface on the CPU has been assigned a subnet address. To verify this, double-click the **PROFINET IO** module on the CPU. If the PROFINET IO module's Networked status indicates No, then click the **Properties** button and add a new subnet.
 - b. Once the PROFINET IO interface on the CPU has been assigned a subnet, add a PROFINET IO system to the hardware configuration diagram by right-clicking the **PROFINET IO** module in the PLC configuration and selecting **Insert PROFINET IO System**.
6. If this is the first In-Sight 3D vision system to be added to the PROFINET network, you must install the Cognex-supplied GSD file. To install the GSD file, follow these steps:
 - a. From the HW Config tool, select Options > Manage GSD Files from the menu.
 - b. Press the Browse button and select the folder: X:\Program Files (x86)\Cognex\In-Sight\In-Sight VC Explorer 7.10.2\Adapters\In-Sight 3D Adapter 7.10.2\FFP\GSD.
 - c. Press the Select All button, then click the Install button to install the hardware description.
7. To add your vision system to a PROFINET network, browse to the appropriate node of the Hardware Catalog (Other **field devices** > **PROFINET IO** > **Controllers** > **Cognex Corp.** > **Cognex Vision**

Introduction

Controllers > In-Sight 3D Vision System). Drag an instance of the desired vision system into the PROFINET IO System in the hardware configuration.

8. Set the device name and IP address to the exact name and IP address of the device that you configured.

The vision system displays as a device on the PROFINET IO system.

How to Use This Manual

2 How to Use This Manual

Throughout this manual, Warnings, Cautions, and Notes are used to draw your attention to important information in the body of the text. It is important to pay attention to the content provided under these headings.



WARNING: This symbol indicates a hazard that could cause death, serious personal injury or electrical shock.



CAUTION: This symbol indicates a hazard that could result in property damage.



Note: This symbol indicates additional information about a subject.

PROFINET System Information

3 PROFINET System Information

The following network identifiers will be advertised by the PROFINET stack:

Network Identifier	In-Sight Vision System
Vendor ID	0x0137
Device ID	0x0A
Module ID	0x01
Family Name	Cognex 3D Vision System
Ordering Number	Depends on vision system type
HW Revision	1
SW Revision	Firmware Revision (1.0.0)

4 PROFINET Support

- Support for cyclic connections with 8 – 1024ms cycle times.
- Support for cyclic connections with 1440 bytes of user data and inspection result.

PROFINET IO Module Reference Table

5 PROFINET IO Module Reference Table

This topic provides the PROFINET IO Module reference table, which should be used in conjunction with the GSD file for incorporating the 3D vision system and a Siemens PLC via the PROFINET protocol.

Note:

- For detailed descriptions of the signals, see the [Industrial Communications Signals](#) topics.
- The Engine Control (Input Channel and Output Channel), User Data, and Inspection Results modules can be plugged into multiple slots.
- When the Engine Control (Input Channel and Output Channel) module is plugged into Slot 2, it will contain the bits for Acquisition Channel 1 and Inspection Channel 1. When the Engine Control (Input Channel and Output Channel) module is plugged into Slot 3, it will contain the bits for Acquisition Channel 2 and Inspection Channel 2.
- When multiple User Data or Inspection Results modules are plugged into PROFINET, the User Data, or Inspection Results data will span all the plugged-in modules. In this scenario, if there is a 240-byte module and a 16-byte module plugged in, the first 240 bytes of data will be mapped to the first module, and bytes 241-256 will be mapped to the second module.

Module	Description	ID	Slots	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
System Control	System Input	0x101	1	0	Reserved	Clear Error	Reserved	Execute Command	Reserved		Buffer Results Enable	Trigger Enable
				1	Reserved							
				2..3	Command ID							
				4..7	Soft Event 0-31							
				8..15	Reserved							
	System Output	0x101	1	0	Run Mode	Processing Enabled	Reserved				System Ready	
				1	Error	Command Failed	Command Completed	Command Executing	Reserved			
				2..3	Reserved							
				4..5	Command Result Code							
				6..7	Error ID							
				8..11	Soft Event Acknowledge 0-31							
12..15				Reserved								
Engine Control	Input Channel	0x401	2..5	0	Reserved			Set User Data N	Clear Exposure Complete N	Inspection Results	Trigger Camera N	

PROFINET IO Module Reference Table

Module	Description	ID	Slots	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0		
											Acknowledge N			
	Output Channel	0x401	2...5	0	Results Buffer Overrun N	Inspection Passed N	Results Valid N	Inspection Completed N	Exposure Complete N	Acquisition Error N	Trigger Acknowledge Camera N	Trigger Ready Camera N		
				1	Reserved									Set User Data Acknowledge N
				2..3	Acquisition ID N									
				4..5	Inspection Image ID N									
6..7	Inspection Result Code N													
User Data - 240 Bytes	User Data	0x701(16) 0x702(32) 0x703(64) 0x704(128) 0x705(240)	6...11	0...	User Data									
Results - 240 Bytes	Inspection Results	0x801(16) 0x802(32) 0x803(64) 0x804(128) 0x805(240)	12...17	0...	Inspection Results									

Industrial Communications Signals

6 Industrial Communications Signals

The In-Sight 3D-A1000 vision system uses a fixed set of pre-named signals that can be used to transfer data and results to and/or from a PLC and the vision system.

For all the signals to be active, the vision system must have its *Trigger Mode* property set to *Factory Floor Protocol*, it must be in Run Mode, and the `$System.ProcessingEnabled` tag must be `True`.

6.1 Acquisition Signals

There is a single acquisition signal for the In-Sight 3D-A1000 vision system.

Trigger Enable: This signal gates the acquisition for the In-Sight 3D-A1000 vision system. This field is set to enable triggering via the *Trigger* bit. Clear this bit to disable the *Factory Floor Protocol* triggering mechanism.

6.2 Acquisition Channels

The In-Sight 3D-A1000 vision systems use a set of signals related to acquisition. These signals have timing relationships, cause actions in the camera dedicated to the acquisition channel, and report the status of the camera, but do not affect any other camera in the system, nor any other acquisition channel.

The acquisition channel is numbered 0, which refers to the camera.

Signal	Description
Trigger Ready 0	Indicates when the 3D vision system can accept a new trigger on one of the four cameras. This field is true when the <i>Trigger Enable</i> bit is set, the camera is not currently acquiring an image.
Trigger 0	Setting the <i>Trigger</i> bit will trigger an acquisition on a specific camera. The <i>Trigger Enable</i> bit must also be set.
Trigger Acknowledge 0	Indicates when the specified camera has been successfully triggered via the <i>Trigger</i> bit. The <i>Trigger Acknowledge</i> bit will stay set until the <i>Trigger</i> bit is cleared.
Exposure Complete 0	This bit is set when the specified camera's image sensor is no longer exposed to light. Used to indicate that the part being inspected can be moved from under the camera's field of view.
Acquisition Error 0	This bit is set when the camera fails to acquire an image for one of the following reasons: • The camera's <i>Trigger Mode</i> property is not set to <i>Factory Floor Protocol</i>. • The In-Sight 3D vision system is not in <i>Run Mode</i>. • The <code>\$System.ProcessingEnabled</code> tag is <code>False</code>. • The camera is currently acquiring an image. • The camera is out of image buffers. This bit is cleared when a successful acquisition is triggered, or the <i>Trigger Enable</i> bit is toggled. Note: If the <i>Trigger</i> bit is set while the <i>Trigger Enable</i> bit is Low, this will result in an acquisition error, because the <i>Trigger</i> bit is ignored.
Acquisition ID 0	This ID increments on the completion of every acquisition, regardless of the trigger source, and can be used to synchronize an acquisition with its <i>Inspection Result</i> . The acquisition ID is changed on the start of an acquisition. If the PLC is the trigger source, the <i>Acquisition ID</i> is set prior to setting the <i>Trigger Acknowledge</i> bit.
Inspection Image ID 0	These bytes are used to provide the acquisition IDs for each of the images associated with this set of results. This data is passed via <i>Acquire</i> block and the <i>Show ID Pins</i> output pin to a <i>Notify PLC</i> block that is configured to use the <i>InspectionComplete Notification Method Type</i> , or the <i>NotifyInspectionComplete</i> function is executed. You can specify multiple cameras in this call, and each <i>Inspection Channels</i> can report a single image ID from each camera that was used to generate a set of results.

6.3 Inspection Channels

There is a single group of signals used to transfer data to the In-Sight 3D-A1000 vision system and for sending inspection result data to the PLC. It supports storing a copy of the *User Data* when the *Set User Data* bit is set and publishing a set of inspection results from the vision system.

Signal	Description
Inspection Completed 0	This bit is toggled when the <i>Notify PLC</i> block or <i>NotifyInspectionComplete</i> function are executed. You specify which of the four inspection channels to send the results through.
Results Valid 0	This bit is set when the <i>Inspected Image ID</i> , <i>Inspection Result Code</i> and <i>Inspection Results</i> fields are valid. The bit is cleared when the <i>Inspection Results Acknowledge</i> bit is set.
Results Buffer Overrun 0	This bit is set when the <i>Enable Results Buffer</i> bit is set, and there are more results than the result queue can hold.
Inspection Result Code 0	These bytes are used to pass the user-defined result code. This code is defined in either the <i>Notify PLC</i> block or <i>NotifyInspectionComplete</i> function, using the <i>resultCode</i> parameter.
Inspection Passed 0	This bit indicates the pass and/or fail state of the inspection. This bit is defined in either the <i>Notify PLC</i> block or <i>NotifyInspectionComplete</i> function, using the <i>inspectionPassed</i> parameter.
Inspection Results Acknowledge 0	When the <i>Buffer Results Enable</i> bit is set, the <i>Inspection Results Acknowledge</i> bit acknowledges that the PLC has received the <i>Inspected Image ID</i> , <i>Inspection Result Code</i> and <i>Inspection Results</i> data.
Set User Data 0 Set User Data Acknowledge 0	These bits are used to signal that new <i>User Data</i> is available to be read in one of the four inspection channels in the vision system. After latching the entire <i>User Data</i> area into a holding buffer for the specified inspection channel, the vision system will indicate to the PLC that it has read the data, and it can start loading new data into the buffer, if required, by issuing the <i>Set User Data Acknowledge</i> signal.

Industrial Communications Signals

6.4 Inspection Signals

The following signals are used to send and/or receive data on the In-Sight 3D vision system and the connected PLC.

Signal	Description
Buffer Results Enable	When the <i>Buffer Results Enable</i> bit is set, the vision system will queue up to 16 sets of results, per Inspection Channel. Each result must be explicitly acknowledged using the <i>Inspection Results Acknowledge</i> signal.
Inspection Results	These bytes are used to create a collection of vision inspection tool results. You define the size of the Inspection Results using the <i>resultData</i> parameter, for each inspection. This allows you to define, for example, the Inspection Results 0 section to be larger than the Inspection Results 2 section. Note: For more information about the <i>resultData</i> parameter, see the NotifyInspectionComplete topic.
User Data	This is data that is sent to the vision system from the PLC, and the size is user-defined for each Inspection Channel. This allows you to define, for example, the <i>User Data 0</i> section to be larger than the <i>User Data 2</i> section. When the PLC sends the <i>User Data</i> for Inspection Channel 1, the data should only be written into the area reserved for Inspection Channel 1, and then the <i>Set User Data 1</i> bit should be set.

6.5 System Signals

These signals are used to send and/or receive information about the In-Sight 3D vision system status.

Signal	Description
Run Mode	This bit indicates that the vision system is in <i>Run Mode</i> and the <i>\$System.ProcessingEnabled</i> tag is <i>True</i> .
Processing Enabled	This bit indicates the state of the <i>\$System.ProcessingEnabled</i> .
Soft Event 0-31	The <i>Soft Event</i> allows the PLC to trigger a script associated with a <i>Soft Event</i> script point. The rising edge of this bit will trigger the associated <i>Soft Event</i> script, and the falling edge will trigger the associated <i>Soft Event Off</i> script.
Soft Event Acknowledge 0-31	The <i>Soft Event Acknowledge</i> will be generated after the associated script finishes its execution. Note: For more information about the <i>Soft Event</i> script point, see the FactoryProtocol Script Points topic.
Error	The <i>Error</i> bit is set in conjunction with either the <i>Notify PLC</i> block set to the <i>Error Notification Method Type</i> , or the execution of the <i>NotifyError</i> function.
Error ID	The <i>Error ID</i> field holds a user-defined error code, defined using the <i>errorID</i> parameter.
Clear Error	The <i>Clear Error</i> bit can be used to acknowledge the current error code, which will clear the <i>Error</i> and <i>Error ID</i> signals. If another <i>Error ID</i> signal was sent, the <i>Error</i> bit and <i>Error ID</i> signal will be set to queued error ID when the <i>Clear Error</i> signal is dropped.
System Ready	This bit indicates when the In-Sight 3D vision system has fully started and is ready to accept and process triggers.

Load/Enable/Test Communications via PROFINET Protocol

7 Load/Enable/Test Communications via PROFINET Protocol

This section goes through each detailed step needed to load, enable, and test PROFINET communications.

Go through the setup wizard and ensure that PROFINET is enabled and that the PROFINET station name is set.

COGNEX 3D-A1000 Dimensioning System

Get Started > Application Details > Baseline > Optimize > **Communications**

Industrial Protocol

- ☐ TCP Server
- ☐ TCP Client
- ☐ DataMan MultiReader Sync
- ☒ **Industrial Protocols**
- ☐ Discrete I/O and Encoder

Industrial Protocols

- ☐ Ethernet/IP
- ☒ **PROFINET**

☒ Use Station Name
IS3DA1000

3D-A1000 can communicate over standard Industrial Protocols

Output Delay

- ☒ None
- ☐ Time-Based 5000 ms
- ☐ Distance-Based 300 mm

Output delay applies only to hardware triggers and FFP results (Profinet and EIP).
The delay is in relation to the time or location where the trigger occurs.

Sample Output String:
[1] 359.000,278.001,362.011 @ 67.0°

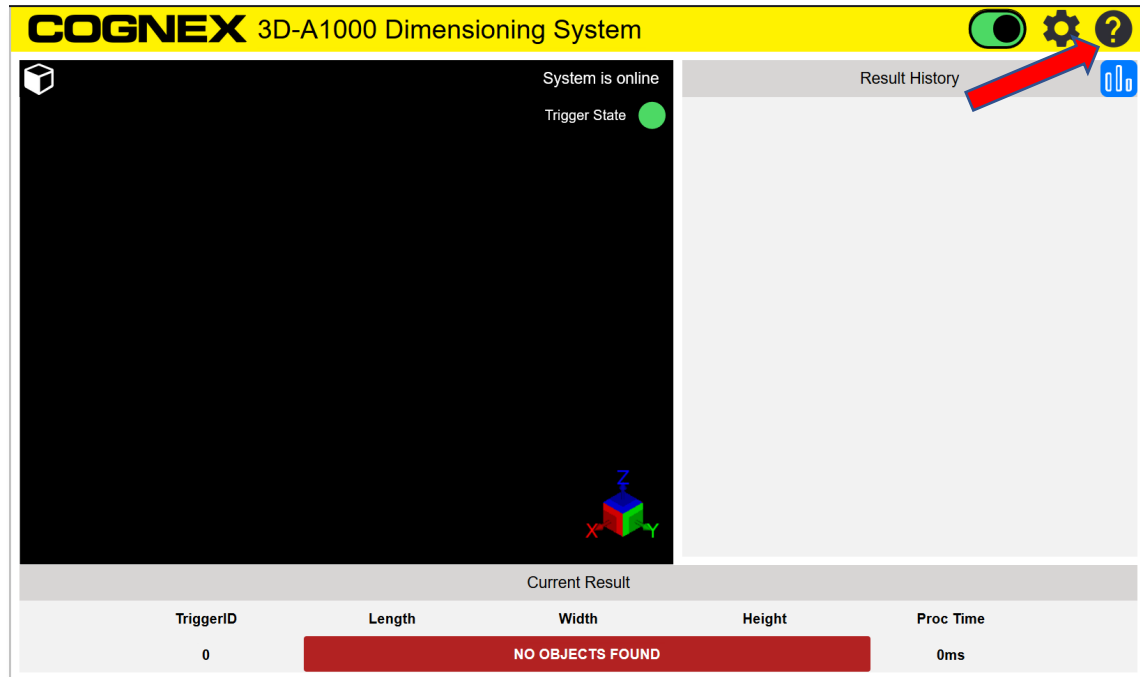
< Previous Test Outputs Finish

Step 2 of 2

Note: You must reboot after completing the setup wizard.

Load/Enable/Test Communications via PROFINET Protocol

7.1 Documentation and Supplemental Material



CONTACT COGNEX

HAVE QUESTIONS?

Cognex representatives are available to assist.

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- Video Tutorials
 - [Getting Started](#)
 - [Application Details](#)
 - [Autotune](#)
 - [Baseline](#)
 - [Communications](#)
 - [CAT](#)

- Supplemental Documents
 - [Deluxe I/O Box Quick Reference](#)
 - [Cognex 3D-A1000 EIP PLC Configuration](#)
 - [Cognex 3D-A1000 EIP Full Guide](#)
 - [Cognex 3D-A1000 Profinet](#)
 - [Cognex 3D-A1000 Setup Tool](#)
 - [A1000R Drawing \(PDF\)](#)
 - [A1000R Drawing \(Step\)](#)
 - [A1000R Mounting Bracket \(Step\)](#)

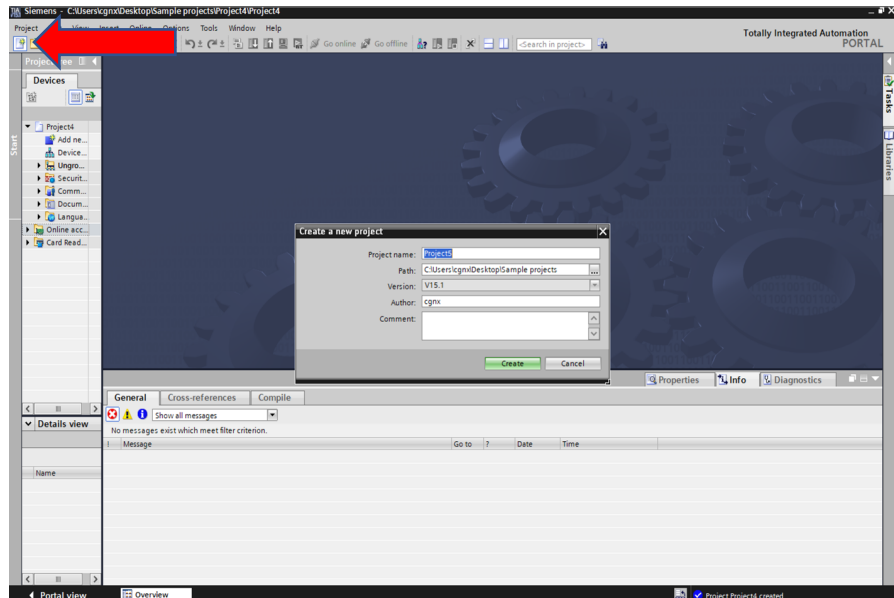
- Supplemental Software
 - [Download Dataman Setup Tool](#)
 - [EDS Installation Files](#)
 - [GSD Installation Files](#)
 - [RSLogix Rung Sample](#)
 - [RSLogix Basic Sample](#)

Load/Enable/Test Communications via PROFINET Protocol

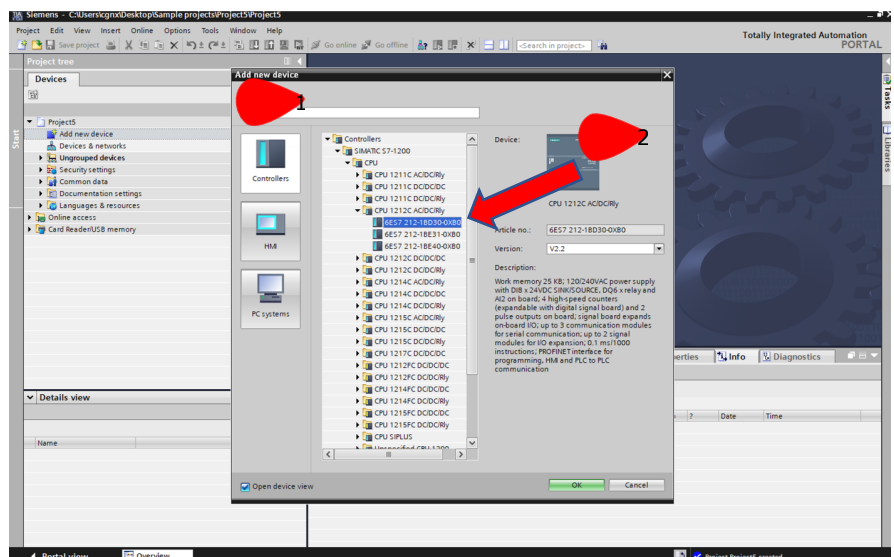
7.2 Loading the GSD (General Station Description) File on PC

1. Copy the GSD, icon, and readme files from Supplemental Software to PC.

2. In the Siemens TIA Portal, open a new project and go to **Tools/EDS Hardware Installation Tool**.



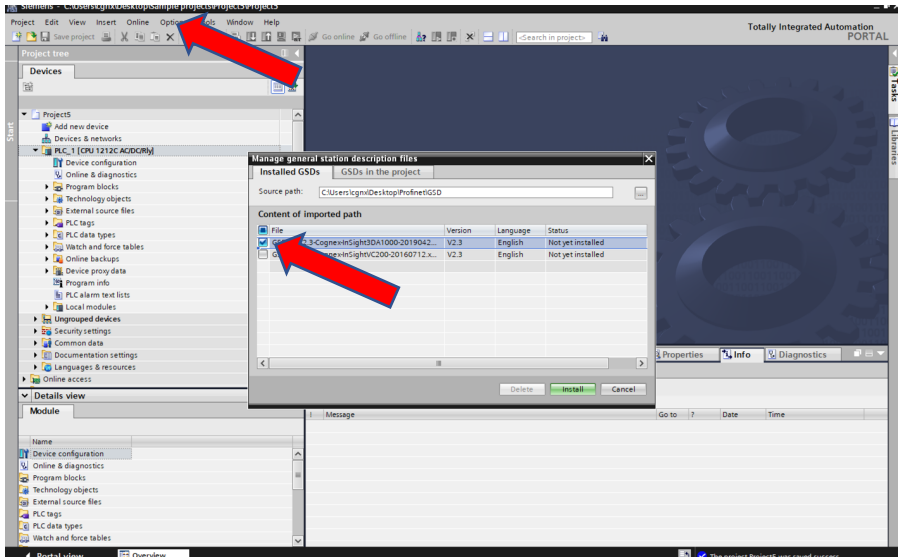
3. Under the Project Tree on the left side of the application, double click on **Add new device**, and select your PLC controller from the list.



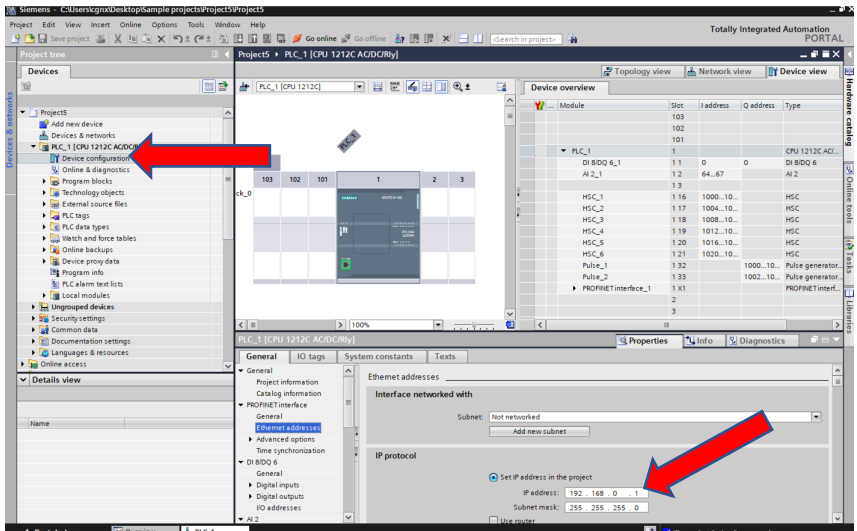
Load/Enable/Test Communications via PROFINET Protocol

7.3 Adding 3D-A1000 to Network

1. Next, you need to install the GSD file for the product you are connecting. Select **Options > Manage General Station Description Files (GSD)**. Once this file is installed, you will be able to select any supported Cognex product from the catalog on the right side of the application. Best practice is to use the GSD file from the version of software that matches the version of firmware running on your camera.

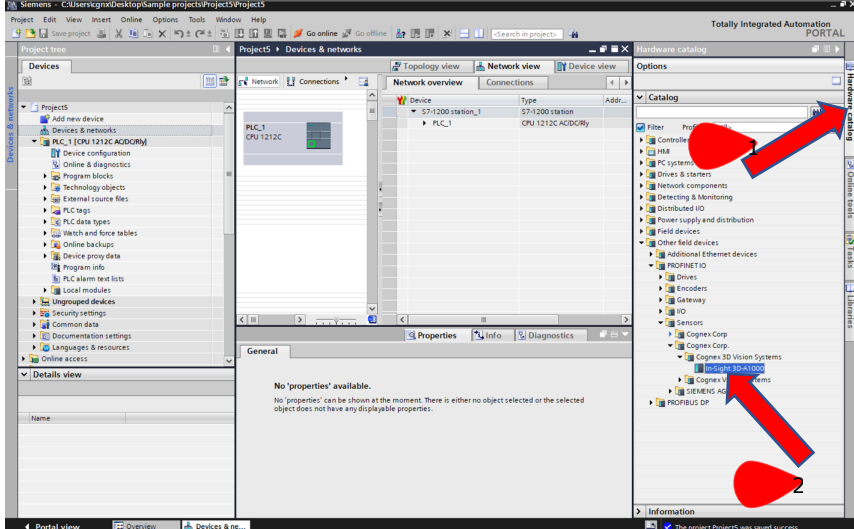


2. Finish setting up the PLC based on the specific model you have. This may mean double clicking on the network port on the controller in the Devices and Networks window and assigning an IP address and naming the controller.

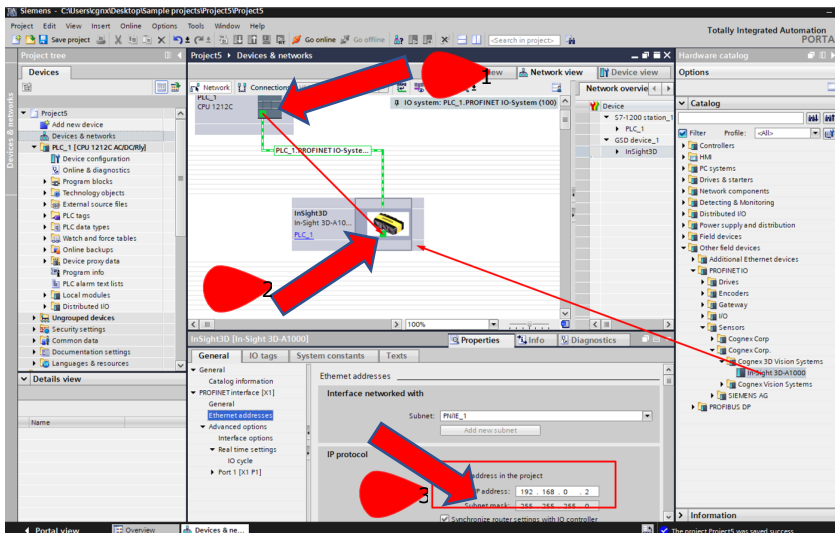


Load/Enable/Test Communications via PROFINET Protocol

- You can now add your Cognex camera. Double click again on the Devices and Networks option from the Project Tree on the left. Then, expand the catalog on the right for Other Field Devices. Then, expand PROFINET IO > Sensors > Cognex Corp > (Cognex ID Readers/Cognex 3D Vision Sensors) and select your A1000 device from the list and drag it into the window with the PLC controller.

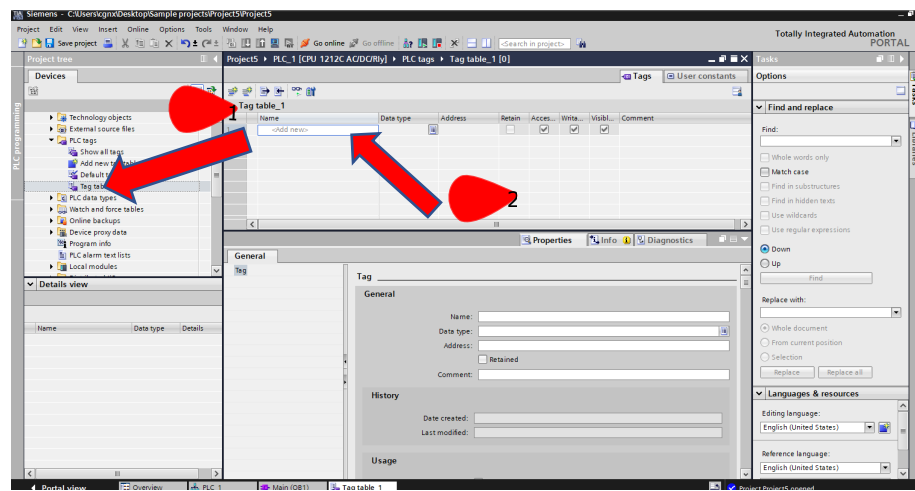


- The camera will show up as Not Assigned. If you click the link, you can select the PLC you added in the previous step to link the two.

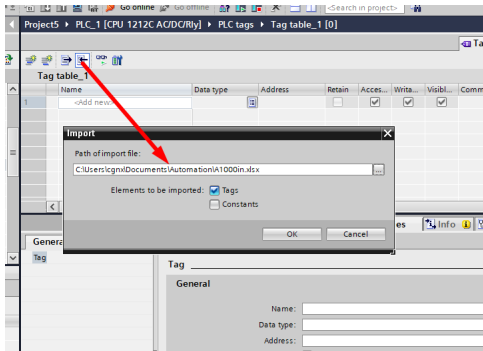


Load/Enable/Test Communications via PROFINET Protocol

5. In the TIA Portal software, expand the PLC Tags and double click on the **Add new tag** table option.



6. Import the tags files A1000in and A1000out into the tag table; this will map the tags with meaningful names.



7.4 Retrieve A1000_PROFINET_Basic.zap15_1

This simple nine-network program lets you trigger your device manually via PROFINET or in a timed loop.

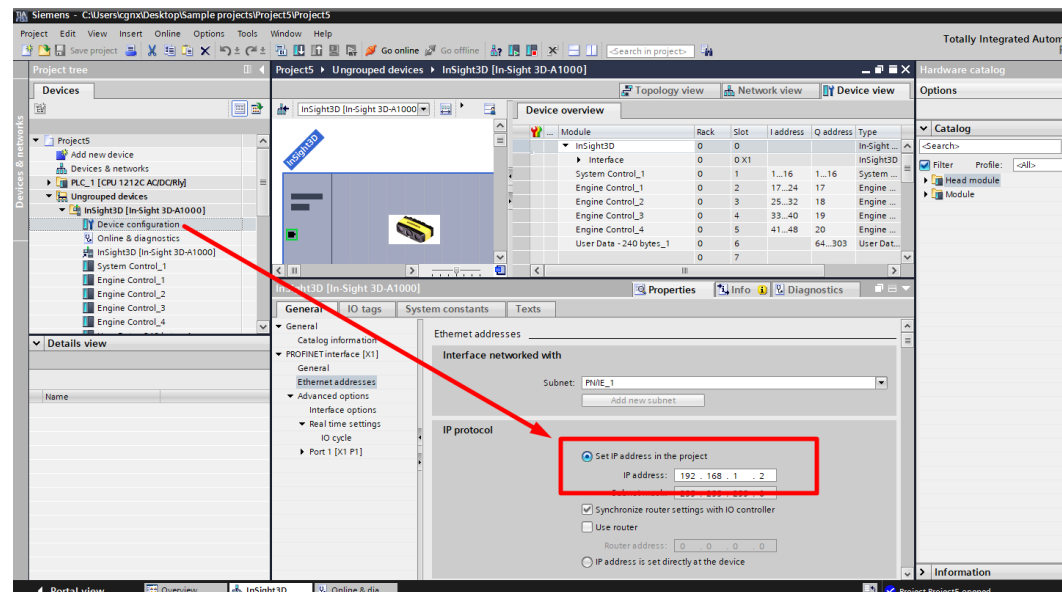
Note: The following details each rung's functionality:



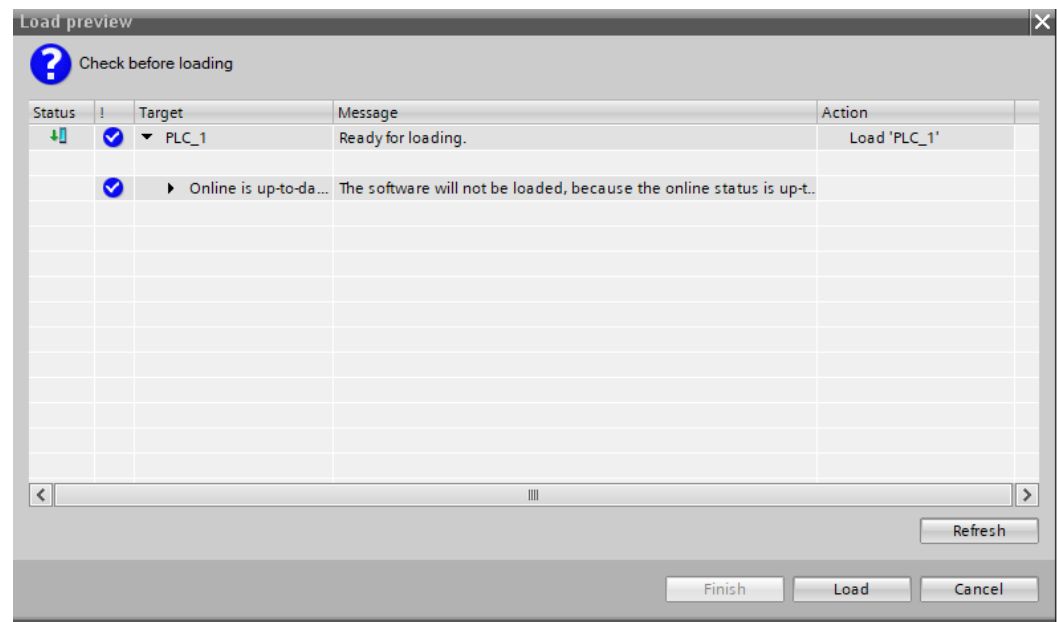
- Network 1 – Will convert output from Bytes to String
- Network 2 – System health check
- Network 3 – Trigger enable
- Network 4 – Set auto trigger
- Network 5 – Timer rung with latching circuit
- Network 6 – Manual trigger and output control
- Network 7 – Job complete check
- Network 8 – Fault check
- Network 9 – Reset faults

Load/Enable/Test Communications via PROFINET Protocol

1. Open the program, and while offline, set the name of the A1000 and IP in IO configuration. See Adding 3D-A1000 to network for reference.

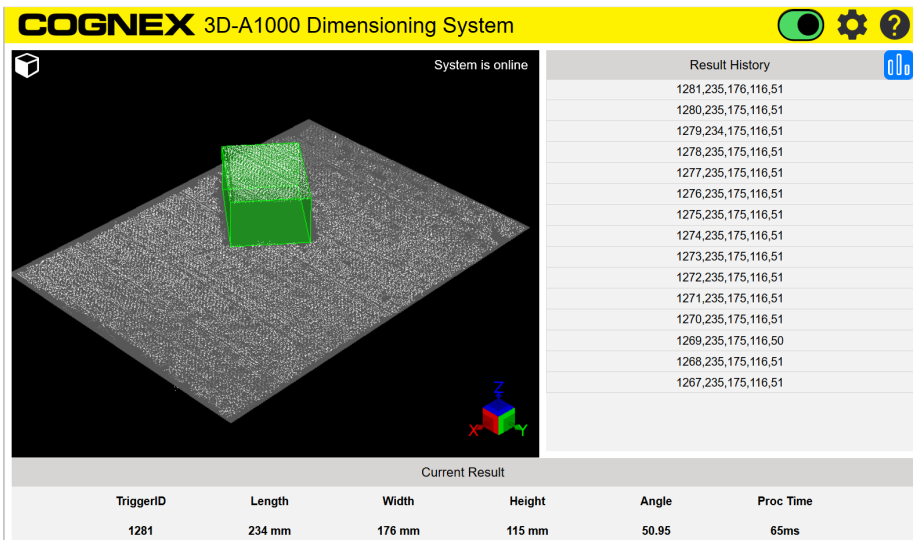
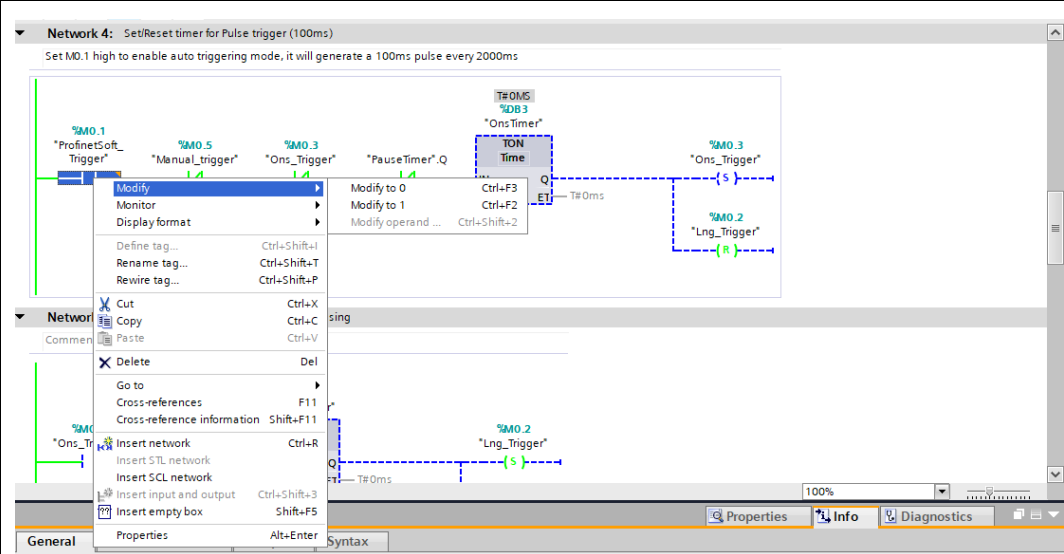


2. Sample Program Tags. Download the program and go online.



Load/Enable/Test Communications via PROFINET Protocol

- Execute the program, enable a trigger type bit, and watch the application run.



Load/Enable/Test Communications via PROFINET Protocol

4. Accessing the inspection result data from the A1000D data assembly:

The A1000 Dimensioner places the inspection result data into specific data registers that can be found in the 3dA1000in Data assembly. Listed below are the available data items; each is 4 bytes in size. Make sure to set the destination registers data type properly; failure to do so may cause irregular results.

- Trigger ID – "InspectionResults_TriggerID" (DINT)
- Length (mm) – "InspectionResults_Length" [4] (REAL)
- Width (mm) – "InspectionResults_Width" [8] (REAL)
- Height (mm) – "InspectionResults_Height" [12] (REAL)
- Rotation (Deg) – "InspectionResults_Angle_D" [16] (REAL)
- Rotation (Rad) – "InspectionResults_Angle_R" [20] (REAL)
- Status Bits – StatusBits_ [24] (DINT)
 - Bit 0 – Item Found
 - Bit 1 – Out of Spec
 - Bit 2 ... 31 – Future Expansion

You can monitor online the data assembly by using the A1000_Watch_table:

1	*InspectionResults_TriggerID	%ID68	DEC	793	TriggerID
2	*InspectionResults_Length	%ID72	Floating-po...	508.989	Length
3	*InspectionResults_Width	%ID76	Floating-po...	168.0163	Width
4	*InspectionResults_Height	%ID80	Floating-po...	190.9545	Height
5	*InspectionResults_Angle_D	%ID84	Floating-po...	1.540764	Angle(Deg)
6	*InspectionResults_Angle_R	%ID88	Floating-po...	0.0268914	Angle(RAD)
7	*InspectionResults_STRLength	%ID96	DEC	31	String Length for Output
8	*Inspection Results 32	%B100	Character	'02'	Output String
9	*Inspection Results 33	%B101	Character	'7'	Output String
10	*Inspection Results 34	%B102	Character	'9'	Output String
11	*Inspection Results 35	%B103	Character	'2'	Output String
12	*Inspection Results 36	%B104	Character	'1'	Output String
13	*Inspection Results 37	%B105	Character	'5'	Output String
14	*Inspection Results 38	%B106	Character	'0'	Output String
15	*Inspection Results 39	%B107	Character	'9'	Output String
16	*Inspection Results 40	%B108	Character	'1'	Output String
17	*Inspection Results 41	%B109	Character	'1'	Output String
18	*Inspection Results 42	%B110	Character	'6'	Output String
19	*Inspection Results 43	%B111	Character	'6'	Output String
20	*Inspection Results 44	%B112	Character	'1'	Output String
21	*Inspection Results 45	%B113	Character	'1'	Output String
22	*Inspection Results 46	%B114	Character	'9'	Output String
23	*Inspection Results 47	%B115	Character	'1'	Output String
24	*Inspection Results 48	%B116	Character	'1'	Output String
25	*Inspection Results 49	%B117	Character	'2'	Output String
26	*Inspection Results 50	%B118	Character	'1'	Output String
27	*Inspection Results 51	%B119	Character	'1'	Output String
28	*Inspection Results 52	%B120	Character	'1'	Output String
29	*Inspection Results 53	%B121	Character	'6'	Output String
30	*Inspection Results 54	%B122	Character	'1'	Output String
31	*Inspection Results 55	%B123	Character	'4'	Output String